Spoken Testimony of Randall L. Keitz, P.E., CFM
In Support of HB 175
Before the Ohio Senate Agriculture and Natural Resources Committee
Pre-Hearing Submittal
November 30, 2021

Honorable Members of the Committee, Chairman Schaffer, Vice Chairman Huffman, and Ranking Member Fedor, Good afternoon.

My name is Randy Keitz. I greatly appreciate the opportunity to testify in support of HB 175.

During my 37 year career in environmental engineering and environmental regulation summarized in my resume, my focus has always been how best to preserve, enhance and restore environmental values. This Bill aligns with my focus and experience.

Passage of HB 175 is imperative to curb the Ohio EPA's irrational new regulation of ephemeral streams which constitutes the <u>exact opposite</u> of what is necessary to improve stream health and water quality.

Ohio EPA Director Stevenson has testified that there are an estimated 36,405 miles of ephemeral streams in Ohio as if this value is a virtue. Unfortunately, this ephemeral stream length merely represents a testament to how degraded the upper reaches of Ohio's watersheds have become due to the extensive network of erosional pathways that have developed over the past 200 years. Rather than reduce erosion by increasing storage in our watersheds using proven stormwater management practices, the Ohio EPA wants ephemeral stream length to not only be replaced but also expanded. This will convey stormwater runoff <u>more rapidly</u> downstream along with pollutants, such as, nitrogen and phosphorus.

Let me explain.

It's first important to understand that ephemeral streams are most often unstable, eroding features that are more commonly known as erosion gullies. Ephemeral streams only flow during rain or snow melt. They are largely the result of past land development, not a gift from nature. In the time of Daniel Boone and Simon Kenton, and the centuries before, Ohio's landscape was covered with dense forests and prairie grasslands, and streams were filled with beaver ponds. This combination of features provided tremendous storage of stormwater within Ohio's watersheds. The dense land cover, deep porous soils and close-knit tree and grass root systems provided significant resistance to stormwater runoff that slowed runoff and allowed it time to infiltrate and be stored in deep porous soils. An extensive in-stream network of beaver ponds captured and stored much of the remaining stormwater runoff. These beaver ponds recharged groundwater systems and released water slowly through their leaky dams. Thus, in these earlier days, ephemeral streams rarely occurred in Ohio's densely vegetated landscape, and most of Ohio's streams were perennial with considerably fewer intermittent streams due to the continual slow release of water from leaky beaver dams located far into the headwaters and from water draining out of fully recharged groundwater systems.

Moving forward in time, beavers were trapped-out of Ohio and Ohio's landscape changed significantly by a vast array of land development activities. These changes to the landscape have resulted in the loss of soil and groundwater storage that has increased stormwater runoff and simultaneously decreased runoff resistance and increased the velocity of runoff as described in my Exhibit 2 in my submitted written testimony, which has resulted in the formation of erosion gullies that have expanded across the upper reaches of watersheds in Ohio.

These erosion gullies or ephemeral streams are now the pathways that allow stormwater to rapidly run off the land to downstream channels and waters, which directly increases stormwater peak flows causing stream channel erosion and sedimentation, increased flooding, increased pollutant conveyance, and other consequences shown in my written testimony's Table 1.

These erosional pathways need to be eliminated and replaced with features and processes that increase storage in our watersheds, such as overland flow to slow runoff and create more time for water to infiltrate into the soil, and stormwater ponds to capture and release stormwater slowly to mimic the functions of beaver ponds.

Ohio EPA's misguided desire to replace and expand erosional pathways is also inconsistent with several of H2Ohio Program's ten (10) most effective and cost-efficient practices to help reduce phosphorus runoff as detailed in my written testimony. Six (6) of the 10 practices recommend slowing water down, reducing erosion, settling and holding phosphorus. The H2Ohio Program recommendations align with creating overland flow and in-stream stormwater ponds that slow water down to allow time for infiltration to occur, time for phosphorus-laden silts & clays to settle within stormwater ponds, and time for vegetation on the land and within storage ponds to capture and hold phosphorus.

The deregulation of ephemeral streams intended by HB175 will not only eliminate the Ohio EPA's misguided ephemeral stream replacement and expansion requirements, but will enhance the usefulness of Ohio EPA's Construction Activity General Permit which correctly addresses Ohio's primary watershed need for more storage through stormwater best management practices (BMPs). BMPs promote features and processes, such as overland flow and stormwater ponds that mimic beaver pond functions to reduce or prevent downstream channel erosion and sedimentation, flooding, pollutant conveyance and other benefits shown in my written testimony's Table 2. But, we need HB 175 so that stormwater ponds can be placed within ephemeral streams without having to pay exorbitant mitigation costs required now by the Ohio EPA.

In summary, the Ohio EPA mitigation requirements are irrationally contrary to environmental protection and punitive for anyone impacting an ephemeral stream. This **MUST** be corrected or decades of stream degradation at the hands of the Ohio EPA will result. Passage of HB 175 is required **NOW**. I am happy to answer any questions. Thank you.

Written Testimony of Randall L. Keitz, P.E., CFM
In Support of HB 175
Before the Ohio Senate Agriculture and Natural Resources Committee
Pre-Hearing Submittal
November 29, 2021

Honorable Members of the Committee, Chairman Schaffer, Vice Chairman Huffman, and Ranking Member Fedor, Good afternoon.

My name is Randy Keitz. I appreciate the opportunity to testify in support of HB 175 on behalf of my current employer B&N Coal.

During my 37 year career in environmental engineering and environmental regulation summarized in my resume in Exhibit 1, my focus has always been how best to preserve, enhance and restore environmental values. I am a registered Professional Engineer in Ohio and a Certified Floodplain Manager. I worked 31 years for the Ohio Department of Natural Resources with a focus on hydrology & hydraulics, stormwater management, stream assessment and restoration, sediment transport, floodplain management and watershed management in order to support environmental regulations and develop stream, floodplain and watershed restoration projects as well as regulation of mining activities. Further, I served as the State Floodplain Engineer. Also, I have taught upwards of 80 short courses on these topics, including classes about streams at Cleveland State University and the University of Akron. I also was an adjunct professor at the University of Mount Union teaching the first graduating civil engineering senior class capstone course. Additionally, I have worked as an expert witness for the OEPA, ODOT and other significant private cases involving stream, floodplain and stormwater issues all with successful outcomes. Further, I have worked two years as a Senior Engineer for a design-build stream restoration firm designing stream and floodplain restoration projects. Currently and for the past 4½ years, I have been the Chief Mine and Water Resources Engineer at B&N Coal helping them continue their 35-year effort remining previously mined lands to eliminate acid mine drainage sources, and to restore productive land and overall watershed processes. This effort by B&N Coal is likely the single largest environmental success story in the State of Ohio.

I am here today to discuss ephemeral streams and offer my professional, experience-based opinion that Ohio's environment will benefit from the passage of HB 175 needed to prevent irrational state regulation. Currently, 36 states have chosen not to regulate ephemeral streams according to research publicized by a national law firm in connection with Indiana's recent passage of a Bill to prevent unneeded regulation of ephemeral streams. It is imperative that Ohio join that list.

Ephemeral streams only flow when it rains or during snow melt. They are typically only a few inches to a few feet wide and are most often unstable, eroding features that are more commonly known as erosion gullies. They tend to have small drainage areas, for example, a few acres as opposed to hundreds of acres, and are located near the upper reaches of watersheds. Ephemeral streams are generally located upstream of intermittent streams which flow seasonally in response to high groundwater tables and perennial streams that flow continuously.

In the time of Daniel Boone and Simon Kenton, and the centuries before, Ohio's landscape was covered with dense forests and prairie grasslands, and streams were filled with beaver ponds. This combination of features provided tremendous storage of stormwater within Ohio's watersheds. First, the dense land cover, deep porous soils and close-knit tree and grass root systems provided significant resistance to stormwater runoff. These features slowed runoff providing the time for it to infiltrate and be stored in deep porous soils. Second, an extensive in-stream network of beaver ponds captured and stored much of the remaining stormwater runoff. These beaver ponds recharged groundwater systems and released water slowly through their leaky dams. Thus, in these earlier days, ephemeral streams rarely occurred in Ohio's densely vegetated landscape, and most of Ohio's streams were perennial with considerably fewer intermittent streams due to the continual slow release of water from leaky beaver dams located far into the headwaters and from water draining out of fully recharged groundwater systems.

Moving forward from these earlier days, beavers were trapped-out of Ohio in the early 1800's, which resulted in the loss of in-stream beaver dams, and Ohio's landscape has been changed significantly over the past 200 years by a vast array of land development activities. These changes to the landscape have resulted in the loss of soil and groundwater storage that has increased stormwater runoff and simultaneously decreased runoff resistance and increased the velocity of runoff, which has resulted in the formation of ephemeral streams (erosion gullies) that have expanded in a dendritic pattern to the upper reaches of watersheds across Ohio.

These erosion gullies/ephemeral streams are now the pathways that allow stormwater to rapidly run off the land to downstream channels and waters, which directly increases stormwater peak flows causing stream channel erosion and sedimentation, increased flooding, increased pollutant conveyance, and other consequences listed in Table 1. This decrease in runoff resistance and resulting increase in runoff velocity is discussed further in Exhibit 2. Figures 1 and 2 describe how an expanding drainage network directly leads to increased stormwater runoff peak flows, and Exhibit 3 provides a detailed explanation of how increases in stormwater runoff volumes and peak flows directly lead to future stream channel degradation and consequences for decades to come.

Ohio EPA Director Stevenson has has testified that there are an estimated 36,405 miles of ephemeral streams in Ohio as if this value is a virtue. Unfortunately, this ephemeral stream length estimate merely represents a testament to how degraded the upper reaches of Ohio's watersheds have become due to the extensive network of erosional pathways that have developed over the past 200 years. Again, these pathways lead directly to stream channel erosion and sedimentation, increased flooding, increased pollutant conveyance and other consequences for downstream channels and waters. These erosional pathways need to be eliminated and replaced with features and processes that increase storage in our watersheds, such as overland flow to slow runoff. We need stormwater best management practices ("BMPs") that allow more time for water to infiltrate into the soil and stormwater ponds that capture and release stormwater slowly to mimic the functions of beaver ponds.

The current regulation of ephemeral streams by the Ohio EPA requires the <u>exact opposite</u> of what is necessary to improve stream health and water quality. That is, the Ohio EPA wants ephemeral stream length to not only be replaced but expanded. This will convey stormwater runoff more rapidly downstream along with pollutants, such as, nitrogen and phosphorus. Ohio EPA's approach reflects a close-minded default to preserving current environmental features with no serious consideration of better options for stream and watershed processes and their management. Further, this outcome directly opposes several of the H2Ohio Program's ten (10) most effective and cost-efficient practices to help reduce phosphorus runoff shown in Exhibit 4. Six (6) of the 10 practices recommend slowing water down, reducing erosion, settling and holding phosphorus. The H2Ohio Program recommendations align with creating overland flow and in-stream stormwater ponds that slow water down to allow time for infiltration to occur, time for phosphorus-laden silts & clays to settle within stormwater ponds, and time for vegetation on the land and within storage ponds to capture and hold phosphorus. The result of Ohio EPA's regulatory approach to convey stormwater runoff more rapidly downstream runs directly counter to these H2Ohio Program recommendations.

The deregulation of ephemeral streams as proposed in HB175 will not only eliminate the Ohio EPA's misdirected ephemeral stream replacement and expansion requirements, but will be superseded by the Ohio EPA's Construction Activity General Permit that correctly addresses Ohio's primary watershed need for more storage by requiring stormwater BMPs that promote features and processes, such as overland flow and stormwater ponds that mimic beaver ponds in order to reduce or prevent downstream channel erosion and sedimentation, flooding, pollutant conveyance and other benefits shown in Table 2. Currently, construction activities cannot place stormwater ponds within ephemeral streams because impacts to ephemeral streams come with exorbitant mitigation costs, and thus, stormwater ponds are placed outside of ephemeral streams on hillsides, which needlessly consumes valuable upland resources. With the deregulation of ephemeral streams, construction activities can properly and correctly place stormwater ponds within ephemeral stream channels in order to mimic the activity of beavers and eliminate the erosional ephemeral pathways that rapidly convey stormwater and pollutants downstream.

Regarding mitigation costs, an individual, business or industry that impacts a length of stream is referred to as a debit. Thus, one (1) foot of stream impact is equal to one (1) stream debit, and for ephemeral streams per the Ohio EPA, each one (1) foot of impact must be offset by the purchase of 1.5 stream credits. Based on a mitigation bank's posted 2020 Ohio mitigation credit fee schedule by primary service area, prices for one (1) stream credit vary from a low of $240 per foot to a high of $440 per foot. Thus, each foot of ephemeral stream impact, if mitigated through a mitigation bank or in-lieu fee project, would cost an individual, business or industry between $360 to $660 per each foot of ephemeral stream impact, depending on the location or service area of the impact. A small project, for example, may easily impact numerous little dry erosion gullies adding up to 1000 feet or more of ephemeral stream length and lead to mitigation costs ranging from $360,000 to $660,000 (1000 feet x 1.5 x $240/ft or $440/ft). A large project, for example, may easily impact numerous little dry erosion gullies adding up to 5000 feet or more of ephemeral stream length leading to mitigation costs in the range of $1.8 to $3.3 million (5000 feet x 1.5 x $240/ft or $440/ft). And these mitigation costs must be paid up-front before any project work begins. Quite simply, these mitigation costs are punitive and project killers for both small and large projects, and further, mitigating ephemeral streams does not address the actual problem. The solution requires the development of more storage (i.e., stormwater BMPs).

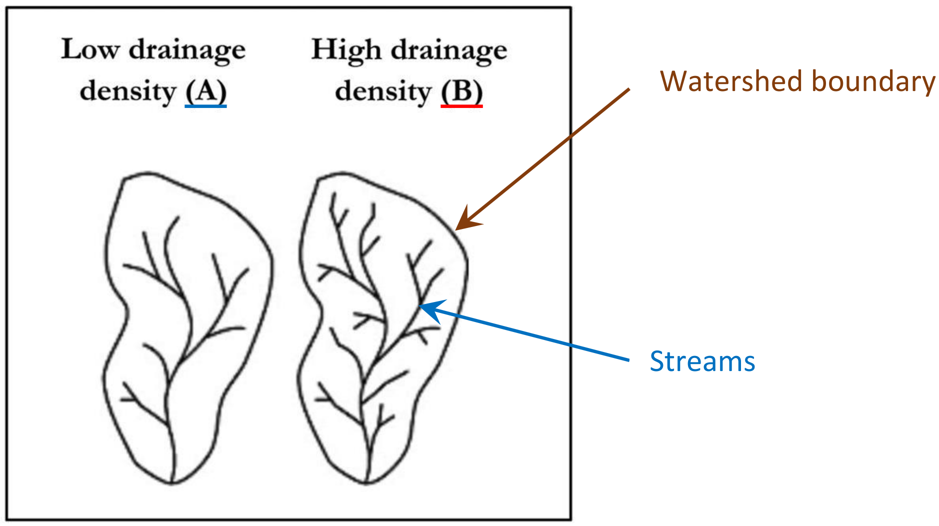


Figure 1 - Plan view of stream drainage network within the watershed boundary expanding from low drainage density (A) to high drainage density (B) as erosion gullies advance headward into the watershed due to land use changes and loss of storage.

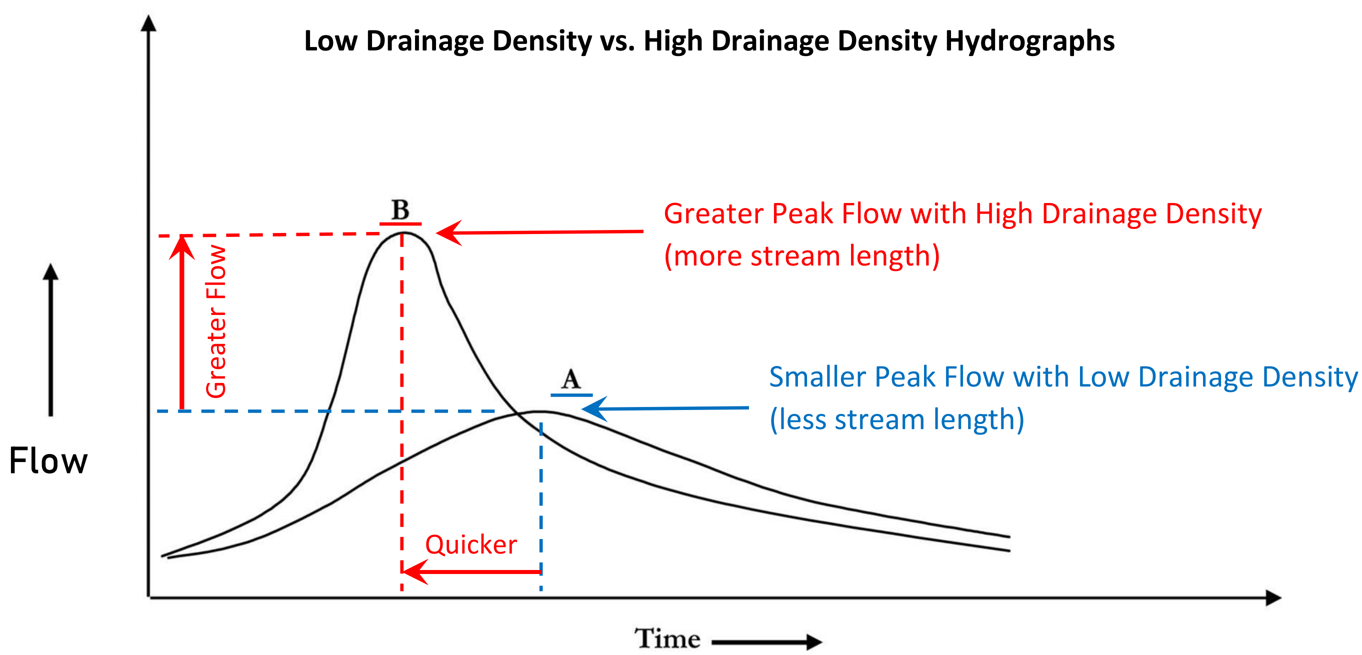


Figure 2 – Increased drainage density from erosion gullies (ephemeral streams) result in quicker runoff and greater peak flows as shown by Curve B or high drainage density as compared to Curve A or low drainage density with a smaller peak flow. Negative consequences of greater peak flows from high drainage density networks are described in Table 1.

TABLE 1

The *negative* consequences to downstream channels and waters from the Ohio EPA's requirement to replace and expand ephemeral stream channels are many, including but not limited to, the following adverse impacts:

a. Increased stormwater runoff volumes and peak flows conveyed downstream faster;
b. Faster moving water within stream channels will increase channel erosion;
c. Stream patterns will become straighter and the stream profiles will become steeper;
d. Eroding upstream channels will fill downstream channels with sediment;
e. Faster moving water in deep channels will increase downstream flooding;
f. Sediment filled channels downstream will increase flooding;
g. Faster moving water conveys pollutants, such as, nitrogen and phosphorus downstream quicker;
h. In-stream and floodprone area habitat will be degraded;
i. Watersheds become drained with little or no water left for wildlife;
j. Groundwater recharge is significantly reduced;
k. Base flows to maintain intermittent streams or perennial streams is reduced;
l. Habitat diversity is reduced;
m. Stream and floodplain water quality functions are lost and water quality degrades;
n. Increased eutrophication potential of water bodies like Lake Erie, the Ohio River and other water bodies, because nutrients are conveyed downstream quickly near their maximum pollution potential; and,
o. Does **NOT** support H2Ohio Program objectives.

TABLE 2

Benefits to downstream channels and waters as the result of using stormwater BMPs to increase watershed storage and not replacing ephemeral streams include, but are not limited to, the following:

a. Decreased stormwater runoff volumes and peak flows conveyed downstream slower;
b. Slower moving water within stream channels will reduce or prevent channel erosion;
c. Stream patterns will not change nor will stream profiles;
d. Upstream channels will not erode and downstream channels will not fill with sediment;
e. Slower moving water in stable channels will flood onto the floodplain increasing storage;
f. Downstream channel flooding will decrease;
g. Slower moving water stores pollutants, such as, nitrogen and phosphorus on floodplains;
h. In-stream and floodprone area habitat will not be degraded;
i. Watersheds will have stored water available for wildlife;
j. Groundwater recharge is significantly restored;
k. Base flows to maintain intermittent streams or perennial streams are significantly increased;
l. Habitat diversity is greatly increased;
m. Stream and floodplain water quality functions are maintained and water quality improves;
n. Decreased eutrophication potential of water bodies like Lake Erie, the Ohio River and other water bodies, because nutrients are stored in the headwaters and this provides time for their pollution potential to decay or become a much weaker pollutant.
o. **Absolutely supports** H2Ohio Program objectives!!!

During the Ohio EPA's online webinar to stakeholders introducing their draft Ephemeral Streams General Permit back on May 7, 2020 at 3:00 p.m., they included specific comments about ephemeral stream functions on Slide 5 of their 26 slide presentation. Slide 5 is shown in Exhibit 5 and contains the following stream function statements:

- Help control run-off and erosion
- Reduce flooding potential; and
- Help filter pollutants.

During this webinar, I provided the following chat comment to all Ohio EPA panelists to counter these incorrect statements about ephemeral streams but received no reply.

> "Ephemeral streams increase runoff, increase downstream flooding and result in degradation to downstream channels. They do not control runoff or reduce downstream flooding."

Then the Ohio EPA made similar and additional statements about the functions and benefits of ephemeral streams in their HB 175 testimony to the House Agriculture and Conservation Committee on May 19, 2021. Specifically, the Ohio EPA offered six (6) bullet points regarding the functions and benefits of ephemeral streams at the bottom of page 1 in their testimony as follows:

- Providing storage capacity during rain events;
- Carrying water flow during rain events;
- Capturing and filtering contaminants such as total suspended solids, nitrogen, and phosphorus;
- Contributing to the biology and ecology of areas through
  - Providing organically available material for macroinvertebrates and
  - Creating habitat areas;
- Providing for surface and ground water interaction and recharge of ground water; and
- Lowering water temperature downstream.

Responses that counter each of these Ohio EPA testimony statements regarding the functions and benefits of ephemeral streams are provided in Exhibit 6.

It is clear that the Ohio EPA has a misunderstanding of the functions and benefits of ephemeral streams. Effectively, each of the Ohio EPA ephemeral stream functions and benefits testimony statements can be classified as misleading or incorrect. It is clear that the Ohio EPA does not recognize the negative functions or adverse impacts that ephemeral streams impose on downstream channels and water bodies.

The Ohio EPA's misguided view of ephemeral stream functions seems to be a recent development. About 10 years ago, the Ohio EPA produced an extensive draft stream mitigation document entitled *Compensatory Mitigation Requirements for Stream Impacts in the State of Ohio* (Revision 5.0) dated February 2010. This document was developed by a joint effort between the Ohio EPA and ODNR. Numerous Ohio EPA lead scientists and management staff reviewed and supported the conclusions. Several of these Ohio EPA supporting staff are listed in the acknowledgements section on page iv, which is provided in Exhibit 7 on the second of four selected pages from this 81-page document. This document classifies ephemeral streams into Mitigation Category 1 (refer to the last two pages of Exhibit 7). On page 7 of this document in the first paragraph it states, "Streams that fall within this category typically have <u>ephemeral flow</u> or exists only because they are constructed drainage conveyances." This same paragraph goes on to state, "Replacement of a defined stream channel is not a requirement for mitigation of Mitigation Category 1 streams." Thus, in 2010, the Ohio EPA specifically did not require the mitigation of ephemeral streams. So, what has now changed at the Ohio EPA to now require not only the replacement of ephemeral streams, but also requiring their expansion?

Another perverse outcome of the Ohio EPA's ephemeral stream replacement and expansion requirements regards the mitigation or stream credit side of the stream mitigation equation, which involves mitigation banks and in-lieu fee projects. That is, one (1) foot of stream mitigation produced by a mitigation bank or in-lieu fee project regardless of whether it is a few inches wide ephemeral stream or a much larger and wider intermittent or perennial stream equals one (1) stream credit. And, they only have to construct one (1) foot of ephemeral stream to receive 1.5 stream credits or a 50% bonus. In comparison, intermittent and perennial stream mitigation bonuses are only slightly higher. Yet, for example, the cost to construct a 1.5-foot wide ephemeral stream is significantly less than say a 15- to 30-foot wide intermittent or perennial stream (e.g., $20 per foot for ephemeral stream versus $200 per foot for an intermittent or perennial stream). This cheaper construction cost and 50% bonus credit for each one (1) foot of ephemeral stream mitigated makes it possible for mitigation banks and in-lieu fee project owners to earn windfall profits from each mitigation project. Given the small size of ephemeral streams, it is easy for a mitigation project to 'slip in' several thousand feet of ephemeral stream length within the foot-print of nearly any mitigation project. For example, in one Ohio mitigation bank project, the project owner inserted 6,159 feet of ephemeral stream length within the project foot-print that produced a total of 9,239 stream credits at a potential selling price of between $2.2 to $4.1 million. And given the minimal construction cost for ephemeral streams of about $20 per foot, the potential additional profit for the mitigation project owner by inserting these negative-functioning/detrimental features into the project are in the neighborhood $2.0 to $3.9 million. This result is tragic since these ephemeral stream features will directly lead to degradation of downstream channels and other consequences. Nonetheless, the Ohio EPA has incentivized ephemeral stream mitigation, such that, a mitigation project can make more money constructing negative-functioning/detrimental ephemeral streams than restoring positive-functioning intermittent and perennial streams or wetlands.

The Federal stream mitigation rules were promulgated in 2008, are contained in 33 Code of Federal Regulations (CFR) Part 332, and the stream mitigation requirements contain the following key features:

a. Use a watershed approach;
b. Restore actual stream functions and services impacted;
c. Address the needs of the watershed;
d. Use watershed scale;
e. Restore historic aquatic resource conditions when possible; and,
f. Move towards functional assessments to quantify debits and credits, instead of surrogates such as linear feet and ratios of linear feet.

The Ohio EPA's Section 401 Water Quality Certification Application Requirements and Procedures in O.A.C. Rule 3745-32-03 specifically requires that a mitigation plan follow the requirements of 33 CFR Part 332.

The Ohio EPA ephemeral stream mitigation requirements do not address these key features contained in the Federal stream mitigation requirements that the Ohio EPA's own rules require them to follow. Specifically, the ephemeral stream mitigation requires that impacts to ephemeral streams *arbitrarily* be mitigated at ratios of linear feet, that is, 1 foot of impacted ephemeral stream must be replaced with 1.5 feet of ephemeral stream, which the Federal regulations requested that these types of mitigation ratios be phased-out back in 2008. Further, these arbitrary ratio requirements fail to use a watershed approach, fail to address watershed needs and scale, and fail to restore historic aquatic resources.

When using a watershed approach, the primary watershed need for Ohio's watersheds is to replace lost storage and not to replace and expand ephemeral stream length that will convey stormwater runoff more rapidly downstream.

If the Ohio EPA merely followed the watershed scale requirement alone, the cost to mitigate ephemeral streams would be reduced to 1/10th or 1/20th of the current costs. For example, a 1.5-foot wide ephemeral stream relative to a 15-foot wide intermittent or 30-ft wide perennial stream is 1/10th or 1/20th of the area or square footage of streambed (e.g., 1.5 ft/15 ft = 1/10th or 1.5 ft/30 ft = 1/20th). Actual streambed width times length or area of streambed impact must be utilized to compare streams. Thus, the current mitigation bank cost range to mitigate one (1) foot of ephemeral stream would be reduced to $12 to $24 per foot on the low end ($240/10 or $240/20) and to $22 to $44 per foot on the high end ($440/10 or $440/20).

Further, if scale alone was utilized by the Ohio EPA, then the Ohio EPA's perverse incentive for mitigation banks and in-lieu projects to insert negative-functioning/detrimental ephemeral streams into mitigation projects would be significantly diminished and mitigation costs for individual, business or industry impacts to ephemeral streams would similarly be much less punitive. Yet, ephemeral streams should not be mitigated or expanded, but rather replaced with in-stream and off-stream storage features, such as, overland flow or stormwater ponds for which the Ohio EPA provides no mitigation value whatsoever except in the case of off-stream wetlands. In summary, the Ohio EPA mitigation requirements are irrationally punitive for anyone impacting an ephemeral stream and are irrationally supportive of the replacement and expansion of negative-value ephemerals streams. This **MUST** be corrected or the result will be decades of future stream degradation at the hands of the Ohio EPA. Passage of HB 175 is required **NOW**.

Lastly, B&N Coal is a member of the Ohio Coal Association (OCA) that submitted public comments to the Ohio EPA back on or about June 10, 2020 in response to the Ohio EPA's proposed draft Ephemeral Streams General Permit. I am including these OCA public comments in Exhibit 8 to provide these additional concerns and discussion items raised by the OCA regarding the Ohio EPA's Ephemeral Streams General Permit because they were ignored by the OEPA. This document contains an Executive Summary along with nine (9) sections. All 9 sections should be easy to read except for Section 2.0, which contains detailed comments regarding the draft Ephemeral Streams General Permit and would require one to have this permit to properly understand all of the comments. One specific suggestion is to read Section 7.0 beginning in the last paragraph on page 19 and extending to page 20. This discussion is by Ben Goldfarb taken from his book Eager, The Surprising Life of Beavers and Why They Matter (2018). Ben Goldfarb is a writer for *Sierra Magazine*. Also, I have included a list of books, manuals and journal articles in Exhibit 9 that further explain the historic role that beavers have had in our watersheds, as well as, discussion of stream functions and stream mitigation. I am happy to answer any questions. Thank you.

Exhibit 1

Randall L. Keitz, P.E., CFM

Education: B.S. Mining Engineering, Ohio State University, 1984; M.S. Civil Engineering, University of Akron, 1998 with emphasis in hydraulics.

License: Professional Engineer, State of Ohio, (License No. E-57820, 1994).

Certification: Certified Floodplain Manager, (Certification No. US-14-07883, 2014).

Work History:
August 2017 to Present (4½ yrs.), Chief Mine & Water Resources Engineer, B&N Coal, Inc.
June 2015 to June 2017 (2 yrs.), Senior Environmental Engineer, EnviroScience, Inc.
September 1984 to June 2015 (31 yrs.), Ohio Department of Natural Resources (ODNR),

- 18 years – Division of Mineral Resources Management (DMRM).
- 12+ years – Divisions of Soil & Water Resources (DSWR) and Division of Water Sources (DWR) including State Floodplain Engineer for 4 years.

Work Experience: Hydrology & Hydraulics, Sediment Transport, Stormwater Management, Stream Assessment and Restoration, Floodplain Management, Watershed Management, Culvert Design for Aquatic Organism Passage, Stream Regulations (404, 401, ODNR-DMRM), FEMA National Flood Insurance Program, US Fish & Wildlife Service endangered species regulations, Mine Safety & Health Administration (MSHA) regulations, Ohio Historical Preservation Society (SHPO) regulations, Mining Regulation, Abandoned Mine Lands (AML) Reclamation, Geotechnical Engineering, Slope Stability, Mine Permitting and Management, and Mine Layout.

Expert Witness for: Ohio EPA, ODOT, and private cases involving stream, floodplain and stormwater management issues.

Continuing Education Courses: Hydrology and Sedimentology, Stream and Floodplain Hydraulics, Stormwater Management, Water Quality Management, Sediment Transport, Stream Morphology Assessment and Restoration Design, Hydrogeology, Groundwater Monitoring, Geotechnical Engineering Slope Stability, Hydric Soils, OEPA QHEI & HHEI.

Teaching Experience:
Instructed Civil Engineering classes in stream morphology at Univ. of Akron and Cleveland State Univ; Instructed Senior Civil Engineering Capstone Course at University of Mount Union, Adjunct Professor; Developed and presented 0.5- to 5-day short courses for County Soil & Water District (SWCD) staff across Ohio and Professional Engineers in Stormwater & Sediment Erosion Control BMPs, Hydrology & Stormwater Management (TR-55), Pipe, Culvert & Stream Hydraulics, Culvert Design for Sediment Transport & Stream Biology Passage, Grassed Waterway Design, Stream Morphology, Stream Assessment and Restoration Design, Stream Channel Evolution, Floodplain Hydraulics & Management, Watershed Management, Sediment Transport, Plan Preparation, Pond Siting & Construction, Construction Materials and Inspection, Wetland Design, Basic Surveying.

Memberships: National Society of Professional Engineers (NSPE), American Society of Civil Engineers (ASCE), Association of State Floodplain Managers (ASFPM), The Ohio State University Alumni Association.

Hobby: Avid kayaker paddling creeks, streams, rivers (Tuscarawas, Muskingum, Ohio) and lakes (Erie).

Exhibit 2

The Natural Resources Conservation Service (NRCS) formerly known as the Soil Conservation Service (SCS) has completed detailed research and produced numerous guidance documents to objectively quantify surface water hydrology (i.e., including stormwater runoff). One of these guidance documents is their National Engineering Handbook (NEH). NEH Part 630 Hydrology, May 2010, specifically discusses stormwater runoff resistance and runoff velocity in Chapter 15.

In Chapter 15, the NRCS defines overland flow as containing both sheet flow and shallow concentrated flow. Sheet flow begins first near the top of the watershed and generally exists for about 100 feet where flow then transitions into shallow concentrated flow. The NRCS identifies seven (7) shallow concentrated flow conditions ranging from higher runoff resistance with slower runoff velocity (e.g., forest) to lower runoff resistance with higher runoff velocity (e.g., upland gullies). Further, the NRCS has developed equations for the velocity of runoff associated with the various surface resistance or retardance conditions. These conditions and velocity equations are contained in Table 1 below.

TABLE 1			
Shallow Concentrated Flow Condition	**Flow Depth (ft)**	**Manning's n-value**	**Velocity Equation (ft/s)**
Forest with heavy ground litter and hay meadows	0.2	0.202	$V = 2.5(s)^{0.5}$
Minimum tillage cultivation, contour or strip-cropped and woodlands	0.2	0.101	$V = 5.0(s)^{0.5}$
Short-grass pasture	0.2	0.073	$V = 7.0(s)^{0.5}$
Cultivated straight row crops	0.2	0.058	$V = 8.8(s)^{0.5}$
Nearly bare and untilled (overland flow)	0.2	0.051	$V = 10.0(s)^{0.5}$
Grassed Waterways	0.4	0.050	$V = 16.1(s)^{0.5}$
Pavement and small upland gullies	0.2	0.025	$V = 20.3(s)^{0.5}$
			s = slope in ft/ft

Subsequently, the NRCS developed Figure 1 below that graphs the seven (7) shallow concentrated flow equations in Table 1 with the slope (s) variable, in feet per foot (ft/ft), on the y-axis and the velocity solution (V), in feet per second (ft/s), on the x-axis.

Assuming a slope of 10% or 0.10 ft/ft and selecting the three different shallow concentrated flow conditions colored red in Table 1 (i.e., forest with heavy ground litter, short-grass pasture and small upland gullies) the runoff velocity for each condition is as follows:

- Forest with heavy ground litter: V = 0.75 ft/s,
- Short-grass pasture: V = 2.2 ft/s, and
- Small upland gullies: V = 6.5 ft/s.

Thus, Figure 1 makes it easy to discern that as surface resistance or retardance decreases (i.e., from forest to small upland gullies conditions), the runoff velocity increases. Thus, for comparison, the small upland gully condition results in a runoff velocity 3 to 8.5 times faster than short-grass or forest conditions (6.5/2.2 = 3 times, 6.5/0.75 = 8.5 times).

Exhibit 2

As shallow concentrated flow velocity increases, the associated shear stress generated by the faster moving water also increases. This increased shear stress eventually erodes the land surface as its resistance decreases, which results in the formation of erosion gullies.

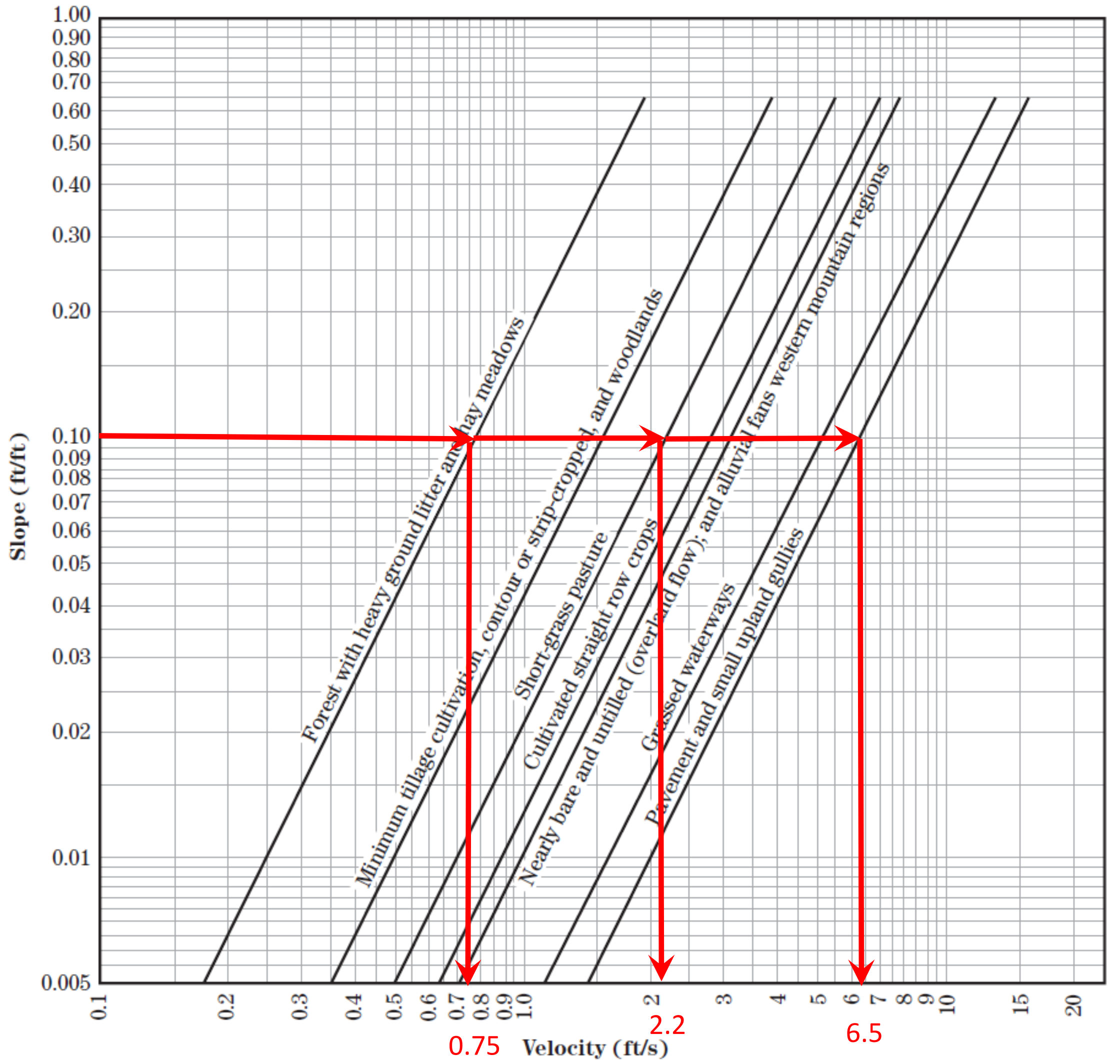


Figure 1 – NRCS graph of shallow concentrated flow equations to determine the runoff velocity, in feet per second (ft/s), given the slope (s), in feet per foot (ft/ft). Runoff resistance decreases as the graphed velocity equations move from left (forest) to the right (small upland gullies).

NRCS discusses that shallow concentrated flow occurs at shallow depths (e.g., 0.1 to 0.5 ft) and beyond that open channel flow occurs. NRCS observes that open channel flow features are generally visible on aerial photographs. Typically, open channels are large enough to be visible on aerial photographs when drainage areas are in the 5- to 8-acre range, but may have smaller and larger drainage areas. Assuming a drainage area of 6.5 acres, the USGS Regional Curve[1] for Region A in Ohio estimates a channel cross-sectional area of 1.55 square feet and erosion gullies have a low width-to-depth (w/d) ratio (e.g., 6:1), and with this information, open channel geometry and flow equations can be used to determine a

Exhibit 2

velocity equation in the same form as the shallow concentrated flow conditions for velocity in Table 1. However, an open channel flow condition has a defined channel and deeper flow than the shallow concentrated conditions. The resulting velocity equation for an open channel erosion gully condition is $V = 38.5(s)^{0.5}$ and this velocity equation is graphed (green line) with the other shallow concentrated flow equations shown in Figure 2. Calculations for this open channel velocity equation is shown in Figure 3.

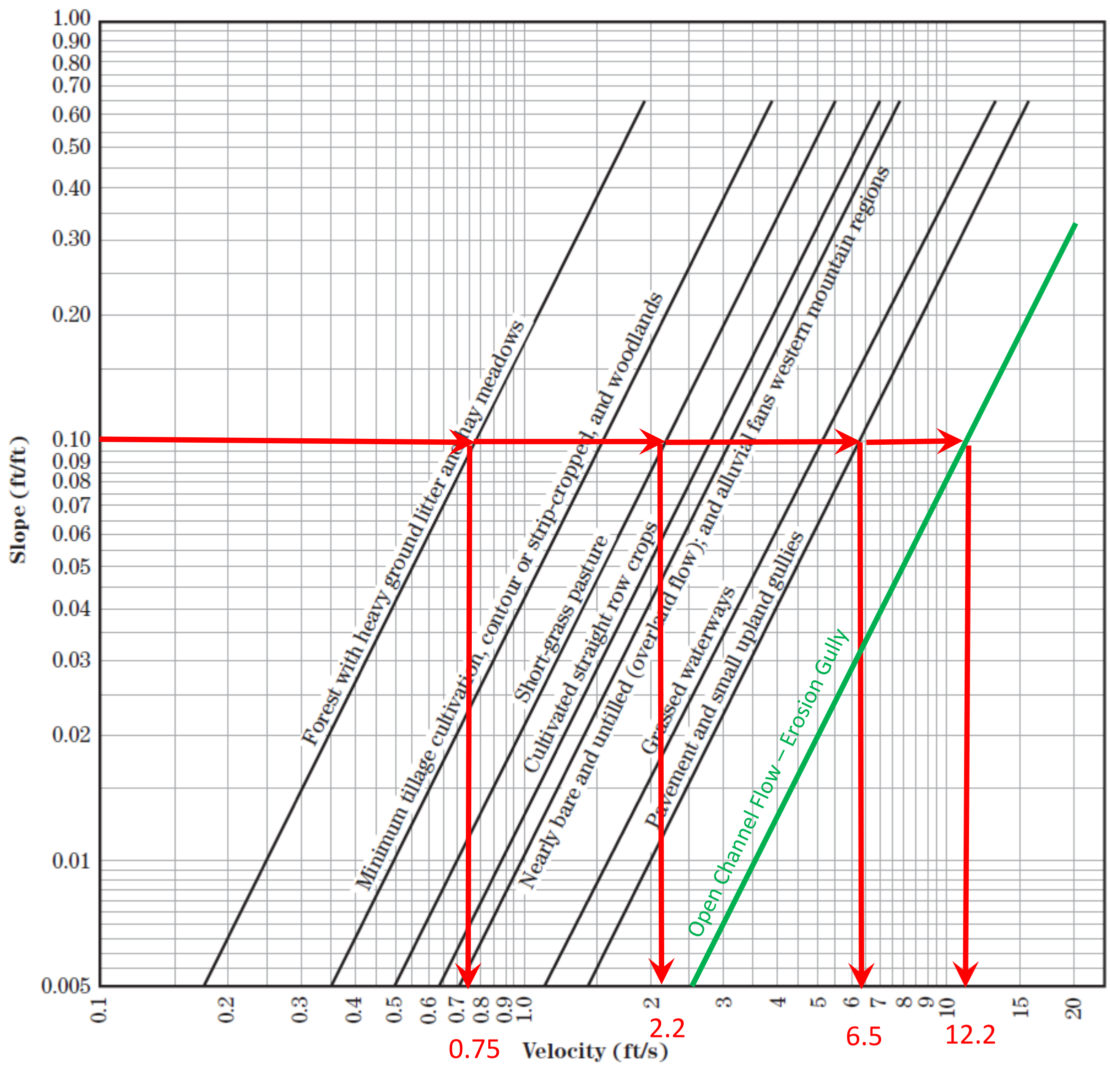
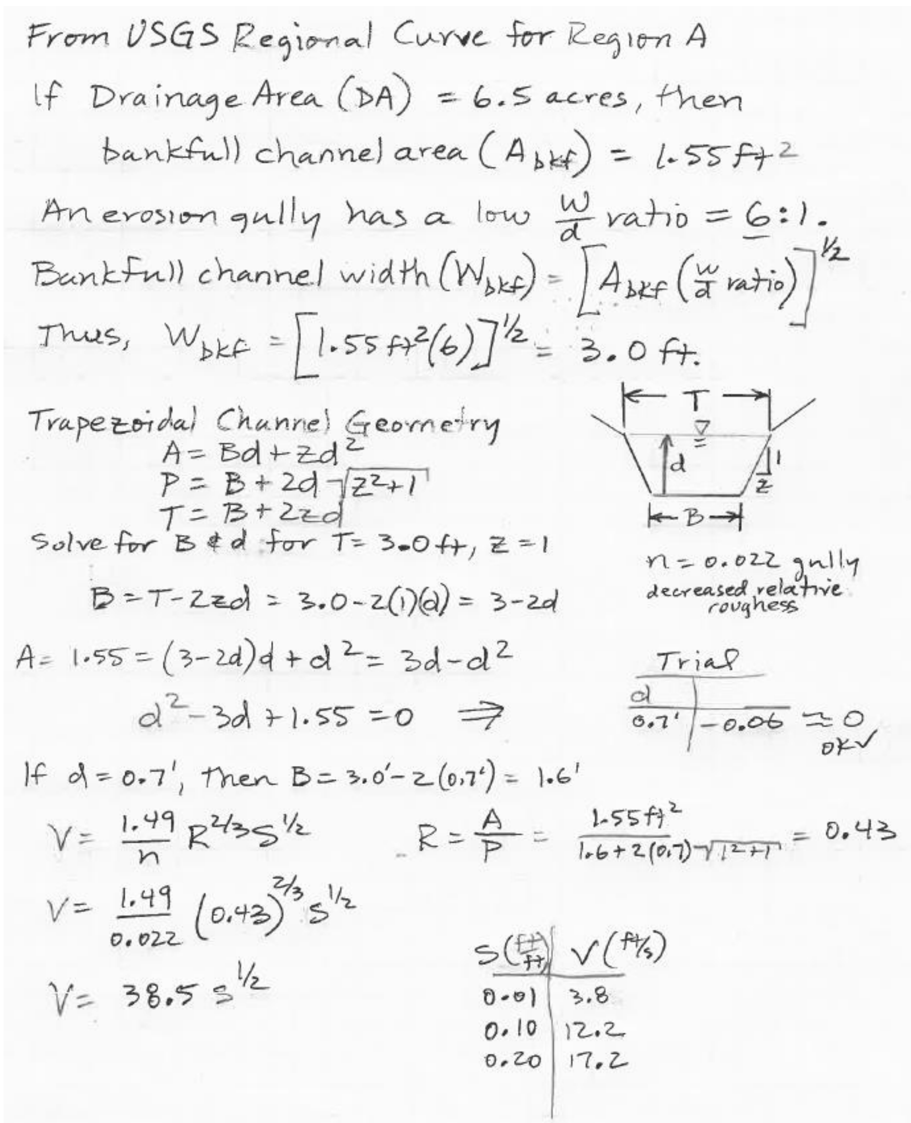


Figure 2 – Open channel flow velocity equation ($V = 38.5(s)^{0.5}$) is added to the NRCS graph of shallow concentrated flow equations to determine the runoff velocity, in feet per second (ft/s), given the slope (s), in feet per foot (ft/ft). The resistance to flow for this erosion gully or ephemeral stream is less than any of the shallow concentrated flow equations and the channel velocity increases to 12.2 ft/s in this example.

[1] Sherwood, J.M., and Huitger, C.A., 2005, *Bankfull Characteristics of Ohio Streams and Their Relationship to Peak Stream-flows*: U.S. Geological Survey Scientific Investigations Report 2005-5153, 38 p.

Exhibit 2

Thus, observing the velocity results in Figure 2 (i.e., 0.75, 2.2, 6.5 and 12.2 ft/second) it is shown that as ephemeral streams form, the conveyance of stormwater runoff to the downstream channels and waters increases rapidly and potentially 8.5 to 16 times more rapid (6.5/0.75 = 8.5 times, 12.2/0.75 = 16 times). This significant velocity increase demonstrates that ephemeral streams do not store water, sediment or nutrients. In comparison, a stormwater pond constructed following the Ohio EPA Construction Activity General Permit is required to capture and slowly release stormwater over at least a 2-day period. Thus, stormwater ponds can tremendously slow down and delay stormwater runoff for days, as well as, store sediment and nutrients rather than conveying them rapidly downstream, in minutes, in the case of ephemeral streams, which leads to more channel erosion and sedimentation, increased flooding, algal blooms and other consequences listed in Table 1 of my written testimony.



From USGS Regional Curve for Region A

If Drainage Area (DA) = 6.5 acres, then

bankfull channel area (A_{bkf}) = 1.55 ft²

An erosion gully has a low $\frac{w}{d}$ ratio = 6:1.

Bankfull channel width $(W_{bkf}) = \left[A_{bkf}\left(\frac{w}{d}\text{ ratio}\right)\right]^{1/2}$

Thus, $W_{bkf} = \left[1.55\ ft^2(6)\right]^{1/2} = 3.0$ ft.

Trapezoidal Channel Geometry

$A = Bd + zd^2$

$P = B + 2d\sqrt{z^2+1}$

$T = B + 2zd$

Solve for B & d for T = 3.0 ft, z = 1

$B = T - 2zd = 3.0 - 2(1)(d) = 3 - 2d$

$A = 1.55 = (3-2d)d + d^2 = 3d - d^2$

$d^2 - 3d + 1.55 = 0 \Rightarrow$

n = 0.022 gully

decreased relative roughness

Trial

d	
0.7'	−0.06 ≃ 0 OK✓

If d = 0.7', then B = 3.0' − 2(0.7') = 1.6'

$V = \frac{1.49}{n} R^{2/3} S^{1/2}$ $\quad R = \frac{A}{P} = \frac{1.55\ ft^2}{1.6 + 2(0.7)\sqrt{1^2+1}} = 0.43$

$V = \frac{1.49}{0.022}(0.43)^{2/3} S^{1/2}$

$V = 38.5\ S^{1/2}$

S (ft/ft)	V (ft/s)
0.01	3.8
0.10	12.2
0.20	17.2

Figure 3 – Hand calculations to develop 6.5 acre drainage area erosion gully velocity equation graphed (green) in Figure 2.

Exhibit 3

Stream Physical Integrity Processes and Assessment

The *objective* of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.

As the objective indicates, an assessment of stream physical integrity must be performed in addition to a chemical and biological integrity assessment in order to maintain and restore the Nation's waters.

As described by Asmus, B., et al. (2009), physical integrity is the result of the interaction of surface water hydrologic and stream geomorphic processes. The surface water hydrologic condition is most often represented by a flow-duration curve as shown in Figure 1 below. However, increases in the surface water runoff volumes and peak flows due to land use changes will shift the flow-duration curve up and to the right. This shift up and to the right in the flow-duration curve (i.e., more stream power) will concomitantly change the stream geomorphic condition or physical integrity (i.e., channel cross-section dimensions, profile and pattern) by creating an *imbalance* in sediment transport processes. This imbalance directly leads to degradation of a stream's geomorphic condition or physical integrity (Hey, R., 2003).

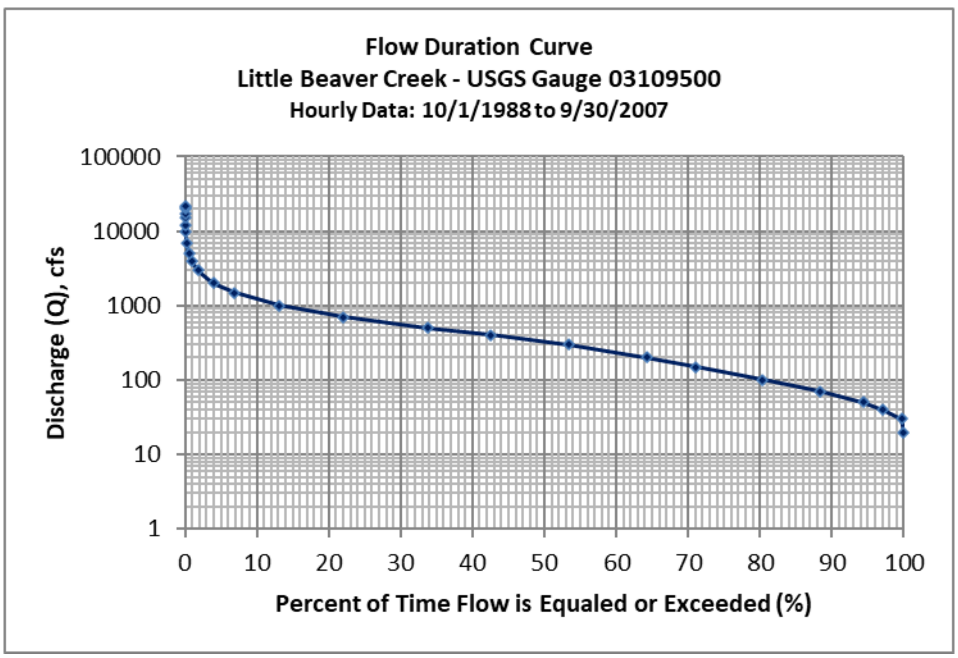


Figure 1 – Example flow duration curve for Little Beaver Creek, Columbiana County, Ohio.

Stream power is the power available for stream flow to transport a sediment load, and it may be defined as γQS, where γ is the specific weight of water, Q is the stream discharge, and S is channel slope (Bull, W., 1979). Stream discharge (Q) over time is represented by the flow-duration curve (e.g., Figure 1).

Increases in surface water runoff due to land use changes that shift the flow-duration curve up and to the right may be more easily understood in Figure 2 below, which compares surface water runoff volumes and peak flows from an 'undisturbed' or pre-development condition to a 'disturbed' or post-development condition. The area underneath the pre- and post-development curves (stream flow x time) represents the total volume of runoff for the time period. A certain flow rate or discharge will fill a channel to a flow depth that initiates sediment transport. This flow depth is roughly about 50% of the bankfull channel depth, and this sediment transport threshold is referred to as the critical discharge (Q_*) as shown in Figure 2. The subsequent increase in runoff volume and peak flows will create an imbalance in the stream sediment transport rates, which leads to channel degradation (i.e., degradation of the physical integrity of the stream channel), unless mitigated. Mitigation involves capturing and storing stormwater runoff in basins and releasing the captured portion of the runoff slowly below the critical discharge (Q_*) threshold. This reduces stream power or shifts the flow duration curve down and to the left (refer to Figure 1).

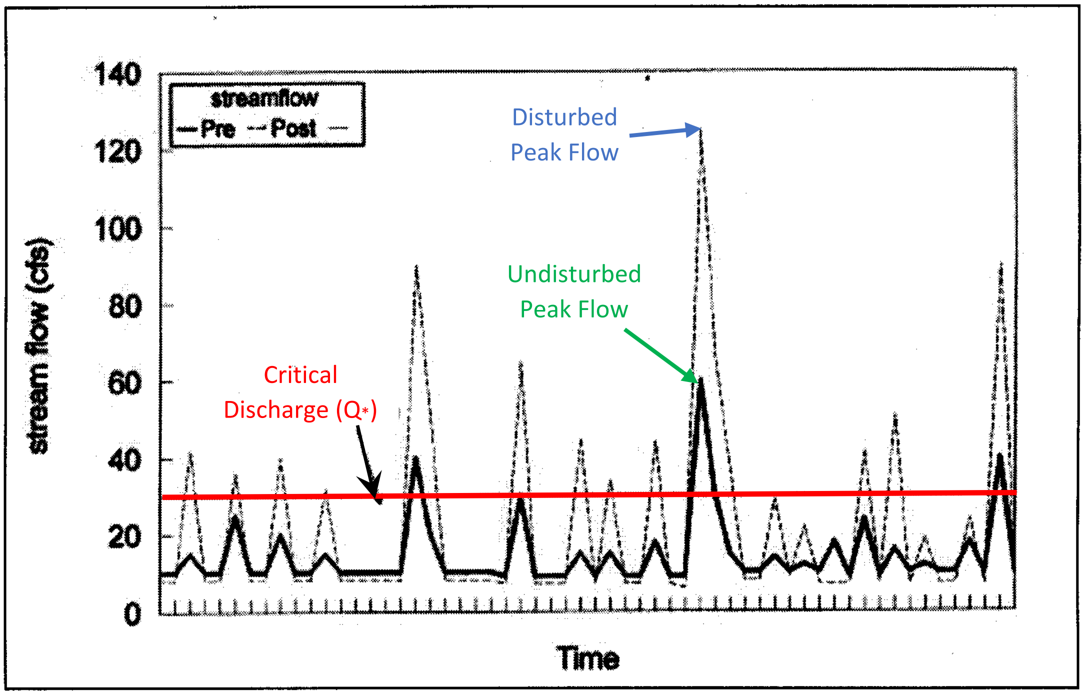


Figure 2 – Pre- and post-development flow-duration curves shown in a manner that represents the relative increase in peak flow for an 'undisturbed' as compared to the 'disturbed' condition, and shows the relative increase in flows greater than the critical discharge (Q_*) or increase in stream power.

As described by D. Rosgen (1996), natural channel stability is achieved by allowing the stream to develop a stable cross-section, profile and pattern, such that, over time, channel features are maintained and the stream neither aggrades (fills up) nor degrades (incision).

A stream that has natural geomorphic stability will just fill the channel to the bankfull stage and this discharge is referred to as the bankfull discharge (Q_{bkf}). The bankfull discharge corresponds to the discharge at which channel maintenance is the most effective. Thus, the bankfull channel discharge (Q_{bkf}) is considered to be the *effective discharge* (Q_{eff}) (Rosgen, 1996).

An effective discharge analysis is shown graphically in Figure 3 and is performed by integrating the flow duration curve (B) and sediment transport curve (A) at a specific stream location to produce the effective discharge curve (C). The effective discharge (Q_{eff}) occurs at the peak of the effective discharge curve (C), which, as discussed, is the bankfull channel flow (Q_{bkf}) for streams with a stable geomorphic condition (Rosgen, 1996).

Exhibit 3

If land use changes occur and the stormwater runoff is not controlled properly by stormwater best management practices (BMPs), then the flow-duration curve will increase or shift up and to the right as described by curve B' in Figure 4. This change in the flow-duration curve increases and shifts the effective discharge curve C to the right to position C', which results in the effective discharge increasing (i.e., it increases from Q_{eff1} to Q_{eff2} as shown in Figure 4) (Beyerlein, D., 2005). This change in effective discharge will also result in the stream channel cross-sectional area concomitantly increasing through erosion to accommodate the larger effective discharge (Q_{eff2}) and simultaneously changing the stream pattern and profile. However, the erosional transition to a larger channel cross-sectional area results in an imbalance in the sediment transport rate that leads to unstable geomorphic conditions (e.g., channel bed incision). Thus, it is critical for stormwater BMPs to be properly designed to maintain the flow-duration curve at its current position or shift it down and to the left (i.e., decrease stream power) (Beyerlein, D., 2005). Therefore, a primary goal of stormwater management through the use of stormwater BMPs is to maintain or reduce the stream power so that post-development runoff conditions produce the same or less stream power than the pre-development runoff conditions in order to maintain the physical integrity of the Nation's waters as required by the CWA (Beyerlein, D., 2005 and Hawley, B., 2015).

When a geomorphically stable stream is impacted by a change in surface water hydrology (i.e., the flow-duration curve shifts up and to the right), channels with gradients greater than 2% will most always degrade by channel bed erosion (incision), because the increased flows from the watershed provide excess stream power or sediment transport capacity to erode the stream bed and banks (Bull, W., 1979). The incision creates a knickpoint that advances the channel erosion in the upstream direction (headwards), which further increases the sediment supply to the downstream channels. As the channel bed continues to incise headwards through erosional processes, the streambanks become more unstable and sediment supply is increased even more. Eventually, the downstream channel capacity is over-whelmed by the imbalance created by the upstream excess sediment supply and the downstream channels aggrade, which results in pools filled and riffles smothered by the excess sediment load (i.e., stream habitat for aquatic life is significantly degraded).

Exhibit 3

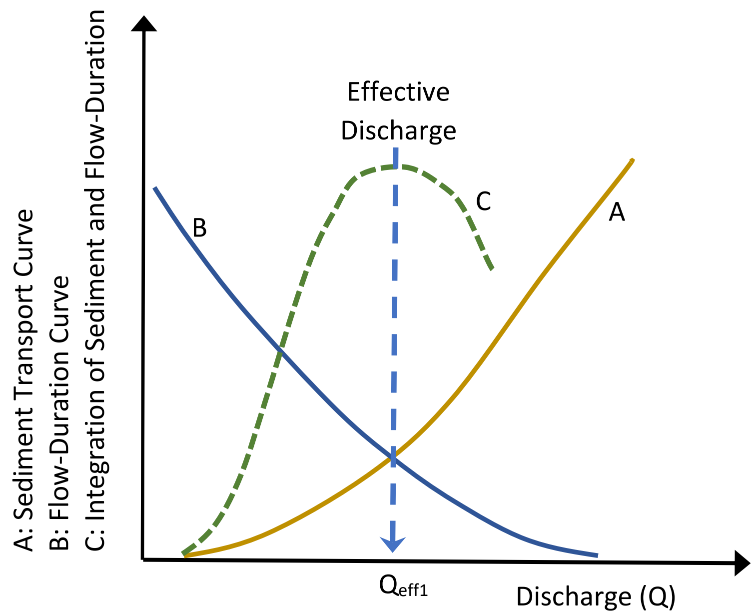


Figure 3 – Integration of flow-duration curve B and sediment transport curve A produces the effective discharge curve C and the peak of this curve is the effective discharge (Q_{eff}), which is the bankfull discharge associated with the stable geomorphic condition (Rosgen, 1996).

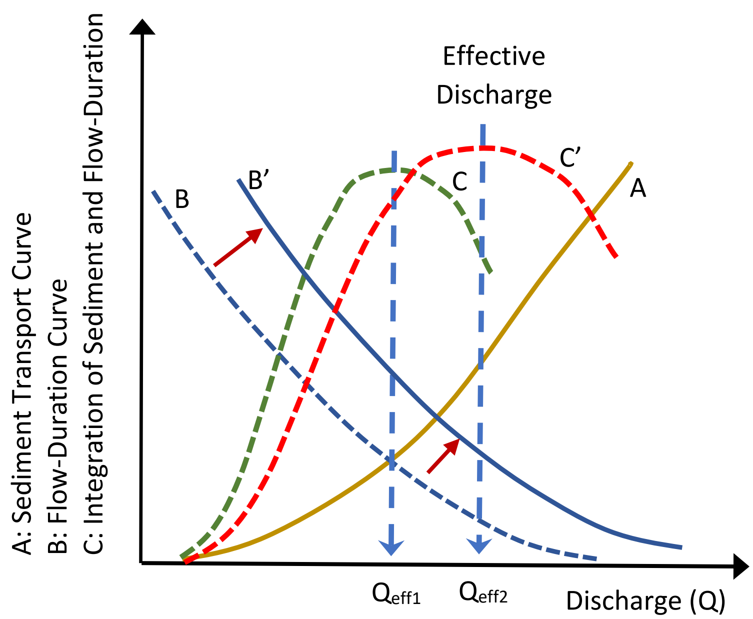


Figure 4 – If land use change is not controlled with proper stormwater BMPs, then the flow-duration curve will shift to the right (B to B’), which results in a larger effective discharge (Q_{eff2}) due to the effective discharge curve moving from C to C’. The channel adjusts to this change in effective discharge through erosional processes creating unstable geomorphic conditions (Rosgen, 1996).

Exhibit 3

The channel structure or geomorphic condition of the stream channel provides the habitat or 'homes' for aquatic life. When a stream channel is geomorphically stable, the stream structure provides the best potential habitat for aquatic life. As stream channel structure is degraded and the channel becomes geomorphically unstable through either incision or aggradation, the channel habitat is simultaneously degraded making the 'homes' for aquatic life less hospitable and more difficult to remain or survive within. Therefore, the quality of stream channel habitat for aquatic life is a direct by-product or result of the interaction between surface water hydrologic (hydrology) and stream geomorphic processes (geomorphology) as described in the diagram in Figure 5 below (Asmus, et al., 2009). If the stream structure is not maintained in a stable geomorphic condition, then aquatic life will be directly and adversely impacted (Sullivan, et al., 2009).

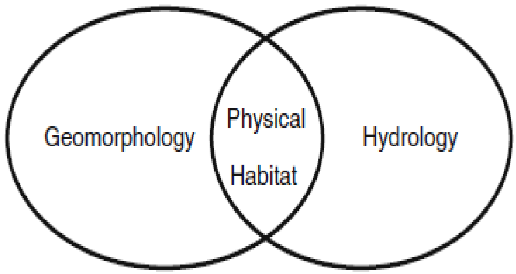


Figure 5 – Stream physical habitat is determined by the interaction between surface water hydrologic (Hydrology) and stream geomorphic processes (Geomorphology) and the quality of this habitat is dependent on the resultant stream geomorphic condition (Asmus, B., et al., 2009).

In conclusion, the physical integrity of streams requires an assessment of the surface water hydrologic (hydrology) and stream geomorphic processes (geomorphology) by evaluating the stream geomorphic condition or physical integrity to determine the quality of the channel structure and stream geomorphic processes that produce the habitat for aquatic life in the stream channel. The stream channel structure and the resultant habitat is the by-product of the interaction between the surface water hydrologic and stream morphologic processes.

References:

1. Asmus, Brenda, Joseph Magner, Bruce Vondracek, and Jim Perry, *Physical Integrity: the missing link in biologic monitoring and TMDLs*, Environmental Monitoring Assessment, 159:443-463, 2009.
2. Hey, Richard, *Natural Rivers: Mechanisms, Morphology and Management*, Short Course at Asheville, NC, School of Environmental Sciences, University of East Anglia, Norwich, UK, 2003.
3. Bull, William, *Threshold of Critical Power in Streams*, Geological Society of America Bulletin, Part I, V. 90, p. 453-464, May 1979.
4. Rosgen, Dave, Applied River Morphology, Wildland Hydrology, Pagosa Springs, CO, 1996.
5. Beyerlein, Douglass, *Flow Duration-Based Stormwater Mitigation Modeling* (Western Washington Hydrology Model), Stormwater Magazine, 2005.
6. Hawley, Robert, and Nora Korth, *Stormwater Design 301: Practical Approaches to Protect Streams from Erosion*, Ohio Stormwater Conference Presentation, Sustainable Streams, LLC, May 8, 2015.
7. Sullivan, S.M.P. and M.C. Watzin, *Stream-floodplain connectivity and fish Assemblage Diversity in the Champlain Valley, Vermont, U.S.A.*, Journal of Fish Biology, Vol. 74, pp 1394 – 1418, 2009.

Exhibit 4

H2Ohio Phosphorus Reduction Impact

Soil testing: Testing results give farmers information on where to place fertilizer and fertilizer application rate.

Variable-rate fertilization: Applying specific fertilizer levels based on the need of each sub-acre to reduce fertilizer application without risk of losing yield.

Subsurface nutrient application: Applying specific fertilizer below the surface to reduce nutrient loss.

Manure incorporation: Mixing manure into the soil to keep it in place and minimize nutrient loss.

Conservation crop rotation: Planting certain crops that reduce erosion and enrich the soil thus reducing runoff and sediment delivery.

Cover crops: When planted after the main harvest, cover crops reduce erosion, hold nutrients in the soil, and improve soil health.

Drainage water management: Slowing down runoff to give phosphorus more time to settle back in the soil.

Two-stage ditch construction: Creating modified drainage ditches to slow water flow and allow the phosphorus to settle.

Edge-of-field buffers: When trees, shrubs or strips of grass are planted along farm fields in the right place, the plants hold on to phosphorus and prevent its release into the water.

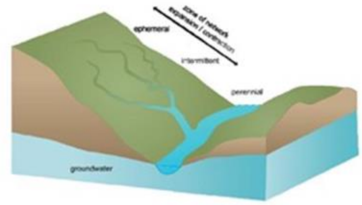
Wetlands: Wetland vegetation and soils absorb phosphorus, slow down the movement of water, offer a natural filtering process, and allow phosphorus to settle.

Exhibit 5

Slide 5 of 26 from OEPA’s May 7, 2020 3:00 p.m. Ephemeral Streams online Webinar.

Function of Ephemeral Streams and Isolated Wetlands

- > 36k miles of ephemeral streams throughout Ohio:
  - help control run-off and erosion;
  - reduce flooding potential; and
  - help filter pollutants



- Isolated wetlands also have important functions in water management, nutrient retention and supporting wildlife habitat

Ohio
Ohio Environmental Protection Agency

Exhibit 6

Responses to the Ohio EPA's HB 175 Testimony Statements regarding the Functions and Benefits of Ephemeral Streams

Statement 1. Providing storage capacity during rain events.

> Response: Disagree. Ephemeral streams provide little to no storage during a storm event. Rather they create the pathways for water to quickly run off the land (i.e., increase flow velocity) and have excess energy to continue erosional processes (i.e., excess stream power). Their watersheds are typically small, are located in steeper terrain, and have channel gradients greater than 2%, and thus, have no floodplains and limited floodprone area to store water, which is necessary to create a measurable storage effect. Muskingum routing methods provide the procedure to evaluate the storage effect from in-channel and floodplain or floodprone area storage. These methods demonstrate that steeper gradient streams with limited floodprone area produce a negligible storage effect.

Statement 2. Carrying water flow during rain events.

> Response: Agree, but this produces negative rather than beneficial functions. That is, ephemeral streams create the pathways for water to quickly run off the land which leads to downstream channel erosion, flooding and rapid conveyance of pollutants, such as, nitrogen and phosphorus, to downstream water bodies directly contributing to eutrophication (algal blooms).

Statement 3. Capturing and filtering contaminants such as total suspended solids, nitrogen, and phosphorus.

> Response: Disagree. A more common name for total suspended solids is silts & clays, which are particle sizes that cannot be seen by the un-aided eye. Pollutants, such as, nitrogen and phosphorus dominantly attach to silts & clays. Once silts & clays are eroded and transported within moving water, these fine particles will not settle until the flowing water reaches a quiescent body of water (e.g., pond or lake) or become stored on a broad floodplain, which is associated with larger, low-gradient streams, during a flood event. Ephemeral streams/erosion gullies do not settle and/or capture and store silt & clays because the rapidly flowing water in ephemeral stream is turbulent (fast moving) and not quiescent (ponded). Thus, ephemeral do not capture or filter contaminants, but rather rapidly convey silts & clays containing contaminants downstream.

Statement 4. Contributing to the biology and ecology of areas through: providing organically available material for macroinvertebrates and creating habitats areas.

> Response: Disagree. Stream biology does not effectively exist in ephemeral streams because they do not contain or store water except for brief periods during a precipitation or snow melt event. Additionally, terrestrial and avian wildlife (e.g., deer, racoons, birds, bats, insects, amphibians, reptiles, etc.) as well as aquatic life do not remain or stay in a dry stream, that is, they look for water sources, such as, ponds and streams containing water. Dr. David Allan, PhD, a nationally recognize biologist at the University of Michigan, states in his text book *Stream Ecology* that riverine geomorphological features (e.g., beaver dams and similarly constructed structures) and debris dams act as important retention devices, counteracting the tendency for export to dominate the fate of organic matter in flowing water. These obstructions clearly play a

significant role in ecosystem function, allowing organic matter to accumulate. This enhances ecosystem processing relative to downstream export (i.e., counteracts ephemeral stream export processes). In the absence of retention devices, the stream functions more like a pipe, allowing inputs to be flushed from the system. Further, ephemeral streams lead to increased downstream peak flows that directly erode downstream channels, and thus, degrading habitat areas rather than creating habitat areas.

Statement 5. Providing for surface and ground water interaction and recharge of ground water.

Response: Disagree. Ephemeral streams are narrow (e.g., a few inches to maybe a few feet wide) and thus have very little areal extent, only convey water during storm events and are otherwise dry, and thus, they contain minimal area and no hydraulic head to drive water into the ground to create recharge. The Darcy equation (Q = kia) that is used to estimate flow or infiltration into finer material requires area (acres) and hydraulic head (feet of water) and time (days, months, years) to promote groundwater recharge. Since ephemeral streams have tiny area (a few inches wide), flow at shallow depths (inches), and flow rapidly disappears after a storm event (minutes), they do not contain these three fundamental requirements (area, depth and time) to promote groundwater recharge. In comparison, stormwater ponds placed in ephemeral streams do provide for large area (acres of ponded water) and hydraulic head (feet of ponded water) and time (months and years) that are necessary to promote groundwater recharge.

Statement 6. Lower temperature downstream.

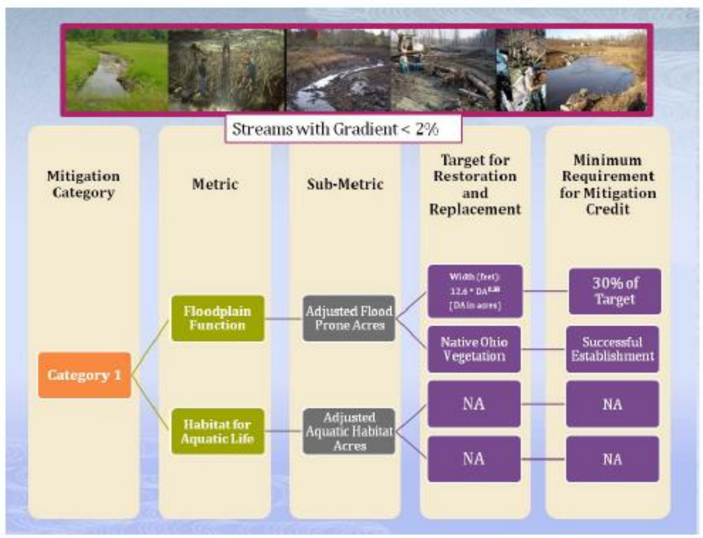
Response: Disagree. Ephemeral streams convey stormwater quickly off the land; thus, the temperature of the stormwater they convey would generally be near the temperature of the rainwater. However, during summer storm events, rainfall will land on very warm surfaces, such as, rooftops and asphalt parking lots and roads that quickly warm the stormwater runoff. Thus, these conditions would be expected to warm downstream flow temperatures. Conversely, stormwater ponds produce significant groundwater recharge and this water is cooled as it moves through subsurface aquifers and then drains back into the downstream channels. Additionally, stormwater ponds designed to slowly release stormwater can convert ephemeral and intermittent streams into perennial or near perennial streams and diversify habitat by lengthening and expanding the availability of water, which increases available in-stream and ponded aquatic habitat area for aquatic life and for terrestrial and avian wildlife.

Exhibit 7

February 2010

Ohio Environmental Protection Agency

Compensatory Mitigation Requirements for Stream Impacts in the State of Ohio (Revision 5.0)



Interested Party Review Draft

Ted Strickland, Governor
Lee Fisher, Lt. Governor
Chris Korleski, Director

Exhibit 7

Acknowledgements

This document was written by Paul Anderson, Ohio EPA Division of Surface Water, Northeast District Office. The concepts regarding the use of flood prone area within the tiered mitigation model were conceived and developed by Dan Mecklenburg of the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation (DSWC). Laura Fay (ODNR, DSWC) and Randy Keitz (ODNR, Division of Mineral Resources Management) also assisted greatly in the development of this concept. The assistance of Dan Ross (Natural Resources Conservation Service), Joan Hug-Anderson Summit Soil and Water Conservation District), James Bissell (Cleveland Museum of Natural History), and Dr. Charles Goebel (The Ohio State University) is also especially acknowledged. In addition, this project could not have been completed without the assistance of many colleagues and stakeholders whose contributions are also acknowledged.

Several Ohio EPA personnel contributed to the formulation and completion of this document and are acknowledged for the time, resources, and energy they provided:

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Mick Miccachion
Greg Orr
Erin Sherer
Dave Stroud
Roger Thoma (retired)
Steve Tuckerman (retired)
Scott Winkler
Bill Zawiski

Exhibit 7

To minimize delays and objections during the permit and Water Quality Certification review process, applicants are encouraged to seek the advice of resource and regulatory agencies during the planning and design of mitigation plans. For restoration or stream relocation proposals and other complex mitigation projects, such consultation may improve the likelihood of mitigation success and reduce permit processing time. Furthermore, applicants should typically seek advice from consultants on complicated mitigation projects.

1.3. Mitigation Categories [OAC 3745-1-56 (B)]

The stream mitigation rule (OAC Rule 3745-1-56) defines four "mitigation categories" that serve as the basis for the development of tiered mitigation goals and requirements. The mitigation categories are based upon aquatic life beneficial uses and antidegradation categories, as defined in OAC Rules 3745-1-05 and 3745-1-07. Mitigation requirements and antidegradation considerations for review of applications for 401 Water Quality Certifications are based upon the mitigation category for the stream in question. It should be noted that in many instances, a stream that is subject to a 401 Water Quality Certification review will not be specifically designated with an aquatic life use, and that a use attainability analysis will be required in order to properly assign the stream to a mitigation category.

1.3.1. Mitigation Category 1 [OAC 3745-1-56 (B)(1)]

Mitigation Category 1 includes the following aquatic life uses:

(a) Limited resource water, acid mine drainage where qualitative habitat evaluation index (QHEI) scores representative of the impacted stream segment are found to be less than forty[2];

(b) Limited resource water, small drainageway maintenance;

(c) Other limited resource water designated streams listed under the provisions of rule 3745-1-07 of the Administrative Code;

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[2] The following comment is included in OAC Rule 3745-1-56 (B)(1)(a) regarding acid mine drainage streams: "Although streams that cannot meet the biological water quality criteria found in rule 3745-1-43 of the Administrative Code because of the effects of acid mine drainage may be designated as limited resource water, many of these streams may have the capacity to recover when and if the chemical pollutant source or sources are treated or eliminated. Acid mine drainage streams with adequate habitat quality (QHEI scores greater than or equal to forty) are placed into a higher mitigation category in order to not preclude restoration of these streams."

Exhibit 7

(d) Class I primary headwater habitat; or

(e) Modified primary headwater habitat stream (regardless of class).

Aquatic life uses listed under Mitigation Category 1 are all considered Limited Quality Waters under OAC 3745-1-05, and have no potential to meet any of the ecological expectations for General High Quality Waters. Streams that fall within this category typically have ephemeral flow or exist only because they are constructed drainage conveyances. The services provided by these streams are overwhelmingly related to their affect on downstream water quality. These services include hydrologic storage and flow moderation, sediment transport processes, and pollutant assimilation. Mitigation goals for replacement, enhancement, or restoration for these stream types relate to physical stability and flood prone area functions. These streams provide no habitat for well balanced communities of aquatic organisms defined within Ohio's biological water quality criteria. Therefore, replacement of a defined stream channel is not a requirement for mitigation of Mitigation Category 1 streams.

1.3.2. Mitigation Category 2 [OAC 3745-1-56 (B)(2)]

Mitigation Category 2 includes the following aquatic life uses:

(a) Modified warmwater habitat (MWH);

(b) Limited resource water (LRW), acid mine drainage where QHEI scores representative of the impacted stream segment are found to be greater than or equal to forty; or

(c) Class II primary headwater habitat (Class II PHWH).

Aquatic life uses listed under Mitigation Category 2 are also considered to be Limited Quality Waters in the antidegradation rule. However, unlike Mitigation Category 1 uses, streams within Mitigation Category 2 do have definable aquatic life expectations and/or can be considered to have an aquatic life restoration potential. This aquatic life potential is lower than the expectations for Mitigation Category 3 streams, and is limited based upon either historic modifications to the stream that are considered to be permanent or of long duration (LRW and MWH uses), or because of natural conditions (Class II PHWH). Therefore, the mitigation goals for streams in Mitigation Category 2 relate both to their influence on downstream water quality as well as expectations (albeit lowered) for aquatic life community integrity.

Data from Ohio EPA surveys has found that the aquatic communities present in Mitigation Category 2 stream types are extremely resilient to perturbation once a stream channel has stabilized. Organisms inhabiting these stream types tend to be adapted to recover quickly from perturbations such as canopy removal, higher water temperatures,

Exhibit 8

Ohio Coal Association

Public Comments

For the OEPA draft General Permit
for Impacts to Ephemeral Streams and Isolated Wetlands

June 10, 2020

Executive Summary

The OEPA's draft *General Permit for Impacts to Ephemeral Streams and Isolated Wetlands*, which adds ephemeral streams to an existing isolated wetlands permit, irrationally and arbitrarily creates ephemeral stream impact assessment and restoration/mitigation criteria that fails to follow long established norms for stream impact assessment and stream restoration/mitigation. This irrational and arbitrary ephemeral stream assessment and restoration/mitigation criteria will directly result in more degraded streams, increased flooding and degraded water quality throughout Ohio.

Long established norms for stream impact assessment and restoration/mitigation criteria were founded in the 2008 Federal Compensatory Mitigation Rules that were contained in Federal Register dated April 10, 2008 and entitled *Compensatory Mitigation Losses for Aquatic Resources* (33 CFR Part 332). These established norms have a primary focus on assessing and restoring aquatic resource functions and services and not arbitrarily on replacing linear feet or ratios of linear feet of stream impacted. Additionally, these norms require a watershed approach that address watershed needs (current and historic) and watershed scale. Additionally, these norms establish that *restoration* address the physical, chemical and biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource (§332.2).

The OEPA's Section 401 water quality certification rules located in O.A.C. 3745-32-03 discusses in subsection (B)(2)(d) that a specific and detailed mitigation plan prepared in accordance with the requirements of 33 CFR Part 332 is required. It is understood that OEPA's draft General Permit for Ephemeral Streams is outside or not subject to Section 404 or 401 of the Clean Water Act, but it is not understandable why the OEPA chose to abandon these long established stream assessment and restoration/mitigation norms to create irrational and arbitrary ephemeral stream assessment and restoration/mitigation criteria without any explanation. Further, given that a broad group of Ohio stakeholders including the ODOT, ODNR and even the OEPA have been opposing similar irrational and arbitrary stream impact assessment and restoration/mitigation criteria that the USACE Huntington District has been attempting to impose on Ohio for over 2 years with a primary stakeholder complaint that the Huntington District failed to involve stakeholders in the criteria development process, it seems incomprehensible that the OEPA would do the same thing and not reach-out to Ohio stakeholders to assist in the development of a new ephemeral stream permit.

The new Waters of the United States (WOTUS) definitions, which eliminated Federal regulation of ephemeral streams, was signed and announced on January 23, 2020; thus, the OEPA new at that time a new ephemeral streams permit would be required given that ephemeral streams are defined as Waters of the State. The OEPA had more than sufficient time to reach-out to stakeholders and involve them in the development process for a new OEPA ephemeral streams permit to make sure the permit was logical and rational. But the OEPA delayed their out-reach to stakeholders until May 7, 2020 when it provided a brief webinar to stakeholders unveiling the OEPA in-house developed General Permit for Ephemeral Streams concepts. Then the OEPA quickly announced a 30-day public comment period beginning May 18, 2020 that expires on June 17, 2020 with implementation of the new General Permit for Ephemeral Streams planned for June 22, 2020 that will coincide with the effective date of the new WOTUS definitions. This is lack of involving stakeholders in the permit development process is serious negligence on the part of the OEPA.

After reviewing the draft General Permit for Ephemeral Streams and providing extensive comments, the OCA provides the following summary list of issues and problems with this draft General Permit:

1. Ephemeral stream functions and services are not assessed for stream impacts or for restored/mitigated streams.

2. An objective and quantitative geomorphic condition assessment is not used to assess ephemeral streams prior to impact nor after restoration/mitigation, which is necessary to determine the degree of stream functioning (e.g., 10%-, 50%-, 100%-functioning) and to know whether a stream is geomorphically stable, unstable or in some degree of instability.

3. A watershed approach for restoration/mitigation is not used, which is required to determine watershed needs.

4. The failure to use a watershed approach to determine watershed needs arbitrarily results in all ephemeral stream impacts to be restored or mitigated with the same and/or additional ephemeral stream length being developed (1:1 or 1.5:1) rather than creating more storage, which is the primary watershed need in watersheds across Ohio when using a watershed approach.

5. Requiring ephemeral streams to be restored/mitigated at ratios of 1:1 or 1.5.1 will directly result in, but not limited to, following consequences:
   - Increased stormwater peak flows;
   - Degraded (incised) streams;
   - Increased streambank erosion;
   - Increased downstream flooding;
   - Degraded water quality;
   - Degraded in-stream and floodprone area habitat;
   - Drained watersheds (creates the aquatic dust bowl);
   - Less water for wildlife;
   - Less habitat diversity;
   - Reduced base flows to maintain intermittent or perennial streams;
   - Rapidly transports nutrients downstream like in a pipe; and,
   - Increased eutrophication potential of water bodies like Lake Erie, the Ohio River and other water bodies.

6. A watershed approach that addresses watershed needs (storage) requires less ephemeral stream length and more in-stream storage, which will result in, but not limited to, the following benefits:
   - Decreased or smaller peak flows;
   - Reduced or prevented stream degradation;
   - Reduced or prevented stream bank erosion;
   - Reduced sediment in streams;
   - Decreased downstream flooding;
   - Improved water quality;
   - Reduced or prevented in-stream and floodplain habitat degradation;

- Reduced or prevented draining of watersheds (no aquatic dust bowl);
- Increased water availability for wildlife;
- Increased habitat diversity;
- Extended base flows resulting in more intermittent and perennial streams;
- Delays (stores) and reduces downstream transport of nutrients; and,
- Reduced eutrophication potential for Lake Erie, Ohio River and other water bodies.

7. Rather than using objective and quantitative geomorphic condition (physical integrity) assessments to evaluate stream physical integrity, *subjective* and *qualitative* habitat assessments (QHEI and HHEI) are required, which cannot evaluate stream functioning (geomorphic condition) nor address watershed needs (storage) and this leads to irrational and arbitrary opinions of success or failure for stream restoration/mitigation. In other words, there are no standards for which to assess the physical integrity of streams that may be impacted or restored/mitigated.

8. The HHEI contains a fatal flaw because the HHEI cannot distinguish between geomorphically stable or unstable streams and evaluates all streams as if they are geomorphically stable (100%-functioning). This leads to geomorphically degraded streams including ephemeral streams, to be greatly over-rated in value and improperly restored with too large of substrate to achieve a higher HHEI score. Given that most headwater streams in Ohio including ephemeral streams are geomorphically degraded, this is a severe problem.

9. The QHEI and HHEI habitat assessments are founded in the River Continuum Concept that implies streams must be single-thread from headwaters to the mouth of streams, which is a falsehood.

10. Stream physical integrity assessments require both an assessment of hydrology and stream geomorphic condition, which addresses watershed needs, and leads to the understanding that watersheds need less ephemeral stream length and greatly more in-stream storage (e.g., more overland flow to promote water infiltration and impoundments functioning like historically correct beaver ponds or stream & wetland complexes).

11. Historically, 1st through 5th order streams in Ohio were impounded extensively by beavers and these historic conditions fail to be addressed by the OEPA due to their great misuse of the River Continuum Concept.

12. Historically-correct, beaver-impounded streams resulted in low-gradient, multi-thread or braided streams dominated by silt, clay and muck bottoms, which were common-place across Ohio in pre-settlement times, but are biased against by the OEPA's QHEI and HHEI that are founded in the River Continuum Concept. These habitat assessments demand single-thread streams that have higher stream powers and generally look like 'trout' streams. This bias leads to lower-functioning, single-thread streams, lack of watershed storage, lack of habitat diversity, little to no nutrient assimilation, reduced groundwater recharge, drained watersheds (the aquatic dust bowl condition), eutrophication, and other degradations.

13. Failure to use geomorphic condition assessments for stream impacts, which are required to address stream functions and services, grossly over-rates the value of stream impacts and leads to excessive and irrational stream length restoration/mitigation requirements and costs.

14. Stream mitigation should be commensurate with the degree of functioning of a stream reach to be impacted (e.g., a 100-foot ephemeral stream impact to a degraded, incised stream functioning at 10% of capacity would only be required to restore and/or mitigate 10-feet of a 100%-functioning stream (i.e., geomorphically stable stream).

15. Failure to address watershed scale for stream impacts and mitigation leads to excessive mitigation requirements and costs.

16. When combined, the effects of not using geomorphic condition assessments for stream impacts and not addressing watershed scale for stream mitigation can over-rate and drive mitigation costs astronomically through the roof (e.g., over-rate the cost of mitigation by as much as 150-fold).

17. The USACE Huntington District's *Stream & Wetland Valuation Metric* (SWVM), if implemented as currently proposed, will dramatically drive up the costs of stream mitigation for mitigation banks and in-lieu fee programs, which will simultaneously drive up costs of ephemeral stream mitigation.

18. The draft General Permit frequently refers to aquatic organisms (fish & bugs) for ephemeral (dry) streams. This is misleading and creates confusion and such references should be removed.

19. The culvert design criteria for ephemeral streams requires that they address the natural movement of aquatic organisms, which is not an issue dry ephemeral streams, and that they accommodate the bankfull discharge, which is an improper culvert sizing requirement for headwater streams where storage is a primary requirement.

20. Statements frequently infer or imply that degraded, incised streams are to be restored, which confounds and confuses, especially due to the restoration/mitigation having no standards.

21. The draft General Permit contains numerous nebulous phases and terms with no examples that will lead to bureaucracy, wasted time and wasted financial resources to determine what these nebulous phrases and terms mean for each permit. These phrases and terms need to be defined and/or have examples provided. Examples of these phrases and terms are as follows:
    - "returning conditions which support pre-impact biological function"
    - "protected long term"
    - "appropriate management measures"
    - "appropriate vegetative buffers"
    - "buffer widths"

22. The Permittee Responsible Mitigation 5-year monitoring period for permanent impacts to ephemeral streams is arbitrarily too long for restoring only physical integrity and should be reduced

to the same 2-year monitoring period as temporary impacts to ephemeral streams, which similarly only restores physical integrity.

23. The draft General Permit appears to eliminate the NWP 49 exemption for coal remining projects under SMCRA to restore ephemeral streams that the OEPA already provided 401-certification approval. If this exemption is eliminated, then the OEPA needs to restore this exemption. Remining is the mitigation.

24. A 2-year renewal period for the General Permit is too frequent to be used for SMCRA permits, which run for 5-year periods and mine operations typically take 5 to 8 years to complete. This means that the General Permit could be easily have to be renewed three, four or even more times over the life of a surface mine, and would create a potential 'moving target' for restoration/mitigation. The General Permit needs to be extended to at least 5 years in the case of SMCRA permits.

25. A rather simple alternative would be for the draft General Permit for Ephemeral Streams to focus on the primary watershed need of storage, which can be accomplished by using Best Management Practices (BMPs) that develop more storage, such as, converting erosion gullies (degraded ephemeral stream length) to overland flow conditions that promotes storage of water within soils, developing in-stream impoundments that function similar to beaver ponds, and other similar concepts.

26. Most all ephemeral stream impacts will occur by activities that directly involve engineers, who are well-trained in surface water hydrology, that can design cost-effective BMPs that will increase watershed storage and improve water quality.

The OCA requests that the OEPA take the time to discuss this extensive list of issues and concerns with the OCA and other stakeholders before this draft General Permit of Ephemeral Streams is implemented. As documented, this draft General Permit irrationally requires incorrect stream impact assessments and restoration/mitigation that will directly lead to more degraded streams, increased flooding and degraded water quality, and incorrectly over-rates the value of ephemeral streams, which makes the cost of restoration and mitigation grossly more expensive than it should be.

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OCA Public Comments for OEPA's draft General Permit for Ephemeral Streams

1.0 Introduction

The USEPA and Department of Army have enacted legislation that has changed the definition of Waters of the U.S. (WOTUS). A fundamental change in the WOTUS definition is that ephemeral streams are no longer regulated by the Federal Government and this change becomes effective on June 22, 2020.

The OEPA is now proposing new general permit for ephemeral streams in Ohio, which are defined Waters of the State (O.R.C. 6111. and O.A.C. 3745-1). The OEPA provided a brief webinar presentation to a broad range of stakeholders on May 7, 2020 to provide an introduction/overview for their proposed ephemeral stream rules. Then on May 11, 2020 at 3:36 p.m. the OEPA provided an email link to a Draft *General Permit for Impacts to Ephemeral Streams and Isolated Wetlands*. Prior to the sending of the email link to the Draft General Permit, the OEPA pre-scheduled a follow-up conference call meeting with smaller groups of stakeholders, which in the OCA's case included the American Petroleum Institute (API) and the Ohio Oil & Gas Association (OOGA). This conference call was pre-scheduled for May 12, 2020 at 1:00 p.m. Thus, this group of stakeholders had less than 24 hours to review the proposed draft general permit for ephemeral streams, which made for quite limited discussions with OEPA because of the extremely short time to review the draft General Permit, and the OEPA provided very little feedback to the few questions that were asked.

Then on May 14, 2020, the OEPA released the public notice for the Draft Ephemeral Stream and Isolated Wetland General Permit, which became effective on May 18, 2020 after publication of the public notice in several major newspapers in Ohio. The public notice provides for 30 days to provide public comments with a due date on or before June 17, 2020 at 5:00 p.m. The OEPA's objective is to issue the draft general permit for ephemeral streams on June 22, 2020 to coincide with the start of the new definitions of WOTUS.

2.0 OCA Comments for the OEPA draft General Permit for Ephemeral Streams

The OEPA draft General Permit for Filling Category 1 and Category 2 Isolated Wetlands and Ephemeral Streams is reviewed below. The OEPA has combined their proposed ephemeral stream general permit requirements with their existing permit for Category 1 and Category 2 isolated wetlands general permit.

Part I., Coverage Under This Permit.

1. The Ephemeral Streams discussion states that coverage under this permit is limited to the filling of, and discharge of dredge material into ephemeral streams determined not to be waters of the United States and not subject to 404 and 401 of the Clean Water Act.

2. Does this mean that ephemeral streams on coal remining projects no longer qualify for exemption under NWP 49? If yes, the OEPA would be flip-flopping on its 401-certification approval for NWP 49, because remining is the mitigation. If yes, then then the OEPA needs to restore this exemption for remining SMCRA permits.

Part II., Notification Requirements.

1. Paragraph A discusses that notification requirements outlined in this section are required for any amount of fill or discharge … into ephemeral streams exceeding 300 liner feet.

2. Does this mean that ephemeral streams that exceed 300 linear feet on coal remining projects no longer qualify for exemption under NWP 49? If yes, the OEPA is flip-flopping on its 401-certification approval for NWP 49, because remining is the mitigation. If yes, then then the OEPA needs to restore this exemption for remining SMCRA permits.

3. Paragraph B, Contents of Notification. Item 4 requires a QHEI or HHEI physical habitat assessment for each ephemeral stream on the project site.

    a. The QHEI and HHEI habitat assessments are subjective and qualitative and cannot evaluate whether a stream including ephemeral streams are geomorphically stable, unstable or in some degree of instability (refer to Section 8.0 below). Further, it cannot evaluate watershed hydrology nor address watershed needs, which is <u>critical</u> to protecting downstream channels and uses. Additionally, these habitat assessments are founded in the River Continuum Concept, which falsely requires single-thread streams from headwaters to the mouth of streams, and blindly ignores the primary watershed need of more storage (refer to Section 5.0, 6.0 and 7.0 below).

    b. Why would the OEPA expand on an alternative stream mitigation tangent for ephemeral streams, when the OEPA's rules follow 33 CFR Part 332 as discussed in O.A.C. 3745-32-03, which assesses functions & services, uses a watershed approach, addresses watershed current & historic needs and watershed scale. This tangent ignores basic foundational norms that are used to objectively and quantitatively assess and restore/mitigate streams.

4. Paragraph D, Timing. The second paragraph discusses the term 'significant negative impact'. Please provide a definition or examples of what a significant negative impact might be for ephemeral streams.

Part III., General Conditions.

1. Paragraph E discusses unpermitted impacts to surface water resources and/or their <u>buffers</u>…. Given the small drainage areas typically associated with ephemeral streams and their associated small bankfull channel width (e.g., 1-, 2-, 3-wide), buffer widths are rationally scaled with geomorphology (e.g., 3 x bankfull channel width).

2. The GP provides no buffer definition, thus, how are buffers defined to know whether an unpermitted impact has occurred?

3. Paragraph K, Best Management Practices (BMPs).

    a. Item 15 discusses that all temporary fill material must be removed to an area that has no waters of the state at the completion of construction activities and the stream … restored to pre-construction elevations to the maximum extent practicable. Does this mean that if an ephemeral stream is degraded and incised, then should a degraded, incised ephemeral stream be restored so the stream pre-construction elevation is restored?

b. Item 16, Culverts.

i. Subparagraph a) discusses that culverts shall be installed at the existing streambed slope to allow for the natural movement of bedload and aquatic organisms. Ephemeral streams are dry streams by nature with typically no aquatic organisms, so why do culverts placed in ephemeral streams need to address aquatic organism passage?

ii. Subparagraph b) discusses that the culvert base or invert with the substrate shall be installed at or below the sediment to allow natural channel bottom to develop and to be retained. Ephemeral streams can be quite steep (e.g., 4%, 10% or greater), but culvert gradients placed greater than about 1% will not retain sediment within the culvert. This required condition may be nearly, if not entirely impossible, to create based upon site conditions. It is recommended that this paragraph be revised or clarified.

iii. Subparagraph c) discusses that the culvert shall be designed and sized to accommodate bankfull discharge and match the existing depth of flow to facilitate the passage of aquatic organisms. Again, ephemeral streams are dry streams by nature with typically no aquatic organisms, so why do culverts placed in ephemeral streams need to facilitate aquatic organism passage?

Additionally, if a culvert is placed at the existing depth of flow and the ephemeral channel is degraded and incised, then placing a culvert deep within a degraded channel could exacerbate head-cutting in the upstream direction and channel erosion in the downstream direction. Given that ephemeral streams are most often in the extreme headwaters, the primary watershed need is for more storage in these locations (refer to Sections 5.0, 6.0 and 7.0 below). Thus, culvert sizes should be reduced to store and delay stormwater runoff to protect downstream channels from additional degradation and placed at the level of a geomorphically stable streambed to prevent head-cutting or additional degradation in the upstream direction. A typical headwater-to-pipe diameter ratio to delay stormwater runoff should be 2.0 or greater with the goal of delaying more frequent storm events (e.g., 3-month storm runoff event). It is recommended that this paragraph be revised. A hydraulic engineer experienced in culvert design can quickly explain this concept, if further explanation is required.

iv. Subparagraph d) discusses that where culverts are placed for temporary crossings, the bottom elevation of the stream shall be restored as nearly as possible to the pre-project conditions. Does this mean that if an ephemeral stream is degraded and incised, then should a degraded, incised ephemeral stream be restored so the stream pre-construction elevation is restored? It is recommended that this paragraph be revised.

Part IV., Restoration of Temporary Ephemeral Stream Impacts

1. In Paragraph A, the phrase 'returning to conditions which support pre-impact biological function' is used. Provide a definition for what the phrase 'returning to conditions which support pre-impact biological function' means and how it applies to an ephemeral stream. Again, ephemeral streams are dry streams with typically no aquatic organisms, so why is biological function being discussed or how does it even apply?

2. Paragraph B discusses that all ephemeral streams subject to temporary impacts, shall be restored onsite to pre-existing contours and conditions upon the completion of the temporary impact. Does this mean that if an ephemeral stream is degraded and incised should a degraded, incised ephemeral stream be restored to achieve pre-existing contours and conditions? This paragraph is not rational and it is recommended to be revised so that a geomorphically stable stream is restored.

3. Paragraph C discusses that the flow regime shall be restored to that of the pre-impact ephemeral flow regime. This statement ignores using a <u>watershed approach</u> and fails to address watershed needs that are necessary to mitigate downstream and upstream consequences of degraded incised ephemeral streams (a.k.a., erosion gullies). For example, a permanent culvert can stop the advancement of head-cutting to protect upstream degradation and provide temporary storage of water to reduce downstream peak flows that will reduce or prevent additional downstream degradation. It is recommended that this statement be revised to address a watershed approach and address watershed needs, rather than blindly and arbitrarily ignoring these critical factors (refer to Section 5.0 and 6.0 below).

4. Paragraph D discusses that the ephemeral stream channel shall be stable. Does this mean that it shall be geomorphically stable or does it have some other meaning? If the ephemeral stream is to be geomorphically stable, then this statement conflicts with Paragraph B, which states that temporary impacts shall be restored onsite to <u>pre-existing</u> … <u>conditions</u> upon the completion of the temporary impacts. It is recommended that the definition of stable be clarified and that the conflict in Paragraphs D and B be corrected.

5. Paragraph E discusses that the ephemeral stream physical habitat, as measured prior to the impact, shall be restored. As discussed in Section 5.0 above, the QHEI and HHEI are subjective and qualitative, and <u>alone</u>, provide no objective or quantitative standard for restoration of streams. Additionally, the QHEI and HHEI habitat assessments are based in the falsehood of the River Continuum Concept and fail to use a watershed approach or address watershed needs (current and historic), which is for more storage. Further, habitat assessments alone lead to irrational stream impact assessments and stream restoration/mitigation outcomes because they are not filtered as to whether the existing stream conditions are geomorphically stable, unstable or in some degree of instability (refer to Section 8.0 and Figures 16 and 17).

   It is recommended that a watershed approach that addresses watershed needs and contains objective and quantitative standards be utilized so that stream impacts and stream restoration/mitigation projects can logically achieve the established objectives via quantitative measurements. Otherwise, the stream impact assessment is arbitrary and determination of the success or failure of restoration/mitigation will be left to the arbitrary opinion of an OEPA field reviewer, who potentially has no training whatsoever in stream restoration and is only guided by their personal subjective opinions, and their subjective and qualitative habitat assessments 'tools'. That is, the General Permit for Ephemeral Streams has no standards for impact assessment or restoration/mitigation, only opinions, which leads to bureaucracy, wasted time and wasted financial resources.

a. For comparison, in regards to stream restoration standards, the *Guidelines for Stream Mitigation Banking and In-lieu Fee Programs in Ohio*, Version 1.1, March 2016, [Ohio IRT 2016] and developed by the Ohio Interagency Review Team (IRT), which includes the OEPA, provides examples objective and quantitative standards for stream restoration in Section 8, page 23. These include items, such as, vertically stability (degree of incision), width-to-depth ratio, and entrenchment ratio, which are discussed in Sections 7.1, 7.2 and 7.3 below and described Figures 6, 7, 8, 9 and 10. An additional example is to meet target stream class through measurement of specific (objective) parameters. Target stream class is presumably the Rosgen Stream Classification, which inherently adjusts stream width-to-depth and entrenchment ratios (refer to Figures 8, 9 and 10) for various stream gradient ranges (i.e., less than 2%, 2 to 4%, and greater than 4%) and for geomorphically stable and unstable streams. However, the draft General Permit for Ephemeral Streams contains no stream impact assessment or restoration/mitigation standards, and only use subjective and qualitative habitat assessments (opinions).

b. The draft OEPA 2010 compensatory stream mitigation model, which does address geomorphic condition and the foundational norms in 33 CFR Part 332 for stream impact assessment and stream restoration/mitigation, such as, a watershed approach, watershed needs, hydrology (storage) and stream geomorphology, also includes standards for stream restoration. Additionally, this mitigation model contains objective and quantitative restoration/mitigation standards for steeper gradient stream (i.e., 2 to 4% and greater than 4%), which establishes target width-to-depth and entrenchment ratios for varying streams drainage areas (proportionally scaled). In the case of the Ohio IRT 2016 guidelines, they only provide examples of standards for low-gradient streams and does not address hydrology.

c. When it comes to restoration/mitigation of ephemeral streams, if determined to be necessary using a watershed approach, objective standards such as provided in the draft OEPA 2010 model could be used. Because ephemeral streams generally exist in the headwaters where stream gradients are steeper (much greater than 2%).

d. Habitat assessments alone only provide a general, high-level view for stream impacts and stream restoration/mitigation and is not a factor when designing stream restoration/mitigation projects. Rather, a stream restoration designer will utilize a local reference reach that has stable geomorphic characteristics and native floodprone area vegetation as their stream restoration template. When this is done, stream restoration efforts will simultaneously achieve sufficient QHEI and HHEI scores. In other words, the QHEI and HHEI is performed for the benefit of the OEPA, because they do not have the training or background to objectively assess and evaluate stream restoration designs or construction projects.

6. Paragraph F, Restoration Monitoring and Reporting. It is recommended that the reporting requirements in Item 2) be revised to consider a watershed approach and watershed needs (storage), provide a definition for stability, and provide for objective and quantitative standards.

Part V., Mitigation for Permanent Ephemeral Stream Impacts

1. Paragraph A discusses mitigation for permanent impacts to ephemeral streams is required for impacts over 300 linear feet in order to qualify for coverage under this general permit.

    a. In regards to surface mining activities, please provide a definition or examples of what OEPA considers a permanent impact to an ephemeral stream.

    b. Does this mean that ephemeral streams that exceed 300 linear feet on coal remining projects no longer qualify for exemption under NWP 49? If yes, the OEPA is flip-flopping on its 401-certification approval for NWP 49, because remining is the mitigation. If yes, then then the OEPA needs to restore this exemption for remining SMCRA permits.

2. Paragraph B discusses that the permittee shall conduct mitigation through either purchasing credits from an approved mitigation bank with a service area that includes the impacted watershed, purchasing credits from an approved in-lieu fee program that serves the impacted watershed or constructing permittee responsible mitigation (PRM).

    a. Mitigation for permanent impacts to ephemeral streams should be considered in the context of the watershed, that is, use a watershed approach and address watershed needs as discussed in Sections 5.0, 6.0 and 7.0 below.

    b. If, when using a watershed approach, and it is determined that mitigation for permanent impacts to ephemeral streams (erosion gullies) are necessary, then ephemeral stream impacts need to be adjusted for the actual functions and services that exists at the time of the impact. For example, if a 100-foot reach of an ephemeral stream (erosion gully) is severely degraded and incised and functioning at 10% of its potential, then only 10-feet (100-feet x 10%) of geomorphically stable ephemeral stream length should be mitigated. Additionally, if mitigation credits are purchased from a mitigation bank or in-lieu fee program, then watershed scale needs to be combined with the degree of functioning assessment to determine final mitigation credits and cost (refer to Section 6.0 below). The determination for degree of stream functioning requires a geomorphic condition assessment, that is, is the stream geomorphically stable, unstable or in some degree of instability.

c. If, when using a watershed approach, the watershed need is for more storage to protect downstream channels and uses, then the mitigation could include:
    i. Eliminating erosion gullies (ephemeral streams) to create overland flow conditions planted in dense grasses to slow stormwater runoff and promote water infiltration into the soil horizon, or
    ii. Creating in-stream storage ponds that function similar to beaver ponds to reduce downstream stormwater peak flows that will reduce or prevent additional downstream channel and habitat degradation, provide diversity of habitat, a local source of water for terrestrial, aquatic and plant communities, recharge groundwater, and over-time, covert single-thread channels to historically correct multi-thread or braided wetland streams (refer to Section 7.0 and 8.0 below).

3. Paragraph C discusses that mitigation for the permanent filling of, or the permanent discharge of dredged material into ephemeral streams covered under this permit when required shall be conducted as follows:
    - Ephemeral stream with sand/silt/muck/clay dominated substrates at a minimum rate of one linear foot for every linear foot (1:1) of permanently impacted ephemeral stream.
    - Ephemeral stream with bedrock/boulder/cobble/gravel/sand mixed substrates at a minimum rate of one and a half linear feet for every linear foot (1.5:1) of permanently impacted ephemeral stream.

    a. These mitigation requirements are arbitrary and fail to use a watershed approach, address watershed needs, determine whether the existing stream condition is geomorphically stable, unstable or in some degree of instability (does not assess functions and services) and ignores watershed scale.

    b. Restoring or mitigating ephemeral streams on-site or off-site at arbitrary ratios of 1:1 or 1.5:1 leads to increasing the drainage network (Figure 3) that directly causes increased stormwater runoff peak flows (Figure 4), which will degrade (incise) downstream stream channels, increase flooding and degrade water quality (refer to Section 5.1 below). In the hilly terrain of Ohio, nearly all ephemeral streams (erosion gullies) will have substrate dominated by cobble/gravel/sand mixtures due to the steeper slopes that produces higher velocity runoff. This will result in extension of the drainage network and increased drainage density (Figure 3), and, as repeatedly discussed, will directly result in increased stormwater peak flows that will degrade (incise) downstream stream channels, increase flooding and degrade water quality.

    c. A watershed approach that addresses watershed needs would lead to ephemeral streams (erosion gullies) being converted to densely-grassed overland flow conditions (return historic conditions) to slow runoff and promote water infiltration into the soil horizon, and/or the creation of historically correct in-stream impoundments that function similar to beaver ponds or stream and wetland complexes (refer to Section 5.0 below).

d. The ephemeral stream mitigation requires more mitigation length (1.5:1) for bedrock/boulder/cobble/gravel/sand mixed substrates as compared to 1:1 mitigation for sand/silt/muck/clay dominated substrates. This difference in mitigation length requirements for the two substrate types demonstrates the OEPA's *bias* of the River Continuum Concept (refer to Section 7.0 and 8.1 below) and arbitrary preference for single-thread streams with higher stream powers (refer to Section 8.3 below and Figure 18). Low-gradient multi-thread or braided streams (wetland streams and stream & wetland complexes) that historically dominated Ohio's watersheds in pre-settlement times have sand/silt/muck/clay dominated substrates (refer to Ben Goldfarb's discussion at the end of Section 7.0). But these low-gradient multi-thread streams do not look like 'trout' streams and the OEPA arbitrarily gives them lesser value, but they actually provide more functions and services than single-thread streams. One would expect that the OEPA would want more higher-functioning, multi-thread streams rather than more lesser-functioning, single-thread streams, but this is not the case. The OEPA's *bias* for single-thread stream with higher stream powers contained within the framework of the QHEI and HHEI are not rational nor historically correct and these biases need to be eliminated.

e. If, when using a watershed approach, it is determined that mitigation for permanent impacts to ephemeral streams (erosion gullies) are necessary, then ephemeral stream impacts need to be adjusted for the actual functions and services that exists at the time of the impact. For example, if a 100-foot reach of an ephemeral stream (erosion gully) is severely degraded and incised and functioning at 10% of its potential, then only 10-feet (100-feet x 10%) of geomorphically stable ephemeral stream length should be mitigated. Additionally, if mitigation credits are purchased from a mitigation bank or in-lieu fee program, then watershed scale needs to be combined with the degree of functioning assessment to determine final mitigation credits and cost (refer to Section 6.0 below). The determination for degree of stream functioning requires a geomorphic condition assessment, that is, is the stream geomorphically stable, unstable or in some degree of instability.

f. If off-site mitigation (bank or in-lieu fee) is selected or required, then both the degree of functioning and watershed scale are of major importance. Regarding degree of functioning with the example 100-foot reach of an ephemeral stream (erosion gully) severely degraded and incised and functioning at 10% of its potential, then only 10-feet (100-feet x 10%) of a geomorphically stable ephemeral stream length should be required to be mitigated. Then, regarding watershed scale, the ratio of impact as compared to typical mitigation bank project sizes and costs (e.g., currently $240 to $440 per foot of mitigation – refer to Section 6.0 below) needs to be combined with the degree of functioning assessment to determine final mitigation costs. That is, the project size may be in the range of 1/10th or 1/20th the size of a typical mitigation project. Therefore, final mitigation credit cost for this example should be $340 [10-feet x $340/foot x 1/10]. An a*ssumed* $340/foot value for mitigation is used merely because it is midway between the $240 to $440/foot range for current mitigation per foot.

Comparatively, the cost of mitigation for a 100-foot degraded and incised reach of stream with gravel dominated substrate as currently required in the General Permit cost $51,000 [100-feet x 1.5 x $340/foot]. **<u>$340 vs $51,000</u>** is a dramatic mitigation cost difference (150-fold arbitrary increase) and demonstrates how easily and arbitrarily mitigation costs can be manipulated and over-rated as is the case for this General Permit for Ephemeral Streams.

g. The USACE Huntington District's *Stream & Wetland Valuation Metric* (SWVM) may potentially increase stream mitigation costs to the range of $1700 to $3300 per foot of stream restoration due to its failure to properly assess functions and services, use a watershed approach and numerous meaningless and redundant assessments requirements. It is understood that OEPA's General Permit for Ephemeral Streams does not employ the SWVM requirements, but nonetheless, SWVM, if not stopped, will drive up the cost of mitigation across the board and will directly result in higher mitigation costs to mitigate ephemeral streams. Thus, ephemeral stream mitigation costs could easily double from say $340/foot to $680/foot or be higher. Then the cost differential for mitigation the example 100-foot degraded, incised ephemeral stream (erosion gully) expands to **<u>$680 vs $102,000</u>** – the difference becomes even more dramatic difference. The methodology to determine the cost of ephemeral stream mitigation needs to be corrected to eliminate this massive stream condition over-rating contained in the General Permit for Ephemeral Streams.

h. In regards to standards for stream impact assessments and stream restoration/mitigation of permanent ephemeral stream impacts, there are none. Additionally, permanent ephemeral stream impacts do not even require a pre-impact habitat assessment as in the case for temporary ephemeral stream impacts (Part IV, (F)(2)(d)).

i. Stream impact assessment and restoration/mitigation standards are necessary for stream restoration/mitigation projects. The *Guidelines for Stream Mitigation Banking and In-lieu Fee Programs in Ohio*, Version 1.1, March 2016, [Ohio IRT 2016] developed by the Ohio Interagency Review Team (IRT), which includes the OEPA, includes examples objective and quantitative standards for stream restoration in Section 8, page 23. These include items, such as, vertically stability (degree of incision), width-to-depth ratio, and entrenchment ratio, which are discussed in Sections 7.1, 7.2 and 7.3 above and described in Figures 6, 7, 8, 9 and 10. An additional example is to meet target stream class through measurement of specific (objective) parameters. Target stream class is presumably the Rosgen Stream Classification, which inherently adjusts stream width-to-depth and entrenchment ratios (refer to Figures 8, 9 and 10) for various stream gradient ranges (i.e., less than 2%, 2 to 4%, and greater than 4%). However, the draft General Permit for Ephemeral Streams contains <u>no</u> restoration standard, and only use subjective and qualitative habitat assessments (opinions).

j. The draft OEPA 2010 compensatory stream mitigation model, which does address geomorphic condition and the foundational norms in 33 CFR Part 332 for stream impact assessment and stream restoration/mitigation, such as, a watershed approach, watershed needs, hydrology (storage) and stream geomorphology, also includes standards for stream restoration. Additionally, this mitigation model contains objective and quantitative restoration/mitigation standards for steeper gradient stream (i.e., 2 to 4% and greater than 4%), which establishes target width-to-depth and entrenchment ratios for varying streams drainage areas (proportionally scaled). In the case of the Ohio IRT 2016 guidelines, they only provide examples of standards for low-gradient streams and does not address hydrology.

k. When it comes to restoration/mitigation of ephemeral streams, if determined to be necessary using a watershed approach, objective standards such as provided in the draft OEPA 2010 model could be used. Because ephemeral streams generally exist in the headwaters where stream gradients are steeper (e.g., greater or much greater than 2%).

l. Habitat assessments alone only provide a general, high-level view for stream impacts and stream restoration/mitigation and is not a factor when designing stream restoration/mitigation projects. Rather, a stream restoration designer will utilize a local reference reach that has stable geomorphic characteristics and native floodprone area vegetation as their stream restoration template. When this is done, stream restoration efforts will simultaneously achieve sufficient QHEI and HHEI scores. In other words, the QHEI and HHEI is performed for the benefit of the OEPA, because they do not have the training or background to objectively assess and evaluate stream restoration designs or construction projects.

4. In Paragraph D it discusses when mitigation will occur at an approved *wetland* mitigation bank or in-lieu fee program…. Should the adjective wetland be removed from in front of mitigation bank, because this could be a stream or wetland mitigation bank?

5. Paragraph E, Permittee Responsible Mitigation.

   a. Item 1) discusses all permittee responsible mitigation (PRM) for ephemeral streams shall be monitored for five (5) years following the completion of mitigation construction activities.

      Five (5) years is an excessive time period for monitoring an ephemeral stream that is only restoring physical integrity. Ephemeral streams have no biological or chemical integrity to address, that is, there is no biology in ephemeral streams (dry) and water flows is only in direct response to rainfall. Thus, only physical integrity needs to be addressed, and this can easily be determined by having objective and quantitative stream restoration/mitigation standards, which the OEPA has not addressed in this General Permit. Subsequently, only two (2) years of monitoring and observation or less should be required for PRM, which is the case for temporary impacts for ephemeral streams. The five (5) year monitoring period is excessive and should be reduced as suggested.

b. Item 3) discusses that a PRM site shall be protected long term, and have appropriate practicable management measures with appropriate vegetative buffers implemented to restrict harmful activities that jeopardize the mitigation.
    i. Provide a definition or examples of what protected long term means.
    ii. Provide a definition or examples of what are appropriate practicable management measures means.
    iii. Provide a definition or examples of what appropriate vegetative buffers means. Typically, buffers (e.g., grasses or trees) are scaled with geomorphology, such that, they might be three times the bankfull width of the channel.

c. Item 6) Performance standards is discussed out of order in the General Permit for Ephemeral Streams and should be placed before current Item 4) Annual Monitoring Reports and Item 5) Monitoring Requirements so that it is known what is to be monitored.
    i. Sub-Item A). The stream restoration/mitigation linear foot requirements (1:1 and 1.5:1) are arbitrary and do not address a watershed approach or watershed needs (refer to Part V, Items 3, sub-items a. through k. above).
    ii. Sub-Item b). Demonstrate that the physical habitat assessment of the mitigation stream channel is equal to or greater than the physical habitat assessment of the originally impacted ephemeral stream. The comments from Part IV, Item 5 and sub-items a. through d. apply and are referenced this sub-item.
    iii. Sub-Item c) requires a demonstration that the stream mitigation channel and banks including up and downstream of the mitigation are stable and show no signs of excessive bank erosion, sedimentation, head-cutting, aggradation, entrenchment, or degradation. It is ironic that these geomorphic conditions show up as performance standards and they were not required to be assessed pre-impact, which is what should be done. Given that required the required ephemeral stream restoration/mitigation will extend the drainage network, the resultant greater peak flows will directly result in downstream stream degradation (incision), increased flooding and degraded water quality (refer to Section 5.0 and 5.1 below). Geomorphic condition assessments are required for both pre-impact and for restoration/mitigation, if when using a watershed approach and addressing watershed needs demonstrates that restoration/mitigation is rational. This would not be expected to occur often when the primary watershed need is storage (refer to Sections 6.0 and 7.0).
    iv. Sub-Item d) requires a demonstration that a minimum of 400 native, live and healthy (disease and pest free) woody plants per acre (of which at least 200 are tree species) are present at the end of the monitoring period in the upland buffer, if applicable. Requiring a specific number of woody plants is arbitrary. Plants should be based upon a combination existing conditions and watershed needs. Additionally, there is no definition of buffer, which is typically scaled with drainage area, such as, three times the bankfull width of the channel.

d. Item 4), which should become Item 5) discusses that annual monitoring reports shall be submitted to the OEPA by December 31 of each year following the end of the first growing season and completion of mitigation construction. Each report shall contain, at a minimum, the following information (also refer to Item 1a discussion above):
    i. In item 4f the annual report is to provide a discussion of stability of the restored/mitigated stream channel. Does stability in this sentence mean geomorphic stability or does it have some other meaning?
    ii. If stability means geomorphic stability, then there needs to be geomorphic standards for the stream mitigation, such as, degree of incision, width-to-depth ratio, entrenchment ratio (refer to Sections 7.1, 7.2 and 7.3 below) among potentially others depending upon stream gradient (i.e., less than 2%, 2 to 4%, and greater than 4%).
    iii. Annual monitoring reports as well as performance standards need to address geomorphic conditions (hydrology and geomorphology) first and habitat assessments are second. Unfortunately, the performance standards or any stream assessment fails to assess hydrologic and geomorphic condition; thus, it impossible to know what factors are leading to impacts that degrade streams and water quality. The monitoring requirements are arbitrary.

e. Item 5) Monitoring Requirements. Ephemeral streams generally exist in the headwaters of watershed where stream gradients are steeper (i.e., greater than 4%). These stream types are step-pool streams and not riffle-pool streams. Terms such as thalwag, sinuosity, meander wave length, belt width, radius of curvature, and meander arc length for a minimum of two meander bends do not apply to step-pool streams. Additionally, thalwag is a feature only observed in lower-gradient streams (e.g., less than 2%) that is the result of double-helical stream flow. It is not correct to measure the longitudinal profile of a stream along its thalwag. The correct measurement for the longitudinal profile of a stream is along its center line.
    i. Regarding Item a) for monitoring in the first-, third- and fifth-year annual reports shall include…. (refer to comments in Part V, 5(a)).
    ii. Regarding Item b) for observations of the stream mitigation…. (refer to comments in Part V, 5(C)(iii)).
    iii. Regarding forested buffer areas, these are need to be based upon reference reaches and buffer widths are rationally scaled with geomorphology (e.g., 3 x bankfull channel width).

Part VII., Limitations.

1. This section discusses that an applicant that qualifies for coverage under this general permit shall complete the filling of, and the discharge of dredged material within two (2) years after the end of the 30-day period following the Director's receipt of a complete PAN (refer to Part II, D regarding the 30-day period).

2. A SMCRA mining permit runs for a 5-year period and most mining permits take 5 to 8 years to complete. Therefore, a 2-year renewal frequency for SMCRA permits are not rational. A permit under SMCRA could potential require 3, 4 or 5 PAN renewals within the life of a mining permit. This high frequency of renewals is financially punitive, results in potential changes to plans creating an ever-moving restoration target, and bureaucratic. The General Permit for Ephemeral Streams when used with SMCRA mining permits needs to have a 5-year renewal period to rationally align with other permits and typical mining time frames.

3.0 OEPA Webinar Addressing the Navigable Waters Protection Rule

The OEPA held a webinar on May 7, 2020 at 3:00 p.m. titled *Addressing the Navigable Waters Protection Rule*. The OEPA stated at the beginning of the presentation that there was a broad range of stakeholders signed into the webinar. The actual presentation length was about 30 minutes and consisted of overviewing 26 PowerPoint slides.

Of note, during this presentation was Slide #5 (refer to Figure 19 in these comments), which overviewed the 'Function of Ephemeral Streams and Isolated Wetlands'. Regarding ephemeral streams, this slide states that there are over 36,000 miles of ephemeral streams throughout Ohio and ephemeral streams do the following:

- Help control run-off and erosion;
- Reduce flooding potential; and
- Help filter pollutants.

These four points in this slide are all fundamentally false, that is, ephemeral streams have the following consequences:

- Increase the rate of stormwater runoff by extending the drainage network to rapidly drain the land;
- Increase stormwater runoff peak flows that cause erosion of streambeds and streambanks resulting in incised channels disconnected from their floodprone areas and causing sedimentation;
- Increase the potential for flooding; and,
- Rapidly convey pollutants downstream because of the typical degraded, incised ephemeral streams function like a pipe (refer to Section 5.0, 5.1 and 5.2 below).

Historically, as discussed in Section 5.0, ephemeral streams would have rarely occurred in pre-settlement times when streams in 1st through 5th order streams were significantly impounded by beaver ponds and logjams, and land use changes had not yet begun to occur in Ohio. Thus, the statement on this slide that there are over 36,000 miles of ephemeral streams in Ohio, which was statistically developed, merely demonstrates how severe the loss of watershed storage actually is in Ohio's watersheds and how important it is for ephemeral streams be mitigated by creating more watershed storage rather than being mitigated at ratios of 1.5:1 as proposed by the OEPA, which will result in even faster runoff conditions to further degrade streams, increase flooding and degrade water quality. But then again, the OEPA's ephemeral stream length statistics may include ephemeral stream length as shown in Figure 20, which are identified as rill erosion in the photo, but each rill meets the OEPA's definition of ephemeral stream and Waters of the State. Prior to the Section 404 and 401 approval of NWP 49 on remining sites, these types of rill erosion features on unreclaimed, pre-law mine sites were required to be identified as ephemeral streams and mitigated.

OEPA's draft General Permit for Ephemeral Streams approach of replacing erosion gullies (ephemeral streams) and expanding them is absolutely insane, which is the case for most all of the ephemeral stream length in Ohio. The replacement and/or extension of ephemeral stream length directly results in, but not limited to, the following:

- Increased stormwater peak flows, degraded (incises) streams;
- Increased streambank erosion;
- Increased downstream flooding;
- Degraded waters quality;
- Degraded in-stream and floodprone area habitat;
- Drained watersheds (creates the aquatic dust bowl);
- Less water for wildlife;
- Less habitat diversity;
- Reduced base flows to maintain intermittent or perennial streams;
- Rapidly transports nutrients downstream like in a pipe; and,
- Increased eutrophication potential of water bodies like Lake Erie, the Ohio River and other water bodies.

If this draft General Permit for Ephemeral Streams advances, then it is to the detriment of Ohio's streams, water quality and taxes paid by Ohioans.

4.0 Alternative Approach for the draft General Permit (BMPs)

There is a relatively simple, logical and rational alternative approach to this draft General Permit for Ephemeral Streams. That is, revise the General Permit to use a watershed approach that focuses on the primary watershed need of storage. The General Permit can do this by using Best Management Practices (BMPs) that are designed and implemented to create more watershed storage as described within this document. Additionally, other stakeholders should provide input on storage alternatives (a.k.a., BMPs).

Most ephemeral stream impacts will likely occur from a fairly narrow range of stakeholders from activities, such as, mining, oil & gas, development, transportation and agriculture. All of these stakeholders directly work with engineers, who are well-trained in surface water hydrology, that can develop and implement pragmatic and cost effective practices that can directly address the primary watershed need of storage to reduce stormwater peak flows that will reduce or protect downstream streams for further degradation, reduce flooding and improve water quality. In fact, the NRCS, which provides technical support for agriculture, wrote the 'manual' on addressing surface water hydrology and storage with Technical Release 20 and 55 (TR-20 and TR-55). These hydrology documents are widely referenced by agencies and used by engineers across Ohio and the U.S.

The OCA strongly recommends that the OEPA adopt this alternative approach to use BMPs that restore watershed storage for the General Permit for Ephemeral Streams. Everyone including the streams;

rivers; lakes; terrestrial, aquatic and plant communities; and, water quality will improve and win. A nice alternative.

5.0 Historical Background for Ephemeral Streams

In the mid-1700's or Pre-Settlement, frontiersman came over the Allegheny Mountains to the Ohio Country namely to trap beavers that were abundant throughout Ohio (Figure 1). Beaver skins were an extremely valuable commodity both in the Eastern U.S. and in Europe. At that time, Ohio's streams were extensively filled with beaver ponds (Figure 2 and Photos 1 and 2) that stored stormwater runoff and released water slowly, so that, downstream streams remained geomorphically stable, healthy and abundant with fish and bugs to sustain diverse plant, wildlife and aquatic communities. Additionally, the beaver ponds provided for low-gradient, braided streams across the beaver pond as it slowly filled with accumulated sediment. Thus, low-gradient, braided streams were common throughout the Ohio Country. These extensive low-gradient, braided streams provided diverse habitats for wildlife, birds, bats, amphibians, insects, reptiles and plant communities (e.g., wetland plants), recharged groundwater and released stored water slowly to create and maintain perennial stream base flows. Numerous professional journal articles suggest that as much as 40% of the stream length in 1st through 5th order streams were impounded by beaver (Naiman (1988), Gurnell (1998), Pollock (2003) and others). However, beavers were trapped-out of Ohio by about 1830 and the vast historical watershed storage created by beavers was lost. This change increased stormwater runoff peak flows that began to erode and incise streams, drain watersheds of its historically-stored surface water and removed primary groundwater recharge sources.

During the same time period, settlement began across Ohio that initiated extensive land improvements for various reasons (logging, farming, grazing, roads, development, etc.). Since the first settlements across Ohio, land use changes have occurred multiple times in virtually every watershed within Ohio over the past 200 to 250 years. These multiple land use changes have typically further reduced watershed storage and increased stormwater runoff peak flows that have initiated the headward advancement of erosion gullies (ephemeral streams) into Ohio's headwaters (Photo 3).

As these erosion gullies (ephemeral streams) extend into the watershed, the drainage density of the watershed stream network increases from a low drainage density to a high drainage density (Figure 3) and provides more pathways for stormwater runoff to travel quickly off the land (Photo 4). This results in greater peak flows from the watershed that directly contribute to downstream channel degradation (incision), streambank erosion, increased flooding and rapid conveyance of nutrients to downstream waters (Figure 4 – Smaller Peak Flow with Low Drainage Density (Curve A) vs Greater Peak Flow with High Drainage Density (Curve B)).

Historically, in Pre-settlement times, stream channels were extensively impounded with beaver ponds, watersheds were covered in native grasses or trees, and stormwater runoff was minimal with very low peak flows. Thus, most streams in Ohio were perennial in nature and there were almost no ephemeral streams (i.e., erosion gullies had not begun to develop). Given that most all ephemeral streams in Ohio are the result of erosion processes initiated by the extirpation of beaver, land use changes, and potentially in-stream impacts that initiated headcuts, ephemeral streams are not historically correct and are significantly the by-product of human activity. Therefore, actions should be taken to remediate the consequences of ephemeral streams rather than replace them or expand them as proposed by the OEPA in their Draft General Permit for Impacts to Ephemeral Streams.

5.1 Consequences of the Proposed Ephemeral Stream General Permit

OEPA's proposed ephemeral stream general permit will increase the stream drainage density of Ohio's watersheds (add stream length) that will directly provide for stormwater to quickly travel off the land and increase stormwater runoff peak flows (Curve B in Figure 4). These proposed rules completely ignore the primary watershed need of more storage, which can easily be accomplished by developing historically correct in-stream storage ponds (beaver pond analogs) and slowing stormwater runoff by creating overland flow conditions that promote more soil infiltration (i.e., eliminate historically incorrect ephemeral streams). The OEPA draft General Permit for ephemeral streams will result in, but not be limited to, the following consequences:

a. Increased or greater peak flows;
b. Degraded incised channels (Photo 5);
c. Increased stream bank erosion;
d. More sediment in streams;
e. Increased downstream flooding;
f. Degraded water quality;
g. Degraded in-stream and floodplain habitat;
h. Draining of watersheds (creating an aquatic dust bowl);
i. Less water for wildlife;
j. Less habitat diversity;
k. Base flows reduced resulting in fewer intermittent and perennial streams;
l. Rapid downstream transport of nutrients (like a pipe, no time to break-down nutrients);
m. Increased eutrophication potential for Lake Erie, Ohio River and other water bodies.

5.2 Benefits of the Conditions Needed

The stream drainage density of Ohio's watersheds needs to be reduced (less stream length) to slow stormwater runoff and reduce stormwater runoff peak flows (Curve A in Figure 4). This is a condition that is *completely opposite* from what the OEPA proposed ephemeral streams general permit will produce (Curve B in Figure 4). Reducing stream length will produce more overland flow conditions that will slow stormwater runoff and promote more soil infiltration. Additionally, watersheds need to re-create lost in-stream storage analogous to that provided historically by beaver ponds to further slow stormwater runoff and reduce peak flows.

Less ephemeral stream length and more in-stream storage will result in, but not be limited to, the following benefits:

a. Decreased or smaller peak flows;
b. Reduced or prevented stream degradation (Photo 6);
c. Reduced or prevented stream bank erosion;
d. Reduced sediment in streams;
e. Decreased downstream flooding;
f. Improved water quality;

g. Reduced or prevented in-stream and floodplain habitat degradation;
h. Reduced or prevented draining of watersheds (no aquatic dust bowl);
i. Increased water availability for wildlife;
j. Increased habitat diversity;
k. Extended base flows resulting in more intermittent and perennial streams;
l. Delays and reduces downstream transport of nutrients (storage creates time to break-down nutrients);
m. Reduced eutrophication potential for Lake Erie, Ohio River and other water bodies.

6.0 33 CFR Part 332 Federal Compensatory Mitigation Rules

The OEPA Section 401 water quality certification rules located in O.A.C. 3745-32-03 discusses in subsection (B)(2)(d) that a specific and detailed mitigation plan prepared in accordance with the requirements in 33 CFR Part 332 is required. 33 CFR Part 332 are the 2008 Federal compensatory stream mitigation rules that were published in the Federal Register (FR) dated April 10, 2008 and entitled *Compensatory Mitigation Losses of Aquatic Resources*. The Preamble discussing these rules are contained on pages 19594 to 19705 in this FR.

The primary focus of these 2008 Federal compensatory mitigation rules is on assessing and restoring aquatic resource functions and services and not on arbitrarily replacing linear feet of stream impacted at ratios, such as, 1:1 and 1.5:1. These rules define *functions* as the physical, chemical and biological processes that occur in ecosystems, and *services* as the benefits that human populations receive from functions that occur in our ecosystems.

The primary compensatory mitigation method is *restoration*, which means the manipulation of physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. Typical physical characteristics of a stream and its floodprone area that must be assessed to determine the level of functions and services that a stream is actually providing, in addition to average stream gradient, are the degree of incision or bank-height ratio, width-to-depth ratio and entrenchment ratio. These three terms are defined in Sections 7.1, 7.2 and 7.3 below.

The long-established norms contained in these rules require that a watershed approach be utilized when assessing and restoring aquatic resource functions and services. A w*atershed approach* is defined (§332.2) as an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in the watershed (§332.2). This involves the consideration of watershed needs and how locations and types of compensatory mitigation projects address those needs. The watershed approach is to consider landscape scale, *historic* and potential aquatic resource conditions, *past* and projected aquatic resource impacts in the watershed, and terrestrial connections between aquatic resources when determining compensatory mitigation requirements. Additionally, authorized impacts and mitigation are to be considered on a watershed scale rather than only project by project [Preamble for 2008 Federal Compensatory Mitigation Rules, Page 19598, Column 3].

When using a watershed approach and considering watershed needs, the primary watershed need is for more watershed storage to replace the lost storage function due to the historic extirpation of beavers and multiple land use changes in Ohio's watersheds (Burchsted (2010), Hawley (2018), Wohl (2019)).

When addressing watershed scale most stream impacts in Ohio occur in smaller drainage areas that are less than 1.0 square mile (640 acres). Ephemeral streams typically located in these smaller drainage areas and can frequently have drainage areas as small as 1-, 2-, or 3-acres and are frequently impacted. Typical bankfull channel widths for these small ephemeral streams (erosion gullies) are in the range of 1 to 3 feet wide and have resulted from historic land use changes and extirpation of beavers (i.e., historically did not exist). However, mitigation banks and in-lieu fee (ILF) stream mitigation projects generally restore streams with drainage areas in the range of 1- to 5-square miles that have typical bankfull channel widths varying from 18 to 32 feet wide. Mitigation credits purchased from Ohio mitigation banks or ILF projects are currently costing the range of $240 to $440 per foot, which are costs representative to restore these larger streams. Using watershed scale, the cost of mitigation should be commensurate with the size of the project. That is, the compensatory mitigation for an ephemeral stream (erosion gullies in most cases) with a small drainage area of 1- to 3-acres could be in the range of 1/10th to 1/20th the cost of a mitigation as demonstrated in the following two examples:

1. Assume a 20-foot wide stream costs $240 per foot to mitigate, then the cost to mitigate a 1-foot wide stream would be 1-foot divided by 20-feet times $240 per foot or about $12 per foot.
2. Assume a 30-foot wide stream costs $360 per foot to mitigate, then the cost to mitigate a 3-foot wide stream would be 3-foot divided by 30-feet times $360 per foot or about $36 per foot.

In other words, using watershed scale commensurately scales the cost of mitigation, because, as in these two examples, the size of the stream impact to mitigate is much smaller than the size of a typical mitigation bank or ILF project size and cost.

Given that these foundational norms have been long-established in 33 CFR Part 332 (since 2008) and are directly referenced in O.A.C. 3745-32-03 to be followed for stream impact mitigation plans, why would the OEPA develop draft a general permit for ephemeral streams that ignore these norms, and in-turn, create a process that does not follow these norms. Further, the draft General Permit for Ephemeral Streams creates an irritational process that cannot be logically followed, and if implemented, will directly result in degradation of the very item, streams and water quality, that the general permit would be expected to minimize or prevent.

7.0 Basic Stream Morphology

A natural single-thread self-formed stream channel achieves stability by allowing the stream to develop a stable cross-section, pattern and profile such that, over time, the channel features are maintained and the stream system neither aggrades (i.e., deposits or fills-up) nor degrades (i.e., erodes or down-cuts) (Rosgen, 1996). Over time, geomorphically stable streams will establish a *balance* that will consistently transport both its discharge (Q) and sediment load (Q_s) while maintaining geomorphic stream stability when the *driving* forces (i.e., stream power, which is flow x slope) are proportional to the *resisting* forces (i.e., Sediment Load (Q_s) and Bed & Bank Resistance (d_{50})), which is explained using a set of scales referred to as Lane's Balance (Lane, E.W., 1955) (Figure 5).

Given the watershed drivers of discharge (stormwater runoff) and sediment load, which are the primary factors effecting stream geomorphic condition, they operate through well-known derivative drivers including catchment topography and rainfall-runoff relationships, valley slope and confinement, channel boundary characteristics and vegetation (Castro & Thorne (2019)).

Converse to single-thread channels are natural multi-thread or braided stream channels, which generally occur when stream gradients are less than 4%. These stream types are generally wide and shallow and aggrade until the gradient of the braided stream achieves a balance with its discharge and sediment load. These stream types are commonly associated with wetland streams. A classic example that demonstrates the multi-thread or braided stream type are beaver impounded streams. The beaver impounded stream flattens the stream gradient that results in larger-sized sediment depositing in the back of the ponded area and finer sediments depositing across the remainder of the ponded area as the finer sediments settle due to the slow-moving ponded water. As the fine sediments accumulate, wetland plants take root, which further slows water moving through the ponded area, and eventually the aggraded fine sediments form geomorphically stable braided streams.

As discussed in Section 5.0, beaver impounded streams containing braided channels were common place in the Ohio Country and potentially were the dominate stream type in headwater streams (e.g., 1st through 5th order streams). However, the braided stream type is commonly ignored as a high-functioning, beneficial stream type for stream restoration/mitigation. This comes at great peril to downstream reaches, because braided stream types and ponded areas provide significant reductions in stormwater peak flows that minimize adverse downstream impacts from otherwise higher stormwater peak flows that lead to channel degradation (incision) and flooding.

This peril is propagated by the regulatory agency bias toward single-thread streams based upon the River Continuum Concept (RRC) that was published by Vannote, et al. (1980), which is an idealized concept to aide in the demonstration of how macroinvertebrate and fish communities generally change along the drainage network as the drainage area increases. The RCC diagram shows only single-thread channels from the headwaters to the mouth of streams. Thus, the perception of biologists due to the RCC morphed into the outcome that all streams must be single-thread channels or they are not good streams, which is absolutely false. In fact, multi-thread or braided streams provide tremendously more functions and services than do single-thread streams.

The consequences of the RCC (i.e., no in-stream impoundments or stream and wetland complexes) is that our watersheds are being drained so severely that Ben Goldfarb (2018), who is a writer for the Sierra Club, refers to this massive RCC drainage problem as the equivalent of creating the '*aquatic dust bowl'*. He states that the watershed goal is *retainage*, not drainage. In short, if the water is drained from our watersheds, then the wildlife, fish, birds, bats, amphibians, reptiles, insects and others will have to go elsewhere or perish. Goldfarb, in his book Eager, The Surprising Life of Beavers and Why They Matter (2018) on page 6, states:

> "Close your eyes. Picture, if you will, a healthy stream. What comes to mind? Perhaps you've conjured a crystalline, fast-moving creek, bounding merrily over rocks, its course narrow and shallow enough that you could leap or wade across the channel. If, like me, you are a fly fisherman, you might add a cheerful, knee-deep angler, casting for trout in a limpid stream.
>
> It's a lovely picture, fit for an Orvis catalog. It's all wrong.

> Let's try again. This time, I want you to perform a more difficult imaginative feat. Instead of envisioning a present-day stream, I want you to reach into the past – before the mountain men, before the Pilgrims, before Hudson and Champlain and the other horsemen of the furpocalypse, all the way back to the 1500s. I want you to imagine the streams that existed before global capitalism purged the continent of its dam-building, water storing, wetland-creating engineers. I want you to imagine a landscape with its full complement of beavers.
>
> What do you see this time? No longer is our stream a pellucid, narrow racing trickle. Instead it's a sluggish, murky swamp, backed up several acres by a messy concatenation of woody dams. Gnawed stumps ring the marsh like punji sticks; dead and dying trees aslant in the chest-deep pond. When you step into the water, you feel not rocks underfoot but sludge. The musty stink of decomposition wafts into your nostrils. If there's a fisherman here, he's thrashing angrily in the willows, his fly caught in a tree."

On pages 35-36, Goldfarb goes on to state:

> "In 1980, for instance, the field of aquatic ecology came to be dominated by "the river continuum," the notion that waterways transition along their course, seamlessly and predictably, from steep, forested headwaters to open valley bottoms. Three decades later, however, an engineer named Denise Burchsted proffered a different model: the *river discontinuum*, which held that pre-colonization streams were disrupted along their length by glacially scoured holes, downed trees, and, most of all, beaver dams. Rather than free-flowing chutes, Burchsted wrote, historical creeks were patchy networks of ponds, meadows, and braided channels – only fitfully connected upstream and down, but inseparable from the floodplains that bracketed their banks."

In other words, the focus of stream restoration/mitigation in our headwaters needs to be on restoring historic watershed needs (storage) by creating in-stream beaver pond analogs, similar functioning structures and stream & wetland complexes that will evolve into multi-thread channels rather than replacing and extending single-thread channels, which is what the draft General Permit for Ephemeral Streams will do.

7.1 Degree of Incision or Bank Height Ratio (BHR)

The Degree of Incision or Bank Height Ratio (BHR) is the measure of the degree of channel incision leading toward channel entrenchment for single-thread streams. BHR is defined as the *lowest bank height* (LBH) divided by the maximum bankfull depth (D_{max}). If the bank height ratio is equal to 1.0, then a flow just greater than the bankfull discharge (e.g., annual flood) will flow out onto the floodplain. As the BHR increases the channel becomes more incised, which requires flows greater than the bankfull flow to have water flow onto the floodplain (Figure 6 - Diagrams A, B, C and D describe varying degrees of incision or BHRs)

A geomorphically stable stream has a BHR of 1.0 to 1.05 and is considered stable with low risk of degradation; a moderately unstable incised stream has a BHR of 1.05 to 1.3; an unstable reach of stream has a BHR of 1.3 to 1.5; and a highly unstable reach of stream has a BHR > 1.5 (Rosgen, 2001). A BHR equal to 2.0 or greater indicates that the channel is *entrenched* or vertically confined within the channel, and it would require a 50-year flood or greater to have water to flow onto the floodplain. As streams become more incised, stream functions and services proportionally decline to the point of entrenchment when the stream is functioning like an open pipe or culvert.

Multiple-thread or braided streams are not defined as incised because they are aggrading stream systems, which works toward improving and maintaining stream functions and services.

7.2 Width-to-Depth Ratio

The width-to-depth (W/D) ratio is defined as the ratio of the bankfull channel width (W_{bkf}) to the bankfull channel mean depth (D_{mbkf}) (Figure 7). The width-to-depth or W/D ratio is an indicator for trends towards channel instability or stability for single-thread streams. Single-thread, geomorphically stable streams generally will have a lower W/D ratio as compared to unstable streams (e.g., W/D ≅ 12 for stable vs W/D ≅ 20 or greater for unstable streams. Based on assessment of stable streams in Ohio by the USGS, stable stream W/D ratio tend to be near 17 or less. The W/D ratio state is the comparison of the current stream W/D ratio to an average W/D ratio, such as, identified by the Ohio USGS or other local reference condition. The W/D ratio state becomes more unstable as the ratio of the two W/D ratios increase (Figure 8).

For general reference regarding Ohio streams, grass-controlled geomorphically stable streams have W/D ratios less than 12:1, tree-controlled geomorphically stable streams have W/D ratios in the range of 12:1 to 19:1, and geomorphically <u>un</u>stable streams may have W/D ratios significantly greater than 20:1. However, various stages of channel instability can exhibit a broad range of W/D ratios as the instability evolves.

Multi-thread or braided stream types can have very high W/D ratios (e.g., greater than 40) and will generally have less than a W/D ratio less than 40 once the stream gradient flattens and balances its discharge and sediment loads.

7.3 Entrenchment Ratio

Entrenchment ratio (ER) is a measure of the vertical containment of a stream or river. It is the ratio of the *flood-prone area* or *width* (W_{fpa}) divided by the *bankfull width* (W_{bkf}) of the channel. The flood-prone width is measured at twice (2x) the bankfull maximum depth (D_{max}) as measured at the bankfull stage (Figure 9).

The Rosgen Classification of Natural Rivers (1996) indicates that streams with an entrenchment ratio of less than 1.4 are entrenched, streams with entrenchment ratios of 1.4 to 2.2 are moderately entrenched, and streams with entrenchment ratios greater than 2.2 are slightly entrenched or have no entrenchment.

Streams with a floodplain width of at least three (3) times the bankfull width of the channel (i.e., ER = 3.0) is generally a minimum ER required to maintain geomorphically stable low-gradient stream reaches. Streams with an ER equal to five (5) times the bankfull width (W_{bkf}) of the channel or greater tend to be sufficient to maintain dynamically stable, healthy streams (OEPA Rainwater and Land Development Manual, Appendix 7, *Planning for Streams* located at https://epa.ohio.gov/dsw/storm/rainwater).

7.4 Channel Evolution

Channel evolution is a term that describes the physical changes that occur to stream channel relative to its floodplain or floodprone area when a stream system moves from a geomorphically stable condition to a geomorphically unstable condition, and, over much time (e.g., 100+ years), recovers to a geomorphically stable condition.

Channel evolution models (CEMs) have been developed by several researchers, but they are generally different ways of describing this same process. A CEM developed by Watson et al., 2002, and Rosgen, 1996, are shown together Figure 10. The first drawing at the top of Figure 10 is Watson's stream profile diagram, which shows headward-advancing channel incision (bed erosion) along with aggraded material deposited downstream that results from the upstream incision. This headward advancing streambed erosion is commonly referred to as head-cut or head-cutting. The second drawing on the left of Figure 10 is the same channel evolution sequence shown in a 3D-diagram. The third diagram on the right show typical cross-sectional shapes and typical W/D ratios for of the associated Rosgen Stream Types next to them (i.e., C4, G4, F4 and C4). Note that the first and second drawings contain the same Rosgen stream type names (C4, G4, F4 and C4) to show the relative position or sequence of changes to the physical form of the stream channel.

This general sequence is quite typical for Ohio streams, but other sequences can occur as documented by Rosgen (1996, 2006). Note that this sequence can repeat itself as the head-cutting advances further upstream for decades or even centuries before a 'stabilization' point is achieved.

The three (3) physical characteristics of a stream and its floodprone area that must be assessed to determine the level of functions and services that a stream is actually providing, in addition to average stream gradient, are:

1. Degree of incision or bank-height ratio,
2. Width-to-depth ratio, and
3. Entrenchment ratio.

7.5 Channel Evolution – 2008 Federal Mitigation Rules Science Document

The Preamble for the 2008 Federal Compensatory Mitigation Losses of Aquatic Resources [Page 19595, Column 2] refers to the 2001 *National Research Council* (NRC) science report regarding the effectiveness of wetlands compensatory mitigation. This NRC report is entitled "*Compensating for Wetland Losses under the Clean Water Act*." Within this NRC report under the section entitled 'Water-Scale Patterns of Wetland Losses', the report points to the issue of the headward advancement of channel erosion (i.e., head-cutting) or channel evolution into the upper-reaches of first-order streams as a major cause of wetland losses. They point out that the channel instability is generally initiated by changes in runoff processes (e.g., land use changes referred to in Section 5.0) that increases stormwater runoff peak flows. Headcuts advance the drainage network further into the headwaters, which makes the watershed more efficient (i.e., water drains from the watershed much quicker). This reduces the time (time of concentration (t_c)) for stormwater runoff to reach a downstream location, which results in larger peak flows that results in downstream channel degradation (incision) and increased flooding.

Land use changes combined with a more efficient drainage network is typically described by comparing a rural watershed to an urban watershed hydrograph, but these conditions will occur anywhere land use changes occur (undisturbed vs disturbed conditions), especially in the headwaters of a watershed. The combined effects of land use change and shorter times of concentration (t_c) will increase stormwater runoff peak flows relative to undisturbed peak flows and will extend the duration of stream flows that transports channel sediment (i.e., stream flows greater than *critical discharge* (Q*)). These effects are shown by comparing the undisturbed vs disturbed flow duration curves (Figure 11). The change in stream flow characteristics from undisturbed to disturbed conditions directly leads to degraded (incised) downstream channels and increased flooding. This effect can be mitigated by increasing watershed storage. Increased watershed storage can be accomplished by creating more overland flow conditions (eliminating erosion gullies (ephemeral stream) length) that slow stormwater runoff and increases water infiltration into the soil horizon, and by constructing in-stream beaver pond analogs, similar functioning structures or stream & wetland complexes. Increased watershed storage will moderate stormwater runoff peak flows and create more low or base stream flow conditions that are below critical discharge (Q*). A stream flow that is typically below critical stream flow (discharge) is one that is less than half of the bankfull channel depth and does not transport sediment (fine sands, coarse sands, gravels, etc.). Extended low or base stream flows resulting from more watershed storage will 'push' streams more towards perennial flow conditions rather than creating ephemeral conditions (a.k.a., the aquatic dust bowl condition).

The most devastating mitigation requirement that directly leads to degraded (incised) downstream channel morphology (i.e., loss of functions) is replacement of ephemeral channels (erosion gullies) in the headwaters of watersheds. These ephemeral streams are most all headward-advancing erosion gullies that provide pathways for water to quickly run off the land that results in greater stormwater runoff peak flows and longer lasting erosive stream flows that erode and incise stream channels. This mistake then directly leads to degraded biological and chemical processes or water quality degradation. This <u>critical issue</u> must be understood and properly addressed by the regulatory agencies.

7.6 Channel Evolution Model by Cluer and Thorne

Channel evolution models (CEMs) have typically been described starting with a single-thread, geomorphically stable stream, then transitioning to a geomorphically unstable stream in multiple steps, and eventually returning to a single-thread, geomorphically stable stream again. However, due to the extensive research on the historical influence of beavers in our watersheds, Channel Evolution Models (CEMs) are being revised to include this extremely important historical fact. Cluer and Thorne (2014) and other fluvial geomorphologists have revised the CEM to <u>reset</u> the initial geomorphically stable stream condition to multi-thread or braided streams that have generally be formed as the result of extensive, historical beaver activity. This initial geomorphic stable state is referred to as Stage 0 as shown in Figure 12, which is the revised Cluer and Thorne channel evolution model.

This means that the highest and geomorphically most stable stream type is one that is impounded by beavers, or in other words, beaver impoundments that create multi-thread streams and provide more functions and services than any other stream type. Once a single-thread stream has formed, whether geomorphically stable or unstable, this is the onset of channel evolution or channel instability and functions and services begin to degrade (Figure 12). This fact is <u>critical</u> for using a *watershed approach* and assessing stream *functions* and *services*, which are long-established norms identified in 33 CFR Part 332.

Another way to explain just how important the role of beavers have been to stream systems is that Castro and Thorne (2019) have re-defined that there is a third primary driver in addition to the two primary drivers of discharge (Q) and sediment load (Q_s) defined by E.W. Lane with the Lane Balance (Figure 5) and that third primary driver is the beaver. Beavers are considered to be *ecosystem engineers* and their direct impact on ecosystem structure and dynamics has also led them to be considered a *keystone species* (Gurnell, 1998). We may not have first-hand knowledge of the extensive impact that beavers had on Ohio's stream systems in pre-settlement times, but we can easily understand that the processes that beavers and their impoundments created have directly influenced terrestrial and aquatic communities for 10's of thousands of years (historically correct), and these are processes that we must work towards restoring to properly restore terrestrial and aquatic communities. The OEPA needs to acknowledge the beaver's extensive role and value, rather than ignore it, and value the importance of multi-thread or braided streams bring to our watersheds and stream systems via in-stream beaver pond analogs or similarly functioning structures, and abandon the falsehood of the River Continuum Concept.

8.0 Habitat Assessments

The Clean Water Act's *objective* is to restore and maintain the chemical, biological and physical integrity of the Nation's waters. The OEPA has been a leader in sampling and analyzing the chemical and biological integrity of Ohio's streams and rivers. However, the OEPA assessment methodologies are greatly deficient when assessing the physical integrity of Ohio's streams, which is necessary to properly assess the structure of streams to determine their degree of functioning. Stream structure and its associated degree of function (i.e., physical integrity) directly influences the chemical and biological integrity of streams, and is a primary tenet necessary to assess and evaluate to achieve the objective of the Clean Water Act.

The OEPA has developed two *qualitative* 'tools' referred to as *Physical Habitat Assessments* that measure various attributes of a stream and surrounding conditions, which are then used to correlate with biology (i.e., fish and bugs). Specifically, these tools are referred to as the *Qualitative Habitat Evaluation Index* (QHEI) and *Headwater Habitat Evaluation Index* (HHEI). In general, the QHEI is used to evaluate the habitat of streams with watershed drainage areas greater than one (1) square mile along with methodology adjustments as the watershed drainage area increases, and the HHEI is used to evaluate the habitat of streams less than one (1) square mile in drainage area. These habitat assessment tools do not measure and evaluate the physical integrity of streams, and they have been used as such, which is a major stream assessment error. These two tools characterize or score various habitat attributes to develop a stream quality assessment rating. These habitat assessments merely place the word *physical* in front of *habitat assessment* to create a perception that a physical integrity assessment has occurred, but it has not. Habitat assessments *alone* do not address the physical integrity objectives in the Clean Water Act.

The physical integrity of a stream requires an assessment of the hydrology (discharge) and the geomorphic condition of the stream structure (i.e., is the stream channel geomorphically stable, unstable or in some degree of instability). Discharge is a primary driver that can quickly result changes to the stream geomorphic condition and key geomorphic characteristics, in addition to channel gradient, that must be to assessed to determine the degree of function for a stream is the degree of incision, width-to-depth ratio, and entrenchment ratio. Neither the QHEI nor the HHEI assess these key geomorphic characteristics.

As described by Asmus, et al. (2009), the stream structure and degree of function of the physical stream is governed by the interaction between geomorphology and hydrology, that is, stream physical habitat is determined by the interaction between channel geomorphology and hydrology (Figure 13).

The Asmus, et al., (2009) discussion continues as follows:

> The interaction among landform, surficial geology, and discharge creates the structural form of the channel that in turn governs the volume and quality of aquatic habitat. This relationship dictates the type and kind of suitable habitat available for biotic organisms (e.g., substrate type, riffles and pools, flow variability, degree of embeddedness).
>
> When the stream channel is stable (i.e., not eroding or aggrading above expectation), the stream is able to maintain its form and structure, and therefore, … demonstrates it has physical integrity.
>
> The resulting dynamically stable physical channel form provides the foundation upon with other elements of habitat are arranged (e.g., vegetation, large woody debris) and biological communities are structured.
>
> Habitat assessments typically focus on the presence of these physical elements (i.e., physical habitat) since biological potential is dependent on the quality of habitat.
>
> If there is a change in the hydrologic regime (e.g., increased peak flows) or change in sediment transport capacity, channel adjustment will be initiated (i.e., defined by the Lane Balance), and the physical structure and biological function of the stream channel and its attendant floodplain will change. Consequently, habitat degradation and water quality impairments occur and biotic communities will be affected. Thus, the fundamental interaction among geomorphology (geology, channel morphology, and substrate size), hydrology pathway, and hydraulic forces (shear stress) forms the physical structure upon which habitat is formed.

In summary, the QHEI and HHEI habitat assessments are not sufficient to determine the physical integrity (i.e., structure and function) of a stream channel and its associated floodprone area. A physical integrity assessment must determine whether the geomorphic condition of the stream channel and floodprone area is stable, unstable, or what degree of instability exists. Therefore, at a minimum, habitat assessments must be combined with geomorphic condition assessments that includes a hydrologic assessment to understand stream functions and services and address watershed needs, which are long-established foundational norms and contained within 33 CFR Part 332.

8.1 River Continuum Concept in Habitat Assessments

Both the QHEI and HHEI are foundationally conceived around the River Continuum Concept (RCC). Again, the RCC requires that single-thread streams must exist from headwaters to the mouth of streams, which was earlier described as a falsehood.

This foundational tenet of the RCC directly precludes the primary watershed need of storage, which is most appropriately addressed by constructing in-stream storage structures that are analogous to beaver ponds and/or function similar to beaver ponds that will evolve into multi-thread, low-gradient streams. But the RCC presumes that any in-stream structure to be a ‘violation’ of the RCC, albeit incorrectly. The OEPA’s application of the RCC must be terminated.

Again, the focus of stream restoration/mitigation in our headwaters needs to be on restoring historic watershed needs (storage) by creating in-stream beaver pond analogs or similar functioning structures that will evolve into multi-thread channels rather than replacing and/or restoring single-thread channels, but this is especially important for the case of ephemeral channels.

8.2 HHEI

The HHEI does not collect sufficient data about a stream’s structure to evaluate its degree of function, that is, it the stream channel geomorphically stable, unstable or have some degree of instability. Also, the *qualitative* nature of the data collected by habitat assessments along with their scoring metrics suggests that certain stream attributes are necessary for a healthy stream when these attributes are not correct when considered in the context of hydrology and geomorphology discussed above. This leads to confusion and misunderstanding about what is necessary for streams to function properly. Further, in the context of a watershed approach, streams need to be replaced with an in-stream beaver analog structure or stream & wetland complex to restore the primary watershed need (storage) and for multi-thread channels to evolve. Additionally, erosion gullies (ephemeral streams) in most cases should be replaced by overland flow conditions to slow stormwater runoff and promote more infiltration into the soil horizon.

The HHEI evaluates only three stream attributes to develop an assessment score. These three attributes are *substrate*, *bankfull width* and *maximum pool depth*. These three attributes are insufficient to characterize the geomorphic condition of a stream, which requires measurements of degree of incision, width-to-depth ratio and entrenchment ratio. Therefore, the HHEI cannot determine if a stream is geomorphically stable (100%-functioning), unstable (not functioning) or in some degree of instability (partially functioning).

The three HHEI stream attributes are then given scores to develop HHEI metric points, which are then totaled. Thus, a greater total metric score indicates a 'higher quality' stream. However, when you look at the individual attributes or metric scores, the scoring is quickly *suspect* if one does not know whether a stream is geomorphically stable or unstable (i.e., the physical integrity is unknown).

For the <u>substrate</u> attribute, scoring is greater for boulders (16 points) than cobbles (12 points), and cobbles score greater than gravel (9 points). If a stream is geomorphically unstable, then the gravels and cobbles may have been eroded or washed away downstream and only the larger boulders remain. This boulder substrate condition scores high (16 points), but in reality, a geomorphically stable stream would have gravel substrate as its dominant substrate (9 points). Therefore, understanding whether a stream is geomorphically stable or unstable is *imperative* to know whether a substrate size is proper in order to establish a metric score that is rational. Thus, in this example, the gravel substrate should have been the highest score and not the boulder or cobble. Given that a majority of streams in Ohio are unstable, this is a serious flaw of the HHEI. The HHEI does not consider geomorphic condition nor use sediment transport equations to validate proper stable stream substrate sizes, and thus, arbitrarily incentivizes the use of substrate larger than would naturally exist. Figure 14 is the Shield's curve which is required to obtain the critical dimensionless shear stress value that is necessary to solve the sediment transport equation in Figure 15 for the median substrate size (d_{50}).

For the <u>maximum pool depth</u>, scoring is not consistent for geomorphically unstable streams. Pool depths can easily scour and fill in geomorphically unstable streams due to high bank erosion and sediment transport rates. Thus, pool depth measurements are arbitrary in geomorphically unstable streams, because they can rapidly change depending on sediment loads. For example, degraded incised streams typically have narrow widths that scour deeper pools in an attempt to slow in-stream channel velocities. These resultant deeper pools could easily exceed 40 cm, which could then arbitrarily require a QHEI assessment to be performed, due to the pool depth exceeding 40 cm as required in the HHEI/Primary Headwater Habitat (PHW) Manual (2009).

For the <u>bankfull width</u> of the channel, the PHW Manual (2009) states that bankfull width for the HHEI is to be measured at riffle, runs or glides. Bankfull channel width measurements <u>must</u> be made at riffles for a consistent measure and not elsewhere. Along a reach of stream, the bankfull channel width can vary significantly (e.g., 50%), which would could easily result in stream bankfull width metric scores being significantly altered arbitrarily. Additionally, the bankfull width measurement location is not addressed for steeper gradient streams (i.e., greater than 4%), which are step-pool streams, and again leads to arbitrary metric scoring, because cause bankfull channel width can vary significantly for steps and pools.

Another significant problem with the HHEI is the PHW classification flow chart on HHEI scoring in Figure 15 in the PHW Manual (2009), page 35, which is provided in Figure 16 of this document. At the "Natural Channel?" decision oval in the flow chart, the options are YES or NO. The NO-option is discussed on page 4 of the PHW Manual to include channels modified by relocation, channelization or dredging, which are separated from natural channels. The YES-option includes natural channels, which includes streams that are geomorphically stable, unstable or in some degree of instability. Because the HHEI fails to address and determine the geomorphic condition of a stream, severely degraded streams are arbitrarily determined to be of high quality, which greatly over-rates the stream's value and results in significantly higher mitigation costs. This is WRONG! The flow chart must be revised to address geomorphically <u>un</u>stable streams (Figure 17), which OEPA has discussed that it has little to no data for this condition and there has been no evaluation of this condition. In other words, the HHEI should <u>not</u> be used to assess any geomorphically unstable stream until such time that the OEPA has sufficient data to properly evaluate geomorphically unstable streams and revise the HHEI flow chart and PHW Manual to correctly address geomorphically unstable streams based on the revised flow chart as provided in Figure 17.

In conclusion, the HHEI is highly subjective and when used <u>alone</u> has no ability whatsoever to evaluate functions and services of a stream, it does not use a watershed approach or address watershed needs (current or historic), and it does not address watershed scale, which are foundational norms for stream impact assessments and stream restoration/mitigation as long-established and contained within 33 CFR Part 332 directly referenced by O.A.C. 3745-32-03. Further, these norms identify that stream impacts are to only replace the degree of stream function that exists prior to a stream impact and not arbitrarily replace stream length. For example, if a 100-foot reach of severely degraded stream is functioning at 10% of the level of a geomorphically stable stream (100%-functioning), then only 10 feet of a 100%-functioning stream is to be mitigated (100-feet x 10%).

8.3 QHEI

The QHEI does address some stream characteristics that suggest stream instability, but the methodology and data collected for the QHEI is highly *subjective* and *qualitative*. For example, multiple QHEI assessors will come up with wide ranges of outcomes or scores for the same stream resulting in indeterminable solutions. That is, you have to correctly define a problem before you can solve it. Further, the outcomes are so general that it is not possible to tell which stream is more unstable than another (i.e., rational mitigation priorities cannot be created). What is needed is an objective, quantitative geomorphic condition assessment that measures key geomorphic characteristics including degree of incision, width-to-depth ratio and entrenchment ratio. Without this fundamental geomorphic information, one cannot objectively determine whether a stream is geomorphically stable, unstable or in some degree of instability, which is required to determine level of functions and services that a stream is providing as discussed in 33 CFR Part 332 and referenced by O.A.C. 3745-32-03.

It is not that the QHEI has no value, it may be a good habitat assessment tool; however, habitat assessment has to be connected or linked to geomorphic condition that can be objective and quantitatively assess stream functions and services to have a rational meaning.

Additionally, the QHEI is strongly *biased* toward higher stream powers (Figure 18), that is, as the QHEI scores increase so does the associated stream power. This means that the OEPA has arbitrarily pre-defined a desired stream condition, which is for single-thread streams that look and function like a trout stream, and are subsequently saying that other natural and historic stream types are not acceptable, which is irrational and arbitrary. For example, the biased QHEI forces stream restoration/mitigation projects in low-gradient streams to try to look like trout streams when their target condition is a multi-channel or braided stream-type that result from in-stream beaver ponds or stream & wetland complexes (refer to discussion by Ben Goldfarb's book in Section 7.0 that starts with "Close your eyes."). Further, these pseudo trout streams constructed in low-gradient areas will most likely revert to a braided, swampy wetland stream-type or even become a beaver-impounded stream again in the long-term. But this results in significant wasted mitigation dollars requiring something to be constructed that is inherently unsustainable. Even if a beaver did construct an impoundment across a stream mitigation site, the regulatory agency would require it to be removed or one would not get mitigation credit for restoring stream length.

In conclusion, the QHEI is highly subjective and when used alone has no ability whatsoever to evaluate functions and services of a stream, it does not use a watershed approach or address watershed needs (current or historic), and it does not address watershed scale, which are foundational norms for stream impact assessments and stream restoration/mitigation as long-established and contained within 33 CFR Part 332 directly referenced by O.A.C. 3745-32-03. Further, these norms identify that stream impacts are to only replace the degree of stream function that exists prior to a stream impact and not arbitrarily replace stream length. For example, if a 100-foot reach of severely degraded stream is functioning at 10% of the level of a geomorphically stable stream (100%-functioning), then only 10 feet of a 100%-functioning stream is to be mitigated (100-feet x 10%).

9.0 Conclusions

The OEPA's draft *General Permit for Impacts to Ephemeral Streams and Isolated Wetlands*, which adds ephemeral streams to an existing isolated wetlands permit, irrationally and arbitrarily creates ephemeral stream impact assessment and restoration/mitigation criteria that fails to follow long established norms for stream impact assessment and stream restoration/mitigation. This irrational and arbitrary ephemeral stream assessment and restoration/mitigation criteria will directly result in more degraded streams, increased flooding and degraded water quality throughout Ohio.

Long established norms for stream impact assessment and restoration/mitigation criteria were founded in the 2008 Federal Compensatory Mitigation Rules that were contained in Federal Register dated April 10, 2008 and entitled *Compensatory Mitigation Losses for Aquatic Resources* (33 CFR Part 332). These established norms have a primary focus on assessing and restoring aquatic resource functions and services and not arbitrarily on replacing linear feet or ratios of linear feet of stream impacted. Additionally, these norms require a watershed approach that address watershed needs (current and historic) and watershed scale. Additionally, these norms establish that *restoration* address the physical, chemical and biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource (§332.2).

The OEPA's Section 401 water quality certification rules located in O.A.C. 3745-32-03 discusses in subsection (B)(2)(d) that a specific and detailed mitigation plan prepared in accordance with the requirements of 33 CFR Part 332 is required. It is understood that OEPA's draft General Permit for Ephemeral Streams is outside or not subject to Section 404 or 401 of the Clean Water Act, but it is not understandable why the OEPA chose to abandon these long established stream assessment and restoration/mitigation norms to create irrational and arbitrary ephemeral stream assessment and restoration/mitigation criteria without any explanation. Further, given that a broad group of Ohio stakeholders including the ODOT, ODNR and even the OEPA have been opposing similar irrational and arbitrary stream impact assessment and restoration/mitigation criteria that the USACE Huntington District has been attempting to impose on Ohio for over 2 years with a primary stakeholder complaint that the Huntington District failed to involve stakeholders in the criteria development process, it seems incomprehensible that the OEPA would do the same thing and not reach-out to Ohio stakeholders to assist in the development of a new ephemeral stream permit.

The new Waters of the United States (WOTUS) definitions, which eliminated Federal regulation of ephemeral streams, was signed and announced on January 23, 2020; thus, the OEPA new at that time a new ephemeral streams permit would be required given that ephemeral streams are defined as Waters of the State. The OEPA had more than sufficient time to reach-out to stakeholders and involve them in the development process for a new OEPA ephemeral streams permit to make sure the permit was logical and rational. But the OEPA delayed their out-reach to stakeholders until May 7, 2020 when it provided a brief webinar to stakeholders unveiling the OEPA in-house developed General Permit for Ephemeral Streams concepts. Then the OEPA quickly announced a 30-day public comment period beginning May 18, 2020 that expires on June 17, 2020 with implementation of the new General Permit for Ephemeral Streams planned for June 22, 2020 that will coincide with the effective date of the new WOTUS definitions. This is lack of involving stakeholders in the permit development process is serious negligence on the part of the OEPA.

After reviewing the draft General Permit for Ephemeral Streams and providing extensive comments, the OCA provides the following summary list of issues and problems with this draft General Permit:

1. Ephemeral stream functions and services are not assessed for stream impacts or for restored/mitigated streams.

2. An objective and quantitative geomorphic condition assessment is not used to assess ephemeral streams prior to impact nor after restoration/mitigation, which is necessary to determine the degree of stream functioning (e.g., 10%-, 50%-, 100%-functioning) and to know whether a stream is geomorphically stable, unstable or in some degree of instability.

3. A watershed approach for restoration/mitigation is not used, which is required to determine watershed needs.

4. The failure to use a watershed approach to determine watershed needs arbitrarily results in all ephemeral stream impacts to be restored or mitigated with the same and/or additional ephemeral

stream length being developed (1:1 or 1.5:1) rather than creating more storage, which is the primary watershed need in watersheds across Ohio when using a watershed approach.

5. Requiring ephemeral streams to be restored/mitigated at ratios of 1:1 or 1.5.1 will directly result in, but not limited to, following consequences:
   - Increased stormwater peak flows;
   - Degraded (incised) streams;
   - Increased streambank erosion;
   - Increased downstream flooding;
   - Degraded water quality;
   - Degraded in-stream and floodprone area habitat;
   - Drained watersheds (creates the aquatic dust bowl);
   - Less water for wildlife;
   - Less habitat diversity;
   - Reduced base flows to maintain intermittent or perennial streams;
   - Rapidly transports nutrients downstream like in a pipe; and,
   - Increased eutrophication potential of water bodies like Lake Erie, the Ohio River and other water bodies.

6. A watershed approach that addresses watershed needs (storage) requires less ephemeral stream length and more in-stream storage, which will result in, but not limited to, the following benefits:
   - Decreased or smaller peak flows;
   - Reduced or prevented stream degradation;
   - Reduced or prevented stream bank erosion;
   - Reduced sediment in streams;
   - Decreased downstream flooding;
   - Improved water quality;
   - Reduced or prevented in-stream and floodplain habitat degradation;
   - Reduced or prevented draining of watersheds (no aquatic dust bowl);
   - Increased water availability for wildlife;
   - Increased habitat diversity;
   - Extended base flows resulting in more intermittent and perennial streams;
   - Delays (stores) and reduces downstream transport of nutrients; and,
   - Reduced eutrophication potential for Lake Erie, Ohio River and other water bodies.

7. Rather than using objective and quantitative geomorphic condition (physical integrity) assessments to evaluate stream physical integrity, *subjective* and *qualitative* habitat assessments (QHEI and HHEI) are required, which cannot evaluate stream functioning (geomorphic condition) nor address watershed needs (storage) and this leads to irrational and arbitrary opinions of success or failure for stream restoration/mitigation. In other words, there are no standards for which to assess the physical integrity of streams that may be impacted or restored/mitigated.

8. The HHEI contains a fatal flaw because the HHEI cannot distinguish between geomorphically stable or unstable streams and evaluates all streams as if they are geomorphically stable (100%-functioning). This leads to geomorphically degraded streams including ephemeral streams, to be greatly over-rated in value and improperly restored with too large of substrate to achieve a higher HHEI score. Given that most headwater streams in Ohio including ephemeral streams are geomorphically degraded, this is a severe problem.

9. The QHEI and HHEI habitat assessments are founded in the River Continuum Concept that implies streams must be single-thread from headwaters to the mouth of streams, which is a falsehood.

10. Stream physical integrity assessments require both an assessment of hydrology and stream geomorphic condition, which addresses watershed needs, and leads to the understanding that watersheds need less ephemeral stream length and greatly more in-stream storage (e.g., more overland flow to promote water infiltration and impoundments functioning like historically correct beaver ponds or stream & wetland complexes).

11. Historically, 1st through 5th order streams in Ohio were impounded extensively by beavers and these historic conditions fail to be addressed by the OEPA due to their great misuse of the River Continuum Concept.

12. Historically-correct, beaver-impounded streams resulted in low-gradient, multi-thread or braided streams dominated by silt, clay and muck bottoms, which were common-place across Ohio in pre-settlement times, but are biased against by the OEPA's QHEI and HHEI that are founded in the River Continuum Concept. These habitat assessments demand single-thread streams that have higher stream powers and generally look like 'trout' streams. This bias leads to lower-functioning, single-thread streams, lack of watershed storage, lack of habitat diversity, little to no nutrient assimilation, reduced groundwater recharge, drained watersheds (the aquatic dust bowl condition), eutrophication, and other degradations.

13. Failure to use geomorphic condition assessments for stream impacts, which are required to address stream functions and services, grossly over-rates the value of stream impacts and leads to excessive and irrational stream length restoration/mitigation requirements and costs.

14. Stream mitigation should be commensurate with the degree of functioning of a stream reach to be impacted (e.g., a 100-foot ephemeral stream impact to a degraded, incised stream functioning at 10% of capacity would only be required to restore and/or mitigate 10-feet of a 100%-functioning stream (i.e., geomorphically stable stream).

15. Failure to address watershed scale for stream impacts and mitigation leads to excessive mitigation requirements and costs.

16. When combined, the effects of not using geomorphic condition assessments for stream impacts and not addressing watershed scale for stream mitigation can over-rate and drive mitigation costs astronomically through the roof (e.g., over-rate the cost of mitigation by as much as 150-fold).

17. The USACE Huntington District's *Stream & Wetland Valuation Metric* (SWVM), if implemented as currently proposed, will dramatically drive up the costs of stream mitigation for mitigation banks and in-lieu fee programs, which will simultaneously drive up costs of ephemeral stream mitigation.

18. The draft General Permit frequently refers to aquatic organisms (fish & bugs) for ephemeral (dry) streams. This is misleading and creates confusion and such references should be removed.

19. The culvert design criteria for ephemeral streams requires that they address the natural movement of aquatic organisms, which is not an issue dry ephemeral streams, and that they accommodate the bankfull discharge, which is an improper culvert sizing requirement for headwater streams where storage is a primary requirement.

20. Statements frequently infer or imply that degraded, incised streams are to be restored, which confounds and confuses, especially due to the restoration/mitigation having no standards.

21. The draft General Permit contains numerous nebulous phases and terms with no examples that will lead to bureaucracy, wasted time and wasted financial resources to determine what these nebulous phrases and terms mean for each permit. These phrases and terms need to be defined and/or have examples provided. Examples of these phrases and terms are as follows:
    - "returning conditions which support pre-impact biological function"
    - "protected long term"
    - "appropriate management measures"
    - "appropriate vegetative buffers"
    - "buffer widths"

22. The Permittee Responsible Mitigation 5-year monitoring period for permanent impacts to ephemeral streams is arbitrarily too long for restoring only physical integrity and should be reduced to the same 2-year monitoring period as temporary impacts to ephemeral streams, which similarly only restores physical integrity.

23. The draft General Permit appears to eliminate the NWP 49 exemption for coal remining projects under SMCRA to restore ephemeral streams that the OEPA already provided 401-certification approval. If this exemption is eliminated, then the OEPA needs to restore this exemption. Remining is the mitigation.

24. A 2-year renewal period for the General Permit is too frequent to be used for SMCRA permits, which run for 5-year periods and mine operations typically take 5 to 8 years to complete. This means that the General Permit could be easily have to be renewed three, four or even more times over the life of a surface mine, and would create a potential 'moving target' for restoration/mitigation. The General Permit needs to be extended to at least 5 years in the case of SMCRA permits.

25. A rather simple <u>alternative</u> would be for the draft General Permit for Ephemeral Streams to focus on the primary watershed need of <u>storage</u>, which can be accomplished by using <u>Best Management</u>

Practices (BMPs) that develop more storage, such as, converting erosion gullies (degraded ephemeral stream length) to overland flow conditions that promotes storage of water within soils, developing in-stream impoundments that function similar to beaver ponds, and other similar concepts.

26. Most all ephemeral stream impacts will occur by activities that directly involve engineers, who are well-trained in surface water hydrology, that can design cost-effective BMPs that will increase watershed storage and improve water quality.

The OCA requests that the OEPA take the time to discuss this extensive list of issues and concerns with the OCA and other stakeholders before this draft General Permit of Ephemeral Streams is implemented. As documented, this draft General Permit irrationally requires incorrect stream impact assessments and restoration/mitigation that will directly lead to more degraded streams, increased flooding and degraded water quality, and incorrectly over-rates the value of ephemeral streams, which makes the cost of restoration and mitigation grossly more expensive than it should be.

FIGURES

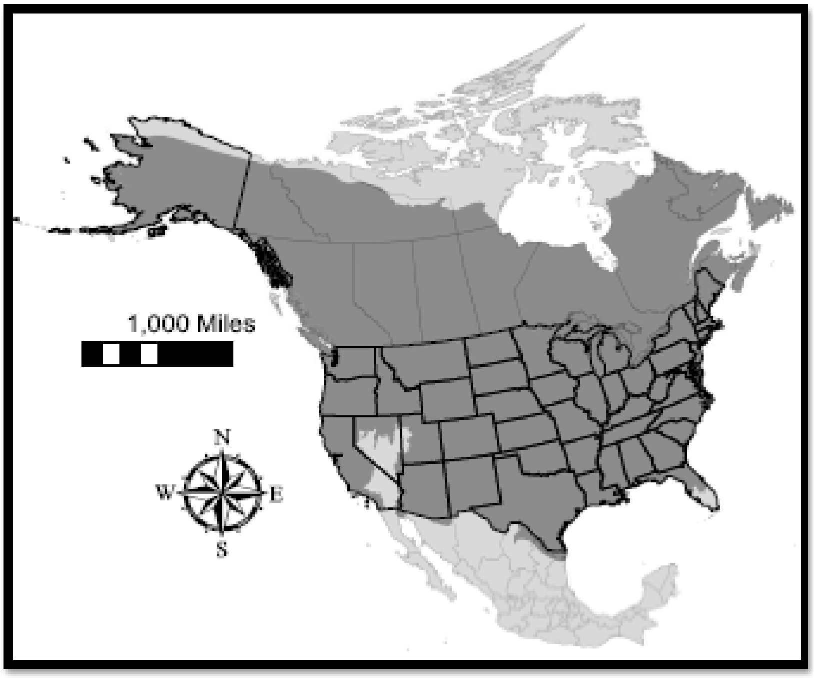


Figure 1 - The probable historic range of the North America beaver (dark shading) (Pollock, et al., 2017).

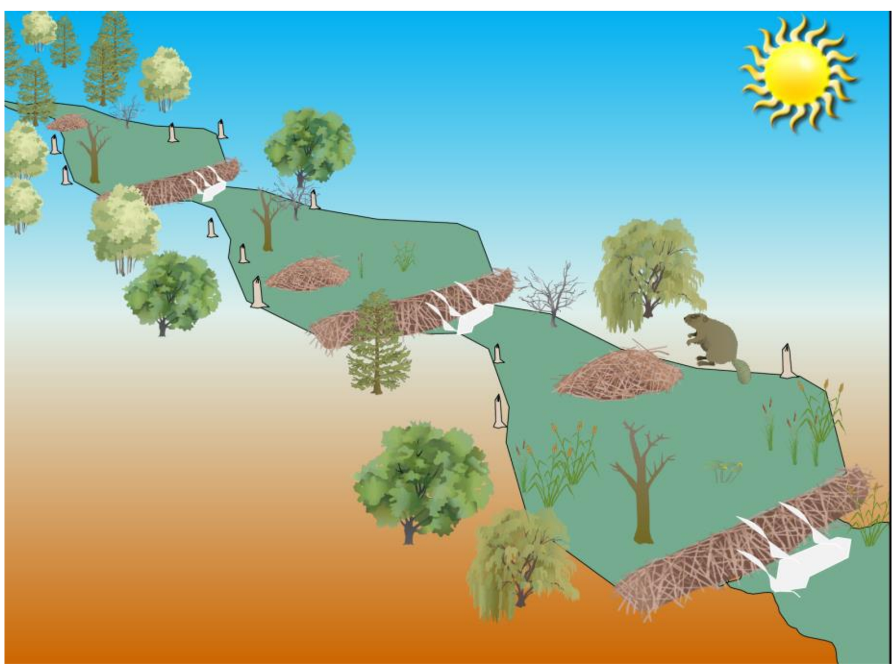


Figure 2 – Depiction of how streams likely appeared in Pre-Settlement times, which creates a target condition for stream and watershed restoration in current times.

FIGURES

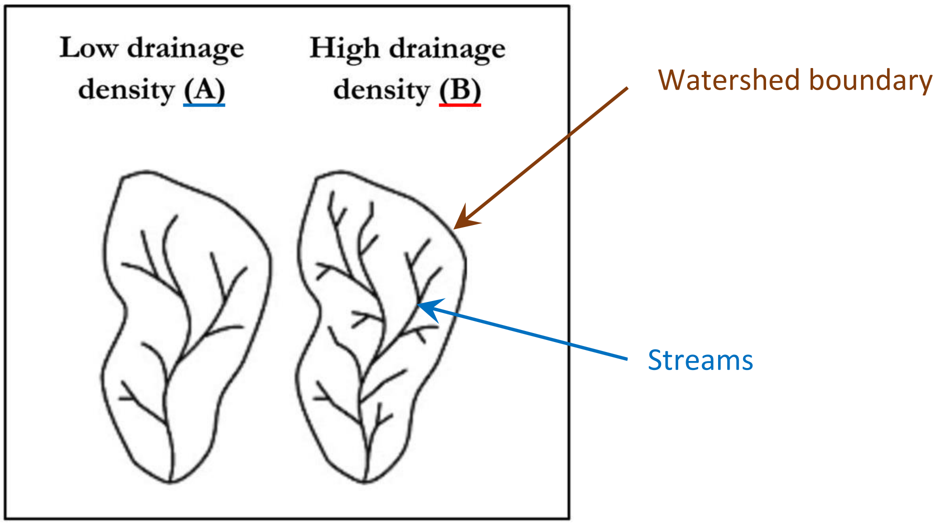


Figure 3 - Plan view of stream drainage network within the watershed boundary expanding from low drainage density (A) to high drainage density (B) as erosion gullies advance headward into the watershed due to land use changes and loss of storage.

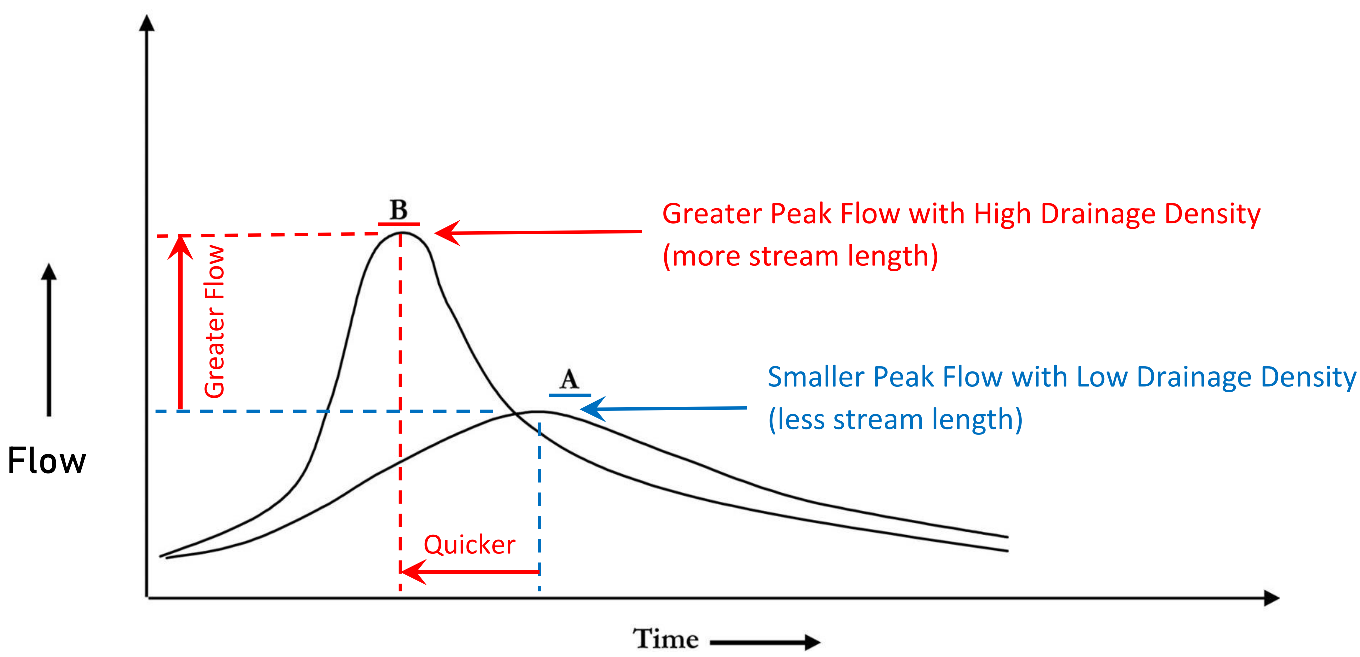
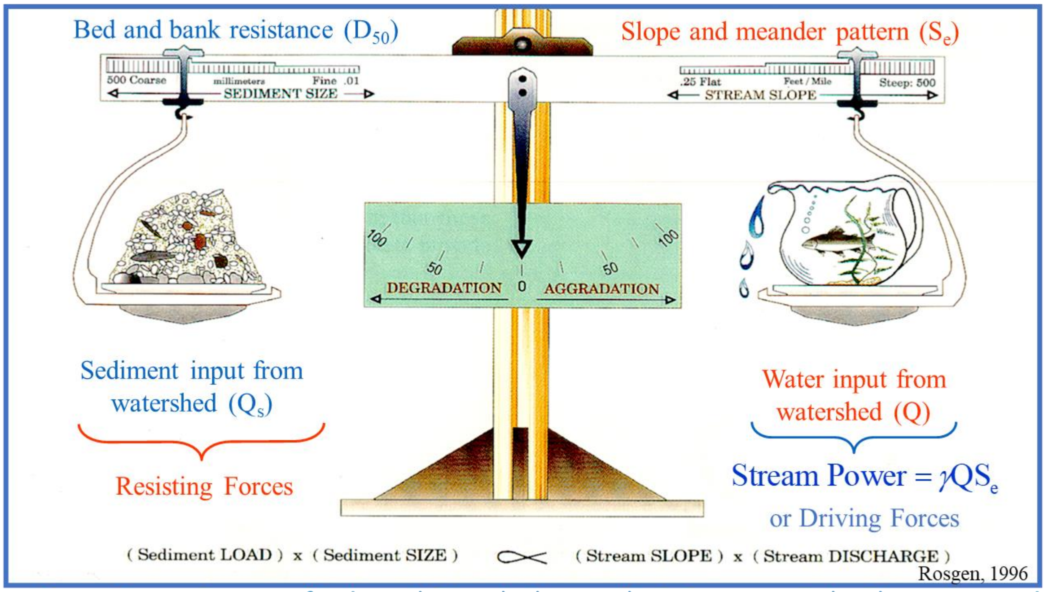


Figure 4 – Increased drainage density from erosion gullies (ephemeral streams) result in quicker runoff and greater peak flows (Curve A – low drainage density and Curve B – high drainage density as described to in Figure 3).

FIGURES

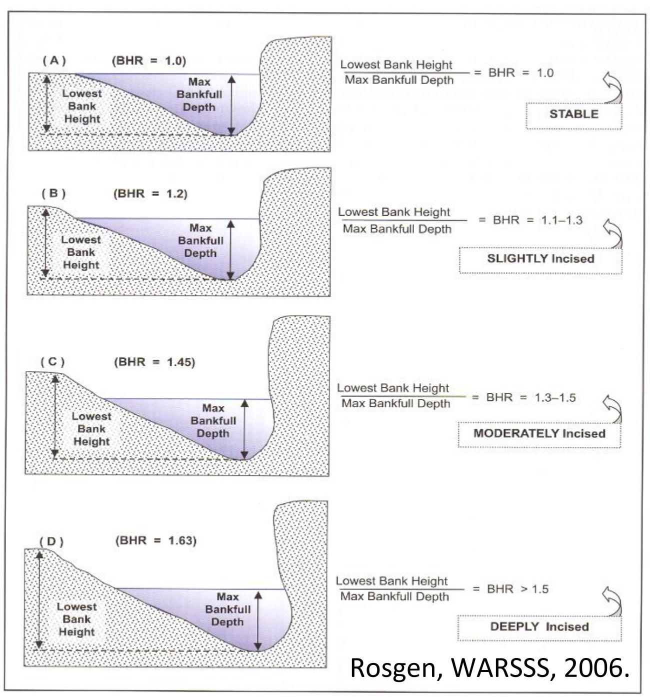
Lane Balance



- Over time, streams find a relative balance that transports both water and sediment (Lane, 1955).

Lane, E.W. 1955. Design of Stable Channels. *Transactions, American Society of Civil Engineers*, 120:1234.

Figure 5 – Lane's Balance diagram describes the balance needed between the primary driving forces (flow and sediment) and the resisting forces (stream slope and substrate size & bank resistance) to maintain a geomorphically stable stream channel.



Adjective Stability Rating	Bank Height Ratio
Stable (low risk of degradation)	1.0 – 1.05
Moderately unstable	1.05 – 1.3
Unstable (high risk of degradation)	1.3 – 1.5
Highly Unstable	> 1.5

Rosgen, D., *A Stream Channel Stability Assessment Methodology*, Wildland Hydrology,

Figure 6 – Diagram demonstrating the Degree of Incision or Bank Height Ratio (BHR) and Table providing adjective stability ratings for various degrees of incision (BHRs).

FIGURES

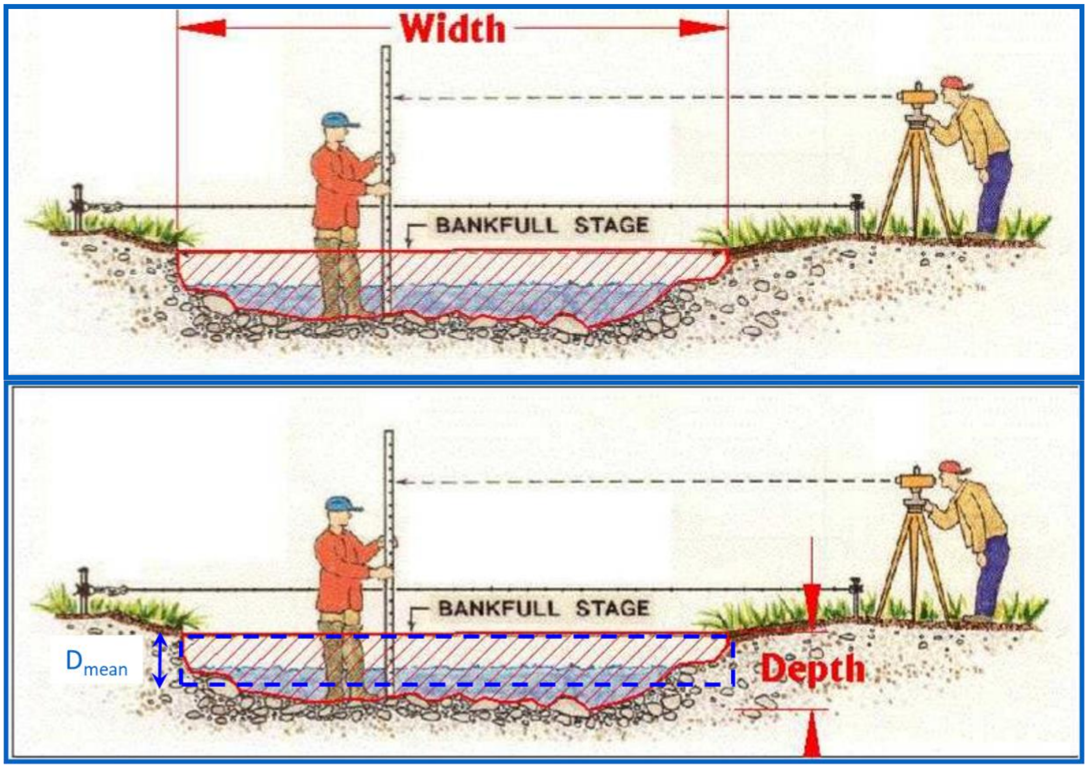
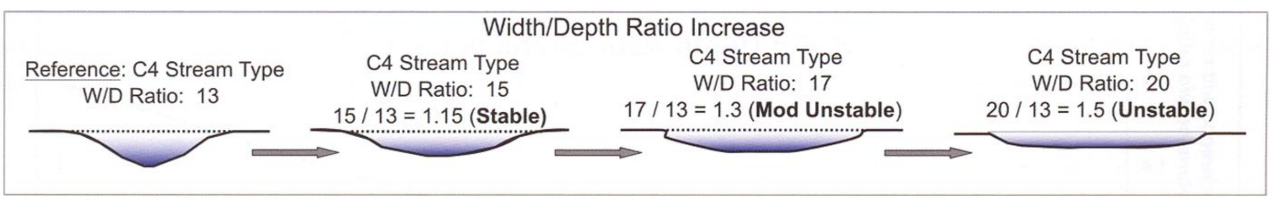


Figure 7 – The top image demonstrates the bankfull channel width (W_{bkf}) measured and the bottom image demonstrates the average or mean depth (D_{mbkf}) measured at bankfull stage at a riffle location for a consistent measure (Rosgen, 1996).



Rosgen, WARSSS, 2006.

The Ohio USGS Region A Curve predicts an average W/D ratio ≅ 17.

Adjective Stability Rating	Ratio of W/D Increase
Very Stable	1.0
Stable	1.0 – 1.2
Moderately Unstable	1.21 – 1.4
Unstable	> 1.4

Rosgen, D., *A Stream Channel Stability Assessment Methodology*, Wildland Hydrology, 2001.

Figure 8 – Diagram demonstrating Width-to-Depth ratios increasing relative to a reference condition, which leads to more channel instability, and a Table with an adjective stability rating for the ratio of increase relative to the reference condition.

FIGURES

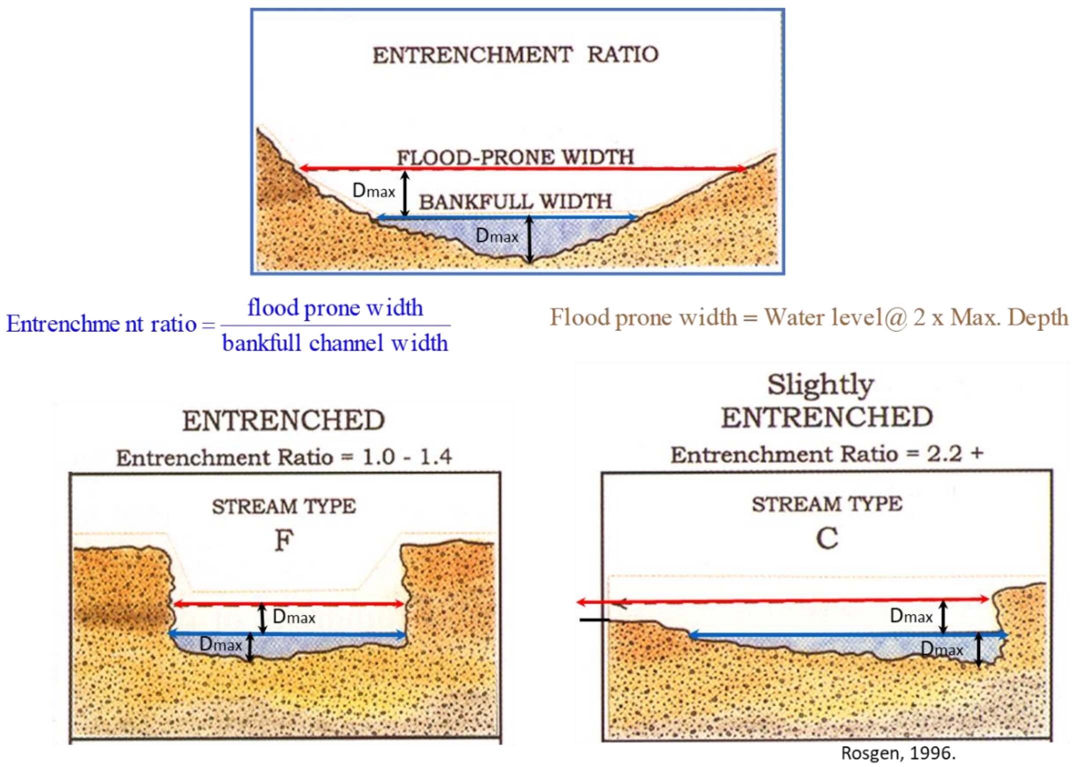


Figure 9 – The top diagrams visually defines entrenchment ratio. The Stream Type F channel diagram is entrenched and has a BHR greater than 2.0. The Stream Type C channel diagram is slightly entrenched with it transitioning to no entrenchment as the entrenchment ratio increasing above 3.

FIGURES

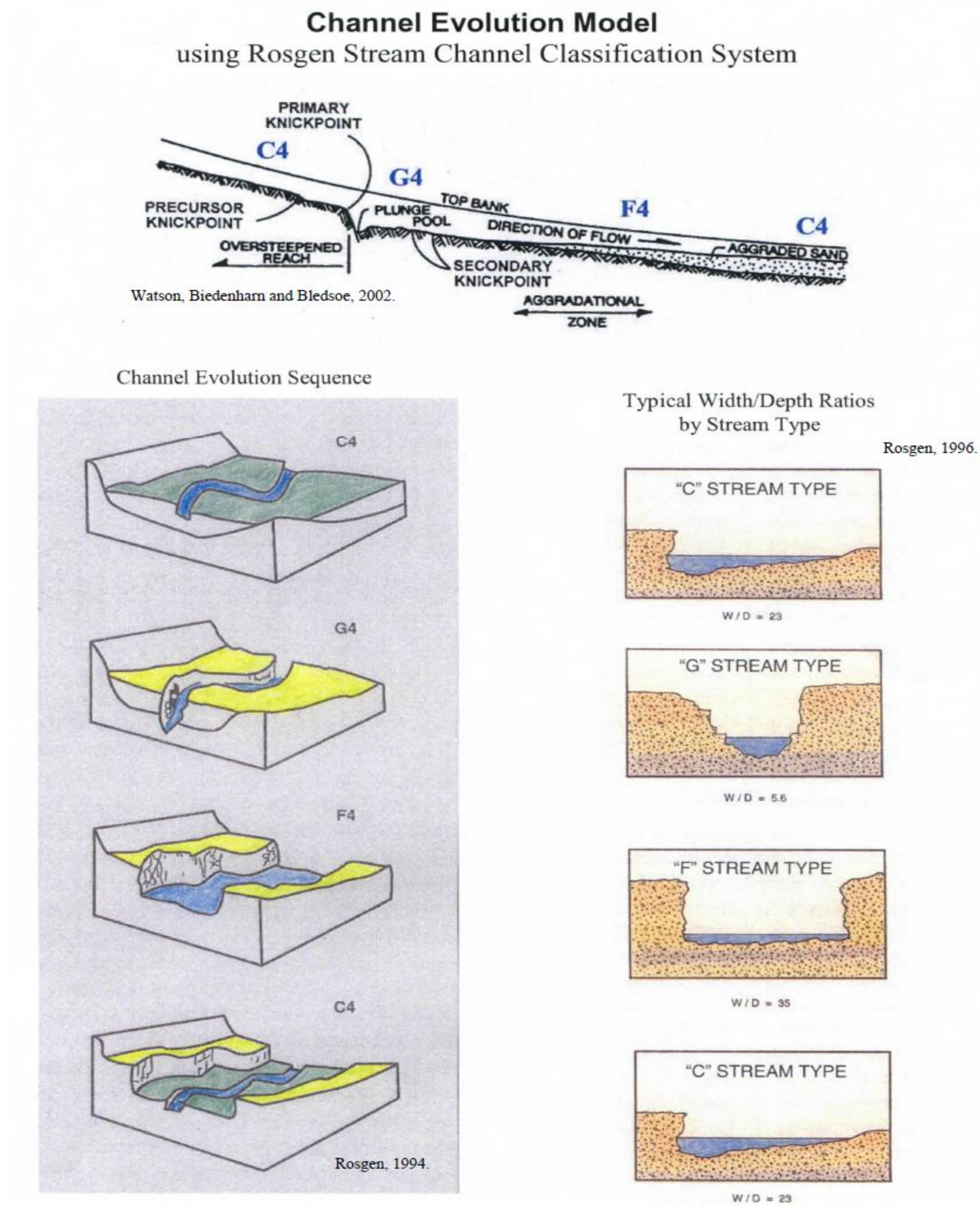


Figure 10 – The top drawing is the stream profile with the streambed eroding and advancing headward with resultant aggradation downstream. The left drawing provides a 3D view of the physical stream condition along the stream profile at the various stream types locations in the top drawing (C4, G4, F4 and C4). The right drawing shows the typical cross-section form and W/D ratio representative of each stream type.

FIGURES

Undisturbed vs. Disturbed Flow-Duration Curves

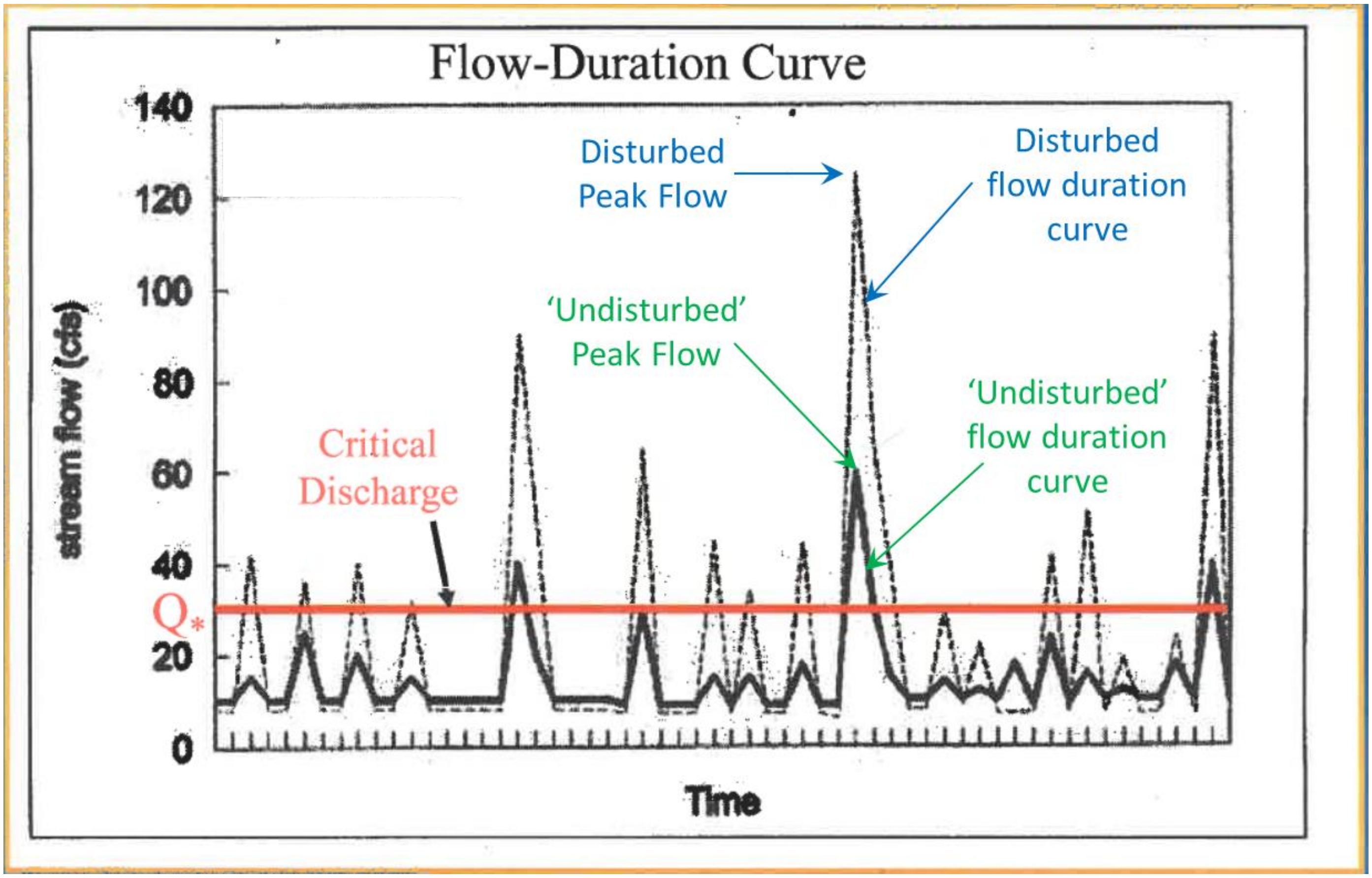


Figure 11 – Comparison of 'undisturbed' land use vs disturbed land use flow duration curves. Critical Discharge (Q*) is the discharge when sediment transport begins. When stream flows persist for longer times above Q* and stormwater runoff peak flows increase (disturbed flow duration curve), then channel degradation (incision), head-cutting (extension of the drainage network via erosion gullies), and increased flooding will result.

FIGURES

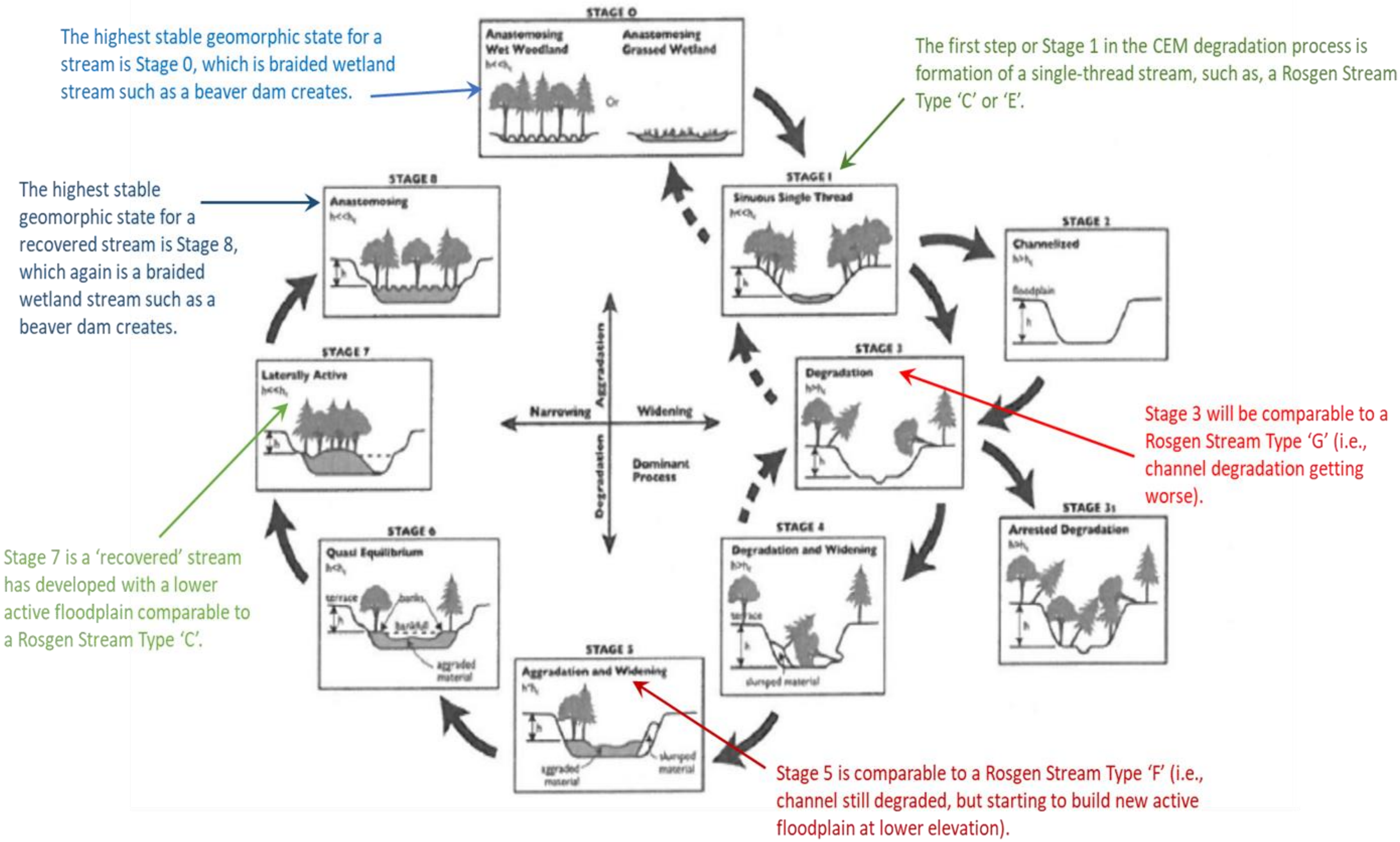


Figure 12 – Cluer and Thorne (2014) revised Channel Evolution Model with Stage 0, which represents multi-thread wetland stream or beaver impounded streams as the initial geomorphically stable stream condition.

FIGURES

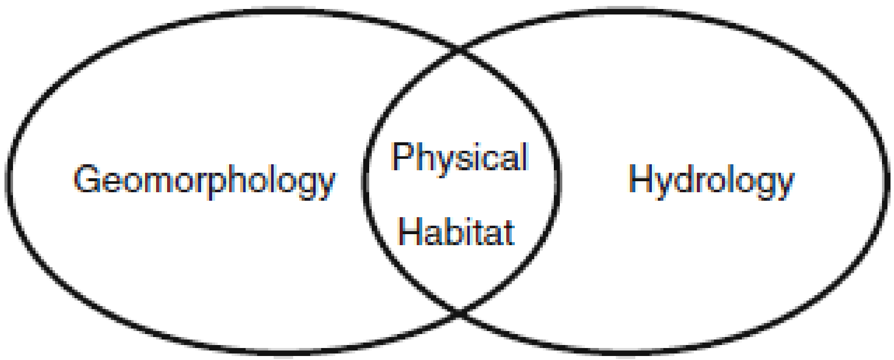


Figure 13 – Stream physical habitat is determined by the interaction between channel geomorphology and hydrology (Asmus, et al., 2009).

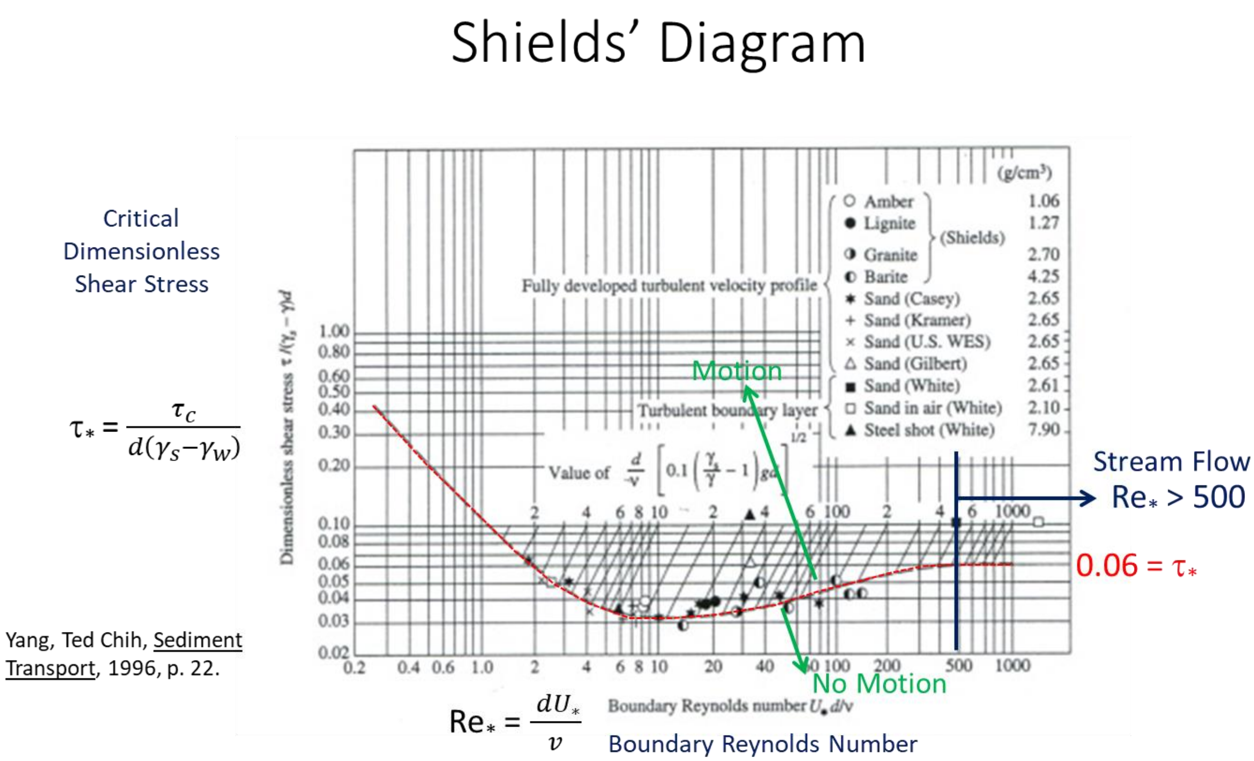


Figure 14 – The Shield's diagram is used to determine the critical dimensionless shear stress (τ_*) that is required to solve for the design of the median substrate size (d_{50}). Example calculations to solve for the median substrate size are provided in Figure 15.

FIGURES

Example sediment transport calculations to determine the mean sediment diameter (d_{50}) transported by the flow

Assume:

- Mean bankfull flow depth (D_{max}) is 5 ft.
- Stream gradient (S_w) = 0.002 ft/ft
- Water temperature = 50°F, $\gamma_w = 62.4 \frac{lb}{ft^3}$
- Specific gravity of sediment = 2.65, $\gamma_s = 2.65 \times \gamma_w$

$$\tau_* = \frac{\tau_c}{d_{50}(\gamma_s - \gamma_w)} = \frac{\gamma_w D_{max} S_w}{d_{50}(\gamma_s - \gamma_w)} \rightarrow \tau_* = \frac{\left(62.4 \frac{lb}{ft^3}\right)(5\,ft)\left(0.002 \frac{ft}{ft}\right)}{d_{50}\left(2.65\left(62.4 \frac{lb}{ft^3}\right) - 62.4 \frac{lb}{ft^3}\right)} = \frac{0.624 \frac{lb}{ft^2}}{d_{50}\left(102.96 \frac{lb}{ft^3}\right)} = \frac{0.00606\,(ft)}{d_{50}\,(ft)}$$

From Shields diagram, assume $\tau_* \cong 0.06$ ($Re_* > 500$).

Then $d_{50} = \frac{0.00606\,ft}{0.06} = 0.101\,ft \left(\frac{304.8\,mm}{1\,ft}\right) = 30.78\,mm\ or\ 1.21\,inches$

Check $Re_* > 500$ assumption

$$Re_* = \frac{dU_*}{v} = \left(\frac{\tau}{\rho_w}\right)^{1/2}\left(\frac{d}{v}\right) = \left(\frac{0.624 \frac{lb}{ft^2}}{1.940 \frac{lb \cdot s^2}{ft^4}}\right)^{1/2}\left(\frac{0.101\,ft}{1.410 \times 10^{-5} \frac{ft^2}{s}}\right) = 4062$$

√ OK $Re_* > 500$

Yang, Ted Chih, Sediment Transport, Theory and Practice, The McGraw-Hill Companies, New York, 1996, pp. 36-37.

Figure 15 **-** Example sediment transport calculations used to determine the median size substrate size (d_{50}) transported by the flow.

FIGURES

Field Evaluation Manual for Ohio's Primary Headwater Streams
Ohio EPA, Division of Surface Water

Review Version 2.3
October 2009

Figure 15. PHWH classification flow chart based on HHEI scoring.
http://www.epa.ohio.gov/portals/35/wqs/headwaters/HHEIFlowChart.pdf

35

Figure 16 – PHW Manual (2009) classification flow chart based on HHEI scoring.

FIGURES

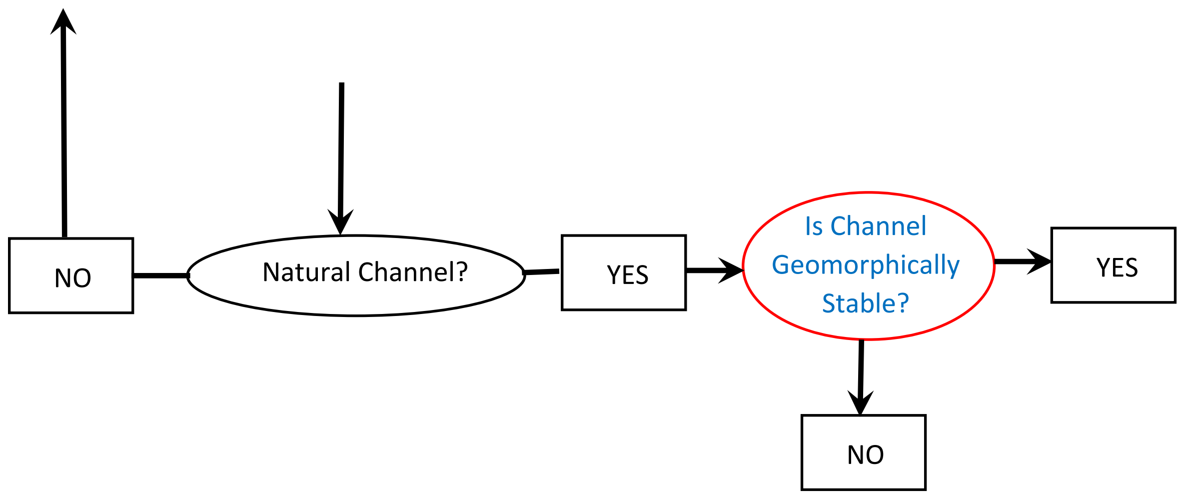
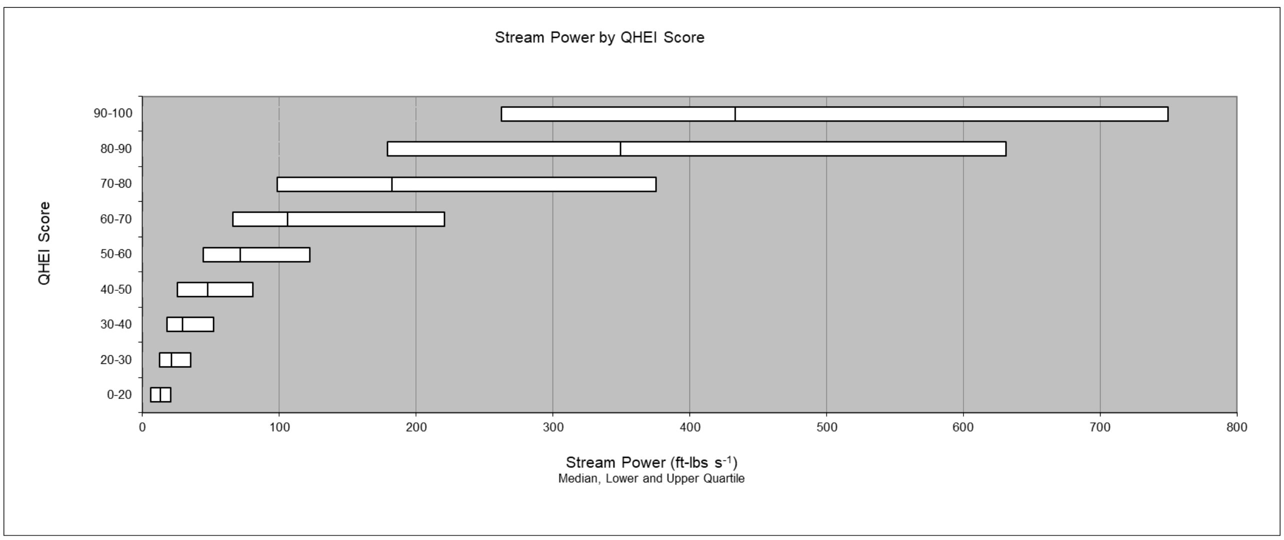


Figure 17 – Flow chart correction needed for the HHEI Flow Chart (Figure 15, p. 39) as presented in the current application PHW Manual, version 2.3 (2009).



ODNR, 2010, Evaluation of QHEI stream assessment scores from OEPA for the Period from 1978 to 2007 and compared against QHEI evaluation location Stream Power.

Figure 18 – OEPA QHEI scores graphed vs Stream Power. As QHEI score increases, so does stream power, which demonstrates the QHEI bias.

FIGURES

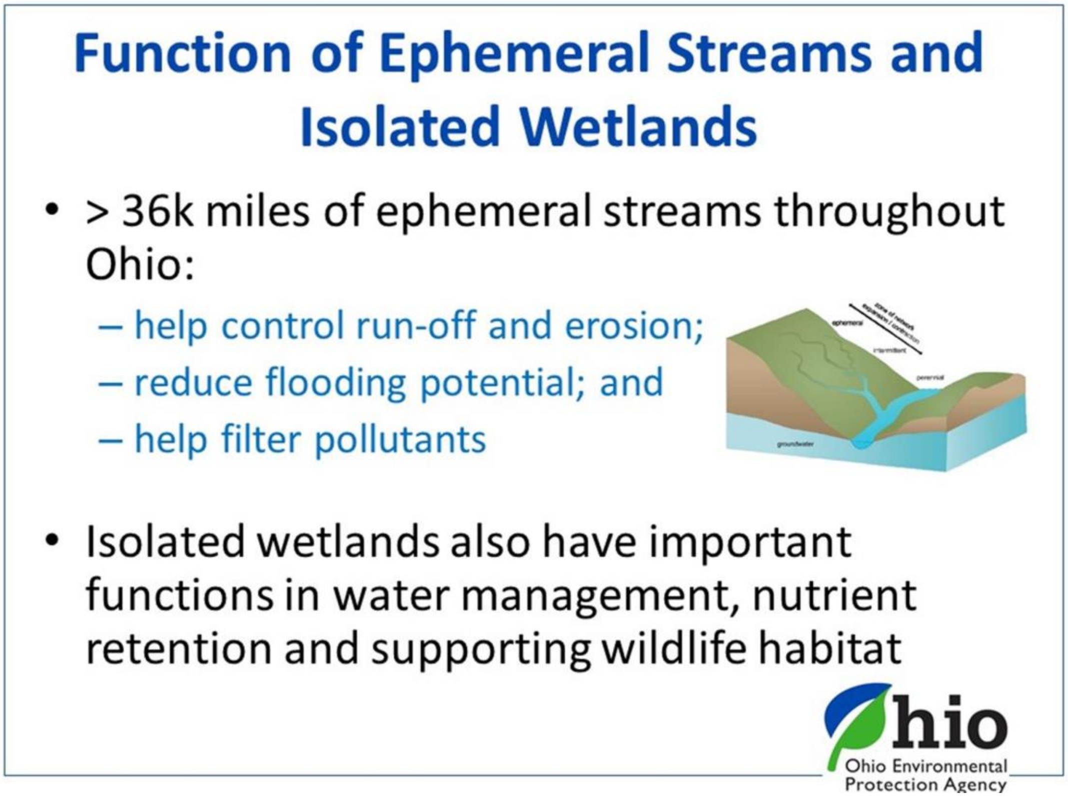


Figure 19 – Slide #5 from the OEPA Webinar Addressing the Navigable Waters Protection Rule held on May 7, 2020 at 3:00 p.m., which lasted about 30 minutes.

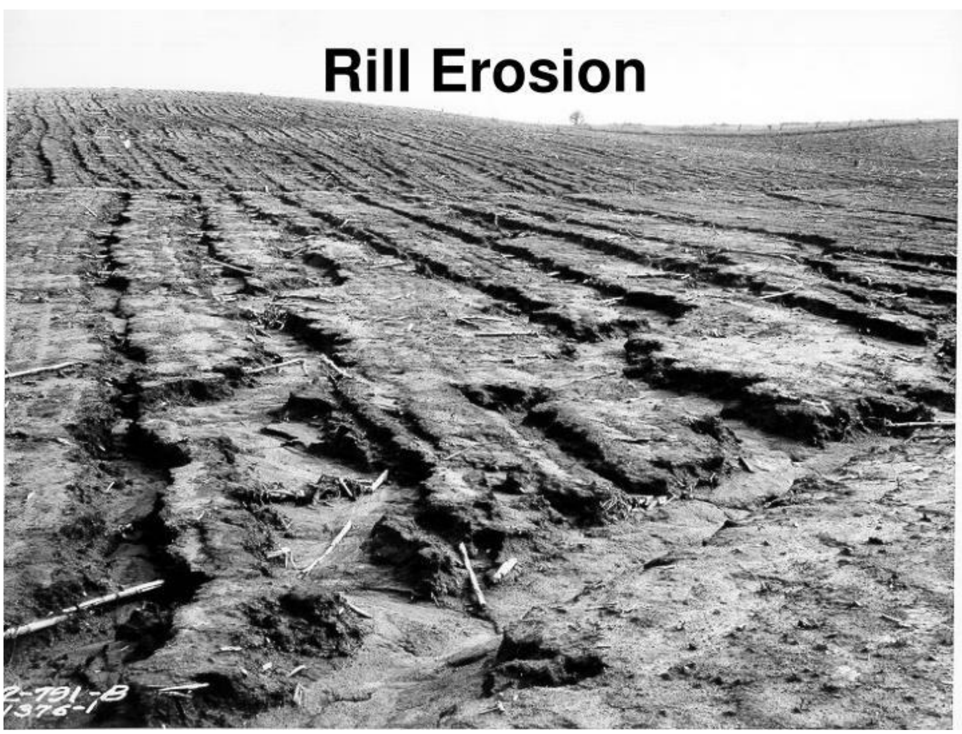


Figure 20 – Erosion gullies (rill erosion) as demonstrated in this photo would be considered to be ephemeral streams, which was the case for pre-law unreclaimed mine areas that were remined prior to Section 404 and 401 approval of NWP 49.

PHOTOS

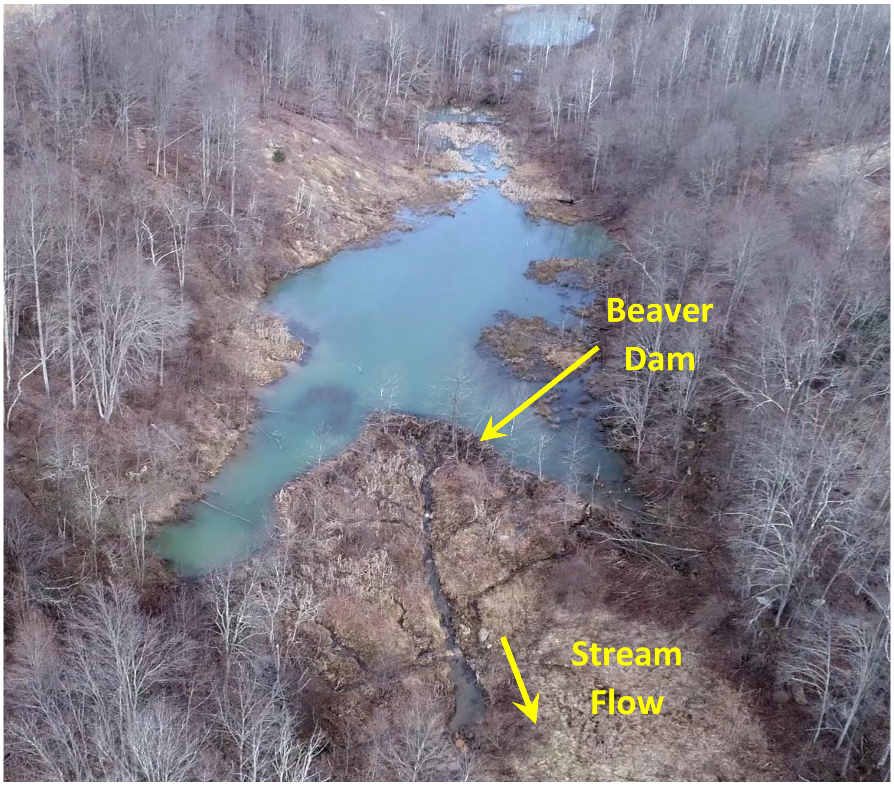


Photo 1 – Beaver dam extending across valley and creating a large in-stream storage impoundment that reduces stormwater runoff peak flows and flooding, improves water quality, stores and breaks-down nutrients, provides habitat diversity and water for wildlife, and creates perennial flows.

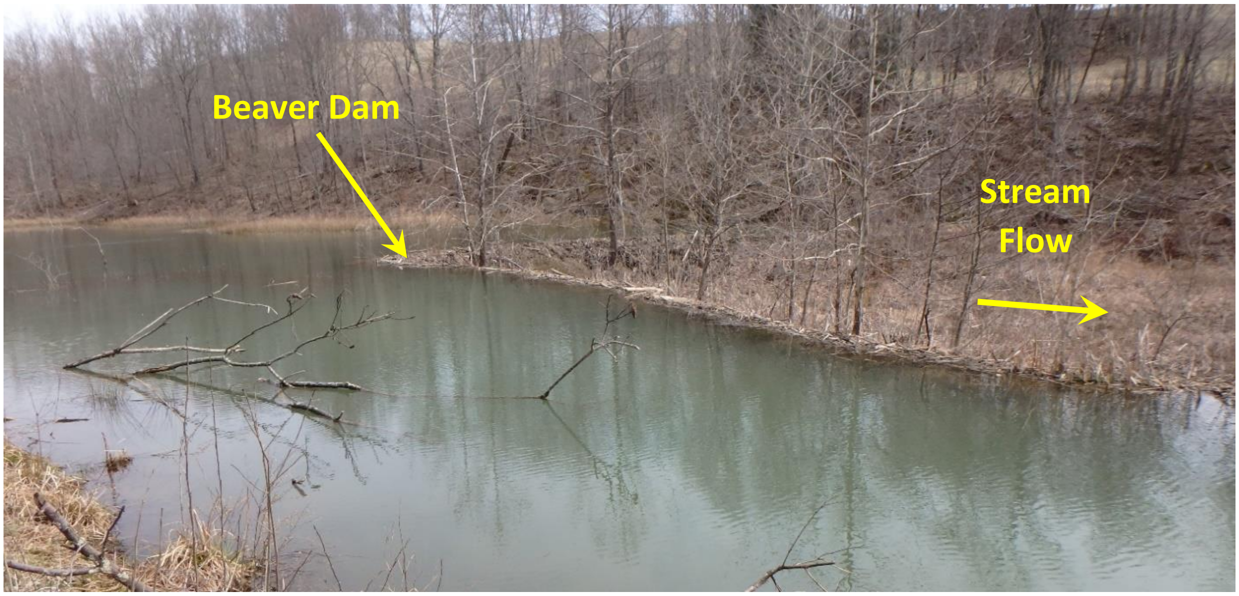


Photo 2 – Close up of 7-foot high beaver dam extending across the valley shown in Photo 1. The OEPA proposed ephemeral stream rules would require the beavers to remove their pond and replace it with a channel, which would drain the watershed, leave no water for wildlife and dry up the perennial stream flows (create the aquatic dust bowl).

PHOTOS

Photo 3 – Erosion gully (ephemeral stream) extending up the hillside that resulted from two historic logging events in the watershed. If this erosion gully is impacted, then the OEPA proposed ephemeral stream rules may require this 'ephemeral stream' to be replaced at a ratio of 1.5:1, which would further increase stormwater runoff peak flows and directly contribute to additional downstream stream degradation and flooding.

Photo 4 – Erosion gully (ephemeral stream) quickly conveying water off the land that results in downstream stream degradation and increased flooding. If this erosion gully is impacted, then the OEPA proposed rules may require this 'ephemeral stream' to be replaced at a ratio of 1.5:1, which would further increase stormwater runoff peak flows and directly contribute to additional downstream stream degradation and flooding.

PHOTOS

Photo 5 - Degraded incised channel that has become a major erosion gully and disconnected from its floodplain. This stream is about 8-feet deep and should only be about 1.5-feet deep if it were a geomorphically stable stream. It now functions like a pipe increasing downstream peak flows, flooding, sediment loads from bank erosion and rapidly conveys pollutants downstream.

Photo 6 – Characteristically geomorphically stable stream that is not degraded nor incised and is nearby the stream in Photo 5. This geomorphically stable stream is about 1 to 1.5 feet deep and connected to its floodplain.

Exhibit 9

Supporting Books, Manuals and Journal Articles

1. Dolan, Eric Jay, Fur, Fortune and Empire: The Epic History of the Fur Trade in America, W.W. Norton, 2010.

2. Goldfarb, Ben, Eager, The Surprising, Secret Life of Beavers and Why They Matter, Chelsea Green Publishing, White River Junction, Vermont, 2018.

3. Backhouse, Frances, They Once Were Hats: In Search of the Mighty Beaver, ECW Press, Toronto, October 2015.

4. Collier, Eric, Three Against the Wilderness, E.P. Dutton & Co., Inc. New York, 1959.

5. Eckert, Allan W., The Frontiersman, Jesse Stuart Foundation, Ashland, KY, 2001.

6. Pollock, M.M., G.M. Lewallen, K. Woodruff, C.E. Jordan and J.M. Castro (Editors) 2017. *The Beaver Restoration Guidebook: Working with Beaver to Restore Streams, Wetlands, and Floodplains*. Version 2.0. United States Fish and Wildlife Service, Portland, Oregon. 219 pp.

7. Burchsted, Denise; Daniels, Melinda; Thorson, Roberts; and Vokoun, Jason, *The River Discontinuum: Applying Beaver Modifications to Baseline Conditions for Restoration of Forested Headwaters*, BioScience, Volume 60, No. 11, December 2010.

8. Naiman, Robert J, Johnston, Carol A, and Kelley, James C., *Alteration of North American Streams by Beaver*, BioScience, Volume 38, No. 11, December 1988.

9. Pollock, Michael M., Heim, Morgan, and Werner, Danielle, *Hydrologic and Geomorphic Effects of Beaver Dams and Their Influence on Fishes*, American Fisheries Society Symposium, Environmental Science, 2003.

10. Gurnell, Angela M., *The Hydrogeomorphological Effects of Beaver Dam-building Activity*, Progress in Physical Geography, 22, 2 (1998) pp. 167-189.

11. Pollock, Michael, Beechie, Timothy, Wheaton, Joseph, Jordan, Chris, Bouwes, Nick, Weber, Nicholas and Volk, Carol, *Using Beaver Dams to Restore Incised Stream Ecosystems*, Volume 64, BioScience, 2014.

12. McCuen, Richard, Johnson, Peggy, and Ragan, Robert, Highway Hydrology, Hydraulic Design Series Number 2, Second Edition, U.S. Department of Transportation, Federal Highway Administration, National Highway Institute, Publication No. FHWA-NHI-02-001, October 2002.

13. Allan, David J., Stream Ecology, Structure and Function of Running Waters, School of Natural Resources, University of Michigan, Kluwer Academic Press, Boston, 1995.

14. Lave, Rebecca and Doyle, Martin, Streams of Revenue – The Restoration Economy and the Ecosystems it Creates, The MIT Press, Cambridge, MA, 2020.