



**DRBC March 11, 2020 Business Meeting Public Comment Session
Theme: Climate Impacts and Water Resources of the Delaware River Watershed
Talking Points and References**

- The Delaware River Basin Commission approved a resolution to establish a Climate Change Advisory Committee, which is being formed now. In the resolution, they recognize that climate change is connected to water resources and that these changes are impacting the Delaware River Basin.

Here is a relevant text from their resolution:

WHEREAS, the Third National Climate Assessment¹ summarized climate change impacts on the water cycle as follows:

Water cycles constantly from the atmosphere to the land and the oceans (through precipitation and runoff) and back to the atmosphere (through evaporation and the release of water from plant leaves), setting the stage for all life to exist. The water cycle is dynamic and naturally variable, and societies and ecosystems are accustomed to functioning within this variability. However, climate change is altering the water cycle in multiple ways over different time scales and geographic areas, presenting unfamiliar risks and opportunities.²

WHEREAS, in both its 2019 State of the Basin Report and DRBC- authored sections of the Partnership for the Delaware Estuary's 2019 Comprehensive Conservation and Management Plan (CCMP) for the Delaware River Estuary, the Commission has recognized potentially significant impacts and threats to the Basin's water resources posed by climate change; and

¹ The Third National Climate Assessment was a three-year analytical effort by a team of over 300 experts, overseen by a broadly constituted Federal Advisory Committee of 60 members. The group's 2014 report was subjected to extensive review by the public and by scientific experts in and out of government, including a special panel of the National Research Council of the National Academy of Sciences. See the full report at: <https://nca2014.globalchange.gov/report/sectors/water>

²Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2. Page 71.

WHEREAS, evaluations and projects conducted and being conducted by the Commission,³ United States Army Corps of Engineers,⁴ United States Geological Survey⁵ and others have shown the potential for changes in the seasonality and volume of streamflows, as well as the potential for sea level rise to impact the location of the salt front and the availability of storage to manage salinity in the Delaware River Estuary;

- Considering that DRBC has now acknowledged that the impacts of climate change must be recognized as part of their water resources program, we are sharing important reports and studies that will assist them in assessing climate impacts.
- We are calling on DRBC to institute a regulatory requirement that all Dockets that are considered for approval must provide an analysis of the potential impacts of the project on climate change, including the greenhouse gas emissions of the proposed project and any reduction of greenhouse gases that the project will implement.

Many members of the public submitted comments on the draft natural gas regulations that included discussion of the impacts of climate change on the Delaware River Watershed. The public comment period closed 2 years ago, on March 30, 2018. Since that time, new reports and studies have been released that have signaled a heightened urgency to address climate impacts by reducing greenhouse gas emissions and ending reliance on fossil fuels. Today representatives of organizations are submitting information regarding the most recent science on this topic to be certain the Commissioners have ready access to these resources as they make a decision on the draft regulations. The Delaware River Frack Ban Coalition Organizing Committee reiterates today that through comments and petitions since the draft gas regulations were proposed, over a hundred thousand people have called for a COMPLETE ban on fracking throughout the Delaware River basin, including a ban on the import and discharge of wastewater produced by fracking, and on the water withdrawal from the Watershed for fracking elsewhere. Highlights from some of these important reports follow:

- The 2019 Intergovernmental Panel on Climate Change (“IPCC”) report from the United Nations describes how the ocean and cryosphere have and are expected to change with ongoing global warming, the risks and opportunities these changes bring to ecosystems and people, and mitigation, adaptation and governance options for reducing future risks.⁶

³ Shallcross, Amy. (2017). Analyzing Climate Change Impacts to Water Resources in the Delaware River Basin - Big Picture Risks. https://www.nj.gov/drbc/library/documents/Shallcross_climate-change-wrm_WRADRBnov2018.pdf

⁴ Johnson, Billy H., (2010). Report prepared for: U.S. Army Engineer District, Philadelphia: Application of The Delaware Bay and River 3d Hydrodynamic Model to Assess the Impact of Sea Level Rise on Salinity. Available from U.S. Army Engineer District, Philadelphia or Delaware River Basin Commission.

⁵ Williamson, T.N., Lant, J.G., Claggett, P.R., Nystrom, E.A., Milly, P.C.D., Nelson, H.L., Hoffman, S.A., Colarullo, S.J., and Fischer, J.M., 2015, Summary of hydrologic modeling for the Delaware River Basin using the Water Availability Tool for Environmental Resources (WATER): U.S. Geological Survey Scientific Investigations Report 2015–5143, 68 p., <http://dx.doi.org/10.3133/sir20155143>.

⁶ *Intergovernmental Panel on Climate Change, Summary for Policymakers, Revised on January 2019 by the IPCC, Switzerland, ISBN 978-92-9169-151-7*, downloaded at: <https://www.ipcc.ch/sr15/>

- The Intergovernmental Panel on Climate Change (“IPCC”) report says limiting warming to 1.5C will require reducing greenhouse gases by 45% from 2010 levels by 2030 and that there can be no carbon emissions from energy production by about 2050.⁷
- Scientists estimate that at least 45% - 50% reduction of greenhouse gases must be achieved by 2030 in order to effectively limit atmospheric warming. “Emissions need to be halved by 2030 to limit warming to 1.5 degrees Celsius but temperatures are on track to reach double that by the end of the century even if countries’ current plans are fully implemented, research by scientists shows.”⁸

See more on greenhouse emissions later in these Talking Points.

- Rising air and water temperatures and changes in precipitation are intensifying droughts, increasing heavy downpours and flooding, reducing snowpack, and causing declines in surface water quality, with varying impacts across different regions of the country.⁹ Changes in temperature and precipitation are increasing air quality and health risks from wildfire and ground-level ozone pollution. All of these climate change impacts effect water resources, including river flows, temperature, and seasonal variability, reservoir levels, water quality and the concentration of pollutants in bath ground and surface water, Delaware River Watershed species (both flora and fauna) and their habitats, recreation, economic values, and human health.
- Climate change has already had observable impacts on biodiversity, ecosystems, and the benefits they provide to society. These impacts include the migration of native species to new areas and the spread of invasive species, which will worsen and could affect ecological balance.¹⁰
- Yields from major U.S. crops are expected to decline as a consequence of increases in temperatures and possibly changes in water availability (drought conditions), soil erosion, and disease and pest outbreaks.¹¹
- The Fourth National Climate Assessment looks at the Northeast region climate impacts. These are among expected changes in the near term:
 - Less distinct seasons with milder winter and earlier spring conditions are already altering ecosystems and environments in ways that adversely impact tourism, farming, forestry, and other economies.¹²
 - Warmer ocean temperatures, sea level rise, and ocean acidification threaten ocean habitats, ecosystem services, and livelihoods.¹³
 - Major negative impacts on critical infrastructure, urban economies, and nationally significant historic sites are already occurring and will become more common with a changing climate.¹⁴

⁷ Ibid.

⁸ <https://climateactiontracker.org/publications/warming-projections-global-update-dec-2018/>

⁹ Intergovernmental Panel on Climate Change, *Summary for Policymakers, Revised on January 2019 by the IPCC, Switzerland, ISBN 978-92-9169-151-7*, downloaded at: <https://www.ipcc.ch/sr15/>

¹⁰ USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 186 pp. Retrieved from <https://nca2018.globalchange.gov/> at 16.

¹¹ Ibid at 14.

¹² Ibid at 116.

¹³ Ibid at 117.

¹⁴ Ibid at 117.

- Changing climate threatens the health and well-being of people in the Northeast through more extreme weather, warmer temperatures, degradation of air and water quality, and sea level rise.¹⁵
- Weather events have become more frequent and more intense. Anthropogenic climate change has increased precipitation, winds, and extreme sea level events associated with a number of observed tropical- and extra-tropical cyclones.¹⁶
- Extreme El Niño and La Niña events are likely to occur more frequently with global warming and are likely to intensify existing impacts, with drier or wetter responses in several regions across the globe, even at relatively low levels of future global warming.¹⁷
- Sea level rise translates into river level rise in the tidal Delaware River. The rising of the seas moves upriver from the ocean, the Bay, the estuary and into tidal reaches of the river, raising the river's level and the level of the river's freshwater tributaries. In the nontidal river and its watershed, extreme weather events cause inland flooding and its cascade of impacts to natural ecosystems, streams, habitats, infrastructure and the human environment, and to the hydrology of waterways and the hydrologic cycle, which is altered by increased stormwater runoff, wetland disruption and less natural infiltration and natural floodplain functions.
- Sea level rise is a dramatic and measurable impact of climate changes. Impacts will be exacerbated in cases of land reclamation and where anthropogenic barriers prevent inland migration of marshes and mangroves and limit the availability and re-location of sediment.¹⁸ In the absence of adaptation, more intense and frequent extreme sea level events, together with trends in coastal development, will increase expected annual flood damages by 2-3 orders of magnitude by 2100.¹⁹
- Since the early 1980s, the occurrence of harmful algal blooms (HABs) and pathogenic organisms (e.g. *Vibrio*) has increased in coastal areas in response to warming, deoxygenation and eutrophication, with negative impacts on food provisioning, tourism, the economy, and human health.²⁰
- Rutgers University's report published in 2019 points out that "New Jersey has already been disproportionately affected by climate change—sea-level rise projections in New Jersey are more than two times the global average."²¹ This is consistent with the findings of other reports that from Virginia northward, sea level rise is having greater effects. New Jersey's condition is exacerbated by the fact that, as the Rutgers Study explains, "Over the last four thousand years, the dominant long-term driver of SLR in New Jersey has been the sinking of the land as part of the ongoing response to the disappearance of the North American ice sheet."²²

¹⁵ Ibid at 117.

¹⁶ IPCC (2019). The Ocean and Cryosphere in a Changing Climate. Intergovernmental Panel on Climate Change. Retrieved from https://report.ipcc.ch/srocc/pdf/SROCC_FinalDraft_FullReport.pdf at 6-3.

¹⁷ Ibid at 6-4.

¹⁸ Ibid at 4-5.

¹⁹ Ibid.

²⁰ Ibid at 5-5.

²¹ Kopp, R.E., C. Andrews, A. Broccoli, A. Garner, D. Kreeger, R. Leichenko, N. Lin, C. Little, J.A. Miller, J.K. Miller, K.G. Miller, R. Moss, P. Orton, A. Parris, D. Robinson, W. Sweet, J. Walker, C.P. Weaver, K. White, M. Campo, M. Kaplan, J. Herb, and L. Auermuller. New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Trenton, New Jersey. p. 1 <https://bloustein.rutgers.edu/njdep-releases-report-on-sea-level-rise-building-on-previous-rutgers-studies/>

²² Ibid. p. 9.

- In a report published last year by the Rhodium Group, New Jersey damages from climate change were examined and calculated. In addition to the growing extent and costs of coastal flooding, the report points out “While New Jersey’s coastal communities face the bulk of hurricane-driven flood risk, the potential for wind damage from these storms extends inland. Four decades ago, the odds that an average New Jersey home outside the state’s coastal counties would experience hurricane-force winds in a given year was less than 1-in-200. That has grown to between 1-in-30 and 1-in-100.”²³ The report explains:

“Global average temperatures have risen by 2° Fahrenheit since the late nineteenth century and by more than 1° Fahrenheit over the past four decades, with the pace of warming accelerated as concentrations of carbon dioxide (CO₂) and other greenhouse gases in the atmosphere have increased. Oceans are also responding to these changes. Sea surface temperature in the Northeast US has warmed faster than 99% of the global ocean since 2004, and projections indicate that this area will continue to warm more quickly than other ocean regions through the end of the century.⁵ 2018 also marked the warmest year on record for ocean heat content, surpassing a record set in 2017.⁶ Warming oceans take up more space, a process known as thermal expansion, which contributes—along with melting glaciers and ice sheets—to sea-level rise.”²⁴
- The damage to buildings in all the counties along Delaware River tidal waters has increased due to climate impacts since 1980 according to the Rhodium Group study. Mapping shows the greatest increases for the Delaware estuarine waters to be Cape May County (from 20.9% to 27% - both from the Delaware Bay and the Atlantic Ocean) and Salem County (12.5% to 15.3%).²⁵
- The “increase in expected average annual loss, as a percent of county output, due to changes in sea level and expected hurricane activity since the 1980s” is greatest in Cape May, Hudson, and Salem Counties of all New Jersey counties, according to the Rhodium study.²⁶ This is a significant cost for these two Delaware River Basin counties.
- Storm surge exacerbates the flooding from storm-induced flooding and was an important factor in the damages caused by Hurricane Sandy in 2012.²⁷
- The Delaware Valley Regional Planning Commission (DVRPC) reports that “...water levels of the tidal section of the Delaware River will rise as sea level rises along the Atlantic Coast. These rising water levels will be a permanent change to the landscape and will introduce new flooding vulnerabilities along the Delaware that communities will need to address.”²⁸
- In the NOAA Technical Report on global and relative sea level rise, it is concluded that seas will continue to rise due to climate change even if substantial action is taken now to address climate change impacts. These impacts include:

“Significant, direct impacts of long-term [relative sea level] (RSL) rise, including loss of life, damage to infrastructure and the built environment, permanent loss of land (Weiss et al., 2011), ecological regime shifts in coastal wetlands and estuary systems (Kirwan et al.,

²³ RHODIUM GROUP, “NEW JERSEY’S RISING COASTAL RISK”, October 2019. p. 2 https://rhg.com/wp-content/uploads/2019/10/Rhodium_NJCoastalRisk_Oct2019final.pdf

²⁴ Ibid. p. 3, 4.

²⁵ Ibid. Figure 4, p. 7.

²⁶ Ibid. Figure 8, p. 12.

²⁷ Ibid., p. 7.

²⁸ DVRPC, Coastal Effects of Climate Change in Southeastern PA, Introduction and Project Background, November 5, 2019. <https://www.arcgis.com/apps/MapSeries/index.html?appid=8080c91a101d460a9a0246b90d4b4610>

2010), and water quality impairment (Masterson et al., 2014), also occur when key thresholds in the coastal environment are crossed (Wong et al., 2014).²⁹

- In an earlier DVRPC report, the study on the effects of sea level rise concluded: “The study concludes that a three- to four-foot rise in sea level during the next 100 years will have a wide range of impacts. Rising seas will inundate almost all of Pennsylvania's 1,500 acres of tidal wetlands. The salt line in the Delaware River will migrate further upstream, threatening Philadelphia's drinking water supply. The pollutants found in contaminated sites may be released into estuary waters. Efforts to increase public access to the waterfront may be jeopardized by rising waters.”³⁰

Greenhouse Gas Emissions; Methane:

- Greenhouse gas emissions must address methane, which means curtailing natural gas development. According to recent tracking greenhouse gas reports, “However, energy-related carbon dioxide emissions were at a record high last year and new renewable power capacity has stalled after years of strong growth. At the same time, methane, a more potent greenhouse gas than carbon dioxide, has risen in recent years due to oil and gas production, including fracking.”³¹
- Atmospheric methane levels rose steadily during the last few decades of the 20th century before leveling off for the first decade of the 21st century.³² Since 2008, however, methane concentrations have again been rising rapidly. This increase, if it continues in coming decades, will significantly increase global warming and undercut efforts to reach the COP21 target of < 2 degrees C above the pre-industrial baseline by 2021.³³ Limiting warming to 1.5C will be even more difficult, if not impossible.
- The composition of natural gas is about 95% methane. Methane leaks or is vented or flared at all stages of the natural gas process (extraction/production, gathering, processing, transmission, storage, local distribution and consumption). Methane is 86 times more efficient than CO₂ at trapping heat over a 20-year period.³⁴ Unless methane emissions are dramatically and intentionally reduced, it will be impossible to meet the required 45% reduction

²⁹ National Oceanic and Atmospheric Administration, U.S. DEPARTMENT OF COMMERCE, National Ocean Service Center for Operational Oceanographic Products and Services, “GLOBAL AND REGIONAL SEA LEVEL RISE SCENARIOS FOR THE UNITED STATES”, NOAA Technical Report NOS CO-OPS 083, Silver Spring, Maryland, January 2017. P. 1

³⁰ DVRPC, “Sea Level Rise Impacts in the Delaware Estuary of Pennsylvania”, Product No.: 04037, 6/2004, Abstract. <https://www.dvrpc.org/Products/04037/>

³¹ <https://www.insurancejournal.com/news/international/2019/06/19/529839.htm>

³² Howarth, R. (2019). Ideas and perspectives: is shale gas a major driver of recent increase in global atmospheric methane? *Biogeosciences* (16), 3033-3046. Retrieved from <https://www.biogeosciences.net/16/3033/2019/bg-16-3033-2019.pdf>

³³ Ibid.

³⁴ Myhre, G. et al. 2013. Anthropogenic and Natural Radiative Forcing. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Stocker, T.F., D. Quin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midglet (eds). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. and https://en.wikipedia.org/wiki/Global_warming_potential

of greenhouse gases that the IPCC and other scientists have concluded is necessary to meet climate goals.

- Natural gas systems emit more anthropogenic methane than any other source in the United States, and are the third highest source for carbon dioxide emissions nationally.³⁵ Natural gas, considered “clean” or a “bridge fuel” is, in fact, a bigger problem than other fossil fuels due to uncontrolled and uncontrollable leaks, intentional flaring and venting. “Methane is far more potent than carbon dioxide in contributing to climate change. That makes it particularly harmful to the environment when it is discharged into the atmosphere. In the U.S. alone, the methane that leaks or is released from oil and gas operations annually is equivalent to the greenhouse gas emissions from more than 69 million cars, according to a Wall Street Journal analysis using conversion formulas from the Environmental Protection Agency and emissions estimates for 2015 published last year in the journal *Science*.”³⁶
- Methane’s impact on atmospheric warming is much shorter and simpler than carbon, as explained in the VOX.com article: “Reduced emissions [of methane] have an almost immediate climate impact. It’s a short-term climate lever, and if the countries of the world are going to hold rising temperatures to the United Nations’ target of “well below” 2 degrees Celsius above the preindustrial baseline, they’re going to need all the short-term climate levers they can get.”³⁷
- According to Dr. Howarth of Cornell University, the planet is going to continue to warm to 1.5 degrees C in 12 years and to 2 degrees C in 35 years or less unless we substantially cut methane emissions.³⁸ He points out that the planet responds much faster to methane than carbon dioxide. There is already so much carbon in the atmosphere that the ONLY hope of meeting global climate targets is to address methane because that can quickly reduce greenhouse gases and slow the warming of the atmosphere.³⁹

³⁵ EPA 2016. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014.

<https://www.epa.gov/ghgemissions/us-greenhouse-gas-inventory-report-1990-2014>

³⁶ Wall Street Journal, *The Leaks That Threaten the Clean Image of Natural Gas*, <https://www.wsj.com/articles/the-leaks-that-threaten-the-clean-image-of-natural-gas-11565280375>

³⁷ <https://www.vox.com/energy-and-environment/2019/8/15/20805136/climate-change-fracking-methane-emissions>

³⁸ Dr. Robert Howarth, Cornell University, “COP21 Reflections on the Historic Paris Climate Agreement”, http://events.cornell.edu/event/cop21_reflections_on_the_historic_climate_agreement

³⁹ Ibid.