Appendix E. Developing regional flow diversion curves

This appendix provides guidance on improved methods to estimate floodplain flow diversions for a particular project reach. The new methods are based on the work by Altland (2019) and "scale" down regional flow gage data for individual projects, using available USGS hydrograph separation methods. This appendix also outlines how post-restoration channel dimensions for FR projects are defined, using baseflow statistics.

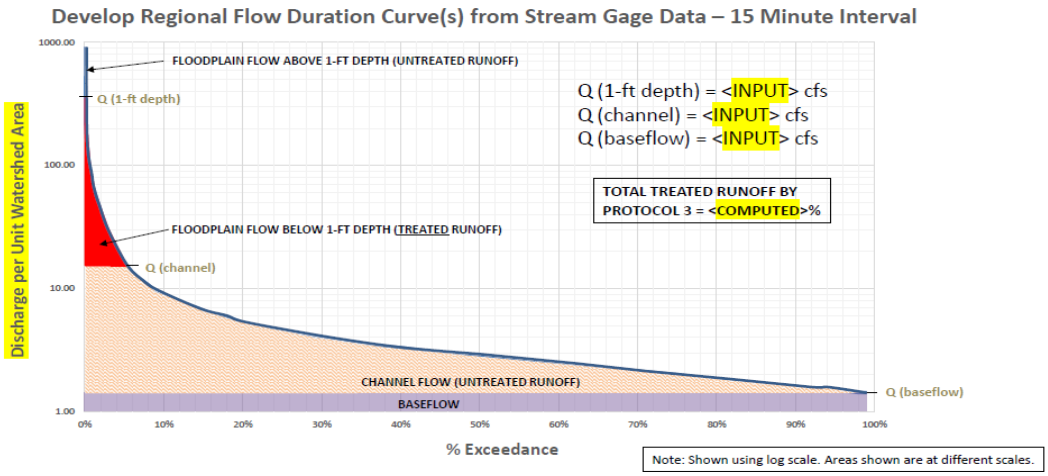
The Regional Flow Curve Approach

For this approach, 15-minute flow data from USGS gage stations would be used to create a series of curves that represent stream discharge as a function of the size of the storm event. Unique curves would be developed for each physiographic region in the Chesapeake Bay Watershed, and for different watershed land use conditions so they are representative of the project site conditions.

By adjusting these curves to the specific project site drainage areas and developing companion spreadsheet tools to run the pollutant removal calculations, a 3-step process can be used to determine the treatable flow:

1. Select the appropriate regional flow duration curve and regional baseflow curve for your project site. Use the baseflow curve to define the baseflow discharge for the 50% recurrence interval.
2. Using HEC-RAS or a similar model, determine the channel flow (the flow that would just fill the existing channel without overtopping its banks) and the floodplain flow at 1ft floodplain inundation depth.
3. Input the channel flow, flow at 1 foot of floodplain inundation, and baseflow into a spreadsheet tool to calculate the percent of flow that can be treated by the floodplain.

Figure E-1. *Flow Duration Curve for calculating floodplain treatment (Altland 2019).*



Developing the Regional Flow Duration Curves

Regional flow duration curves would be developed for the Piedmont, Coastal Plain, and Ridge & Valley provinces using the best available or most appropriate USGS gage data (evaluation of up to 50 total gages). Stations with 15-minute or better and 10+ years of data are preferred when feasible. The data are scaled by comparing the drainage area of gage site to project site drainage area.

From these 50 gage sites, one curve per province would be developed; however, more than one curve may be needed for each province to address varying watershed conditions. Other critical parameters that would be assessed include: similar watershed land cover, watershed slope, and percent karst. It is assumed that no more than 3 curves would be required for each province to address these varying conditions.

For the same 50 gage sites, average base flow values will be developed using hydrograph separation methods for the 50% exceedance interval. Hydrograph separation can be performed using the USGS HySep computer program, which is part of the Groundwater Toolbox program. There are 8 different methods to perform the HySep computations, which can be averaged for this computation.

Finally, a series of spreadsheet tools would then be produced to easily compute Protocol 3 treatment efficiency as described in Step 3 above. The spreadsheets would allow users to input the channel flow, baseflow, and flow at 1ft depth above the floodplain in order to calculate the treatment efficiency. There would be one spreadsheet per regional flow duration curve. It is estimated that the development of all of these products would require between 200 and 250 hours and approximately $35,000.