GUIDELINES TO SCREEN FOR

DRINKING WATER USAs IN LOUISIANA

The rule set defined below is based on information published in the USGS Hydrologic Investigations Atlas 730-F (referred to as Segment 5 atlas, USGS, 1998 below) and the Guide to Louisiana's Groundwater Resources (referred to as USGS Report 94-4085,1994). The data set available to us included: 1. surface geology, 2. state defined aquifer names and boundaries, 3. well locations, 4. well depths, and 5. source aquifer. In addition to PettyJohn classifications, most rules include a maximum depth at which well classification becomes "unknown". At outcrop locations this is based on maximum aquifer thickness as published in USGS Report 94-4085 (1994) and/or cross sections from the Segment 5 atlas, USGS (1998). In subcrop this usually based on the cross sections and isopach maps in Segment 5 atlas, USGS (1998). In some cases an additional buffer of 50 to 200 ft. is added to the published depth numbers; when this is done it is noted in the rule. The addition of a buffer accommodates uncertainty in the measurement of well depth, local changes in the depth to the aquifer, and local changes in aquifer thickness. Total dissolved solids (TDS) concentration contours were also used to evaluate the maximum well depth for any given aquifer. It was assumed groundwater with TDS concentrations greater that 10,000 parts per million was saline. Lastly, maximum depths stated here are based on the down dip portions of the units discussed. Because depth to the base of an aquifer will change significantly due to both the regional southward dip and structural variability (i.e. the Sabine uplift in the northwest) it may be best to incorporate this portion of the rules into an interactive component of the GIS model.

1) In much of the area of the coastal parishes, including the entire modern Mississippi delta (Plaquemines Parish), and northward in a band up the Atchafalaya River to central Iberville Parish, the aquifers contain only salt water.

Therefore, these areas should be eliminated from this study (i.e., there should be no community wells in that region). See Figures 4 and 29 of USGS Report 94-4085 (1994).

2) Classification of all wells is based on the shallowest sourced interval in the well when source information is available.

3) Wells located within the flood plains of the Mississippi, Atchafalaya, and Red Rivers that derive water from the Quaternary deposits of the Alluvial aquifer system should be Class Id USAs if the upper confining unit (flood plain deposits <12,000 years old) is <50 ft. thick. This aquifer system is comprised of permeable sands and gravels. Wells are Class Ia USAs where the upper confining unit is missing. In a few areas, the upper confining unit may be >50 ft. thick, in which case the wells would be Class III. However, in the current model, the thickness of upper confining unit is unknown. Therefore, all wells are currently assigned Class Id because the river valleys typically contain flood plain deposits and therefore it is probable that shallow, thin confining units exist. In general, wells deriving water from depths greater than 300 ft. are Class III because greater than 50 feet of confining units are highly probable within the alluvium. The maximum depth of the alluvial aquifer is 500 ft, based on the thickness of alluvium published in USGS Report 94-4085 (1994). Significantly deeper wells that source older aquifers are Class III, because of the high probability of intervening confining units. An exception to this rule is where the Cockfield Formation (upper Claiborne aquifer) or the Sparta Sand (middle Claiborne aquifer) are covered by less than 300 ft. of alluvium, because these aquifers may be in hydraulic continuity with the overlying Quaternary sand and gravel in the northeastern portion of the state. In these cases classification depends on the rules devised for each unit (rules 10 and 12).

4) The Alluvial/Valley Trains aquifer system is composed of Quaternary braided stream deposits overlain, in some areas, by loess deposits. The aquifer consists of unconsolidated and highly permeable sands. Wells deriving water from this aquifer are Class Ia USAs and can be no deeper than 250 ft. When covered with

loess, wells are Class Id and can be no deeper than 300 ft., because the loess is an impermeable layer, usually less than 50 ft. thick.

5) The Chicot/Terraces aquifer system ranges in age from Pliocene to Holocene and is composed of deltaic sands of Permeable Units A and B (Segment 5 atlas, USGS, 1998) in central and southwestern Louisiana, and fluvial terrace deposits in the central and northern portion of the state. As such, the thickness of this system ranges from 250 ft. in the north to a maximum thickness of greater than 5000 ft. in the south. Wells deriving water from the Chicot/Terraces system which are screened at depths less than 300 ft. are Class Ia USAs because this system is composed primarily of permeable unconsolidated sediments of fluvial and deltaic origins. Wells deriving water from depths greater than 300 ft. are Class III because of the high probability of confining units. One reason for the 300 ft. cut-off is given as follows in the USGS Segment 5 atlas (page F15):

> "Although permeable zone A is not overlain by a regional confining unit, ground water is contained within the deeper parts of the zone under confining conditions. This is due to abundant, but discontinuous, fine-grained beds of local extent that act as confining units, but cannot be traced over an area larger than several counties. Because these local confining units combine to retard the vertical movement of ground water, water in the aquifer at depths of a few hundreds of feet is under confined conditions in most locations."

The 300 ft. cut off between Class Ia and Class III is also reasonable given that even the thickest of deltaic deposits (delta mouth bar sands) are rarely over 200 ft. thick in any one location.

Because the aquifer ranges greatly in thickness and is of a wide geographic extent, it is not practical to speculate on a depth beyond which wells cannot possibly be deriving water from the Chicot/Terrace aquifer. Determining the probability that an unclassified well sources the Chicot/Terrace aquifer on the basis of depth is best done interactively.

6) The South East Louisiana Aquifer (SELA) system consists of Miocene to Holocene deltaic sands overlain, in some areas, by loess deposits. The aquifer includes permeable units A, B, C and D of the Coastal Lowlands Aquifer system. These units or portions of them are also known as the Chicot Equivalent, the Jasper Equivalent and the Evangeline Equivalent aquifer systems (Segment 5 atlas, USGS, 1998 and USGS Report 94-4085, 1994). In the Baton Rouge area the aquifer, or portions of it, may be referred to as a series of individual sands named according to their depth (i. e. the "400 foot sand" and "1700 foot sand"; see Fig. 47, Segment 5 atlas, USGS, 1998).

Wells less than or equal to 300 ft. deep, that derive water from the SELA aquifer and are located within Prairie Terrace, Intermediate Terrace, and High Terrace outcrops are Class Ia, USAs, because these units are highly permeable unconsolidated sediments. Wells within these outcrops that are deeper than 300 ft. are Class III, because of the high probability of confining units. Wells within the Loess covered portions of the Prairie, Intermediate, and High Terraces that derive water from the aquifer at depths less than or equal to 350 ft. are Class Id, because loess deposits are low permeability sediments, commonly of a thickness less than 50 ft. Wells in the loess covered areas and deeper than 350 ft. are Class III, because of the high probability of confining units.

Wells deeper than 4000 ft. do not source the SELA aquifer. This maximum depth is derived from the isopach maps and cross sections produced by the USGS (Figs. 46,48, 49, and 50 of Segment 5 atlas, USGS, 1998) as well as thicknesses reported in USGS Report 94-4085 (1994). Figure 50 of the USGS Segment 5 atlas (1998) shows that beyond all other considerations, water derived from depths greater than 4000 feet are well within a zone containing concentrations of dissolved solids above 10,000 milligrams per liter. Therefore 4000 ft. is used as a reasonable maximum depth for the SELA aquifer.

7) Wells deriving water from depths less than or equal to 300 ft. within the Evangeline Aquifer in the western portion of the state, are Class Ia USAs, because these are unconsolidated permeable sediments. Wells sourcing the aquifer from

depths greater than 300 ft. are Class III due to the high probability of overlying confining units. Wells within the Evangeline outcrop deriving water from deeper units are Class III because the aquifer is underlain by confining layers. Wells can extend no deeper than 2400 ft and still source the Evangeline aquifer based on maximum reported well depths in USGS Report 94-4085 (1994).

8) The Miocene Aquifer is comprised of the Jasper and Catahoula aquifers of the coastal lowland aquifer system. The Miocene aquifer is confined at the top by Castor Creek confining unit and the bottom by the Vicksburg-Jackson confining unit. The Jasper and Catahoula aquifers are separated by the Lena confining unit. Wells within the Jasper or Catahoula outcrops that source older aquifers are Class III, because of these confining units. Wells located in the outcrop belt of the Jasper aquifer (and equivalents) or within the Alluvial aquifer that derive water from Jasper are Class Ic USAs, if the depths are less than or equal to 300 ft. Wells located in the outcrop belt of the Catahoula or within the Alluvial aquifer that derive water from the Catahoula are Class Ic USAs if the water source is at depths less than or equal to 300 ft. Class Ic is used because these units are semi-consolidated. Wells located in areas where the Catahoula is covered with Loess, deriving water from depths less than or equal to 350 ft. are Class Id, because the loess is a layer of low permeability generally less than 50 ft. thick. In all other areas if a well derives water from either aquifer at depths greater than 300 ft., it is Class III, because of the high probability of confining units overlying the producing horizon. The reason for this is the same as that presented in rule 5 for the Chicot/Terraces aquifer.

Well depths within the outcrop of the Jasper or in areas where the Jasper is covered by the Alluvial aquifer can be no greater than about 2000 ft. based on cross section 49 of the Segment 5 atlas, USGS, 1998. Well depths within the subcrops of the Jasper to the south and southeast (below only the Chicot/Terrace aquifer system or Chicot/Terrace and Alluvial aquifers combined) may reach depths up to approximately 3700 ft. This is based in part on USGS cross sections (Figs. 49 and 50 Segment 5 atlas, USGS, 1998) and published maximum well

depths of 3500 ft. (USGS Report 94-4085, 1994) plus a 200 ft. buffer to be conservative.

The maximum depth at which wells can be reliably said to derive water from the Catahoula in outcrop or where covered by only the Alluvial aquifer is 500 ft., based on a maximum thickness published in USGS Report 94-4085 (1994) of 450 ft., plus a 50 ft. buffer. Wells deriving water from the Catahoula subcrop to the south may have a range of depths up to and beyond 7000 ft., based on published cross sections (see Figs. 49 & 50 of Segment 5 atlas, USGS, 1998).

9) Wells located in the outcrop belt of the Vicksburg-Jackson (Eocene) unit, sourcing older aquifers, (northeast/southeast oriented band across north-central part of state) are Class III, because this unit is a confining unit.

10) Wells located in and deriving water from the outcrop belt of the Eocene Cockfield Formation (also known as the upper Claiborne aquifer of the Mississippi embayment aquifer system) at depths less than or equal to 300 feet are Class Ic USAs, because this aquifer is semi-consolidated sandstone. Wells that derive water from below 300 ft. are Class III because confining units are probable beyond this depth. Wells in the Cockfield outcrop belt cannot exceed 600 ft. total depth. This is based on a published thickness range for the Cockfield (USGS 94-4085, 1994). Wells sourcing the Cockfield subcrop should not exceed 2000 ft. in depth based on USGS cross sections (Fig. 68, Segment 5 atlas, USGS, 1998) and published well depths (USGS 94-4085, 1994).

11) Wells located in the outcrop belt of either the Cook Mountain Formation (Eocene; Middle Claiborne confining unit;) or the Cane River Formation (Eocene; Lower Claiborne confining unit) which source older aquifers are Class III, because these units confine all older aquifers.

12) Wells located in the outcrop belt of the Sparta Sand (also known as the middle Claiborne aquifer of the Mississippi embayment aquifer system), which occupies an arcuate band across the northwest part of the state, that derive water from this unit are Class Ic USAs, if the water source is less than or equal to 300 ft. deep, because the producing horizons are semi-consolidated sandstones. Wells greater

than 300 ft. deep are probably Class III, because most of these sandstones were deposited in deltaic settings and are, hence, interbedded with clay and lignite which act as internal aquicludes. Wells within the Sparta sandstone outcrop belt may not exceed 400 ft. in depth, based on USGS isopach maps (Fig. 71 Segment 5 atlas, USGS, 1998). Wells sourcing the subcrop may have a range of depths depending on the cover type. In areas covered by the Alluvial aquifer the maximum depth is 900 ft. based on an average Sparta sand thickness of 900 ft. (Fig. 71 Segment 5 atlas, USGS, 1998). In areas with Chicot/Terrace material (in the northern portion of the state) the maximum depth of a well sourcing the Sparta sandstone is 1250 ft. based on an average Sparta sand thickness of 900 ft. (Fig. 71 Segment 5 atlas, USGS, 1998), 250 ft. of terrace alluvium, and 100 extra ft. to be conservative. In areas with overlying Cockfield and Cook Mountain the maximum well depth may be as much as 2500 ft., based on the cross section shown in figure 68 of the USGS segment 5 atlas, (1998). Wells that derive water from deeper aquifers are Class III, because the middle Claiborne aquifer is typically confined at top and bottom.

13) Wells located in the outcrop belt of the Eocene Carrizo-Wilcox aquifer (Carrizo Sand; Wilcox Group; Dolet Hills Formation; Naborton Formation) found in the northwest portion of the state that derive water from these units are Class Ic USAs, if the water source is less than or equal to 300 ft. deep, because the producing horizons are semi-consolidated sandstones. Wells greater than 300 ft. deep are probably Class III, because most of these sandstones were deposited in upper delta plain settings and are, hence, interbedded with clay and lignite which act as internal aquicludes. Wells deriving water from the Carrizo-Wilcox system, in the outcrop belt, may not be deeper than 850 ft., based on aquifer thickness (USGS 94-4085, 1994). Any well in this outcrop belt that derives water from older rocks is Class III (or Class III-v if confining unit thickness is <50 ft. or is unknown) because the older aquifers are overlain by the Midway confining unit (Paleocene). Wells deriving usable water from the subcrop of the Carrizo-Wilcox may not be deeper than 3700 based on the cross section shown in figure 68 of the USGS segment 5 atlas (1998).