MINUTES of the regular **City Council** meeting of Wellsville City held **March 01, 2023,** at the Wellsville City Offices at 75 East Main. City officials present were Mayor Thomas G. Bailey; Councilwoman Kaylene Ames; Councilmen Bob Lindley, Chad Poulsen and Austin Wood. City Manager Scott Wells was also present. A copy of the Notice and Agenda were mailed to the Mayor and Councilmembers and emailed and faxed to the Herald Journal on February 24, 2023. The meeting was called to order at 6:00 p.m. by Mayor Thomas G. Bailey.

Councilwoman Denise Lindsay arrived at 6:09 p.m. City Planner Jay Nielson was excused from this meeting.

Others Present:	Glenn Ames	Shane Brane	Zandra Cooper
	Emily Funk	CaMarie Hoffman	Alicia Jenkins
	Cindy Maughan	Perry Maughan	Tom Maughan
	Megan Petersen	Diane Roundy	Art Smith
	Linda Wursten		

Opening Ceremony: Councilman Austin Wood

The Council reviewed the agenda. **Councilman Austin Wood made a motion, seconded by Councilman Bob Lindley, to approve the agenda as presented.**

YEA 4	NAY 0
Kaylene Ames	
Bob Lindley	
Chad Poulsen	
Austin Wood	

The Council reviewed the minutes of the February 15, 2023, regular City Council meeting. **Councilman Bob Lindley made a motion, seconded by Councilman Chad Poulsen, to approve the minutes of the February 15, 2023, regular City Council meeting.**

YEA 4	NAY 0
Kaylene Ames	
Bob Lindley	
Chad Poulsen	
Austin Wood	

Payroll is approved through the budget, therefore, the checks approved in the City Council minutes are not in numerical order from City Council meeting to City Council meeting as the city uses the same checking account for payroll and accounts payable. After review and discussion, **Councilman Chad Poulsen made a motion, seconded by Councilwoman Kaylene Ames, to approve the city's accounts payable bills for payment, represented by check number 28029 through 28057.**

YEA 4	NAY 0
Kaylene Ames	
Bob Lindley	
Chad Poulsen	
Austin Wood	

At 6:06 p.m., Mayor Thomas G. Bailey opened the meeting for citizen input. Cindy Maughan asked how the citizens can best provide the Council with "guidance for their vision of their own space." Mayor Bailey noted that his and the Council's phone numbers are included in the City Newsletter. Citizens also have the option to ask the Council questions during Citizen Input which is available at the beginning of every City Council meeting. Ms. Maughan referenced the upcoming Planning Commission meeting in which they will receive public input, then consider for approval four final permits for the Bridle Path Subdivision consisting of 130 lots total, located at approximately 7625 South Highway 89/91 (Tax Id. #10-053-0006,

#10-053-0010, #10-050-0006, #10-062-0007, #10-053-0013). She stated that she wants to "take inventory of the current water situation and figure out how we can better take care of that situation" and suggested creating a work group. "We have some deep heavy civil infrastructure situations coming at us that are not cheap. I've tried to explain that to you in meetings... I guess I'm volunteering to help with that situation because I don't think we have the wording in place to make sure we are making great decisions. Right now, we are allowing the urban sprawl to occur and reacting rather than having a position of what our identity looks like. How are we going to proceed into our future? Where should we stop the growth... Should we have some work meetings about this and what our 50-year plan looks like." Mayor Bailey replied that that is a possibility. Ms. Maughan added she has been part of the "Utah Water Project" and encouraged the Council to plan for the future.

Councilwoman Denise Lindsay arrived at 6:09 p.m.

CaMarie Hoffman asked the Council to teach her more regarding Wellsville City's current water situation. She referenced the proposed Bridle Path Subdivision consisting of 130 lots total, located at approximately 7625 South Highway 89/91 (Tax Id. #10-053-0006, #10-053-0010, #10-050-0006, #10-062-0007, #10-053-0013) adjoining the City's water source protection zone. Mayor Thomas G. Bailey explained that **Temporary Land Use Regulation 2022-10**, an ordinance establishing a *moratorium* on residential and commercial building permits and subdivision applications within certain areas of Wellsville City, is still in effect. He detailed Wellsville City's progress towards entering a contract with the Bankhead family for a proposed new culinary well site (Tax Id. #10-039-0004) which will hopefully service those in the city living above 4,650-feet of elevation. Mayor Bailey expounded that two of Wellsville City's culinary wells are currently each producing 3,000-acre feet of water per minute. The City currently has ample water however the present difficulty is pushing the water up to residents above 4,650-feet. Ms. Hoffman asked if the proposed subdivision may lead to contamination of Wellsville City's water source. Mayor Bailey responded that the Council and City representatives have been investigating that substantial concern for over a year and a half. Ms. Hoffman asked if the planned new culinary well will allow the proposed subdivision to be built. Mayor Bailey replied that if Wellsville City has the water resources for the proposed development and the development meets City Code, the property owners may have the right to develop that property. "Even within our drinking water zone?" Ms. Hoffman asked. Mayor Bailey replied that the State of Utah Code allows building above the recharge area of a spring. He detailed special sewer requirements and mentioned tonight's agenda includes exploring the use of a dye test to determine potential contamination of the aquifer at Leatham Springs. He added unfortunately there is no guarantee that Leatham Springs will never be contaminated. Ms. Hoffman thanked Mayor Bailey and the Council for the information shared and their efforts to protect Leatham Springs.

At 6:16 p.m., citizen input was closed.

Alicia Jenkins met with the City Council to request a **Business License** to operate "Honey Marie's Barbecue," out of the property located at 25 West 100 North (Tax Id. #11-081-0056). Ms. Jenkins shared that "Honey Marie's Barbecue" is a mobile food vendor business. The proposed home occupation will consist of food preparation and parking of the mobile food trailer. The trailer will travel to events throughout Cache Valley. Commissioner Chad Poulsen shared that the Planning Commission approved Ms. Jenkins request for a **Conditional Use Permit** contingent upon the trailer not parking in the city rights-of-way and that no signage will be used to advertise the business at Ms. Jenkins' home. Ms. Jenkins stated the trailer will be parked on a cement pad located west of her garage. The Council wished Ms. Jenkins success with her new business. **Councilman Austin Wood made a motion, seconded by Councilman Chad Poulsen, to approve the request from Alicia Jenkins for a Business License to operate "Honey Marie's Barbecue," out of the property located at 25 West 100 North (Tax Id. #11-081-0056).**

YEA 5	**NAY 0**
Kaylene Ames	
Bob Lindley	
Denise Lindsay	
Chad Poulsen	
Austin Wood	

Glenn Ames met with the City Council to discuss a dye test which can be utilized to determine potential contamination of the aquifer at Leatham Springs. Mayor Thomas G. Bailey explained that Leatham Springs, much of which is used for the public water supply, is located on the east flank of the Wellsville Mountains at the head of Wellsville Canyon, about four miles southwest of the community of Wellsville. Mr. Ames introduced himself as a resident of Wellsville who worked as a geologist in his past career. He recognized that one of the City Council's chief concerns regarding the proposed Bridle Path Subdivision consisting of 130 lots total, located at approximately 7625 South Highway 89/91 (Tax Id. #10-053-0006, #10-053-0010, #10-050-0006, #10-062-0007, #10-053-0013) is the potential contamination of the City's adjoining water source protection zone and subsequently Leatham Springs. Mr. Ames pointed out that while concerns regarding breaks in the specialized seamless sewer system are warranted, he warned that contaminates from horse waste have a higher probability to cause problems given the development's equestrian emphasis. He asked the Council to consider what their horse corrals look like at this time of year and to multiply that by 130 homes in a dense area which in turn all drains to the same point. Then picture that situation along the spring melt and runoff which will take place in the next several weeks he added. Mr. Ames presented a **Water Fact Sheet, U.S. Geological Survey, Department of the Interior** titled **Hydrologic Hazards in Karst Terrain** on the overhead screens (see Attachment A and B). Mr. Ames informed the Council that the Sherwood Hills Area (the previous golf course and resort property sold to the proposed developer) geology is a "Karst Formation."

- *"Karst is formed in limestone dissolved by rain and underground water.*
- *Underground water enlarges subsurface flow paths over time.*
- *Surface streams lose water to subsurface flows.*
- *Shallow aquifers in karst terrain are extremely vulnerable to contamination.*
- *Contaminates move at a faster rate in karst formations.*
- *Contaminates from livestock waste are potential problems in karst.*
- *Leaks and spill are a serious hazard for karst terrains.*
  - *Nibley City is a local example of water contamination in a karst formation from an oil spill.*
- *Multiple papers on karst terrain contamination have been provided.*
- *The potential for ground water contamination was also identified in the **Environmental Implications of Urbanization of Wellsville Canyon, 1971"***

Mr. Ames listed local karst formation examples such as Peter Sinks and Ricks Spring. He pointed out that there is not a single stream that runs from the Wellsville Mountains to the valley floor which means that all water goes subsurface into limestone to form conduits. Water and contaminants flow very quickly through karst formations. Ground water is purified by the slow movement through ground layers which acts as a filter. That slow filtration does not happen in karst formations as water quickly flows through the limestone. Therefore, shallow aquifers in karst terrains are extremely vulnerable to contamination. Mr. Ames provided the Council with multiple papers on karst terrain contamination from livestock which is a worldwide problem in karst formations. In 1971, The Cache Defenders of the Environment addressed potential contamination of this aquifer given possible development of the Sherwood Hills area. Mr. Ames read several excerpts from the book ***Environmental Implications of Urbanization of Wellsville Canyon.***

"The regolith (the porous gravely surface on top of the limestone Mr. Ames defined) *in this area has little capacity to hold water. The water seeps to the bedrock and flows downhill and ultimately ends up in Cache Valley."* (Page 16)

"...in Wellsville Canyon area the overlying lose earth material is very fine and lies generally on porous limestone which permits the water to drain through deep channels which in turn drain to adjacent valleys. In review of this geologic formation it appears that in all probability any type of wastewater treatment device installed in the Wellsville Canyon area would eventually lead to seepage into the Springs and the water supply of Wellsville City. The only means of wastewater treatment that would be acceptable in this area is total confinement of the liquid." (Page 18)

Mr. Ames acknowledged the proposed specialized seamless sewer system is considered total confinement of the waste. However, livestock waste at the proposed equestrian subdivision will drain directly into Wellsville City's aquifer. He stressed this is not new geological information and it is historically very well understood that shallow aquifers in karst terrain are extremely vulnerable to contamination.

Mr. Ames proposed a water tracing study using fluorescent dyes which is an established method (developed in 1871) to study ground water movement.

- *"Citizens of Wellsville City are requesting a water tracing study to guarantee the Sherwood Hills development will not contaminate our drinking water before final approval is given for Phase 1 and 2.*
- *The potential is real and documented hundreds of times including in Cache Valley.*
- *Unlike a spill, this horse property development would not be able to be cleaned up and would forever contaminate our water."* Mr. Ames repeated and stressed that horse waste contamination could not be cleaned up, such as Nibley City's oil spill was, and would contaminate our aquifer forever.
- *Larry Spangler, USGS retired would perform the water tracing study. He has performed numerous studies in the Bear River Range as recently as this summer.*
- *Total cost $8,750 and would start with spring run-off.*
- *Approximate time 2 months or less if dye is detected sooner."*

Councilman Austin Wood asked for additional technical details. Mr. Ames expounded that a point of recharge will be located "below the springs," then a dye is injected to determine if a connection exists from that input to one or more of the springs. The injection would be done during the snowmelt runoff period when there is an opportunity for surface water to be lost to the subsurface. Fluorescein dye will be used for the injection due to its ability to be detected at very low concentrations and over long distances underground. Mr. Ames emphasized that fluorescein dye is non-toxic and is often used in tracing groundwater to public water-supply springs. The primary method of recovery entails using activated charcoal, whereby dye is cumulatively absorbed on the charcoal over a period of time. Mr. Ames added that underground pressures do not always push water downhill therefore he recommended expanding dye detection to other known springs and wells in the area. Following the study, Mr. Spangler will write a summary report detailing where the water and dye entered the subsurface and how quickly the water traveled (which duration will give an indication of filtration). Councilman Wood asked if the proposed study could have potential to override previous studies done in the area. City Manager Scott Wells replied that dye tracing has never been conducted before in this area. Mr. Ames underscored that runoff from 130 horse corrals is going to end up somewhere and most likely in the aquifer since there is no stream for runoff to flow down the canyon. All runoff in Wellsville Canyon percolates into the ground.

Councilman Chad Poulsen stated that he would like to know how much of the surface water at the proposed development flows to the springs and asked that a point of recharge for dye tracing be located within the proposed area of development. Mr. Ames stated he will explore Councilman Poulsen's suggestion. Councilwoman Denise Lindsay asked what duration of time the dye tracing study will take. Mr. Ames read aloud from Mr. Spangler's ***METHODS/APPROACH*** paragraph (see Attachment C),

"Prior to the injection, charcoal detectors will be placed in the water-supply springs and other springs that may be potential discharge points at least 2 weeks prior to determine the natural level of fluorescence that is present in the water. This "background" fluorescence originates from organic material in the water and is used as a reference point for comparison with the fluorescence of the dye in the water. The first set of charcoal detectors from the spring(s) will be exchanged with a new set of detectors and then followed by the dye injection. Subsequent sets of detectors will be exchanged on a timed basis (generally 7 to 10 days) until dye is detected or approximately 2 months has elapsed. This time frame is based on previous studies and expectations of groundwater travel times in karst terrains."

Mr. Ames mentioned that Mr. Spangler studied the area last fall and has thoughts on possible points of recharge. He added they will consult with additional geological experts familiar with the area concerning focused pointes of recharge (input). Mr. Ames asked the Council to withhold voting on Phase 1 and 2 of the proposed Bridle Path Subdivision until there is a better knowledge of where subsurface water flows and an understanding that the proposed subdivision will not contaminate the aquifer. Councilwoman Lindsay pointed out that **Temporary Land Use Regulation 2022-10,** an ordinance establishing a *moratorium* on residential and commercial building permits and subdivision applications within certain areas of Wellsville City, is still in effect. She emphasized no approvals of the proposed subdivision will be given while the moratorium is in effect. The moratorium will be reevaluated and likely extended in May 2023. The

duration of the moratorium is contingent upon proving the proposed new culinary well (Tax Id. #10-039-0004) which will hopefully service those in the city living above 4,650-feet of elevation. She stressed the crucial importance of protecting Leatham Springs. She noted there was conflicting information at the Utah League of Cities and Towns Convention concerning the proximity of development allowed above the recharge area of a spring. Mr. Ames urged the Council to read and review the data he presented and utilize the proven scientific expertise available for this area and protect the aquifer. He encouraged the Council to probe the development team concerning their proposal to construct 130 horse corrals above the aquifer recharge area. Mr. Ames agreed to explore additional costs to expand the dye tracing and detection locations. The Council thanked Mr. Ames for his research and expertise. **Councilman Austin Wood made a motion, seconded by Councilman Chad Poulsen, to continue the discussion regarding utilizing a dye test to determine potential contamination of the aquifer at Leatham Springs.**

YEA 5	NAY 0
Kaylene Ames	
Bob Lindley	
Denise Lindsay	
Chad Poulsen	
Austin Wood	

Department Reports:

Denise Lindsay-
1) The March City Newsletter includes a request for volunteers to drive the city float in parades throughout the valley over the summer.
2) Expressed appreciation to City Manager Scott Wells and the city's public works employees for their snow removal efforts.

Chad Poulsen
1) Expressed appreciation to City Manager Scott Wells and the city's public works employees for their snow removal efforts.
2) Councilman Chad Poulsen suggested creating a small group of individuals to review and revise the City's General Plan along with the Planning Commission. He suggested mailing a survey out to city residents for public feedback such as was sent to residents in Ivins, Utah.

Mayor Thomas G. Bailey
1) Expressed appreciation to City Manager Scott Wells and the city's public works employees for their snow removal efforts.

Kaylene Ames-
1) The Wellsville Foundation has applied for a State Historic Preservation Office (SHPO) grant, with which they hope to replace the waterline connecting the Tabernacle to 100 East to make plumbing functional inside the building. Councilwoman Kaylene Ames shared that the SHPO deemed their application a "worthwhile project." The amount of funding The Wellsville Foundation will receive (up to $10,000.00) will be determined in April 2023.

Bob Lindley-
1) Baseball, softball, and tee ball registration has begun.

Austin Wood-
1) Expressed appreciation to City Manager Scott Wells and the city's public works employees for their snow removal efforts.
2) The Utah Food Bank is asking the City of Wellsville to participate in the annual food drive. Nonperishable food donation by bag should be placed by front doors before 9 a.m. on Saturday, March 18, 2023. A week prior to collection, door hangers will be distributed. Wellsville and Mendon City youth will collect bags from doorsteps and box the donations at the city bowery March 18, 2023. Cache County Search and Rescue is providing the trailer and helping transport donations to the Food Bank. City Manager

Scott Wells and the public works employees will clear snow from the bowery and the surrounding parking lot for the event.

City Manager/Recorder's Report:
1) City Manager Scott Wells presented the Council with the architectural drawings of "Maple Market LLC," the grocery business out of the property located at 85 East Main Street (Tax Id. #10-022-0006), which the Council granted a Business License at the previous meeting (February 15, 2023).
2) In an upcoming meeting, the Planning Commission shall receive public input, then consider for approval four final permits for Phase 1 and Phase 2 of the Bridle Path Subdivisions consisting of 130 lots total, located at approximately 7625 South Highway 89/91 (Tax Id. #10-053-0006, #10-053-0010, #10-050-0006, #10-062-0007, #10-053-0013). The Council discussed the **Temporary Land Use Regulation 2022-10**, an ordinance establishing a *moratorium* on residential and commercial building permits and subdivision applications within certain areas of Wellsville City. The Council agreed that their focus and principal obligation regarding the proposed development is to protect Leatham Springs. Resident Cindy Maughan interrupted City Manager Well's report. She recommended the Council review the Flint, Michigan water crisis which was a public health crisis that started in 2014 after the drinking water for the city was contaminated. She urged the Council to postpone the proposed development and take the time to protect the city's water source now before it's too late. She said, "We owe them no loyalty (Bridle Path Estates), we owe our citizen's the loyalty, we owe the water the loyalty. You are well within your rights to say "no" and protect our city as it is using Flint, Michigan as your precedence. We have to be assured that this is not going to negatively affect us… Absolutely protect us and our water. They can wait. They can wait as long as it takes. I understand everyone gets to use their land the way they see fit but not when it comes down to threatening our very existence." Resident Diane Roundy asked the Council to approve the earlier proposed dye test which can be utilized to determine potential contamination of the aquifer at Leatham Springs. Mayor Thomas G. Bailey explained that the dye test cannot be approved until a future agenda lists a line item to approve funding for the study. Councilwoman Denise Lindsay mentioned how quickly the proposed subdivision has progressed through the UDOT approval process. Councilwoman Kaylene Ames shared that Cache County is separately working on corridor studies and workshops. Councilwoman Lindsay expressed concern that a Homeowners Association (HOA) cannot effectively enforce Covenants, Conditions, and Restrictions (CC&Rs). Ms. Maughan repeated encouraging the Council to create a special workgroup and to plan ahead for future infrastructure.
3) Snow was pushed to widen the 200 West roadway.

At 7:07 p.m., **Councilman Bob Lindley made a motion, seconded by Councilman Chad Poulsen, to adjourn the meeting.**

YEA 5	**NAY 0**
Kaylene Ames	
Bob Lindley	
Denise Lindsay	
Chad Poulsen	
Austin Wood	

Thomas G. Bailey
Mayor

Scott Wells
City Manager

Attachment a

WATER FACT SHEET

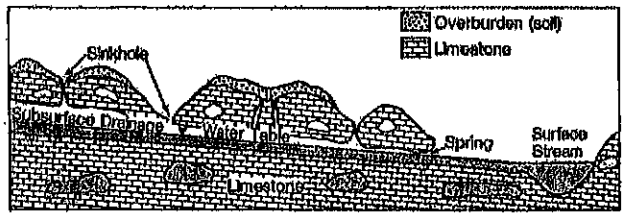
U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

HYDROLOGIC HAZARDS IN KARST TERRAIN

NOTE: Figures on this Fact Sheet are two-dimensional and appear to show rocks and surficial material floating on cave streams. This was done to emphasize the concept of an open flow system. In reality, the third dimension would show the material above and below the cave streams to be connected in places.

WHAT IS KARST?

Karst or karst terrain refers to a type of topography formed in limestone, dolomite, or gypsum by dissolution of these rocks by rain and underground water, and is characterized by closed depressions or sinkholes, and underground drainage. During

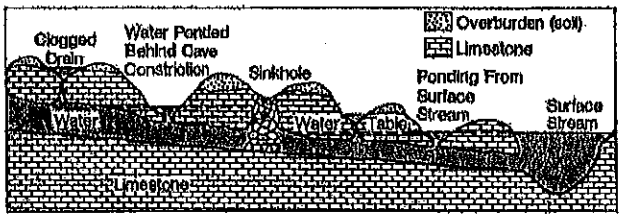


the formation of karst terrain, water percolating underground enlarges subsurface flow paths by dissolving the rock. As some subsurface flow paths are enlarged over time, water movement in the aquifer changes character from one where ground-water flow was initially through small, scattered openings in the rock to one where most flow is concentrated in a few well-developed conduits. As the flow paths continue to enlarge, caves may be formed and the ground-water table may drop below the level of surface streams; surface streams may then begin to lose water to the subsurface. As more of the surface water is diverted undergound, surface streams and stream valleys become a less conspicuous feature of the land surface, and are replaced by closed basins. Funnels or circular depressions called sinkholes often develop at some places in the low points of these closed basins.

SINKHOLE FLOODING

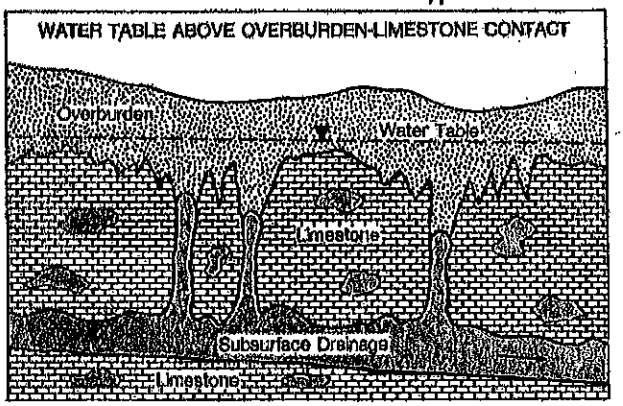
Ponding in sinkholes of surface runoff from storms is a part of the natural hydrologic system in karst regions. Ponding occurs during periods of intense rainfall when the rate of storm water runoff exceeds the drainage capacity of sinkholes. Water in underground conduits can back up into sinkholes when the rate of storm water inflow exceeds the drainage capacity of either the cave stream or the receiving surface stream.

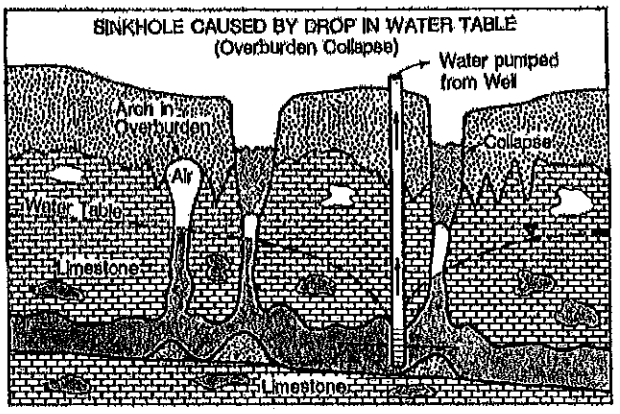
Urban structures are often built near sinkholes where flooding problems may be aggravated by (1) increased rates of runoff from impervious roofed or paved areas, (2) decreased storage due to sinkhole grading and filling, and (3) clogging of sinkhole drains by debris and silt.



HOW DO SINKHOLES DEVELOP?

Sinkholes develop as a result of the collapse of surface or near-surface material. There are two basic types of sinkhole-



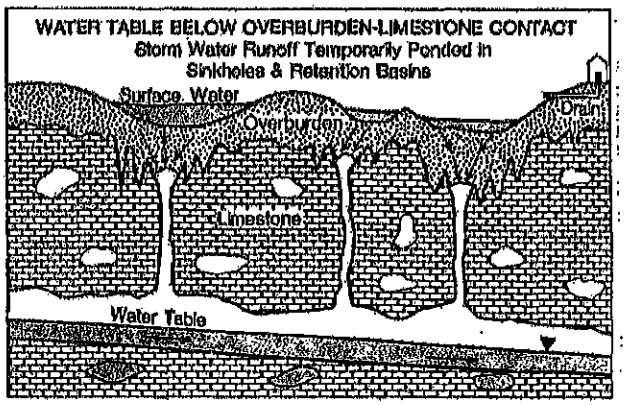


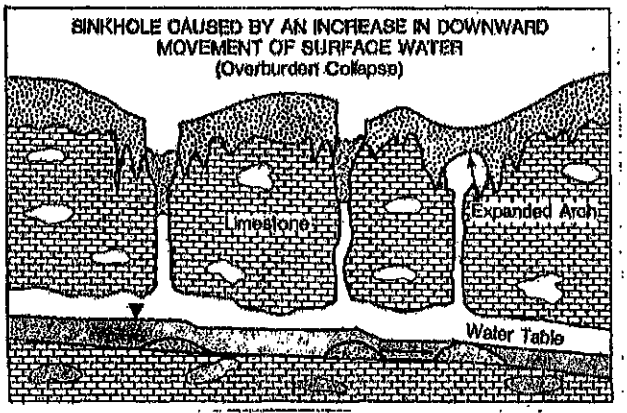
Attachment A

forming collapses: (1) limestone collapses and (2) overburden collapses into underlying limestone cavities. Limestone collapses generally occur due to the enlargement of cave passages in limestone. The enlargement causes the roofs above the passages to weaken and eventually collapse to create sinkholes. Overburden collapses are more common than limestone collapses and generally result in overburden slumping into openings or cavities in the underlying limestone.

In areas where the water table is usually above the overburden-limestone contact, collapses often occur when the water table drops below the overburden-limestone contact, either during droughts or during high-volume pumping. Phys- ically the collapses in this case are caused by loss of buoyant support for the overburden arches over openings in the limestone. Collapses are also caused by sloughing of saturated overburden down the opening, enlarging the arch, and eventually causing collapse at the land surface. When the water table fluctuates above and below the overburden-limestone contact, collapse may result from repeated wetting (swelling) and drying (shrinking) of material supporting overburden arches.

Overburden collapses also may occur in situations where the water table is usually below the overburden-limestone contact. Construction and land use changes that concentrate surface runoff in drains and impoundments may locally increase the downward movement of water resulting in slumping of saturated overburden into openings in the limestone. Loading of the surface by structures or ponded water, or vibrating the surface by blasting may also occasionally cause the collapse of overburden arches.





Although sinkhole-forming collapses occur naturally, many are induced by pumping or by constructing facilities that alter surface drainage. Collapses cause millions of dollars in damages each year to reservoirs, roads, buildings, and homes. In most States, losses are not usually covered by homeowners insurance policies.

GROUND-WATER CONTAMINATION

Shallow aquifers in karst terrains are extremely vulnerable to contamination. The aquifers receive water either by percolation through the soil or by concentrated flow directly into the aquifer from sinkholes and disappearing streams. In many karst areas, subsurface streams are simply surface streams that, after disappearing underground, flow through subsurface conduits to reappear at springs where they become surface streams again. Because these underground streams flow at velocities commonly between 0.1 and 5 miles per day, contaminants may move in a shorter period of time than contaminants in aquifers that are unaffected by karst development.

Contaminants associated with agricultural activities, such as fertilizers, nitrate and bacteria from livestock waste, or organic compounds from pesticides, are potential problems in karst terrains. Contaminants associated with urban storm water runoff, such as lead, chromium, oil and grease, and bacteria from pet-animal wastes, may be a threat to people using water supplies in karst terrains and to cave aquatic life. Dye-tracing techniques have shown that septic tank effluent can travel through the thin soils that are characteristic of most karst terrains into the aquifer and to springs in only a few hours. Water samples collected at some springs following heavy rains contain bacteria that probably are derived from human wastes, indicating that recharge water flushes effluents from septic tank drain fields into the shallow limestone aquifer.

Contamination problems are aggravated in karst terrains by the common practice of disposing of soil and liquid wastes in sinkholes where they may be washed directly into the aquifer. The development and widespread use of hazardous materials has increased the threat from this practice.

Leaks, spills, or deliberate dumping of toxic or explosive chemicals are a particularly serious hazard for karst terrains. Chemicals that leak from buried tanks may be carried into conduits or caves below by percolating water following heavy rains. Most conduits or caves become completely water-filled at some downstream point forming natural traps for floating chemicals that accumulate against the ceiling. Not only are these materials a threat to water supplies and cave aquatic life, but, upon vaporizing, they may become highly concentrated in the cave atmosphere and rise through fractures in the overlying lime-stone to enter inhabited structures on the surface. Occasionally homes in urban areas must be evacuated because fumes in base-ments reach explosive levels.

The degree of contamination of shallow aquifers in karst terrain depends primarily upon whether these aquifers receive distributed or concentrated recharge, and upon the proximity and types of sources of contamination. Springs and water wells in karst terrain, if supplied entirely by distributed recharge through thick overburden or from sources distant from contaminated areas, may be free of contaminants and therefore excellent sources of potable water. However, many springs and water wells in karst terrain receive concentrated recharge from a nearby area where sources of contamination are present.

For additional information write to:

U.S. Geological Survey, WRD
600 Federal Place, Room 572
Louisville, Kentucky 40202

Professor Nicholas C. Crawford
Center for Cave and Karst Studies
Western Kentucky University
Bowling Green, Kentucky 42101

Open-File Report 85-677

Attachment 12

Hydrologic Hazards in Karst Terrain

Source: Water Fact Sheet, US Geologic Survey

- Sherwood Hills Area geology is a "Karst Formation"
- Karst is formed in limestone dissolved by rain & underground water
- Underground water enlarges subsurface flow paths over time
- Surface streams lose water to subsurface flows
- Shallow aquifers in karst terrain are extremely vulnerable to contamination
- Contaminates move at a faster rate than non karst formations
- Contaminates from livestock waste are potential problems in karst
- Leaks & spills are a serious hazard for karst terrains
  - Nibley City is a local example of water contamination in a karst formation from an oil spill
- Multiple papers on karst terrain contamination have been provided
- The potential for ground water contamination was also identified in the Environmental Implications of Urbanization of Wellsville Canyon, 1971

Attachment B

Dye Testing Proposal

- Water tracing using fluorescent dyes is an established method to study ground water movement
- Citizens of Wellsville City are requesting a water tracing study to guarantee the Sherwood Hills development will not contaminate our drinking water before final approval is given for Phase 1 & 2
- The potential is real & documented hundreds of times including in Cache Valley
- Unlike a spill this horse property development would not be able to be cleaned up and would forever contaminate our water
- Larry Spangler, USGS retired would perform the water tracing study. He has performed numerus studies in the Bear River Range as recent as this summer.
- Total cost $8,750 and would start with spring run-off
- Approximate time 2 months or less if dye is detected sooner

Attachment B

Other concerns not currently addressed

- A dryer climate is predicted to continue in the west
  - This would result is less water than currently available
  - What guarantees do the citizens of Wellsville have that the Bridle Path developer & residence would have 100% responsibility for the lack of water?
  - In summary approving the first stage of development before a new water source is on line is not in the best interest of either the current residence or the new residence of Bridle Path.

- Wildlife migration including the 150 head of elk currently wintering on the property will be disrupted.
  - As stated by the UDW & wildlife experts in a Wellsville City council meeting the elk will be forced onto the highway during migration with this plan
  - The elk will push through fences into private hay stacks to feed in the winter
  - In summary what guarantees do we have that the Bridle Path developer & residence will bear 100% responsibility for this?

Attachment C

PRINCIPAL INVESTIGATOR:

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SUBJECT: Proposal to conduct dye-tracing investigation in Sherwood Hills proposed area of development

BACKGROUND: Sherwood Hills golf course and resort is located on the east flank of the Wellsville Mountains at the head of Wellsville Canyon, about 4 miles southwest of the community of Wellsville. In 2022, the golf course and resort properties were sold to a land developer that proposed the construction of 150 houses on the 800-acre parcel, which would include land on both sides of highway 89. Construction on the property is expected to begin in 2023. Residents of Wellsville and the surrounding area have expressed concerns that the development of this property could potentially impact the flow and water quality of springs in the area, some of which are used for public water supply, including Leatham and Wellsville Springs.

OBJECTIVE: The principal objective of this investigation is to determine if a hydrologic relationship exists between the proposed area of development and water-supply springs that serve the community of Wellsville. Because the area is at least partly underlain by carbonate rocks, which are subject to solution along fractures and bedding planes, a potential exists for the rapid movement of groundwater along these flow paths to discharge points downgradient (downslope), particularly springs. If these flow paths have connections to the surface, such as through sinkholes and losing or sinking streams, surface water and contaminants potentially could be transported into and through the aquifer to the springs. Losing streams and sinkholes are characteristic of karst terrains and have been documented extensively throughout the Bear River Range where they have been shown to connect hydrologically to large springs. Some of these same features are also present in the Wellsville Mountains.

METHODS/APPROACH: In order to determine if there is a hydrologic connection between the proposed area of development and water-supply springs, a thorough search of the area will need to be done to locate possible focused points of recharge (input) to the aquifer that could then move along underground pathways to the springs. If a point of recharge can be located within the proposed area of development, then a dye injection can be done to determine if a connection exists from that input to one or more of the springs. The injection would be done during the snowmelt runoff period in April–May, when there is an opportunity for surface water to be lost to the subsurface. Fluorescein dye will be used for the injection due to its ability to be detected at very low concentrations and over long distances underground. The dye is also non-toxic and is often used in tracing groundwater to public water-supply springs. The primary method of recovery will entail using activated charcoal, whereby dye is cumulatively adsorbed on the charcoal over a period of time but can be extracted later.

Prior to the injection, charcoal detectors will be placed in the water-supply springs and other springs that may be potential discharge points at least 2 weeks prior to the injection to determine the natural level of fluorescence that is present in the water. This "background" fluorescence originates from organic material

in the water and is used as a reference point for comparison with the fluorescence of the dye in the water. The first set of charcoal detectors from the spring(s) will be exchanged with a new set of detectors and then followed by the dye injection. Subsequent sets of detectors will be exchanged on a timed basis (generally 7 to 10 days) until dye is detected or a period of approximately 2 months has elapsed. This time frame is based on previous studies and expectations of groundwater travel times in karst terrains. This qualitative approach is only used to establish a connection between the input point and the spring(s) and to determine an approximate time of travel of the groundwater. Because it is not a quantitative approach, an accurate determination of dye arrival times or dye concentrations cannot be made. Processing and analysis of the charcoal detectors will be done by the principal investigator using standardized extraction and analytical techniques, along with analysis on a scanning spectrophotofluorometer. Selected samples will also be sent out for analysis to an independent commercial laboratory for verification.

DELIVERABLES: Results of analysis of the charcoal detectors will only be presented as either positive (dye was recovered) or negative (dye was not present). Concentrations of dye from charcoal detectors do not represent concentrations of the dye in spring water and are thus not reported. These qualitative results along with the test parameters and any ancillary information will be provided in a written summary along with a map showing the results of the dye test and instrument scans for positive samples.

COSTS: Costs incurred during the study will include travel to and from Salt Lake City (day trips); reconnaissance of the field area to identify potential dye injection sites, if they exist, and sites that will be monitored (springs, streams); field time servicing each monitored site for the duration of the monitoring period; processing and analysis of the charcoal samples; material costs (dye, activated charcoal, laboratory reagents, field supplies); possible discharge measurements of springflow if not currently metered; summarization of the results; and any other unforeseen costs. These are detailed as follows:

Labor (field work, lab analyses, and written summary): $7,200
Travel (vehicle costs for ten day trips): $800
Supplies (field and lab): $300
Other laboratory analytical costs: $450

Total costs: $8,750

SCHEDULE: Results of this investigation and the proposed tasks outlined in this proposal could be influenced by flow (runoff) conditions, weather, ability to find suitable injection points, and other unforeseen circumstances, which in turn could affect the stated objectives. The initial reconnaissance trip for locating potential points for dye injection will occur upon initiation of snowmelt runoff. This generally occurs during April, with runoff persisting into June. If a suitable location for a dye injection can be determined, then monitoring (placement of charcoal detectors) will be initiated at the water-supply springs and other potential discharge sites, followed by the dye injection within approximately 2 weeks. Monitoring will then be carried out for approximately 2 months or less, if dye is detected earlier.

CAVEATS: The success of this proposed dye-tracing test is dependent upon finding a suitable location for a dye injection in order to establish a hydrologic connection between the proposed area of land development and one or more water-supply springs for the city of Wellsville. Suitable locations are defined as ones where a stream loses to the subsurface, preferably through a hole in the streambed, or a sinkhole that takes snowmelt runoff. These types of locations are necessary in order to improve the

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chances that a successful test can be carried out. If a suitable location cannot be found within the proposed area of development, then the test cannot be conducted unless one of the following occurs: (1) a well can be located within the proposed area of land development into which the injection can be made, or (2) a suitable location can be located immediately adjacent to the proposed area of land development that is highly likely to be along the groundwater flow path (within the recharge area) under the property to the point of discharge. An injection into a well will require a different approach than a natural feature such as a losing stream, which will increase the cost of the study beyond what this proposal allows for. A dye injection on the surface through the soil or in a trench dug into the soil is also an option but has a very low probability of success unless permeable fractured bedrock is encountered. However, in either case, a well or a dug pit used for an injection would need to be adequately flushed with water and evaluated to determine if an adequate hydraulic connection to the groundwater flow system (aquifer) is present at that location. If a suitable point for injection cannot be located, then an assessment of the feasibility of the test will need to be made and other options considered.

In addition, there is a possibility that even if a suitable injection point is found that a negative result could occur. Although dye-tracer tests are designed so that dye will eventually discharge at a spring or other surface water body, reasons for negative tests can include (1) an insufficient amount of dye was used for the test parameters, (2) the dye discharged at an unmonitored or not recognized point of discharge, or (3) an insufficient amount of time was allotted for the monitoring period of the tracer test. The monitoring period for this tracer test is 2 months, more than ample time for groundwater flow velocities in most karst terrains. However, flow system complexities including slower than expected travel times could result in the dye re-emerging at some point after the monitoring period has stopped. If no dye is detected at the end of the 2-month period, an assessment will need to be made with regard to continuation of monitoring.