

## Appendix 3. Stepwise Main Logic for Classifying Year 2012 to Land Uses

The following steps serve as an informal, but structured, English language-like syntax for the main logic flow for reclassifying the initial base dataset into the final 2012 NWALT raster (grid). It is designed to be supplemental information to the main text, and intended for users and readers who want significantly more detail. See main text for dataset descriptions and citations. NWALT is the **NAWQA Wall-to-Wall Anthropogenic Land Use Trends** dataset; NAWQA is the U.S. Geological Survey's (USGS) National **Water-Quality Assessment** Program.

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/******
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/* NOTES:
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/* Explanatory comments are preceded by /*
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/* Class names of NWALT classes are bolded (for example, Water, Developed, and so forth).
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/* Control words are in all caps (for example, IF, THEN, ELSE, and so forth).
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/* base_grid is the 2012 "base grid" (described in paper), which is a 60-m version of the National Land Cover Database (NLCD) 2011 with some Developed pixels that represent rural roads replaced with the surrounding land cover. This is the starting point from which the NWALT 2012 land uses are built.
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/* final_2012_grid is the grid that is being built.
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/* END NOTES
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/* Each set of steps classifies pixels that are then masked from subsequent IF statements. If a Barren pixel is classified as Conservation, it will not subsequently be reclassified as Mining in the step that follows, regardless if those conditions are also met.
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2 /* Water
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3 IF base_grid == Water THEN /* NLCD class 11
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4     final_2012_grid = Water /* NWALT class 11
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5 ENDIF
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6 /* Wetlands; NLCD 2001 and 2011 classes 90 and 95; NLCD 1992 classes 91 and 92.
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7 IF base_grid == Wetlands and NLCD 1992 == Wetlands and NLCD 2001 == Wetlands, THEN
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8     final_2012_grid = Wetlands /* core wetlands; NWALT class 12
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9  ENDIF
10 /* Burn major roads in, even in Conservation areas.
11 IF base_grid == Developed (NLCD 21–24) and HSIP Func_class == 1, 2, or 3, THEN
12     final_2012_grid = Developed, Major Transportation      /* NWALT class 21
13 ENDIF
14 /* Conservation
15 IF base_grid == (Barren (NLCD class 31), Forest (41–43), Shrubland (52), Grassland (71), or Wetlands (90–
16 95)) and Protected Areas Database (PAD) grid == USGS Gap Analysis Program (GAP)_status 1, THEN
17     final_2012_grid = Conservation          /* NWALT class 60
18 ENDIF
19 /* Mining/Extraction
20 IF base_grid == Barren (NLCD class 31) and intersects any of (in-house mining polygons or State mining-
21 permitted areas or NLCD 1992 class 32 120-m buffer or U.S. Environmental Protection Agency (EPA)
22 mining, metal or nonmetal points 2000-m buffer or (USGS 2005 oil/gas polys and EPA oil/gas points
23 2000-m buffer)), THEN
24     final_2012_grid = Production, Mining/Extraction      /* NWALT class 41
25 ENDIF
26
27 /* Crops
28 IF base_grid == Cultivated Crops (NLCD class 82), THEN
29     final_2012_grid = Production, Crops          /* NWALT class 43
30 ENDIF
31 /* Pasture/Hay
32 IF base_grid == Pasture/Hay (NLCD class 81), THEN
33     final_2012_grid = Production, Pasture/Hay      /* NWALT class 44
34 ENDIF
35 /* Grazing Potential
36 IF base_grid == (Forest (NLCD classes 41–43), Shrubland (52), Grassland (71), or Wetlands (90–95)) and
37 (within 1 km of NHD 1:24k water body or water pixel in this year or within 500 m of NHDPlus streamline)
38 and slope <30 percent and NLCD 1992 == Pasture/Hay and CDL 2009 == (Alfalfa, Other Hay/Alfalfa or
39 Grassland/Pasture) and Homeland Security Infrastructure Program (HSIP) != Military, Natl Park or
40 Developed Industrial and housing unit density (hden) 2010 <124, THEN
41     final_2012_grid = Production, Grazing Potential      /* NWALT class 45
42 ENDIF
43

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44  /* Semi-Developed, urban interface high
45  IF base_grid == (Forest (NLCD classes 41–43), Shrubland (52), Grassland (71), or Wetlands (90–95)) and
46  (hden_2010 >500 or (10-pixel expanded zone of agreement of urban from Geographic Information
47  Retrieval and Analysis System (GIRAS)/NLCD 1992 to NLCD 2011 and intersects 1990 Census Urban
48  Area)), THEN
49      final_2012_grid = Semi-Developed, Urban Interface High      /* NWALT class 31
50  ENDIF
51
52  /* Semi-Developed, urban interface low medium
53  IF base_grid == (Forest (NLCD classes 41–43), Shrubland (52), Grassland (71), or Wetlands (90–95)) and
54  (hden > 16 and hden <= 500) and PAD grid != GAP_status 1,2, or 3, THEN
55      final_2012_grid = Semi-Developed, Urban Interface Low Medium      /* NWALT class 32
56  ENDIF
57
58  /* Semi-Developed, anthropogenic, other
59  IF base_grid == (Forest (NLCD classes 41–43), Shrubland (52), Grassland (71), or Wetlands (90–95)) and
60  (known current (Commercial/Industrial/Recreation land use from HSIP/Esri/in-house polys/EPA point
61  buffers or Theobald) and (GIRAS == Industrial/Transportation/Confined Feeding Lots/Beaches or
62  Mining)), THEN
63      final_2012_grid = Semi-Developed, Anthropogenic Other      /* NWALT class 33
64  ENDIF
65
66  /******
67  /* The remainder of the pseudo-code is for mapping the Developed class into the NWALT schema.
68  /******
69  /* Developed – Assign Level 2 class; in-house manual polys take precedence over any other source.
70  IF base_grid == Developed (NLCD 21–24) and In-house polys == an urban class
71  (Commercial/Industrial/Recreation/Transportation/Residential), THEN
72      final_2012_grid = Developed, appropriate class      /* assign appropriate class (NWALT
73  21,22,23,24, or interim Residential)
74  ENDIF
75
76  /* Developed – Assign Level 2 class; known Transportation.
77  IF base_grid == Developed (NLCD 21–24) and HSIP or Esri == Major roads, Rail, Airports or Theobald grid
78  == Airports), THEN
79      final_2012_grid = Developed, Major Transportation      /* NWALT class 21

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80  ENDIF
81
82  /* Developed – Assign Level 2 class; known Industrial or Military.
83  IF base_grid == Developed (NLCD 21–24) and (HSIP or Esri == Industrial or Military or Theobald grid ==
84  Industrial) THEN
85      final_2012_grid = Developed, Industrial/Military  /* NWALT class 23
86  ENDIF
87
88  /* Developed – Assign Level 2 class; known Recreation.
89  IF base_grid == Developed (NLCD 21–24) and (HSIP or Esri == Recreation or Theobald grid == Golf
90  Course), THEN
91      final_2012_grid = Developed, Parks/Recreation  /* NWALT class 24
92  ENDIF
93
94  /* Developed – Assign Level 2 class; known Commercial/Services.
95  IF base_grid == Developed (NLCD 21–24) and (HSIP or Esri == Commercial or Institutions or Theobald
96  grid == Commercial or Institutions), THEN
97      final_2012_grid = Developed, Commercial/Services          /* NWALT class 22
98  ENDIF
99  /* Developed – Assign Level 2 class; known Commercial or Industrial, and high industrial employment.
100 IF base_grid == Developed (NLCD 21–24) and (In-house polys == Commercial-Industrial mix or HSIP night
101 – day population <= -3 or Theobald grid == Miscellaneous Developed) and (industrial employment –
102 commercial employment > 10), THEN
103      final_2012_grid = Developed, Industrial/Military          /* NWALT class 23
104  ENDIF
105  /* Developed – Assign Level 2 class; agreement of GIRAS and NLCD 1992.
106  IF base_grid == Developed (NLCD 21–24) and (NLCD 1992 == Commercial/Industrial/Transportation and
107  GIRAS == Commercial or Industrial/Commercial Complex), THEN
108      final_2012_grid = Developed, Commercial/Services          /* NWALT class 22
109  ENDIF
110
111  /* Developed – Assign Level 2 class; very small number of GIRAS roads pixels if close to current roads.
112  IF base_grid == Developed (NLCD 21–24) and (HSIP major roads buffered by 1 pixel and GIRAS ==
113  Transportation/Communications/Utility), THEN

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114      final_2012_grid = Developed, Major Transportation      /* NWALT class 21
115  ENDIF
116
117  /* Developed – Assign Level 2 class; known Commercial or Industrial; not much is left, but default to
118  Commercial.
119  IF base_grid == Developed (NLCD 21–24) and (In-house polys == Commercial-Industrial mix or HSIP night
120  – day population <= -3 or Theobald grid == Miscellaneous Developed), THEN
121      final_2012_grid = Developed, Commercial/Services      /* NWALT class 22
122  ENDIF
123  /* Developed – Assign Level 2 class; check blocks with high employment and low housing density.
124  IF base_grid == Developed (NLCD 21–24) and (industrial employment – commercial employment >50
125  and hden 2010 <84) or (hden 2010 <32 and NLCD 1992 == Mining), THEN
126      final_2012_grid = Developed, Industrial/Military      /* NWALT class 23
127  ENDIF
128
129  IF base_grid == Developed (NLCD 21–24) and (commercial employment – industrial employment >50
130  and hden 2010 <84), THEN
131      final_2012_grid = Developed, Commercial/Services      /* NWALT class 22
132  ENDIF
133  /* At this point, everything left over is Residential or Residential/Other. Simply break out by hden.
134  IF (base_grid == Developed (NLCD 21–24) or Interim Residential from manual polys) and hden 2010 >
135  500, THEN
136      final_2012_grid = Developed, Residential High Density      /* NWALT class 25
137  ENDIF
138  IF (base_grid == Developed (NLCD 21–24) or Interim Residential from manual polys) and hden 2010 >16,
139  THEN
140      final_2012_grid = Developed, Residential Low-Medium Density      /* NWALT class 26
141  ENDIF
142  IF (base_grid == Developed (NLCD 21–24) or Interim Residential from manual polys), THEN
143      final_2012_grid = Developed, Other      /* NWALT class 27
144  ENDIF
145
146  /*Anything left over and not assigned to a land use class must be Low Use.
147  IF still Unassigned in final_2012_grid, THEN

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148     final_2012_grid = Low Use    /* NWALT class 50
149 ENDIF
150
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