TETRA TECH

April 29, 2021

Mr. Richard S. Novak, Chairman
Sherborn Zoning Board of Appeals
Town Hall
19 Washington Street
Sherborn, MA 01770

Re: Wetlands Protection Recommendations (Letter 3 – Address Conservation Comments)
Coolidge Crossing Comprehensive Permit
84-86 Coolidge Street
Sherborn, Massachusetts

Dear Mr. Novak:

As discussed at last evening's hearing, please find our thoughts and responses related to comments expressed in the Sherborn Conservation Commission's April 28, 2021 memorandum to the Board (Commission Memo). In general, the comments seem to look to the Board to address a range of issues that would typically be addressed during Project review under the Wetlands Protection Regulations. As we understand the Comprehensive Permit process, the Board issues its decision based on a Preliminary Plan to set the general expectations for development. Once the permit is issued the Project can then seek other specific state and federal approvals after which a set of Final Plans are submitted to the Board incorporating any changes and addressing any outstanding details. In our opinion the Board should avoid being overly prescriptive with its conditions to allow the Project and subsequent reviewing agencies latitude to address concerns within their domain.

Please note, the Commission memo was issued in response to our April 20, 2021 comment letter only and did not have the benefit of information included in the Project's April 23, 2021 response or our April 28, 2021 follow up letter. As such, we have tried to qualify our remarks as clearly as possible in consideration of those responses.

We respectfully offer our thoughts on the Commission Memo below. Our comments below address only areas where additional clarification and/or comment is needed assuming that areas of agreement require no further discussion.

1. Sherborn General Wetlands Bylaw Waivers – General

It remains our opinion that applying Riverfront performance standards for evaluating Project impacts within the "No Alteration Zone" is a practical, reasonable, and defensible method for the Board to determine if a waiver is justified. It is also our opinion that the Project has demonstrated compliance with those performance standards.

2. Stormwater Management

In its April 23, 2021 response the Project has incorporated reductions to impervious surfaces and extent of alteration as recommended. It is our opinion that the Project has incorporated measures that appropriately reduce impact and impervious surfaces for the scope of development proposed.

a. Applicant has incorporated impervious area and impact reductions as recommended and has committed to a revegetation program to upgrade areas of the No Alteration Zone.

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b. We are familiar with much of the documentation provided in Appendix A and in particular the Greenland, NH case study. The Greenland case study was one of our projects that had very restrictive underlying soil conditions which mitigated concerns for contaminant transport and an extremely expensive underground traditional design option. While there are definitely applications where porous pavement is an appropriate use, it remains our recommendation that pervious pavement should not be required in this application. While its incorporation may result in modest reductions to the size of stormwater management facilities it will have negligible impact on the extent of alteration since the lateral extent of impact is more closely related to the layout of the facility which is not impacted by use of pervious pavement. It is our opinion that the stormwater management system currently proposed will provide more effective and reliable protection of groundwater quality since porous pavement will not provide the same level of pretreatment or spill containment to protect underlying groundwater.

   In our opinion, porous pavements are without question substantially more expensive to install largely due to the cost of the supporting gravel/stone layer needed to manage freeze/thaw cycles. Maintenance is also more expensive since the surface must be cleaned by vacuum truck regularly to maintain its porosity. In our experience traditional stormwater systems are a more reliable and effective method for protecting groundwater and maintaining hydrology in applications such as proposed on this Project.

3. Stormwater Management: Long-Term Pollution Prevention Plan (LTPPP)

The Project is subject to review under the Massachusetts Wetlands Protection Regulations (310 CMR 10.00) which includes specific LTPPP requirements. The Sherborn Conservation Commission will have the opportunity to review the LTPPP and issue related conditions. That being said, we support the Board's incorporation of any reasonable conditions resulting in greater protection of the resource.

a. Deicing: We support conditions limiting the use of potentially harmful deicers. We recommend the Board work with the Applicant to draft a condition specifying the type and amount deicing chemicals to be used. Any such condition should also include the ability to modify the deicing program should it prove unable to maintain safety or should future information support an alternate approach.

b. Snow Disposal: We support conditions that define snow removal responsibilities and expectations. However, it is preferable snow be stored in areas that flow to the stormwater management system as often as possible to provide the benefit of treatment and mitigation prior to discharge. We recommend the Board incorporate a condition requiring Project compliance with then current Mass DEP snow disposal guidance. A copy of current guidance is attached for reference.

c. Lawn, Garden and Landscape Management: We support reasonable conditions managing the use of pesticides and herbicides on site. We recommend the Board and Applicant work to craft a mutually acceptable condition limiting pesticide and herbicide use. Please note, the Project includes proposed mitigation plantings that may need initial fertilization or protection to support its survival during initial transition.

4. Wildlife Habitat

a. Wildlife Crossings. In this application there is no specific requirement or targeted need for the wildlife crossings. The project is not located within or proximate to an area of priority or estimated habitat that would warrant a specific design or targeted approach. Our recommendation for the crossing(s) was in response to a general situational sensitivity and our reason for limiting its size was based on experience with larger crossings that often end up being frequented by predators such as coyote and fox. In our

opinion the crossings provided are a reasonable accommodation and their particular features and design can be explored further during review of impacts under the Wetlands Regulations.

b. Exterior Lighting. Incorporation of dimmers and motion detectors on the five lights referenced seems like a reasonable request given the relief requested. We support the Board's inclusion of a condition requiring dimmers and motion sensors be included on the fixtures noted.

5. Landscape Plan for Jurisdictional/Buffer Zone Areas

Work within the areas noted are subject to review under the Wetlands Protection Regulations and acknowledgement of impacts as part of the Comprehensive Permit seems unwarranted and potentially overcomplicating. Any work proposed within the resource area or its buffer zones is subject to review by the Conservation Commission including a significant portion of the proposed landscaping.

a. We recommend the Comprehensive Permit consider the specific relief requested and any related condition be crafted in a manner that is not overly restrictive to allow change or refinement during subsequent review of the work under the Wetlands Protection Regulations or similar review. The Project has minimized unnecessary impacts and proposes what we consider a minimal amount of lawn at the rear of the buildings when considering minimum access needed to maintain the building and associated egress.

b. Recent Project submittal (Sheet L1.0) includes a site planting plan and plant schedule identifying location, species and size of proposed trees as well as a range of location-specific seed mixes. The plan also identifies areas where mitigation planting is proposed to revegetate existing cleared areas within the NAZ. In our opinion the plan is responsive the Commission's comment and serves as a suitable basis for a Board decision on the Comprehensive permit and subsequent detailed review by the Commission under the Wetlands Protection Regulations.

c. The Project has provided information requested in its recent (April 23, 2021) submittals including a summary of its status in comparison to Riverfront performance standards. At this point we believe the Project has provided enough information on which the Board can base its decision.

In closing, our opinion remains as expressed in our April 28, 2021 letter and we require no additional information or request any further changes from the Project. Hopefully the documentation and commitments provided in the Project's April 23, 2021 submittals addresses many of the Commission's concerns. Others can be, and are likely better, addressed during their coming review of the Project's Notice of Intent. If you have any questions or comments please feel free to contact me at (508) 786-2230 or you can reach me by email at sean.reardon@tetratech.com.

Very truly yours,

Sean P. Reardon, P.E.
Vice President

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Massachusetts Department of Environmental Protection
Bureau of Water Resources
Snow Disposal Guidance

Effective Date: December 23, 2019

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: Bureau of Resource Protection (BRP) Snow Disposal Guideline No. BRPG97-1 issued December 12, 1997 and BRPG01-01 issued March 8, 2001; Bureau of Water Resources (BWR) snow disposal guidance issued December 21, 2015 and December 12, 2018.

Approved by: Kathleen Baskin, Assistant Commissioner, Bureau of Water Resources

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are protective of wetlands, drinking water, and water bodies, and are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources.

APPLICABILITY: These Guidelines are issued by MassDEP's Bureau of Water Resources on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to all federal agencies, state agencies, state authorities, municipal agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While MassDEP is aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into

waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything that occurs on the land has the potential to impact the Commonwealth's water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help federal agencies, state agencies, state authorities, municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter. Following these guidelines and obtaining the necessary approvals may also help municipalities in cases when seeking reimbursement for snow disposal costs from the Federal Emergency Management Agency is possible.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas or upland locations on impervious surfaces away from water resources and drinking water wells. At these locations, the snow meltwater can filter into the soil, leaving behind sand and debris which can be removed in the spring. The following conditions should be followed:

- Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones. Municipalities may have a water supply protection land use control that prohibits the disposal of snow and ice containing deicing chemicals from outside the Zone A and Zone II, subject to the Massachusetts Drinking Water Regulations at 310 CMR 22.20C and 310 CMR 22.21(2).
- Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches. Snow combined with sand and debris may block a stormwater drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Recommended Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

- Estimate how much snow disposal capacity may be needed for the season so that an adequate number of disposal sites can be selected and prepared.
- Identify sites that could potentially be used for snow disposal, such as municipal open space (e.g., parking lots or parks).
- Select sites located in upland locations that are not likely to impact sensitive environmental resources first.
- If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

Snow Disposal Mapping Assistance

MassDEP has an online mapping tool to assist in identifying possible locations to potentially dispose of snow. MassDEP encourages municipalities to use this tool to identify possible snow disposal options. The tool identifies wetland resource areas, public drinking water supplies and other sensitive locations where snow should not be disposed. The tool may be accessed through the Internet at the following web address: **https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/**.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.
- Clear debris from the site prior to using the site for snow disposal.
- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.

3. SNOW DISPOSAL APPROVALS

Proper snow disposal may be undertaken through one of the following approval procedures:

- Routine snow disposal – Minimal, if any, administrative review is required in these cases when upland and pervious snow disposal locations or upland locations on impervious surfaces that have functioning and maintained stormwater management systems have been identified, mapped, and used for snow disposal following ordinary snowfalls. Use of upland and pervious snow disposal sites avoids wetland resource areas and allows snow meltwater to recharge groundwater and will help filter pollutants, sand, and other debris. This process will address the majority of snow removal efforts until an entity exhausts all available upland snow disposal sites. The location and mapping of snow disposal sites will help facilitate each entity's routine snow management efforts.
- Emergency Certifications – If an entity demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions may issue an Emergency Certification under the Massachusetts Wetlands Protection regulations to authorize snow disposal in buffer zones to wetlands, certain open water areas, and certain wetland resource areas (i.e. within flood plains). Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency. See 310 CMR 10.06(1)-(4). Use the following guidelines in these emergency situations:
    - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
    - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
    - Do not dispose of snow where trucks may cause shoreline damage or erosion.
    - Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

- Severe Weather Emergency Declarations – In the event of a large-scale severe weather event, MassDEP may issue a broader Emergency Declaration under the Wetlands Protection Act which allows federal agencies, state agencies, state authorities, municipalities, and businesses greater flexibility in snow disposal practices. Emergency Declarations typically authorize greater snow disposal options while protecting especially sensitive resources such as public drinking water supplies, vernal pools, land containing shellfish, FEMA designated floodways, coastal dunes, and salt marsh. In the event of severe winter storm emergencies, the snow disposal site maps created by municipalities will enable MassDEP and the Massachusetts Emergency Management Agency (MEMA) in helping communities identify appropriate snow disposal locations.

  If upland disposal sites have been exhausted, the Emergency Declaration issued by MassDEP allows for snow disposal near water bodies. In these situations, a buffer of at

least 50 feet, preferably vegetated, should still be maintained between the site and the waterbody. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, the Emergency Declaration issued by MassDEP may allow disposal of snow in certain waterbodies under certain conditions. ***A federal agency, state agency, state authority, municipality or business seeking to dispose of snow in a waterbody should take the following steps***:

- Call the emergency contact phone number [(888) 304-1133)] and notify the MEMA of the municipality's intent.
- MEMA will ask for some information about where the requested disposal will take place.
- MEMA will confirm that the disposal is consistent with MassDEP's Severe Weather Emergency Declaration and these guidelines and is therefore approved.

During declared statewide snow emergency events, MassDEP's website will also highlight the emergency contact phone number [(888) 304-1133)] for authorizations and inquiries. For further non-emergency information about this Guidance you may contact your MassDEP Regional Office Service Center:

Northeast Regional Office, Wilmington, 978-694-3246
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7650
Western Regional Office, Springfield, 413-755-2114

Sherborn Conservation Commission

19 WASHINGTON STREET
SHERBORN, MASSACHUSETTS 01770

MEMO

TO: Sherborn Zoning Board of Appeals (ZBA)

FROM: Sherborn Conservation Commission

DATE: April 28, 2021

RE: Comments on Tetra Tech April 20, 2021 ZBA letter on "Wetlands Protection Recommendations"

The Sherborn Conservation Commission (Commission) has the following comments in response to the peer reviewer (Peer Reviewer), Tetra Tech's, April 20, 2021 letter to the ZBA responding to the Commission's April 11, 2021 memo on the Coolidge Crossing project.

1. Sherborn General Wetlands Bylaw Waivers - General

   The Peer Reviewer has recommended that the ZBA *not* grant the applicant's requested blanket waiver from the Sherborn General Wetlands Bylaw (Wetlands Bylaw). Instead, they recommend that the applicant's "request for relief be specific and include a justification for granting such relief and a description of any specific mitigation offered in exchange." The Commission agrees with this assessment.

   The Peer Reviewer goes on to note the difficulty in balancing the application of the performance standards contained in Section 5.2 of the local regulations regarding the 50-foot No Alteration Zone (NAZ) with economic considerations. They suggest instead that the ZBA create conditions using the state's Massachusetts Wetlands Protection Act (WPA) performance standards for protection of Riverfront Area. While using the state's Riverfront standards has the potential to produce useful conditions, the Commission believes that because there is no riverfront on the project site, that applying such performance standards is impracticable. But, we agree with the spirit of the Peer Reviewer's suggestion, and we agree that specific elements of the Wetlands Bylaw and

regulations should not be waived. The specific elements are embedded in the conditioning comments/recommendations below.

2. Stormwater Management

As supported by the Peer Reviewer, the Commission again recommends reduction of impervious areas with the goal of lessening the alterations of wetland buffer zone, which is extensive in the stormwater system. Specifically, we recommend the following:

a. Formally include conditions that reduce parking (both size and number) in the final stormwater design to lessen buffer zone impacts, especially in the NAZ.

b. Use of porous/pervious asphalt where practicable.

The Peer Reviewer recommends against requiring pervious paving systems for high traffic paved surfaces. The Commission, however, would like the Peer Reviewer to more closely examine the option of porous asphalt and help create conditions based on the results of this examination.

The Commission specifically requests that the Peer Reviewer examine the extent to which porous asphalt would reduce temporary and permanent disturbance to the buffer zone from the stormwater management system. We request that the Peer Reviewer explore whether the project site is appropriate for the use of this material (e.g., scale, type of existing and planned base materials, etc.) and/or any constraints on its use. We specifically request the Peer Reviewer help articulate conditions for the use of pervious asphalt to help reduce or eliminate grading and detention basin work in the NAZ.

For wetlands protection, water quality is a major concern. We request that the peer reviewer also comment on the comparability of porous asphalt to the current on this issue. Some initial Commission research indicates good water quality treatment. See Appendix A for references.

Lastly, though the Commission is not tasked with examining economic elements of any project, we understand that such considerations play a role in the Comprehensive Permit process. Therefore, while we recognize a difference in initial cost and ongoing maintenance for pervious asphalt (e.g., 4 annual cleanings vs. 2 for impervious), some case studies (see Appendix A) show an overall lower total cost due to reduced stormwater management system costs, etc.

3. Stormwater Management: Long-Term Pollution Prevention Plan (LTPPP)

The Commission recommends that the LTPPP be revised to reflect the following:

a. Deicing and Salt Storage. Given proximity to wetlands, a condition should be created to specify that deicing products cannot include sodium chloride, with a preference for limiting use to magnesium chloride due to less chloride and less overall toxicity, and acetate-based deicers compared to calcium chloride. All deicers have some negative impacts on wetlands and groundwater and the conditions in the

Comprehensive Permit should be written to recommend that deicer use be minimized.

b. Snow Disposal. Conditions should be written so that snow storage will be required to be located outside of buffer zones with a designated area to be noted on the Site Plan on the eastern edge, which maximizes distance from wetland resources, and on a pervious area that does not enter the stormwater management system. If practicable, having snow removed from the site entirely should be considered.

c. Lawn, Garden and Landscape Management. The Commission would like to see a condition specifying that within the NAZ, no fertilizers and pesticides/herbicides will be applied. In the outer buffer zone (50-100 foot), only "organic" slow-release nitrogen fertilizers should be permitted, and again no pesticide/herbicide use should be allowed.

4. Wildlife Habitat

The Commission requests that the Peer Reviewer address the following two areas:

a. Wildlife Crossings. The Commission requests that the Peer Reviewer provide specific details on the wildlife crossings they suggest/support. Factors such as specific design, location, quantity and species accommodated should be listed/articulated in the conditions. We'd also request that these conditions require crossings on *both* sides of Building 2. Lastly, in articulating design, location, etc., the Commission requests that the Peer Reviewer address concerns that a) the six-inch size suggested may be too constrained (depending on species articulated) and b) such crossings are limited to paved areas, as this may not be the best design depending on types of species at issue.

b. Exterior Lighting. The Commission requests the addition of dimmers to the approximately five lights whose lighting overlaps the NAZ so that there is at least the option to reduce exterior lighting intensity in buffer zone areas. Where safety concerns allow, the addition of motion detectors on these lights should also be considered.

5. Landscape Plan for Jurisdictional/Buffer Zone Areas

The Commission recommends that the ZBA add conditions to the Comprehensive Permit acknowledging that the project is creating significant temporary and permanent alterations in wetland buffer zones. It should also state that the applicant's final landscaping plan for wetland jurisdictional areas should maximize protecting wetland values and functions, especially wildlife habitat and water quality protection. The Commission recommends at least adding specific conditioning of this type around the following:

a. In buffer zones where revegetation will occur after work and grading is completed, plantings should be selected to restore the pre-existing/ecologically healthy buffer zone contribution to wetland functions and values. This includes attention to pre-existing buffer zone structure with regard to herbaceous, shrub, understory and canopy layers using native species of a density that maximizes the buffer zone

contribution to wetland functions and values. This is particularly important in the NAZ. Suggestions in the existing application materials that grass will be planted in areas of the NAZ, such as behind certain buildings, should be rejected in favor of the aforementioned use of native species and structure for maximized buffer zone functions and values.

b. It is noted that the current Site Planting Plan does include a tree planting schedule. It is the Commission's opinion that this tree planting schedule should be treated as preliminary, and only indicative of what the final Landscaping Plan could be. The comment in a. above is repeated here, that the choice of trees in the buffer zones and especially in the NAZ (in terms of native species, density, etc.) should be conditioned to require maximization of pre-existing/ecologically healthy buffer zone contributions to wetland functions and values. Because of the preliminary nature of the current tree planting schedule, the Commission is not commenting on it in its current state. We've only made recommendations here as to what the final plan ought to contain.

c. Lastly, the Commission recommends gathering more information on mitigating buffer zone impacts and including conditions to address such mitigation in the Comprehensive Permit. Details on the two areas mentioned in the Peer Reviewer's April 21 letter (and the requested sketches) are needed in order for the Commission to provide specific comments about their inclusion in the final plans.

Finally, the Commission suggests that the ZBA could add a condition to the Comprehensive Permit stating that the final, detailed Landscaping Plan must be submitted to the Conservation Commission as part of any future NOI application, and that the plan must meet the satisfaction of the Commission with regard to the above-mentioned maximization of wetland functions and values.

APPENDIX A

1. Water Quality Treatment by Porous Asphalt

- https://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/porous_ashpalt_fact_sheet.pdf
- https://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/UNHSC%20GrMeadows-ECO%20Fact%20Sheet%205-11.pdf
- https://ascelibrary.org/doi/10.1061/%28ASCE%29EE.1943-7870.0000459
- Water Quality and Hydrologic Performance of a Porous Asphalt Pavement as a Storm-Water Treatment Strategy in a Cold Climate
- Robert M. Roseen, Ph.D., P.E., D.WRE, M.ASCE; Thomas P. Ballestero, Ph.D., P.E., M.ASCE; James J. Houle; Joshua F. Briggs; and
- " …. There was exceptional water-quality treatment performance for petroleum hydrocarbons, zinc, and total suspended solids with nearly every value below detection limits. Only moderate removal was observed for phosphorous, and treatment for nitrate (NO3) was negative."
- https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9210.pdf

2. Removing pollutants

- The primary stormwater function of porous pavement is reducing the volume of runoff. Secondary functions include flow attenuation (retaining water and then slowly infiltrating it), and nutrient reduction.

  Two processes remove pollution:
  - Sediments settle out in the aggregate.
  - Pollutants can be sequestered or broken down by microbes in the aggregate and native soils below the system.

  The Center for Watershed Protection estimates the total amount of phosphorus removed for level 1 and 2 designs at 59 to 81 percent, and nitrogen removal at 59 to 81 percent. Runoff reduction was estimated at 45 to 75 percent (CWP&CSN 2008), although studies in Oregon indicate that a reduction of runoff of 95 to 99 percent is possible. Runoff reduction itself contributes to pollutant removal, simply by reducing the volume of pollutants going downstream. Other studies have found that porous pavement effectively removes suspended solids, metals, oils, and grease (UDFCD 2008).