DOWNLOAD PDF SURFACE WATER AND GROUNDWATER INTERACTION

Chapter 1 : Optional courses | Groundwater Week

Pollution of surface water can cause degradation of ground-water quality and conversely pollution of ground water can degrade surface water. Thus, effective land and water management requires a clear understanding of the linkages between ground water and surface water as it applies to any given hydrologic setting.

The natural arsenic pollution occurs because aquifer sediments contain organic matter that generates anaerobic conditions in the aquifer. These conditions result in the microbial dissolution of iron oxides in the sediment and, thus, the release of the arsenic , normally strongly bound to iron oxides, into the water. As a consequence, arsenic-rich groundwater is often iron-rich, although secondary processes often obscure the association of dissolved arsenic and dissolved iron. Arsenic is found in groundwater most commonly as the reduced species arsenite and the oxidized species arsenate, being the acute toxicity of arsenite somewhat greater than that of arsenate. This tool also allows the user to produce probability risk mapping for both arsenic and fluoride. This contaminants can be important locally but they are not as widespread as arsenic and fluoride. Groundwater pollution with pathogens and nitrate can also occur from the liquids infiltrating into the ground from on-site sanitation systems such as pit latrines and septic tanks , depending on the population density and the hydrogeological conditions. Liquids leach from the pit and pass the unsaturated soil zone which is not completely filled with water. Subsequently, these liquids from the pit enter the groundwater where they may lead to groundwater pollution. This is a problem if a nearby water well is used to supply groundwater for drinking water purposes. During the passage in the soil, pathogens can die off or be adsorbed significantly, mostly depending on the travel time between the pit and the well. In any case, such recommendations about the safe distance are mostly ignored by those building pit latrines. In addition, household plots are of a limited size and therefore pit latrines are often built much closer to groundwater wells than what can be regarded as safe. This results in groundwater pollution and household members falling sick when using this groundwater as a source of drinking water. Sewage treated and untreated [edit] Groundwater pollution can be caused by untreated waste discharge leading to diseases like skin lesions, bloody diarrhea and dermatitis. This is more common in locations having limited wastewater treatment infrastructure, or where there are systematic failures of the on-site sewage disposal system. The treated effluent from sewage treatment plants may also reach the aquifer if the effluent is infiltrated or discharged to local surface water bodies. Therefore, those substances that are not removed in conventional sewage treatment plants may reach the groundwater as well. Groundwater pollution can also occur from leaking sewers which has been observed for example in Germany. This is because only a fraction of the nitrogen-based fertilizers is converted to produce and other plant matter. The remainder accumulates in the soil or lost as run-off. The nutrients, especially nitrates, in fertilizers can cause problems for natural habitats and for human health if they are washed off soil into watercourses or leached through soil into groundwater. The heavy use of nitrogenous fertilizers in cropping systems is the largest contributor to anthropogenic nitrogen in groundwater worldwide. The US Environmental Protection Agency EPA and the European Commission are seriously dealing with the nitrate problem related to agricultural development, as a major water supply problem that requires appropriate management and governance. Ore mining and metal processing facilities are the primary responsible of the presence of metals in groundwater of anthropogenic origin, including arsenic. The low pH associated with acid mine drainage AMD contributes to the solubility of potential toxic metals that can eventually enter the groundwater system. Oil spills associated with underground pipelines and tanks can release benzene and other soluble petroleum hydrocarbons that rapidly percolate down into the aquifer. There is an increasing concern over the groundwater pollution by gasoline leaked from petroleum underground storage tanks USTs of gas stations. It has also been used for metal-degreasing operations. Because it is highly volatile, it is more frequently found in groundwater than in surface water. Although non-miscible, both LNAPLs and DNAPLs still have the potential to slowly dissolve into the aqueous miscible phase to create a plume and thus become a long-term source of contamination. Hydraulic fracturing The recent growth of Hydraulic Fracturing "Fracking" wells in the United States has raised concerns regarding its potential risks of contaminating groundwater resources. The Environmental

Protection Agency EPA , along with many other researchers, has been delegated to study the relationship between hydraulic fracturing and drinking water resources. While it is possible to perform hydraulic fracturing without having a relevant impact on groundwater resources if stringent controls and quality management measures are in place, there are a number of cases where groundwater pollution due to improper handling or technical failures was observed. Within one kilometer of these specific sites, a subset of shallow drinking water consistently showed higher concentration levels of methane , ethane , and propane concentrations than normal. An evaluation of higher Helium and other noble gas concentration along with the rise of hydrocarbon levels supports the distinction between hydraulic fracturing fugitive gas and naturally occurring "background" hydrocarbon content. This contamination is speculated to be the result of leaky, failing, or improperly installed gas well casings. So far, a significant majority of groundwater contamination events are derived from surface-level anthropogenic routes rather than the subsurface flow from underlying shale formations. In many of these events, the data acquired from the leakage or spillage is often very vague, and thus would lead researchers to lacking conclusions. They concluded that the probability is small that the rise of fracking fluids through the geological underground to the surface will impact shallow groundwater. Love Canal was one of the most widely known examples of groundwater pollution. In , residents of the Love Canal neighborhood in upstate New York noticed high rates of cancer and an alarming number of birth defects. This was eventually traced to organic solvents and dioxins from an industrial landfill that the neighborhood had been built over and around, which had then infiltrated into the water supply and evaporated in basements to further contaminate the air. Eight hundred families were reimbursed for their homes and moved, after extensive legal battles and media coverage. Other[edit] Further causes of groundwater pollution are chemical spills from commercial or industrial operations, chemical spills occurring during transport e. An area can have layers of sandy soil, fractured bedrock, clay, or hardpan. Areas of karst topography on limestone bedrock are sometimes vulnerable to surface pollution from groundwater. Earthquake faults can also be entry routes for downward contaminant entry. Water table conditions are of great importance for drinking water supplies, agricultural irrigation, waste disposal including nuclear waste , wildlife habitat, and other ecological issues. A noteworthy class of such chemicals is the chlorinated hydrocarbons such as trichloroethylene used in industrial metal degreasing and electronics manufacturing and tetrachloroethylene used in the dry cleaning industry. Both of these chemicals, which are carcinogens themselves, undergo partial decomposition reactions, leading to new hazardous chemicals including dichloroethylene and vinyl chloride. Conversely, groundwater can also feed surface water sources. Sources of surface water pollution are generally grouped into two categories based on their origin. Interactions between groundwater and surface water are complex. Consequently, groundwater pollution, sometimes referred to as groundwater contamination, is not as easily classified as surface water pollution. A spill or ongoing release of chemical or radionuclide contaminants into soil located away from a surface water body may not create point or non-point source pollution but can contaminate the aquifer below, creating a toxic plume. The movement of the plume, may be analyzed through a hydrological transport model or groundwater model. Prevention[edit] Schematic showing that there is a lower risk of groundwater pollution with greater depth of the water well [6] Further information: Precautionary principle The precautionary principle , evolved from Principle 15 of the Rio Declaration on Environment and Development , is important in protecting groundwater resources from pollution. They are important components to understand the hydrogeological system, and for the development of conceptual models and aquifer vulnerability maps. Effective groundwater monitoring should be driven by a specific objective, for example, a specific contaminant of concern. When a problem is found, action should be taken to correct it. There are two types of zoning maps: Depth to water table, net Recharge, Aquifer media, Soil media, Topography slope , Impact on the vadose zone , and hydraulic Conductivity. Thus, potential sources of degradable pollutants, such as pathogens, can be located at distances which travel times along the flowpaths are long enough for the pollutant to be eliminated through filtration or adsorption.

Chapter 2 : How Does Groundwater Interact With The Surface Environment?

Covers natural processes of interaction (interactions in the hydrologic cycle, chemical interactions of groundwater and surface water, interactions in different landscapes), effects of human activities on groundwater and surface-water interactions, and challenges and opportunities in these interactions.

Groundwater Interaction and Streams As indicated by the hydrologic cycle , groundwater interacts with the surface water environment including streams and rivers that drain the landscape, lakes and wetlands that hold and store water that supports important ecosystems. Generally, the interaction with these systems takes place in three ways: Streams gain water from inflow of groundwater through the streambed gaining stream Streams lose water to groundwater by outflow through the streambed losing stream Streams both lose and gain water from groundwater discharge along various reaches This interaction is shown in the diagram above. For groundwater to discharge into a stream channel, the elevation of the water table in the vicinity of the stream must be higher than the elevation of the stream-water surface. The opposite holds true for a losing stream. Losing streams can be connected to the groundwater system by a continuous saturated zone or can be disconnected from the groundwater system by an unsaturated zone. Groundwater Interaction and Lakes With respect to lakes, groundwater interacts with these features in three ways: Groundwater inflow gaining lake Seepage loss to the saturated zone losing lake Groundwater inflow in certain parts and seepage loss from others flow-through lake Although the basic interactions are the same for lakes as they are for streams, the interactions differ in several ways. The water level of natural uncontrolled lakes generally does not change as rapidly as the water level of streams. Evaporation has the greatest natural effect on lake levels but water withdrawals, either through direct off-take of pumping of shallow groundwater nearby, can also effect a change in lake water levels by directly lowering levels or encouraging enhancing seepage loss. Groundwater Interaction and Wetlands Wetlands exist in areas where groundwater discharges to the land surface or on landscapes that prevent rapid drainage of water from the surface. Wetlands can receive groundwater inflow, recharge the groundwater system, or do both. Wetlands that occupy depressions in the land surface have interactions with groundwater similar to lakes and streams. Unlike lakes and streams, wetlands do not always occupy low points and depressions in the landscape. They also can be present on slopes such as fens or even on drainage divides such as some types of bogs. Wetland areas can also gain or lose water much like lakes. In areas of steep terrain, the water table sometimes intersects the land surface, resulting in groundwater discharge directly to the land surface. If the discharge is a sustained flow, it is referred to as a spring. Conversely, if the rate of evaporation is nearly equal to the rate of delivery then it may only manifest as a wet patch, or seep. The constant source of water to these features supports the growth of wetland vegetation.

Chapter 3 : Groundwater pollution - Wikipedia

The interaction of ground water and surface water in coastal terrain is affected by discharge of ground water from regional flow systems and from local flow systems associated with scarps and terraces (Figure 23), evapotranspiration, and tidal flooding.

Chapter 4 : Surface Water-Groundwater interaction

Diagrams illustrating surface water-groundwater interaction, including (A) a gaining stream, (B) a losing stream in which surface water percolates downward and laterally to the water table, and (C) a losing stream that is "disconnected" or "detached" from the underlying aquifer; this scenario typically occurs only in arid environments.

Chapter 5 : Groundwater and Surface Water Interactions | www.nxgvision.com

ii POSTER SESSION ABSTRACTS Use of Multi-Parameter Sensitivity Analysis to Determine Relative Importance of

Processes Involved in Transport of Mining Contaminants.

Chapter 6 : Surface Water Groundwater Interaction () - www.nxgvision.com - www.nxgvision.com

The interaction of ground water and surface water has been shown to be a significant concern in many of these issues. For example, contaminated aquifers that discharge to streams can result in long-term contamination of surface water; conversely, streams can be a major source of contamination to aquifers.

Chapter 7 : How do groundwater and surface water interact? | American Geosciences Institute

An improved understanding of the contribution of groundwater to surface water is required for the classification of groundwater body status and the determination of groundwater quality thresholds. The overall aim of this study is to estimate the contribution of groundwater to surface waters, particularly river flows.

Chapter 8 : Surface Water-Groundwater interaction | EARTH Water: Science and Society

Table Surface Water and Groundwater Interaction, Nueces River Basin Table Surface-Water and Groundwater Interaction, Brazos River Basin 3~ Table Occurrence ofAquiferOutcrops within a Major RiverBasin'