**APPENDIX 1-3. Carbaryl Scenario Development for Aquatic Modeling**

The purpose of this Appendix is to provide supporting information for the aquatic modeling work.

The use sites simulated for carbaryl are documented in **APPENDIX 3-1**. Agricultural modeling simulations are also summarized in **Table 2**. The modeling for uses in residential areas are fully described in **Chapter 3**. In **Table 2**, the use data layer was obtained from information provided in **APPENDIX 3-1**. The PWC scenario simulated was determined based on the use data layers used in mapping. The HUC2 was simulated when the 2012 National Agricultural Statistics Service Census Data indicated that a crop was grown in that HUC2 region. Limited data were available with regards to Puerto Rico, Alaska, and Hawaii and some assumptions were made in those areas based on best available information. Most crops were assumed to be grown in these areas when information was not available; however, some crops were assumed not to be grown in HUC2 region 20 or HUC2 region 21. For example, tobacco and sunflowers were assumed not to be grown in HUC2 region 20 and HUC2 region 21. See **Chapter 3** for additional details on the aquatic modeling.

In selecting application dates for aquatic modeling, EPA considers many factors.  Label directions, such as whether a pesticide application is made during a dormant season, or if it is applied during preemergence or postemergence of the crop, may be considered.  Labels for various uses specify various treatment timings including pre-harvest, post-harvest, foliar, ground, and “as needed”. Application dates were an analysis of weather files to determine the time of year most likely to produce the greatest off-site transport.  The meteorological information is considered as pesticide loading to surface water is directly affected by precipitation events. The wettest month (*i.e.*, the month with the highest cumulative precipitation) within each HUC2 was identified (**Table 1**), and the 1st day of that month was assumed to be the date of first application each year to ensure conservatism in the environmental exposures simulated. Carbaryl is applied to foliage or soil in agricultural settings, and by various methods depending upon the use (**Table 2**). When ground applications were allowed on orchard crops, citrus, and grapes, airblast spray drift assumptions were assumed in modeling.

In HUC-02 regions with differing amounts of rainfall across the region, an additional location was selected with substantially different meteorological conditions to represent the range of conditions across the HUC2 region **Table 1.** These HUC2 regions with differing conditions are 10, 11, 12, 15, 16, 17, 18, and 20.

**Table 1.  Month with highest total precipitation in each 30-year weather file in each HUC2**

| **HUC2** | **City, State** | **Meteorological File** | **Average Wettest Month in 30 years of data** |
| --- | --- | --- | --- |
| 1 | Hartford, CT | w14740 | May |
| 2 | Lynchburg, VA | w13733 | July |
| 3 | Atlanta, GA | w13874 | March |
| 4 | Milwaukee, WI | w14839 | August |
| 5 | Covington, KY | w93814 | May |
| 6 | Knoxville, TN | w13891 | March |
| 7 | Des Moines, IA | w14933 | June |
| 8 | Fort Smith, AR | w13970 | July |
| 9 | Fargo, ND | w14914 | June |
| 10a | Grand Island, NE | w14935 | June |
| 10b | Sheridan, WY | w24029 | May |
| 11a | Fort Smith, AR | w13964 | May |
| 11b | Amarillo, TX | w23047 | June |
| 12a | Fort Worth, TX | w03927 | May |
| 12b | Abilene, TX | w13962 | September |
| 13 | El Paso, TX | w23044 | September |
| 14 | Rock Springs, WY | w24027 | May |
| 15a | Flagstaff, AZ | w03103 | July |
| 15b | Phoenix, AZ | w23183 | December |
| 16a | Salt Lake City, UT | w24127 | April |
| 16b | Winnemucca, NV | w24128 | November |
| 17a | Eugene, OR | w24221 | December |
| 17b | Pocatello, ID | w24156 | May |
| 18a | Sacramento, CA | w23232 | January |
| 18b | San Diego, CA | w23188 | January |
| 19a | Big Delta, AK | w26415 | July |
| 19b | Talkeetna, AK | W26528 | August |
| 20a | Hilo, HI | w21504 | November |
| 20b | Honolulu, HI | w22521 | December |
| 21 | Puerto Rico | w11641 | May |

**Table 2. Modeled Crop Groups with Maximum Single Application Rate, Application Types, and Application Timing and/or Target**

| **Filename** | **Use Data Layer** | **PWC scenario** | **HUC2s** | **Crop Group** | **Specific crops included in this group** | **Max. Single App. Rate****(lb a.i./acre), # of Apps, RTI** | **Application****Type** | **Application Timing/ Target** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Asparagus | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetable | All | Asparagus, leafy vegetables | endive, dandelion, parsley, spinach, leaf petioles, prickly pear cactus, garden beets | 2, 5x, 7d | Aerial, Ground, Chemigation | Preharvest, Postharvest |
| Beans | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetable | All | Beans, Legumes | peas, beans (except soybeans) | 1.53, 4x, 3d | Aerial, Ground, Chemigation, Shaker Can | Foliar, Soil/ Ground |
| sbeets | CONUS\_OtherRow Crops, NL48\_Ag | Other row crops | All but 6, 8, 12, 13 | Sugar Beets | sugar beets | 1.53, 2x, | Aerial, Ground, Chemigation, Spreader, Shank | Foliar, Soil/ Ground |
| Berries | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetable | All | Berries | blackberries, blueberries, boysenberries, caneberries, dewberries, loganberries, raspberries, strawberries, “other berries”, cranberries | 2.04, 5x, 7d | Aerial, Ground, Chemigation, Duster, Shaker Can, Bait | Foliar, Soil/ Ground |
| Brassica | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetable | All | Cruciferous vegetables (Brassica) | broccoli, Brussel sprouts, cauliflower, collards, kale, kohlrabi, mustard greens | 2.04, 4x, 7d RTI | “Broadcast”, “Spray”, Shaker can, Bait | Foliar, Soil/ Ground |
| Clover | CONUS\_Other Crops, NL48\_Ag | Other Crops | All | Forage Crops | Clover | 1.53, 4x, 56-d | “Broadcast” | Foliar, Soil |
| CitrusCA | CONUS\_Citrus | Citrus | 18 | Citrus | “crop group 10” | 12.2, 1x | Aerial, Ground, Chemigation, Airblast | Foliar |
| CitrusFL | CONUS\_Citrus | Citrus | 3 | Citrus | “crop group 10” | 8.16, 2x, 14d followed by a 3rd app at 4 lb a.i./A | Aerial, Ground, Chemigation, Airblast | Foliar |
| CitrusAll | CONUS\_Citrus | Citrus | All but 1, 14, 18 | Citrus | “crop group 10” | 5.1, 4x, 14d | Aerial, Ground, Chemigation, Airblast | Foliar |
| Corn | CONUS\_Corn, NL48\_Ag | Corn | All but 19 | Corn | field corn, popcorn | 2.04, 8x, 14d | Aerial, Ground, Chemigation | Foliar |
| Scorn | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetable | All but 21 | Sweet Corn | Sweet Corn | 2.04, 8x, 3d | Aerial, Ground, Chemigation | Foliar |
| Cucurbit | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetable | All | Cucurbits | cantaloupe, cucumbers, melons, pumpkin, squash | 1.02, 6x, 7d | Aerial, Ground, Chemigation, Duster, Shaker Can | Foliar, Soil/Ground |
| Forest\_trees | CONUS\_Forest Trees, NL48\_Forest Trees | Other trees | All | Forest Trees, Ornamentals (Unspecified) | forested areas, rangeland trees | 1.02, 2x, 7d | “Sprayer” | Foliar |
| Flax | CONUS\_Other Grains, NL48\_Ag | Other grain | All but 6, 8, 12, 13, 14, 15, 20, 21 | Flax | Flax | 1.53, 2x, 14d | Aerial, Ground, Chemigation | Foliar |
| Fruit\_veg | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetable | All | Fruiting Vegetables | tomato, peppers, eggplant*,* groundcherries | 2.04, 7x, 7d | Aerial, Ground, Chemigation, Shaker can, Shank | Foliar, Soil/Ground |
| Golf | CONUS\_Open Space Developed, NL48\_Open Space Developed | Golf | All | Golf Courses | golf courses | 8, 2x, 7d | Ground | Soil/Ground |
| Grapes | CONUS\_Grapes, NL48\_Ag | Grapes | All | Grapes | grapes | 2.04, 5x, 7d | Aerial, Ground, Chemigation, Duster, Shaker Can, Airblast | Foliar |
| Noncropland | CONUS\_Right of Way1, CONUS\_Alfalfa, CONUS\_Developed, NL48\_Right of Way, NL48\_Ag, NL48\_Developed,  | ROW, Grassland, Developed | All | Non-Cropland | CRP land, rights-of-way, hedgerows, ditchbanks, roadsides | 1.02, 2x, 14d | Aerial, Ground, Chemigation | “Spray” |
| Okra | CONUS\_Vegetables and Ground Fruit, NL48\_Ag,  | Vegetables | All | Okra | Okra, soybean3 | 1.53, 4x, 6d | Ground, Duster | Foliar |
| Olive | CONUS\_Other Orchards, NL48\_Ag | Other Orchards | 3, 12, 13,15, 16, 17, 18, 19 | Olive | olives | 7.65, 2x, 14d | Aerial, Ground, Chemigation | Foliar |
| Ornamental | CONUS\_Nurseries, NL48\_Nurseries | NS landcover | All | Ornamentals | ornamental trees and plants, woody shrubs and vines | 1.2, 6x, 7d | “Sprayer” ground boom assumed | Foliar |
| Pasture1 | CONUS\_Alfalfa, NL48\_Ag | Grassland | All | Pastures | grasses grown for hay or seed, flax, pastures, alfalfa, trefoil | 1.53, 4x, 14d | Aerial, Ground, Chemigation | Foliar, Soil/Ground |
| Pasture2 | CONUS\_Alfalfa, NL48\_Ag | Grassland | All | Forage Crops | Alfalfa, trefoil | 1.53, 4x, 56-d | Aerial, Ground, Chemigation | Foliar |
| Peanut | CONUS\_OtherRow Crops, NL48\_Ag | Other Row Crops | 2, 3, 5, 6, 8, 11, 12, 13, 19 | Peanuts | peanuts | 2.04, 5x, 7d | Aerial, Ground, Chemigation | Foliar |
| PistachiosAll | CONUS\_Other Orchards, NL48\_Ag | Other Orchards | 12, 13, 14, 15, 16, 17, 18, 19 | Pistachios | pistachios | 5.1, 4x, 14d | Aerial, Ground, Chemigation, Spreader, Shank, Airblast | Foliar, Soil/Ground, Dormant, Delayed dormant |
| PistachiosCA | CONUS\_Other Orchards | Other Orchards | 18 | 6, 1x | Aerial, Ground, Airblast |
| Pome | CONUS\_Other Orchards, NL48\_Ag | Other Orchards | All | Pome Fruits | apples, pears | 3.06, 8x, 14d | Aerial, Ground, Chemigation | Foliar, Fruit Thinning |
| Potato | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetables | All but HUC21 | Potato | Potato | 2, 3x, 7d | Spreader or shank applicator, no drift | Foliar |
| Rangeland | CONUS\_Rangeland, NL48\_Rangeland | Grassland | All | Rangeland | rangeland | 1.02, 1x | Aerial, Ground, Chemigation, Spreader, Shank | Foliar, Soil/Ground, When needed |
| Simulated with PFAM, CONUS\_rice | All but 1, 2, 10, 13, 14, 15, 20, 21 | Rice | rice | 1.53, 2x, 7d | Aerial, Ground, Chemigation | Foliar |
| Root | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetables | All | Roots & Tuber Vegetables | carrots, horseradish, parsnip, rutabaga, salsify, turnip | 2.04, 6x, 7d | Aerial, Ground, Chemigation, “Broadcast” | Foliar, Soil/Ground |
| Sorghum | CONUS\_Other Grains, NL48\_Ag | Other grains | All | Sorghum | Sorghum, flax | 2.04, 4x, 7d | Aerial, Ground, Chemigation | Foliar |
| Stone | CONUS\_Other Orchards, NL48\_Ag | Orchard | All but 18 and 21 | Stone Fruit | apricot, cherries, nectarines, peaches, plums, plumcot, and prunes | 3.06, 3x, 7d | Aerial, Ground, Chemigation, airblast | Foliar |
| StoneCA | CONUS\_Other Orchards, NL48\_Ag | Orchard | 18 | Stone Fruit | apricot, cherries, nectarines, peaches, plums, plumcot, and prunes | 4.08, 3x, 7d | Aerial, Ground, Chemigation, Airblast | Foliar |
| Sunflower | CONUS\_OtherRow Crops, NL48\_Ag | Other row crops | All but 15, 16, 19, 20, 21 | Sunflower | sunflowers | 1.53, 2x, 7d | Aerial, Ground, Chemigation | Foliar |
| Sweetpot | CONUS\_Vegetables and Ground Fruit, NL48\_Ag | Vegetable | All | Sweet Potato | Sweet potatoes | 2.04, 8x, 7d | Aerial, Ground, Chemigation | Foliar, Soil/Ground |
| Soybean | CONUS\_Soybeans, NL48\_Ag | Soybean | All but 15, 19, and 21 | Soybean | Soybean | 1.53, 4x, 7d | Ground | Foliar |
| Tobacco | CONUS\_OtherRow Crops, NL48\_Ag | Other row crops | All but, 9, 12, 13, 14, 15, 16, 17, 18, 20, 21 | Tobacco | tobacco | 2.04, 2x, 7d | Aerial, Ground, Chemigation | Foliar |
| Sod | CONUS\_Other Crops , NL48\_Ag  | Turf | All | Turf | sod farms, residential lawns | 8.32 | “Broadcast”, Spot | Foliar, Soil/Ground |
| Tree\_nut | CONUS\_Other Orchards, NL48\_Ag | Other orchards | All | Tree Nuts | almonds, cashews, filberts, pecans, walnuts, etc. | 5.1, 4x, 7d | Aerial, Ground, Chemigation, Airblast | Foliar, Dormant, Delayed Dormant |
| Ticks | CONUS\_Rangeland, NL48\_Rangeland | Grassland | All | Not applicable | Ticks | 2 lb a.i./A, 4x, 7d |  |  |
| Residential | CONUS\_Developed, NL48\_Developed | Residential | All | Not applicable | Lawns, perimeter treatments, ornamentals around homes, fencerows, gardens | 8.36 lbs a.i./A, 4x, 7d with 58.7% are treated assumption | Handheld equipment | Based on pest pressure |

1 Non-cropland includes conservation reserve program land which was not mapped, the rights-of-way (ROW) which is linked to the ROW use data layer; hedgerows are assumed to be adjacent to and included in other agricultural land cover classes that are mapped with other use patterns; and ditch banks and roadsides are assumed to be adjacent to and included with any road. Therefore, ROW was used to map this use pattern.