pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Clean Water

MS4 STREAM RESTORATION
CREDITING REVIEW CHECKLIST – EXPERT PANEL PROTOCOLS

Permittee Name: _____   Project Name.: _____

I. CREDITING EVALUATION – EXPERT PANEL REPORT PROTOCOLS		
A. Creditable Restoration Length Crediting adjustment from Consensus Recommendations for Improving the Application of the Prevented Sediment Protocol (2020)	**Yes**	**No**
1. Does the restoration project design include "non-creditable" armoring practices? *If Yes, non-creditable lengths must be excluded from load reduction calculations.*	☐	☐
2. Does the restoration project design include "creditable w/ limits" armoring practices? *If Yes, complete 2A (as applicable). If no, skip to Section B.*	☐	☐

2A. "Creditable w/ Limits" Armoring Load Reduction Credit Adjustment *(if applicable)*
Creditable w/ limits armoring practices are allowable (with full credit) on up to 30% of the restored banks.
    Percent of banks stabilized using "creditable w/ limits" armoring practices _____ (%)
If the "creditable w/ limits" armoring exceeds the allowable limit, a proportional adjustment must be made to the final load reduction credit.
    Percent of banks with "creditable w/ limits" armoring – 30% = Credit adjustment _____ (%)		

B. Calculation Methodology - Expert Panel Protocols	**Yes**	**No**
3. Is the restoration load calculation calculated using the Stream Restoration Protocols from the Chesapeake Bay Expert Panel Reports? *If Yes, indicate below which Expert Panel Protocol(s) were used to calculate the pollutant load reduction.*	☐	☐
Protocol 1: Credit for Prevented Sediment during Storm Flow *(complete Appendix A)*	☐	☐
Protocol 2: Credit for Instream and Riparian Nutrient Processing *(complete Appendix B)*	☐	☐
Protocol 3: Credit for Floodplain Reconnection Volume *(complete Appendix C)*	☐	☐
Protocol 4: Credit for Dry Channel RSC as an Upland Stormwater Retrofit *(complete Appendix D)*	☐	☐

Comments:

Recommendation:

☐ Crediting is acceptable   ☐ Revisions are required   ☐ Insufficient Information provided by permittee

Reviewer Name: _____   Date: _____

APPENDIX A
CREDITING REVIEW CHECKLIST – EXPERT PANEL PROTOCOL 1

EXPERT PANEL PROTOCOL 1: Credit for Prevented Sediment During Storm Flow		
A. Protocol 1: Field Data Collection	**Yes**	**No**
1. Is documentation provided to indicate that the standards for Rosgen Bank Erosion Hazard Index (BEHI) provided in the Expert Panel Report (Appendix E) were followed?	☐	☐
2. Is documentation provided to indicate that the standards for Estimating Near-Bank Stress (NBS) provided in the Expert Panel Report (Appendix F) were followed?	☐	☐
3. Is documentation provided to indicate that bulk density samples were collected in accordance with the guidance provided in the Expert Panel Report (Appendix D)? • *One sample collected every 200-500 linear feet along the project reach.* • *If multiple samples are taken, they should alternate cross-sections, left and right bank.* • *Samples should be taken from erosional areas where feasible.* • *Samples should be collected from each soil horizon identified within the restoration reach.* • *Take samples from in-tact banks (not bank material that has fallen/slumped).* • *Where samples are unable to be taken because of large rocky material, select another location.* • *If a sample is too gravelly to keep the core intact, the sample may need to be disregarded.*	☐	☐
B. Protocol 1: Sediment Load Reduction Calculation	**Yes**	**No**
4. Is the Spreadsheet Tool for Erosion Rate Estimates from the Expert Panel Report (Appendix C) or equivalent provided for review?	☐	☐
5. Is the Spreadsheet Tool for Erosion Rate Estimates (or equivalent) completed in full and free from mathematical errors?	☐	☐
6. Are the calculated bank erosion rates consistent with the Hickey Run Bank Erosion Rate Curve (Expert Panel Report, Figure B-1)?	☐	☐
7. Are all reaches of the restoration stabilized using "non-creditable" armoring practices excluded from the pollutant load reduction calculation? *(if applicable)*	☐	☐
8. Is an adjustment to the calculated pollutant load made to compensate for banks stabilized using "creditable w/ limits" armoring practices beyond the allowable 30%? *(if applicable)*	☐	☐
9. Is a 50% restoration efficiency applied to the pollutant reduction calculation? *If Yes, skip to 11.*	☐	☐
10. Is a restoration efficiency greater than 50% being requested? *If Yes, complete 10A & 10B.* **Restoration efficiency requested: _____ (%)**	☐	☐
10A. Is the restoration efficiency being requested less than or equal to the max restoration efficiency allowable using only pre-restoration data (75%)?	☐	☐
10B. Is adequate justification for use of the higher than default restoration efficiency provided? • *Documentation that a secondary method of assessing the bank erosion rate was used to validate the field assessment (BANCS) data.* • *1 years' worth (minimum) of pre-construction monitoring data collected.* • *Documentation of post-construction monitoring plan.*	☐	☐
11. Has an appropriate sediment delivery ratio (SDR) been applied to the load reduction calculation? • *Default SDR 0.181 (PRP Instructions) or watershed-specific SDR (MS4 FAQs, FAQ #40)*	☐	☐
C. Protocol 1: Nutrient Load Reduction Calculation *(if applicable)*	**Yes**	**No**
12. Do the nutrient load reduction calculations use the default soil nutrient concentrations from the Expert Panel Report? *If no, list site specific nutrient concentrations and complete 12A.* **TN Concentration: _____** **TP Concentration: _____**	☐	☐
12A. Is documentation provided to indicate that the soil nutrient concentrations were determined using appropriate field and laboratory protocols?	☐	☐

APPENDIX B
CREDITING REVIEW CHECKLIST – EXPERT PANEL PROTOCOL 2

EXPERT PANEL PROTOCOL 2: Credit for Instream and Riparian Nutrient Processing		
A. Protocol 2: Eligibility Evaluation	**Yes**	**No**
1. Does the project design satisfy the floodplain restoration qualifying criteria from the Expert Panel Report? • *Meets applicable floodplain management requirements in the stream corridor.* • *Includes evaluation of the duration of floodplain ponding in the context of restoration goals.* • *Demonstrates consideration of potential unintended consequences of the restoration.*	☐	☐
2. Is the floodplain restoration strategy Legacy Sediment Removal (FR-LSR)? *If Yes, complete 2A.*	☐	☐
2A. Does the project meet the qualifying conditions for FR-LSR projects? • *Presence of legacy sediment deposits has been confirmed.* • *Design approach restores channel and floodplain connection with the hyporheic aquifer and restoration of processes within a hyporheic exchange zone.* • *Defined effective hyporheic zone (EHZ) boundaries across channels/floodplain.* • *Legacy sediment removal is the primary floodplain restoration technique.*	☐	☐
3. Is the floodplain restoration strategy Raising the Stream Bed (RSB)? *If Yes, complete 3A.*	☐	☐
3A. Does the project meet the qualifying conditions for FR-RSB projects? • *Project demonstrates that it either provides or is tied into existing upstream and downstream grade control to ensure the project reach can maintain the intended stream invert to access the floodplain.* • *Project clearly defines the boundary of the effective hyporheic zone (EHZ).* • *Project demonstrates that baseflow conditions are not reduced as a result of the restoration (ex. change from perennial to seasonal intermittent flow).*	☐	☐
4. Is documentation provided that clearly identifies the Effective Hyporheic Zone (EHZ) in accordance with the guidance provided in the Expert Panel Report? • *The lateral dimensions of the EHZ are defined by locations where the restored floodplain elevations are less than 18 inches above the channel or low flow water elevations.* • *Were the actual dimensions of the EHZ determined by site investigations to confirm that the intended water table elevations have been achieved.*	☐	☐
B. Protocol 2: Nutrient Load Reduction Calculation	**Yes**	**No**
5. Is the appropriate base denitrification rate from the Expert Panel Report used in the nitrogen credit calculation (2.69×10^{-3} lbs NO_3/sq ft/year)?	☐	☐
6. Is the base denitrification rate properly adjusted for site conditions in accordance with guidance in the Expert Panel Report (Table 10: Site Specific Discount Factors for Adjusting the Dentification Rate)?	☐	☐
7. Does the final nitrogen reduction reflect the difference between pre- and post-restoration conditions? *If it is being assumed that the pre-construction conditions provided negligible denitrification in the hyporheic zone during baseline conditions, justification of this assumption must be provided.*	☐	☐

APPENDIX C
CREDITING REVIEW CHECKLIST – EXPERT PANEL PROTOCOL 3

EXPERT PANEL PROTOCOL 3: Credit for Floodplain Reconnection Volume		
A. Protocol 3: Eligibility Evaluation	**Yes**	**No**
1. Does the project design satisfy the floodplain restoration qualifying criteria from the Expert Panel Report? • *Meets applicable floodplain management requirements in the stream corridor.* • *Includes evaluation of the duration of floodplain ponding in the context of restoration goals.* • *Demonstrates consideration of potential unintended consequences of the restoration.*	☐	☐
2. Is the floodplain restoration strategy Legacy Sediment Removal (FR-LSR)? *If Yes, complete 2A.*	☐	☐
2A. Does the project meet the qualifying conditions for FR-LSR projects? • *Presence of legacy sediment deposits has been confirmed.* • *Design approach restores channel and floodplain connection with the hyporheic aquifer and restoration of processes within a hyporheic exchange zone.* • *Defined effective hyporheic zone (EHZ) boundaries across channels/floodplain.* • *Legacy sediment removal is the primary floodplain restoration technique.*	☐	☐
3. Is the floodplain restoration strategy Raising the Stream Bed (RSB)? If Yes, complete 3A.	☐	☐
3A. Does the project meet the qualifying conditions for FR-RSB projects? • *Project demonstrates that it either provides or is tied into existing upstream and downstream grade control to ensure the project reach can maintain the intended stream invert to access the floodplain.* • *Project clearly defines the boundary of the effective hyporheic zone (EHZ).* • *Project demonstrates that baseflow conditions are not reduced as a result of the restoration (ex. change from perennial to seasonal intermittent flow).*	☐	☐
B. Protocol 3: Floodplain Restoration Design	**Yes**	**No**
4. Is documentation provided that clearly identifies the vertical and lateral dimensions of the Floodplain Trapping Zone (FTZ) in accordance with the guidance provided in the Expert Panel Report? • *On-site data is needed to establish channel flow and floodplain capacity and define the future boundaries of the FTZ.*	☐	☐
5. Is the max one-foot maximum floodplain elevation limit used to define the vertical extent of the FTZ? *If no, compete 5A.*	☐	☐
5A. Is documentation provided to demonstrate a FTZ elevation limit greater than 1 foot is justified? • *Modeled floodplain flow velocities in the FTZ must be below 2 ft/s.* • *The maximum vertical extent of the FTZ is 3 feet or the 10-year water surface elevation, whichever is lower.*	☐	☐
C. Protocol 3: Pollutant Load Reduction Modeling Approach	**Yes**	**No**
6. Is an "upstream" modeling approach used to determine how stream flow is diverted into the floodplain? *If Yes, complete 6A and skip 7 - 8.* • *The "upstream" approach relies on upstream watershed models to compute flows to the project site using long-term rainfall/runoff statistics.*	☐	☐
6A. Is the documentation provided by the permittee consistent with the following Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects (2014) guidance documents? • Appendix C Protocol 2 and 3 Supplemental Details • Technical Addendum A: Alternative Protocol 3 Nutrient and Sediment Removal Rate Curves	☐	☐

7. Is a "downstream" modeling approach used to determine how stream flow is diverted into the floodplain? *If Yes, complete 7A and skip 8.* • *The "downstream" approach relies on scaling USGS flow data measured at long-term gages.*	☐	☐
7A. Is the documentation provided by the permittee consistent with the guidance on found in following Expert Panel Report guidance document? • [Consensus Recommendations to Improve Protocols 2 and 3 for Defining Stream Restoration Pollutant Removal Credits (2020)](#)	☐	☐
8. Is floodplain reconnection being modeled as a floodplain wetland? *If Yes, complete 8A – 8B.* • *This approach uses the 6:1 treatment area ratio (from the [2019 Wetland Expert Panel Report](#)) in lieu of modeled flow data to determine the treatment capacity of the floodplain wetland.*	☐	☐
8A. Is the treatment area reported for the floodplain wetland restoration less than or equal to six times the area of the floodplain wetland restoration?	☐	☐
8B. Is the pollutant load for the treatment area calculated in a manner consistent with how the permittee's baseline pollutant load (in the PRP) was calculated?	☐	☐
9. Were the BMP effectiveness values from the [Wetland Expert Panel Report (2019)](#) applied to the floodplain wetland restoration? • *The Wetland Expert Panel Report (Table ES-1) provides three different categories of wetland restoration BMPs.*	☐	☐
10. Is documentation provided to justify that the floodplain restoration project will result in the wetland category chosen?	☐	☐

Table embedded in item 9:

Wetland BMP Type	TN (%)	TP (%)	TSS (%)
Restoration	42	40	31
Creation	30	33	27
Rehabilitation	16	22	27

APPENDIX D
CREDITING REVIEW CHECKLIST – EXPERT PANEL PROTOCOL 4

<table>
<tr>
<td colspan="3">EXPERT PANEL PROTOCOL 4: Credit for Dry Channel Regenerative Stormwater Conveyance (RSC) as an Upland Stormwater Retrofit</td>
</tr>
<tr>
<td>A. Protocol 4: Eligibility Evaluation
Eligibility from <u>Expert Panel to Define Removal Rates for Individual Stream Restoration Projects (2014)</u></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>1. Is the project Dry Channel RSC? <i>If Yes, skip to Section B.</i>

• <i>Dry channel RSC restoration of ephemeral streams or eroding gullies uses a combination of step pools, sand seepage wetlands, and native plants. These applications are often located at the end of storm drain outfalls or channels. The receiving channels are dry in that they are located above the water table and carry water only during and immediately after a storm event.</i></td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Is the project Wet Channel RSC?

• <i>Wet channel RSC can be located in intermittent streams but are more typically located farther down the perennial stream network and use instream weirs to spread storm flows across the floodplain at minor increases in the stream stage for events much smaller than the 1.5-year storm event. Wet channel RSC may also include sand seepage wetlands or other wetland types in the floodplain to increase floodplain connection, reconnection, or interactions with the stream.</i>

Wet channel RSC systems are a type of stream restoration practice and their pollutant removal can be calculated using the default stream restoration rate or protocols. <i>Compete Appendices A - C (as applicable), or complete Default Rate Crediting Review Checklist.</i></td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>B. Pollutant Load Reduction Calculations
<i>For pollutant load reduction calculation purposes, Dry Channel RSC is classified as a stormwater retrofit practice rather than as stream restoration.</i></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3. Is documentation provided to shows the entire RSC drainage area? <i>If Yes, complete 3A.</i></td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3A. Does the drainage area to the RSC list the impervious and pervious portions of the drainage area?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Is the runoff volume to be treated by the RSC calculated using the retrofit equation from the <u>Stormwater Retrofit Expert Panel Report</u>?

$$Runoff\ Volume\ (in) = \frac{(RS)(12)}{IA}$$

Where:
RS = Runoff Storage Volume (acre-feet)
IA = Impervious Area (acres)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Were the appropriate Removal Adjustor Curves from the <u>Stormwater Retrofit Expert Panel Report</u> used to determine the pollutant removal efficiencies?
• <i>RSC is a "Runoff Reduction (RR)" practice (Table 2: Classification of BMPs based on Runoff Reduction Capability)</i></td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. Are the pollutant removal efficiencies determined for the RSC consistent with the calculated runoff depth captured per impervious acre?

Sediment removal efficiency: _____ (%)

Nitrogen removal efficiency <i>(if applicable)</i>: _____ (%)

Phosphorus removal efficiency <i>(if applicable):</i> _____ (%)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. Is the pollutant load reduction credit calculated for the RSC based on only the portion of the drainage area that is within the permittee's planning area?</td>
<td>☐</td>
<td>☐</td>
</tr>
</table>