Underground Sources of Drinking Water in the San Joaquin Valley

Stephen Anderson | Dr. Janice Gillespie | California State University Bakersfield

Purpose

• A map of the distribution of TDS (total dissolved solids) and specific chemical constituents (Arsenic, Boron, Selenium, Lithium) needs to be created to illustrate how drinking water quality changes within and outside of oil field boundaries in the SSJV (Southern San Joaquin Valley).

• This map will help to determine which waters must be protected from oil field disposal and development activities in the SSJV. It will also provide a picture of how groundwater quality may change as water levels in the aquifer fall due to overdraft.

• It is critical that a definitive benchmark for groundwater quality be defined in the SSJV to help quantify future changes in water quality for those aquifers that are being aggressively pumped due to drought.

Project Overview

• Compile water well surface location and perforation interval data from State Water Resources Control Board, USGS, KCWA and private agencies.

• Correlate well completion depth and location with TDS and chemical constituent data found on Geotracker GAMA, USGS NWIS, KCWA, DWR and private agencies.

• Enter data into an Excel database (figure 1).

• Upload data into a 3D Geographic Information System (GIS) mapping program (figure 2 & 3) in order to plot depths and locations of TDS and chemical constituent data.

• Well groupings showing abnormally high TDS’s (3,000-19,190 PPM) have been selected as preliminary zones of interest (figure 4). These high TDS well groupings will help to define where the base of USDW (underground source of drinking water) exists.

Data Collection

• Data types
  - TDS – Collected from USGS NWIS, KCWA, DWR, Geotracker Gama and private agencies
  - Arsenic – Collected from USGS, EPA, KCWA
  - Boron – Collected from KCWA
  - Completion Interval/Surface Location – KCWA, USGS NWIS, DWR, private agencies

Procedure

Current Progress

Figure 2: GIS map with water wells extruded to depth. View is looking up from subsurface to south of valley. Blue wells show the base of freshwater (<3,000 PPM) and green wells brackish protected water (USDW 3,000-10,000PPM). Most wells in the study area are <3000PPM (shown in blue).

Figure 3: Arsenic distribution in Kern County. Five water wells (in red) contain >50 PPB arsenic (original US arsenic maximum contaminant level (MCL) from 1942-2001). Ten water wells (in orange) contain arsenic >10 PPB (current US MCL).

Figure 4: Area inside white box contains wells with TDS ranging from 100-19,190 PPM. High TDS wells have depths from 16-150 ft in the area. High TDS at shallow depths is likely due to evaporative pumping due to the shallow water table.

Current Progress

Conclusions

• Currently, data associated with 943 USGS wells and 67 private water wells has been entered in the database and mapped in ArcGIS to include depth, location, and TDS information. Additionally, 58 water wells have mapped Arsenic concentrations.

• Most wells in the database are less than 1,000 feet in depth and have a TDS of less than 3,000 parts per million (PPM), indicating that most shallow aquifers in the study area contain fresh water.

• A few wells in specific areas with depths less than 500 feet were observed to contain TDS greater than 10,000 ppm. These wells are believed to have high concentration of TDS due to evaporative pumping.

• Ten water wells with Arsenic data were found to contain concentrations higher than the current US EPA standard of 10PPB. At this Arsenic level there is 1 in 1,667 lifetime risk of contracting skin cancer. Five water wells have As concentrations > 50PPB. This increases the lifetime risk of contracting skin cancer to 1 in 333.

Work Cited

• ftp://ftp.consrv.ca.gov/pub/oil/D4%20Chemical%20Analysis
• http://www.conservation.ca.gov/DOG/Pages/Index.aspx
• http://geotracker.waterboards.ca.gov
• http://waterdata.usgs.gov/usa/nwis/gw
• Kern County Water Agency

Acknowledgements

• CSUB/National Science Foundation Grant NSF HRD #1137774
• CA Department of Conservation
• USDA

Figure 1: Excel database

• Well ID
• Location and Depth
• TDS Concentration and Sample Date
• Arsenic Concentration and Sample Date

Purpose

Current Progress

Current Progress

Conclusions

Work Cited

Acknowledgements