

FINAL REPORT | March 2026

GROUNDWATER CONDITIONS, LEVELS, AND ISOTOPIC STUDY REPORT

PREPARED FOR

TEHAMA COUNTY FCWCD GSA

CORNING SUB-BASIN GSA



PREPARED BY



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1. INTRODUCTION

This report outlines the methodology and results of the groundwater conditions, levels, and isotopic study for the Corning Subbasin.

1.1. Objectives

The primary purpose of the study is (1) to expand the understanding of the aquifer characteristics related to vertical interconnectivity of different aquifer zones, (2) improve the knowledge of recharge sources and contributions from local precipitation and river water to the Corning groundwater subbasin and (3) establish a baseline of general inorganic parameters as they relate to groundwater quality.

1.2. Document Organization

This report consists of the following sections:

- Section 1.0, Introduction, provides introductory and background information, including the study objectives
- Section 2.0, Field Sampling Plan, outlines the field investigations to be performed including media to be sampled, sampling locations, and the constituents to be analyzed.
- Section 3.0, Reporting Methods, outlines the timeline for the study and the sections to be included in the final report
- Section 4.0, References, lists documents and sources referenced or consulted during the preparation of this work plan.

1.3. Background

The Corning Subbasin submitted the Groundwater Sustainability Plan (GSP) in January of 2022 and a revised version that was accepted by the California Department of Water Resources (DWR) in April 2024. The revised GSP identified multiple data gaps including the interconnection between surface water and groundwater, water quality, and hydrostratigraphy of the principal aquifers including aquifer parameters like interconnectivity. Additionally, projects and management actions were identified in the GSP to aid in the sustainable management of the Subbasin. These PMAs included recharge projects. To help fill data gaps and aid in the facilitation of future recharge projects, this water quality sampling study, focusing on stable isotopes in groundwater, was implemented and funded by the Sustainable Groundwater Management (SGM) Implementation Program by DWR.

Stable isotope analysis is used to track the relative age of water and the source of groundwater. As water vapor condenses into precipitation, heavier isotopes of Oxygen and Hydrogen (^{18}O and ^2H or D, respectively) preferentially fall as rain. This water falls to the ground and percolates into the aquifers. If the water is transported along the surface through streams and canals, the lighter isotopes are preferentially evaporated and the water that is left to percolate through the stream beds has a higher concentration of the heavier isotopes. Thus, when groundwater samples are analyzed for Oxygen and Hydrogen isotopes, the concentration can discern if the water source is meteoric (precipitation) or if it is

sourced from stream seepage (Brown and Caldwell, 2017). Helium isotope concentrations can give an idea to the relative age of groundwater. Helium-3 (^3He) is a stable helium isotope that is a result of radioactive decay of Tritium (^3H). Tritium is naturally occurring isotope that is produced in the atmosphere with a significant increase from nuclear testing in the 1950's and 1960's. Therefore, the presence of tritium indicates the water entered the groundwater system within the last 60 to 70 years and since the half-life of Tritium is known (12.43 years), the concentration compared to ^3He can give an age of the water in the system (Grimm, 2020). Radon is produced in subsurface sediments by the natural decay of Uranium and dissolved radon enters pore water through diffusion. The presence of dissolved radon in a stream water sample is an indicator of groundwater discharge to the stream, and radon patterns are used to identify and quantify gaining stream reaches.

This water quality sampling study will seek to expand the understanding of the interconnectivity and recharge potential of the aquifer/aquifers within the Subbasin through sampling of stable isotopes.

2. FIELD SAMPLING PLAN

2.1. Media to be sampled

The primary goal of the study is to enhance our understanding of aquifer properties in the subbasin specifically related to the interconnectivity of surface water and recharge processes. To achieve these objectives, samples were collected from surface water and groundwater. All sampled media had field parameters recorded at time of sampling (Electrical Conductivity, Temperature, pH).

2.1.1. Surface Water

Surface water samples from creeks within the Subbasin were collected. These surface water samples will be compared with groundwater data to evaluate recharge sources and mixing processes in various parts of the Subbasin. Several creeks within the Subbasin provided ideal sampling locations. There are two main types of sample collection techniques that will be utilized for this project based on the conditions at each site.

Surface Water Grab Samples

Grab samples are simple and require no equipment other than nitrile gloves and a clean, wide mouth container that the sampler used to transfer the water sample into the labeled sample containers. The sampler can be located on a safe location on the side of a creek, river, pond or lake, or can wear rubber boots or hip waders and if the conditions are safe, enter the surface water body and collect the sample upstream of their location with minimal disturbance of sediment. The sampler collected one to four grab water samples with a clean wide-mouth poly container sampler and collected portions of the sample for field parameters. The sampler then transferred the water sample from wide-mouth containers into the sample containers.

Dipping Cup Surface Water Samples

When larger water bodies were sampled, there was not always a safe location to collect a grab water sample. In such situations, the dipping cup sampling method was used. A clean sample container was secured to the end of an aluminum or PVC pipe allowing the sampler to dip the wide-mouth container into a flowing, clean portion of the surface water body from a safe location. This technique allowed the collection of a relatively clean, low solids sample that was transferred into the sample containers.

2.1.2. Groundwater

Groundwater samples from hydrostratigraphic units within the primary aquifer or aquifers were collected as part of this study. These samples will be compared with surface water, and groundwater from other depth intervals to assess aquifer characteristics like vertical connectivity, potential for recharge, and other hydrological characteristics. Samples were collected from newly completed multi-completion wells with discreet screen intervals at depth. These wells have detailed lithology/geophysical logs, spatial distribution, and are constructed with multiple co-located discrete screen depths.

Standard Operating Procedures- Groundwater

The newly installed multi-completion and dual-completion wells would require more than 200 gallons or more than 4 hours to purge the well. Due to time and equipment constraints, purging three to five casing volumes was not practical; therefore, the use of a Hydrasleeve Speedbag was. Standard operating procedure was used consisting of three steps to using the Hydrasleeve Speedbag:

1. The exact length of nylon cord or stainless steel wire needed to suspend the sampler at the desired depth was measured and the Hydrasleeve bag sampler and weight were attached. The spring clip must be used with the Speedbag.
2. The Hydrasleeve sampler was placed into the well to the specified sample depth, pulling up on the tether hard for 1-2 feet to open the check valve, and oscillating the bag the 1-2 feet 4 times before reeling the sampler to the surface.
3. Once the Hydrasleeve Speedbag was at the surface, the collected water sample was transferred to laboratory bottles and placed on ice for transport to analytical laboratories.

2.2. Sample locations

As of March 2026, 5 new multi-completion wells, 10 shallow dual completion wells, and 10 stream gaging sites have been installed in the Corning Subbasin as part of the SGM Grant Implementation. These wells and stream gaging sites are the primary subject of this study.

2.2.1. Groundwater Sampling Locations

The 5 multi-completion wells and 10 shallow dual completion wells were sampled as part of the groundwater portion of this study. The sample locations are visible on **Figure 1** and well construction information is contained in **Table 1**.

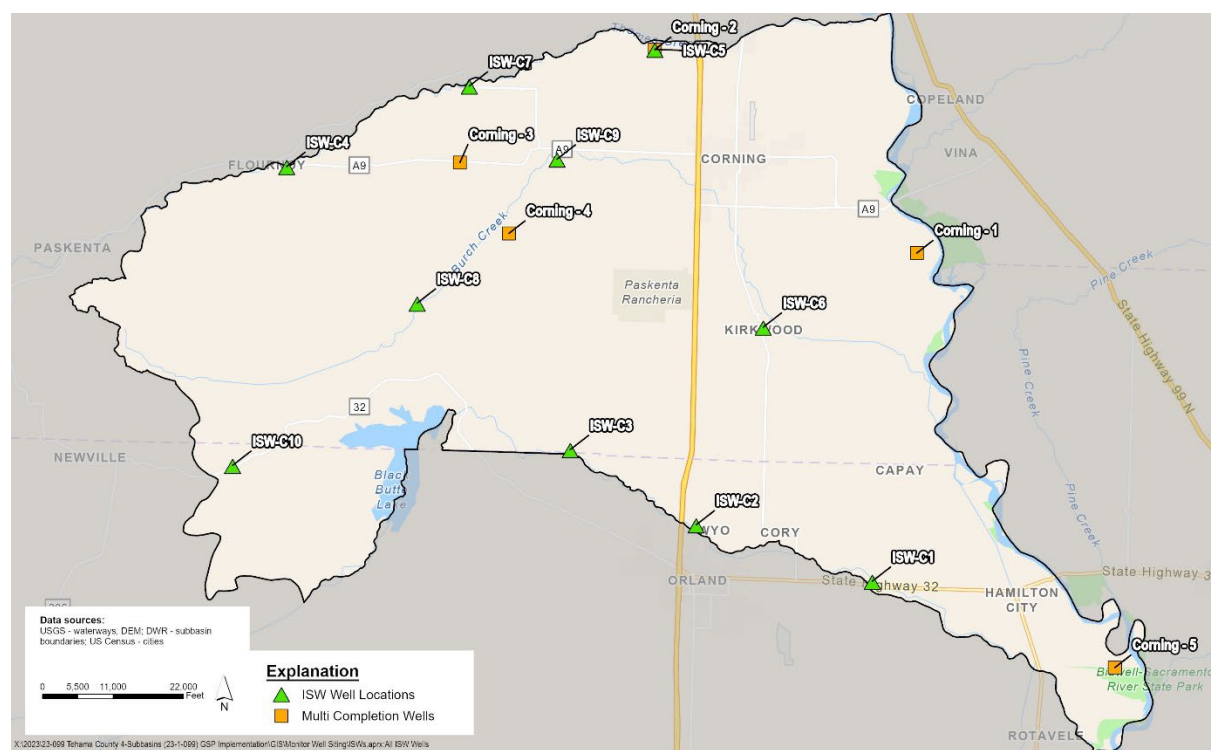


Figure 1 – Groundwater Sampling Locations

Table 1. Well Construction Information

Well ID	Total Depth (ft bgs)	Screen Top (ft bgs)	Screen Bottom (ft bgs)
Corning-1 Shallow	115	100	110
Corning-1 Intermediate	495	450	490
Corning-1 Deep	905	870	900
Corning-2 Shallow	175	160	170
Corning-2 Intermediate	295	280	290
Corning-2 Deep	365	320	360
Corning-3 Shallow	140	125	135
Corning-3 Intermediate	690	665	685
Corning-3 Deep	940	925	935
Corning-4 Shallow	200	185	195
Corning-4 Intermediate	625	600	620
Corning-4 Deep	925	900	920
Corning-5 Shallow	215	190	210
Corning-5 Intermediate	365	340	360
Corning-5 Deep	1,145	1,120	1,140
ISW-C1 Shallow	25	15	25
ISW-C1 Deep	40	30	40
ISW-C2 Shallow	30	20	30
ISW-C2 Deep	45	35	45
ISW-C3 Shallow	60	50	60
ISW-C3 Deep	80	70	80
ISW-C4 Shallow	25	15	25
ISW-C4 Deep	45	30	45
ISW-C5 Shallow	50	40	50
ISW-C5 Deep	100	90	100
ISW-C6 Shallow	65	55	65
ISW-C6 Deep	80	70	80
ISW-C7 Shallow	25	15	25
ISW-C7 Deep	45	30	50
ISW-C8 Shallow	25	15	25
ISW-C8 Deep	40	30	40
ISW-C9 Shallow	25	15	25
ISW-C9 Deep	50	30	50
ISW-C10 Shallow	30	20	30
ISW-C10 Deep	65	50	70

2.2.2. Surface Water Sampling Locations

Each shallow dual completion monitoring well is coupled with a stream gaging location to monitor the interconnectivity of the surface water. Each of these locations was assessed for accessibility for stream gage installation and thus are ideal candidates for collecting surface water samples. These proposed sample locations are presented on **Figure 2**. As feasible, additional surface water samples were collected on more stream reaches depending on accessibility. These additional sample collection sites are visible on **Figure 2**.

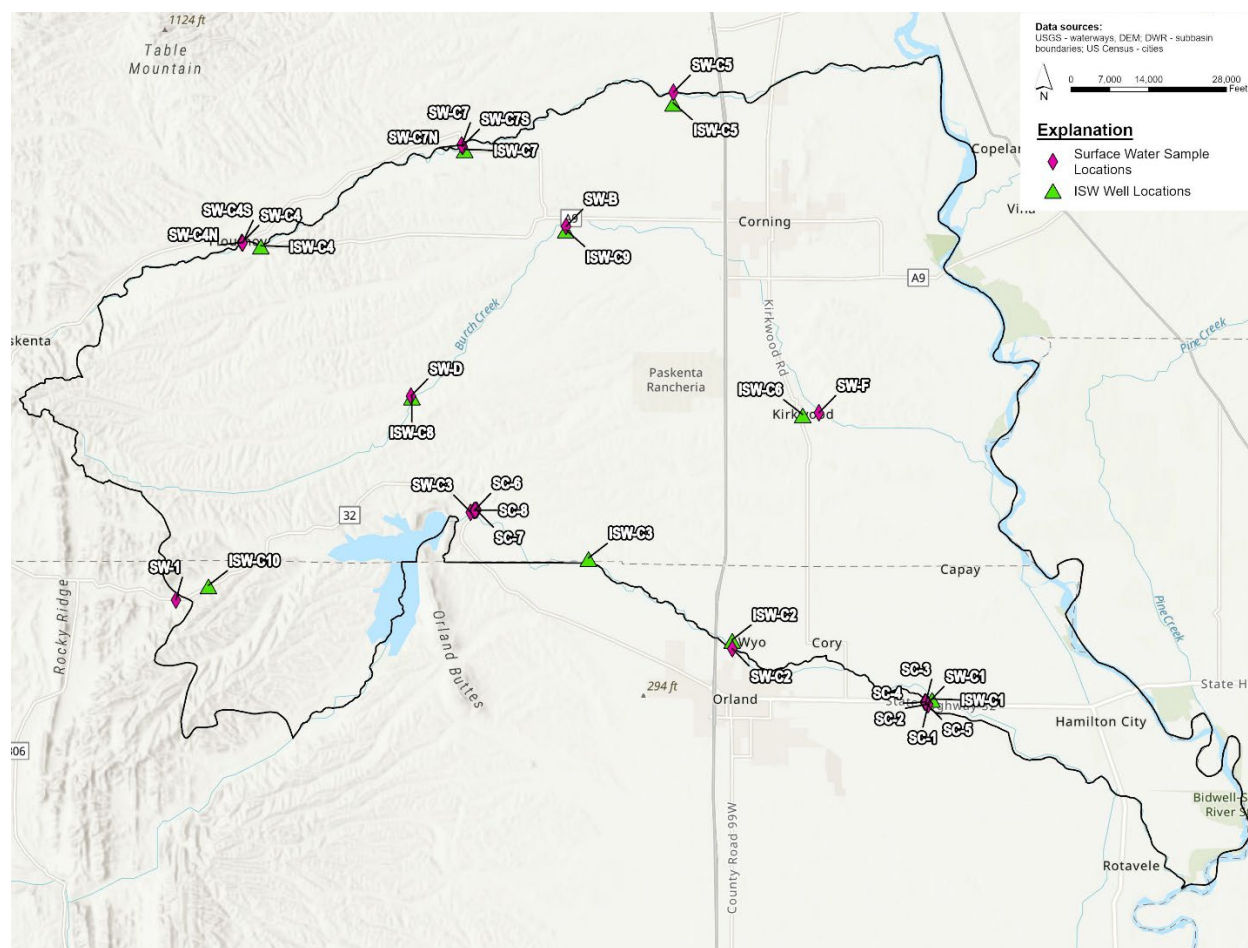


Figure 2 – Surface Water Sample Locations

2.3. Analytical Constituents

2.3.1. Isotopes

Stable isotopes of deuterium (D) and oxygen (^{18}O) in groundwater and surface water samples are the primary analytical parameters. The stability of these isotopes, combined with the straightforward processes for sampling, preservation, and analysis, makes ^2H and ^{18}O ideal tracers for identifying the original sources of meteoric or agricultural water contributing to groundwater recharge. Tritium is useful for dating groundwater that is less than 60 years old. This timeframe is useful information as it can help to plan potential groundwater recharge projects for sustainable management criteria. Radon concentrations can give insight into the connection between the streams and the shallow groundwater systems. All samples will be analyzed for stable isotopes and Tritium and surface water samples and shallow groundwater samples will additionally be analyzed for Radon.

Stable isotopes of sulfur (S), nitrogen (N), helium (He), and boron (B) can provide insights into the fate and transport of specific constituents or the age dating of groundwater. However, this Field Sampling Plan (FSP) focuses on collecting data to enhance the understanding of recharge processes rather than constituent transport or groundwater age. Consequently, isotopes other than deuterium (D), oxygen-18 (^{18}O), and Tritium (^3H) will not be analyzed as part of this study.

2.3.2. General Inorganic Parameters

General inorganic parameters, such as total dissolved solids (TDS), pH, anions, and cations, complement stable isotope data and can provide additional insights into identifying the specific source of recharge or the water-bearing groundwater zone. These parameters offer standard analytical information that can be used to visualize surface water and groundwater quality through diagrams like trilinear (Piper) and Stiff plots. When stable isotope data suggests a connection between a surface water body and one or more aquifer zones, general mineral data can help confirm whether the water chemistry at those points is similar, indicating they are part of the same hydrodynamic system. If the water chemistry is consistent across samples, it may suggest a recharge pathway. Conversely, significant differences in water chemistry would indicate that the points do not share a recharge pathway.

TDS serves as an indicator of the degree of contact between rainfall, surface soils, and aquifer solids, with higher TDS concentrations suggesting increased infiltration through soils. High pH and alkalinity (bicarbonate/carbonate) can naturally occur in some valley soils. Rainwater, in equilibrium with atmospheric carbon dioxide, is slightly acidic (pH 5.5–6), but as stormwater interacts with surface soils and rocks, hydrolysis reactions typically drive it toward neutrality. These general chemical parameters can all help elucidate aspects of recharge. The general chemical parameters include:

- Cations (calcium [Ca], magnesium [Mg], sodium [Na], potassium [K], boron [B], manganese [Mn] and iron [Fe]),
- Anions (chloride [Cl], sulfate [SO₄], phosphate [PO₄], nitrate [NO₃-N] and fluoride [F]),
- Alkalinity - bicarbonate [HCO₃]/carbonate [CO₃],
- TDS,
- and Field parameters (pH, electrical conductance [EC], temperature).

3. FIELDWORK PERFORMED

This section summarizes field activities performed between March 23, 2026 and March 31, 2026. The activities outlined in this section follow the procedures outlined in section 2 above. Groundwater samples were collected in the newly installed multi-completion and interconnected surface water monitoring wells and from streams within the subbasin.

3.1. Groundwater Samples

Depth-to-groundwater was measured in the sampled wells to the nearest ± 0.01 foot using an electronic water level meter. Three of the wells (Corning-3 shallow, Corning-4 shallow, and ISW-C9 Shallow) were dry and thus were not measured for groundwater levels or sampled. Additionally, ISW-C8 deep did not have enough water for a full suite of analysis so it will not have all constituents reported. Sampling field parameters and water levels are contained in **Table 2**.

Table 2 – Groundwater Sample Summary

Sample ID	Collection Date	Collection Time	pH	Temperature (C)	Conductivity (μS)	Static Water (ft bgs)
Corning-1 Deep	3/30/2026	1150	7.86	21.1	442	14.51
Corning-1 Intermediate	3/30/2026	1130	8.01	21.4	401	13.42
Corning-1 Shallow	3/30/2026	1105	8.57	18.5	373	12.85
Corning-2 Deep	3/30/2026	1425	7.27	25	403	83.35
Corning-2 Intermediate	3/30/2026	1405	7.14	23.4	326	75.58
Corning-2 Shallow	3/30/2026	1350	7.15	25.4	417	67.27
Corning-3 Deep	3/30/2026	1710	8.28	23.8	490	169.95
Corning-3 Intermediate	3/30/2026	1300	7.57	23.9	370	187.41
Corning-3 Shallow	Dry					
Corning-4 Deep	3/30/2026	1225	7.56	27.4	392	173.22
Corning-4 Intermediate	3/30/2026	1210	7.61	23.3	491	193.7
Corning-4 Shallow	Dry					
Corning-5 Deep	3/30/2026	1000	8.16	19.9	423	7.87
Corning-5 Intermediate	3/30/2026	1045	7.22	21	192.1	10.87
Corning-5 Shallow	3/30/2026	1025	7.3	19.2	247	10.89
ISW-C1 Deep	3/24/2026	1145	7.5	-	-	21.3
ISW-C1 Shallow	3/25/2026	1145	7.5	27	557	21.2
ISW-C2 Deep	3/24/2026	1445	7.6	27.9	645	20.71
ISW-C2 Shallow	3/24/2026	1515	7.3	26.2	597	20.48
ISW-C3 Deep	3/25/2026	1658	7.73	24.6	548	52.01
ISW-C3 Shallow	3/25/2026	1641	8.01	25.1	584	51.77
ISW-C4 Deep	3/25/2026	1247	7.8	22.1	548	7.61
ISW-C4 Shallow	3/25/2026	1315	7.93	20.4	708	7.59
ISW-C5 Deep	3/24/2026	1400	7.48	23	357	55.05
ISW-C5 Shallow	3/24/2026	1350	7.31	24.5	633	38.76
ISW-C6 Deep	3/24/2026	1615	-	-	-	49.77
ISW-C6 Shallow	3/24/2026	1615	-	-	-	48.23
ISW-C7 Deep	3/24/2026	1230	7.58	21.7	431	17.8
ISW-C7 Shallow	3/24/2026	1310	7.08	21.8	651	13.92
ISW-C8 Deep	3/25/2026	1501	8.28	22.8	319	--
ISW-C8 Shallow	3/25/2026	1520	8.09	22.3	464	22.22
ISW-C9 Deep	3/25/2026	1155	8.17	23.1	453	36.83
ISW-C9 Shallow	Dry					
ISW-C10 Deep	3/24/2026	1009	9.22	19.8	794	14.5
ISW-C10 Shallow	3/24/2026	1053	7.39	19.1	846	18.44

3.2. Surface Water Samples

Surface water samples were collected using the grab sample or the dipping cup method as outlined in section 2. Samples collected near ISW wells will be analyzed for all constituents and additional surface water samples will only be analyzed for Radon. Field parameters and sample collection times are presented in **Table 3**. Electrical conductivity sensor was malfunctioning and that parameter is not available for 13 of the samples.

Table 3 – Surface Water Sample Summary					
Sample ID	Collection Date	Collection Time	pH	Temperature (C)	Conductivity (μS)
SW-1	3/24/2026	1110	8.37	22.7	543
SW-C5	3/25/2026	1840	8.04	25.7	248
SW-C7	3/25/2026	1855	8.39	22.2	250
SW-C7N	3/25/2026	1900	8.22	22.3	312
SW-C7S	3/25/2026	1910	8.18	21.3	366
SW-C4	3/25/2026	1940	8.37	20.03	239
SW-C4N	3/25/2026	1950	8.4	19.4	242
SW-C4S	3/25/2026	1930	8.4	21.4	239
SW-8	3/25/2026	2007	8.49	23.3	333
SW-C2	3/25/2026	2110	8.49	20.1	267
SW-C1	3/26/2026	1110	8.41	66.4	-
SC-1	3/26/2026	1115	8.55	64.4	-
SC-2	3/26/2026	1120	8.65	63	-
SC-3	3/26/2026	1125	8.64	62.4	-
SC-4	3/26/2026	1130	8.7	61.9	-
SC-5	3/26/2026	1135	8.3	61.7	-
SW-C3	3/26/2026	1200	7.92	70.5	-
SC-6	3/26/2026	1205	7.95	67.4	-
SC-7	3/26/2026	1210	7.61	65.3	-
SC-8	3/26/2026	1215	8.09	66.3	-
SW-B	3/25/2026	1920	6.58	70.8	-
SW-D	3/25/2026	1945	6.84	78.5	-
SW-F	3/25/2026	2040	7.35	74.9	-

4. GROUNDWATER MONITORING RESULTS

Due to the turnaround times for analysis of the isotopic samples, the results are anticipated to be received by the GSAs after the grant implementation timeline. When the results are received from the laboratory, they will be incorporated into the periodic evaluation for the Subbasin including a summary table of laboratory results and conclusions and recommendations based on the analytical results. The raw laboratory reports will be included in appendices as well as all field notes and recorded sample parameters.

5. REFERENCES

Brown and Caldwell, 2013. *Lower Tuscan Aquifer Investigation, Final Report.*

Brown and Caldwell, 2017. *Stable Isotope Recharge Study Final Report.*

Grimm, 2020. *Master's Thesis. COMPARING MODEL-COMPUTED TURNOVER RATES WITH ISOTOPIC AGES FOR SUSTAINABLE GROUNDWATER MANAGEMENT*