APPENDIX L-2G - LACUSTRINE RAP FORMS AND FIGURES

Summary of Methods for Pennsylvania Lacustrine Condition Level 2 Rapid Assessment Protocol

On behalf of PennEast Pipeline Company, LLC (PennEast), AECOM Biologists conducted a review of delineated lakes, reservoirs and large streams and river systems with drainage areas greater than 2,000 square miles that are proposed to be impacted by the PennEast Pipeline Project (Project) in accordance with the Pennsylvania Department of Environmental Protection's (PADEP) *Pennsylvania Lacustrine Condition Level 2 Rapid Assessment Protocol* (L2RAP). The Lacustrine Condition Assessment Form (Form) was used to evaluate these resources as part of the Joint Permit Application (JPA).

The assessment area (AA) consisted of the area of each resource that is proposed to be impacted by construction and/or operation of the Project, plus an additional 25 feet extending from each side. Each resource with the potential to be impacted by the Project was evaluated using a number of parameters, referred to as condition indices, as outlined by the L2RAP procedure. A brief summary of each condition index is discussed below.

Appendix L-2G provides a Form and corresponding map displaying the AA, land use condition category, and area of proposed impact of each resource assessed via the Lacustrine L2RAP impacted within Luzerne County.

Header Information

Project Number
This is designated as AECOM's internal project number associated with PennEast.

Project Name
This was determined to be the name of the project (i.e. PennEast).

AA # The AA is defined by the Feature ID used by AECOM for unique identification of lacustrine features.

Name(s) of Evaluator(s)
The evaluators were the names of the AECOM biologists who completed the evaluation.

Date
The date was determined to be the day the field survey and Form was completed.

Latitude and Longitude
Since these features are typically crossed via horizontal direction drill (HDD), the latitude and longitude was determined in GIS using field collected data to determine the location of the resource's impact.

Impact Size (acres)
The lacustrine impact size was calculated in GIS using the intersection of the proposed right-of-way (ROW) and Project workspace to the delineated boundary of the resource that was field

delineated and data points collected using a Trimble GPS unit 7. This information is provided within the Aquatic Resource Impact Table in JPA Section A-1.

AA Size (acres)
The lacustrine AA size is calculated in GIS and consists of the sum in acres of the Impact Size plus an additional 25 feet extending from each side of the impact.

Lacustrine Assessment Form Process – Form

Condition Indices
The following section describes each of the four condition indices evaluated for each lacustrine resource. Each condition index was assessed and a numerical, qualitative score was determined for each index. The four scores are then averaged together to determine the overall Lacustrine Condition Index (LCI). This is the final, combined results of the individual assessment categories.

Condition categories were assigned for each parameter in the form. There were categories that had specific details as to properly describe the feature. This was typically based on percentage of visible impact. These categories were optimal, suboptimal, marginal, and poor. Once narrowed down to a single category, a score would be assigned. The scores ranged from 0 to 20 with approximately 3 to 5 scores per category. In certain situations, the percentage range from the condition category was adjusted evenly across the scores and then selected based upon which score matched with the percentage evaluated.

1. Average Depth Condition Index
The evaluation of the lacustrine feature's average depth within the AA was determined using publically available data such as nautical charts or approximate visual estimations by biologists conducting the resource evaluations. Waterbodies that range 0-6-ft in depth are scored the highest, along with special aquatic habitats (i.e. mud flats, submerged vegetation beds, or emergent wetlands). Waterbodies that were greater than 20-ft in depth received a lower score.

2. Riparian Shoreline Vegetation Condition Index
The evaluation of the Riparian Shoreline Vegetation for lacustrine features was evaluated up to 50-ft inland from the AA's perimeter. A percent aerial coverage was determined based on the vegetative cover type observed in the area. Coverage where vegetation is comprised of mature forested areas is scored higher than areas that are of comprised of maintained lawns or lower quality lots (i.e. impervious surfaces, row crops, mine spoil lands, etc.). Observation percentages are computed in GIS and field verified. Once a percentage is given to these areas, a score is qualitatively assessed producing sub-scores. Sub-scores are then summed to provide an overall score for the index.

3. Riparian Zone of Influence Vegetation Condition Index
The evaluation of the Riparian Zone of Influence Vegetation Condition Index for lacustrine features was evaluated from 50-100-ft inland from the AA's perimeter. A percent aerial coverage was determined based on the vegetative cover type observed in the area. Coverage where vegetation was comprised of mature forested areas is scored higher than areas that are of comprised of maintained lawns or lower quality lots (i.e. impervious surfaces, row crops, mine spoil lands, etc.). Observation percentages are computed in GIS and field verified. Once a percentage was given to these areas, a score is qualitatively assessed producing sub-scores. Sub-scores are then summed to provide an overall score for the index.

4. Shoreline and Near-shore Human Alterations Index

The Shoreline and Near-shore Human Alterations Index for lacustrine features was evaluated for manmade structures or disturbances within 50-ft or along the shoreline of the resource. The condition categories are distributed on a percentage of the area impacted by disturbances (i.e. rip-rap, logs and debris, ramps, docks, etc.). An AA with fewer impacts receives a higher score.

Once all these factors have been calculated, they are averaged to determine an overall Lacustrine Condition Index (LCI) score for the lacustrine resource. Scores can range from 0.05 to 1. A score of one or close to one is interpreted as being a feature that is of higher quality. Lacustrine resources with a lower score can be interpreted as features that have many factors that degrade the quality of the resource and subsequently, lower quality.

Riverine Assessment Form 1

Pennsylvania Riverine Condition Level 2 Rapid Assessment Protocol (Document No. 310-2137-003)

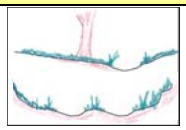
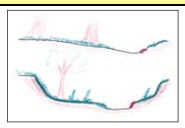
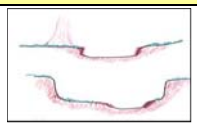
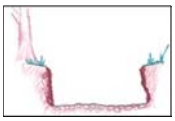
Pennsylvania Department of Environmental Protection

For use in intermittent or perennial watercourses with drainage areas ≤ 2,000 square mile drainage areas.

Project #	Project Name		Locality	Date	Ch 93 Classification		AA Id	Length
					Designated:	Existing:		
60414094	PennEast		Luzerne, PA	4/20/2017	HQ-CWF	None	052115_JC_1001_P_MA	2300.00
Latitude	41.130792	Longitude	-75.688018	FGM Level 1 Channel Classification			F	

Evaluator(s)	Stream Name and Information	Notes:
M. Kline, J. Dancho	052115_JC_1001_P_MA: PERENNIAL, Lacustrine form	

1. CHANNEL/FLOODPLAIN: Assess the cross-section of the stream and prevailing conditions along the AA.

	Condition Category				
	Optimal	**Suboptimal**	**Marginal**	**Poor**	**Severe**
Channel / Floodplain	 **Channel Geometry:** These channels show very little incision or widening and little or no evidence of active erosion. Anastomosing channels may be present. **Channel Stability:** Visual indicators include: 1) the banks are not eroding along greater than 5% of the reach; 2) natural vegetative or rock stability features are present along greater than 80% of the banks; 2) stable point bars and bankfull benches may be present; 3) mid-channel bars and transverse bars are rare and if transient channel sediment deposition is present, it covers less than or equal to 10% of the stream bottom; 4) baseflow is connected to the rooting depths of vegetation in the active floodplain. **Active Floodplain Connection:** The bankfull stream flows have frequent access to the active floodplain and fully developed point bars or bankfull benches that are accessed at most flows greater than baseflow.	 **Channel Geometry:** These channels are slightly incised or overwidened and contain a few areas of active erosion. **Channel Stability:** Visual indicators include: 1) the banks are actively eroding along less than 25% of the reach; 2) depositional features such as point bars and bankfull benches are present and stable during high flows and occur along greater than 50% of the reach; 3) natural bank protection like vegetation or rock is providing stability along greater than 50% of the reach; 4) baseflow is connected to vegetated point bars and bankfull benches. **Active Floodplain Connection:** The bankfull stream flows frequently access bankfull benches, or point bars along portions of the reach and may frequently inundate the active floodplain.	 **Channel Geometry:** These channels are over-widened or incised, but to a lesser degree than the Severe and Poor channel conditions. **Channel Stability:** Visual indicators include: 1) the banks are eroding or severely undercut along greater than 25% and less than or equal to 50% of the reach; 2) depositional features like point bars or bankfull benches occur along greater than 25% and less than or equal to 50% of the reach; 3) the stream banks may consist of some vertical or undercut banks or nick points associated with head cuts; **Active Floodplain Connection:** The bankfull stream flows have infrequent connection to the active floodplain.	 **Channel Geometry:** These channels are over-widened or incised and eroding vertically and/or laterally. **Channel Stability:** Visual indicators include: 1) the banks are eroding or severely undercut along greater than 50% of the reach; 2) active or recent bank sloughing is present along greater than 50% of the reach; 3) natural bank protection like vegetation is not preventing bank erosion along the reach; 4) depositional features, such as point bars and bank full benches, are absent from the reach or newly developing along less than 25% of the reach; 5) bank full benches and point bars frequently scour during high flows; 6) baseflow is disconnected from plant rooting depths and the active floodplain. **Active Floodplain Connection:** The bankfull stream flows are not connected to the active floodplain.	 **Channel Geometry:** These channels are deeply incised and actively eroding vertically and/or laterally. Over widened channels may contain sections of unstable braided channels from aggradation. **Channel Stability:** Visual indicators include: 1) the banks are actively eroding or being undercut along greater than 80% of the reach; 2) active or recent bank sloughing is occurring along greater than 80% of the reach; 3) natural bank protection like vegetation is not preventing bank erosion or sloughing; 4) depositional features such as point bars and bankfull benches are absent; 5) flood flows are disconnected from the active floodplain. **Active Floodplain Connection:** The bankfull stream flows are never connected to the active floodplain.
SCORE	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1

Comments:

CI = (Score)/20		CI
SCORE:	20	1.00

2. RIPARIAN VEGETATION: Assess the floodplain along the entire AA (Visual estimates of areal coverage from aerial photos with field verification acceptable).

	Condition Category							
	Optimal	**Suboptimal**		**Marginal**		**Poor**	
Riparian Vegetation (Floodplain)	Riparian area vegetation consists of a tree stratum present (diameter at breast height (dbh) > 3 inches) with greater than or equal to 60% tree canopy cover. Areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are scored as optimal.	**High Suboptimal:** Riparian area vegetation consists of a tree stratum (dbh > 3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian area vegetation consists of a tree stratum (dbh > 3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover with a maintained understory.	**High Marginal:** Riparian area vegetation consists of non-maintained, dense herbaceous vegetation with either a shrub layer or a tree stratum (dbh > 3 inches) present, with less than 30% tree canopy cover.	**Low Marginal:** Riparian area vegetation consists of non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, areas of hay production, and ponds or open water areas (< 10 acres). If trees are present, tree stratum (dbh > 3 inches) present, with less than 30% tree canopy cover with maintained understory.	**High Poor:** Riparian area vegetation consists of lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, pervious trails, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Riparian area consists of impervious surfaces; mine spoil lands, denuded surfaces, row crops, active feed lots, impervious trails, or other comparable conditions.
		High	Low	High	Low	High	Low
SCORE	20 19 18 17 16	15 14 13	12 11	10 9 8	7 6	5 4 3	2 1

Comments:

1. Identify Condition Category areas along the floodplain using the descriptors above.
2. Estimate the % area within each condition category.
3. Enter the % Riparian Area in in decimal form (0.00) and Score for each category in the blocks below. Ensure the sum of the % Riparian Area Blocks equal 100

	Condition Category	Optimal	High Suboptimal	Low Suboptimal	High Marginal	Low Marginal	High Poor	Low Poor	Side Sub-Index	
Right Side	% Riparian Area:	95%	0%	0%	0%	0%	5%	0%	**0.92**	**Side Sub-Index = SUM(%Areas*Scores)/20**
	Score:	19	0	0	0	0	5	0		
	Total Sub-score:	**18.05**	**0.00**	**0.00**	**0.00**	**0.00**	**0.25**	**0.00**		
	Condition Category	**Optimal**	**High Suboptimal**	**Low Suboptimal**	**High Marginal**	**Low Marginal**	**High Poor**	**Low Poor**		
Left Side	% Riparian Area:	95%	0%	0%	0%	0%	5%	0%	**0.92**	**CI = (Left Side CI + Right Side CI)/2** = **0.92**
	Score:	19	0	0	0	0	5	0		
	Total Sub-score:	**18.05**	**0.00**	**0.00**	**0.00**	**0.00**	**0.25**	**0.00**		

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3. RIPARIAN ZONE OF INFLUENCE: Assess land cover along both sides, 100 feet from edge of floodplain into the upland along the entire AA. (rough measurements of length & width may be acceptable)

	Condition Category				Comments:
	Optimal	**Suboptimal**	**Marginal**	**Poor**	
Riparian ZOI	Riparian ZOI area vegetation consists of a tree stratum present (diameter at breast height (dbh) > 3 inches) with greater than or equal to 60% tree canopy cover. Areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are scored as optimal.	**High Suboptimal:** Riparian ZOI area vegetation consists of a tree stratum (dbh > 3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory. **Low Suboptimal:** Riparian ZOI area vegetation consists of a tree stratum (dbh > 3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover with a maintained understory.	**High Marginal:** Riparian ZOI area vegetation consists of non-maintained, dense herbaceous vegetation with either a shrub layer or a tree stratum (dbh > 3 inches) present, with less than 30% tree canopy cover. **Low Marginal:** Riparian ZOI area vegetation consists of non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, areas of hay production, and ponds or open water areas (< 10 acres). If trees are present, tree stratum (dbh > 3 inches) present, with less than 30% tree canopy cover with maintained understory.	**High Poor:** Riparian ZOI area vegetation consists of lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, pervious trails, recently seeded and stabilized, or other comparable condition. **Low Poor:** Riparian ZOI area consists of impervious surfaces; mine spoil lands, denuded surfaces, row crops, active feed lots, impervious trails, or other comparable conditions.	
		High / **Low**	**High** / **Low**	**High** / **Low**	
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1**	

1. Identify Condition Category areas along the floodplain using the descriptors above.
2. Estimate the % area within each condition category.
3. Enter the % Riparian Area in decimal form (0.00) and Score for each category in the blocks below. Ensure the sums of % Riparian ZOI Blocks equal 100

	Condition Category	Optimal	High Suboptimal	Low Suboptimal	High Marginal	Low Marginal	High Poor	Low Poor	Side Sub-Index	
Right Side	% Riparian Area:	95%	0%	0%	0%	0%	5%	0%	**0.92**	**Side Sub-Index = SUM(%Areas*Scores)/20**
	Score:	19	0	0	0	0	5	0		
	Total Sub-score:	**18.05**	**0.00**	**0.00**	**0.00**	**0.00**	**0.25**	**0.00**		
	Condition Category	**Optimal**	**High Suboptimal**	**Low Suboptimal**	**High Marginal**	**Low Marginal**	**High Poor**	**Low Poor**		
Left Side	% Riparian Area:	95%	0%	0%	0%	0%	5%	0%	**0.92**	**CI = (Left Side CI + Right Side CI)/2** — **CI**
	Score:	19	0	0	0	0	5	0		
	Total Sub-score:	**18.05**	**0.00**	**0.00**	**0.00**	**0.00**	**0.25**	**0.00**		**0.92**

4. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths, woody and leafy debris, stable substrate, low embeddedness, shade, undercut banks, root mats, SAV, macrophytes, emergent vegetation, riffle-pool complexes, stable features.

	Condition Category				Comments:		
	Optimal	**Suboptimal**	**Marginal**	**Poor**			
Instream Habitat/ Available Cover	Physical Elements that enhance a stream's ability to support aquatic organisms are present in greater than or equal to 50% of the reach. Substrate is favorable for colonization by a diverse and abundant epifaunal community, and there are many suitable areas for epifaunal colonization and/or fish cover.	Physical Elements that enhance a stream's ability to support aquatic organisms are present in greater than or equal to 30% and less than 50% of the reach. Conditions are mostly desirable and are generally suitable for full colonization by a moderately diverse and abundant epifaunal community.	Physical Elements that enhance a stream's ability to support aquatic organisms are present in greater than or equal to 10% and less than 30% of the reach. Conditions are generally suitable for partial colonization by epifaunal and/or fish communities.	Physical Elements that enhance a stream's ability to support aquatic organisms are present in less than 10% of the reach. Conditions are generally unsuitable for colonization by epifaunal and/or fish communities. The reach.			
					CI = (Score)/20		**CI**
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1**	**SCORE:**	**20**	**1.00**

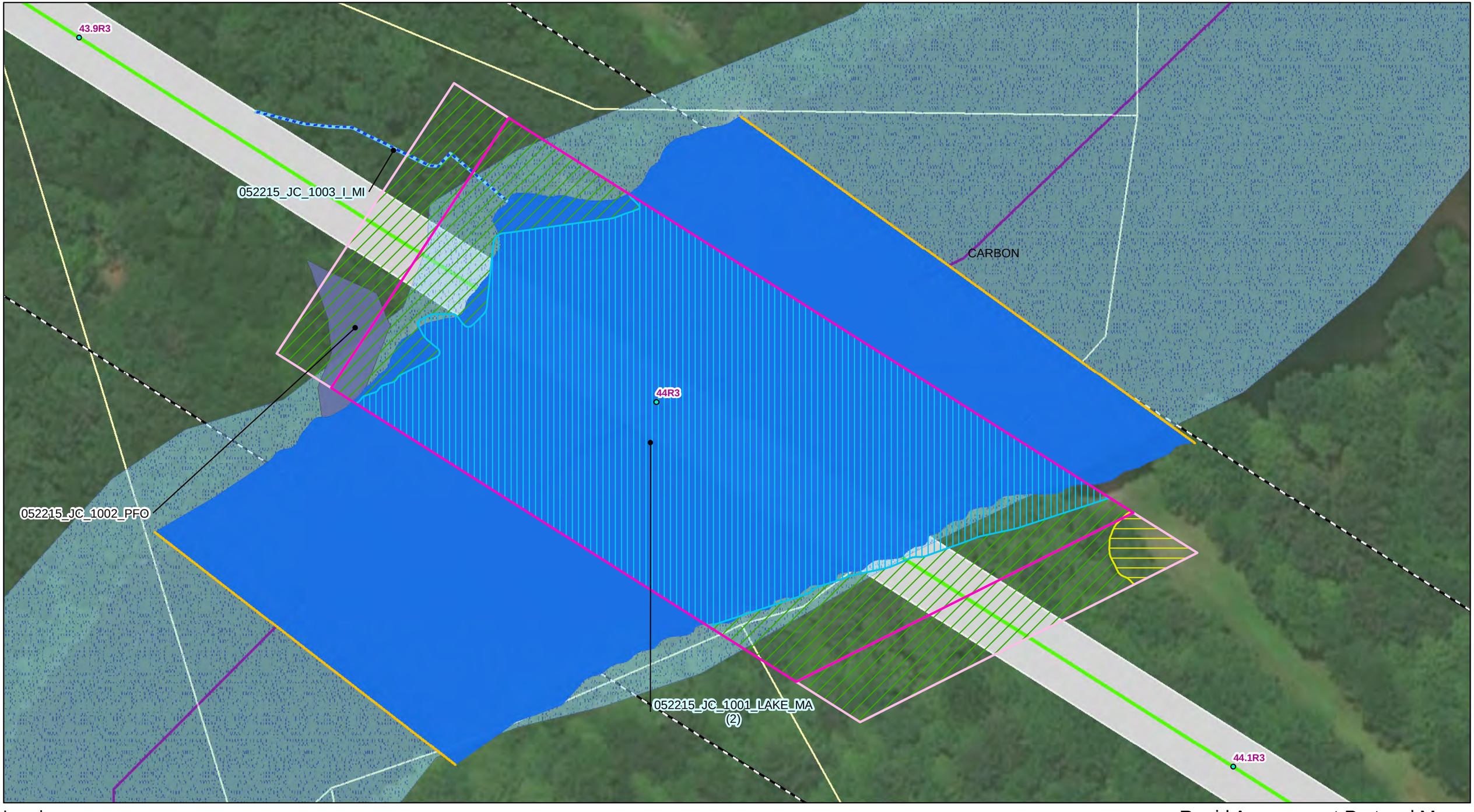
5. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel/channelization, embankments, spoil piles, constrictions, etc.

	Condition Category				Comments:		
	Negligible	**Minor**	**Moderate**	**Severe**			
Channel Alteration	Channel alterations listed above are absent in the SAR. The stream has unaltered pattern or has normalized.	**Minor High:** Less than or equal to 20% of the stream reach is disrupted by any of the channel alterations listed above. Alteration or channelization present, usually adjacent to structures, (such as bridge abutments or culverts); evidence of past alteration, (i.e., channelization) may be present, but stream pattern and stability have recovered; recent alteration is not present. **Minor Low:** Greater than 20% and less than or equal to 40% of the stream reach is disrupted by any of the channel alterations listed above. Alteration or channelization present, usually adjacent to structures, (such as bridge abutments or culverts); evidence of past alteration, (i.e., channelization) may be present, but stream pattern and stability have recovered; recent alteration is not present.	**Moderate High:** Greater than 40% and less than or equal to 60% of reach is disrupted by any of the channel alterations listed above. If the stream has been channelized, normal stable stream meander pattern has not recovered. **Moderate Low:** Greater than 60% and less than or equal to 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If the stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed above. Greater than 80% of banks shored with gabion, riprap, or concrete.			
		High / **Low**	**High** / **Low**		**CI = (Score)/20**		**CI**
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1**	**SCORE:**	**20**	**1.00**

RIVERINE CONDITION INDEX (RCI)		**RCI**
NOTE: **The CIs and RCI should be rounded to 2 decimal places.**	**RCI = (Sum of all CI's)/5 or Ephemeral/Intermittent RCI = (Sum non instream CI's)/4**	**0.97**

If a CI is not applicable (e.g. due to use on intermittent watercourse or >100 sq. mile drainage area) in order to utilize the auto calculator feature the user will need to modify the RCI formula or enter the maximum score for that CI to achieve a CI of 1.0 which will offset the divisor difference.

General Comments:



Legend

- Milepost
- 9/19/18 IFC Pipeline Centerline
- 9/19/18 IFC Permanent Easement
- 9/19/18 IFC Survey Area
- Parcel Boundary
- Riparian Vegetation Boundary
- Riparian ZOI

Riparian ZOI MM Landuse

- Forest/Woodland
- Open Land

Shoreline Area MM Landuse

- Forest/Woodland
- Open Water
- Open Land

Delineated Waterbody

- Bank Delineation
- Centerline Delineation

Delineated Wetland

- PFO
- Open Ended Delineation

Public Features

- NHD Stream
- NHD Waterbody

Rapid Assessment Protocol Maps

Lacustrine

Feature: 052215_JC_1001_LAKE_MA (2)
RAP Score:
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0 20 40 80 120 160 Feet