# Hydrogeologist Examination Test Plan

# Effective January 2020

**General Definition of Hydrogeology:**

"Hydrogeology" means the application of the science of geology to the study of the occurrence, distribution, quantity and movement of water below the surface of the earth, as it relates to the interrelationships of geologic materials and processes with water, with particular emphasis given to groundwater quality. (Title 16, CCR 3003)

This area of practice is structured into four primary content areas:

I. Project Planning (20%)

II. Data Collection (22%)

III. Evaluation and Analysis (38%)

IV. Application (20%)

| BPELSG Certified Hydrogeologist-2019 | |
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| | **Percentage of Questions on the Exam** |
| **I. Project Planning**<br><br>**Professional Activities:**<br>**1. Develop an investigation approach to achieve project objectives**<br>**2. Determine type, collection methods, quantity and quality of data, and method of data analysis needed to achieve project objectives based on anticipated geology**<br>**3. Identify technical requirements for hydrogeologic investigations**<br>**4. Determine regulatory requirements for hydrogeologic investigations**<br>**5. Examine potential off-site/on-site contaminant sources**<br>**6. Develop and refine a conceptual hydrogeologic model**<br>**7. Identify water quality criteria for the intended use**<br>**8. Determine the potential for saline water intrusion**<br>**9. Evaluate potential sources of water supply**<br>**10. Identify the potential need to control groundwater flow direction or head**<br>**11. Develop preliminary well design based on existing site data**<br>**12. Assess hydrogeologic factors in water management decisions** | **20%** |
| **Test questions on these professional activities may include one or more of the following:** | |
| A. Applicable laws, regulations, permitting and policies pertaining to groundwater sampling, testing and reporting | |
| B. Regulatory agencies that have jurisdictional authority over water (e.g., supply, quality, rights, use, sustainability) | |
| C. Regional and local hydrogeologic conditions that may affect investigation approaches (e.g., basin boundaries, buried stream channels, proximity to pumping wells, utility trenches) | |
| D. Different site investigation methods (e.g., aquifer testing, geophysical techniques, soil and groundwater sampling) | |
| E. Laboratory methods to determine physical properties and chemical concentrations of soil, rock, water, gas, and waste samples | |
| F. Various drilling methods for different geologic settings | |
| G. The characteristics of different types of wells (e.g., siting, design, construction, development, testing, sampling) | |
| H. Methods for measuring groundwater levels, free product thickness, and field water quality parameters from wells | |
| I. Field testing and sampling methods for soil gas | |
| J. Groundwater monitoring program elements (e.g., frequency, data distribution) | |
| K. Aquifer testing methods and procedures, including their uses and limitations | |
| L. The elements of preparing a conceptual site model | |

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| M. Quality assurance and quality control methods for hydrogeologic and water quality data | |
| N. Characteristics of groundwater basins and geologic environments | |
| O. The types and sources of potential groundwater contaminants associated with various categories of land uses, industrial processes, and geologic conditions | |
| P. The sources and quality of climate data related to hydrogeologic analysis | |
| Q. Aquifer characteristics and the principles of groundwater flow | |
| R. Potential groundwater effects from long-term land use and water management plans | |
| S. Dynamic relationship between fresh water and saline water in aquifers | |
| T. Tidal and barometric pressure effects on groundwater levels | |
| U. Elements of water budgets | |
| V. Elements of sustainable groundwater management | |
| W. Hydrogeologic factors related to on-site wastewater disposal (e.g., septic systems, land application, ponds, injection wells) | |
| X. Hydrogeologic factors related to surface water and storm water management | |
| **II. Data Collection**<br><br>**<u>Professional Activities:</u>**<br>**1. Collect hydrogeologic data from public and private sources (e.g., land use information, aerial photographs, remote sensing, historical records, online databases)**<br>**2. Assess surficial conditions and site features in the field**<br>**3. Map hydrogeologic features (e.g. springs, wetlands, wells, geologic structures)**<br>**4. Collect samples and field data (e.g., lithology, stratigraphy, structure, moisture, water levels, flow, chemistry, geophysics, other properties)**<br>**5. Apply quality control standards to the collection of data**<br>**6. Assess the physical condition, construction, and performance of existing wells**<br>**7. Conduct hydraulic testing (e.g., pumping and slug tests, stream gaging, other multi-well and single well tests)** | **22%** |
| **Test questions on these professional activities may include one or more of the following:** | |
| A. Sources and interpretive techniques for aerial photographs and remote sensing imagery | |
| B. Site reconnaissance elements related to hydrogeology (e.g., land modification, current conditions, past use) | |
| C. The relationships among geologic strata, hydrostratigraphic units and hydraulic characteristics | |
| D. How the properties of geologic media may affect contaminant and water migration through surface water, vadose zone, and aquifer | |
| E. Techniques and equipment to conduct single and multi-well aquifer tests | |
| F. Techniques and equipment to measure groundwater levels and non-aqueous phase liquid thickness in wells | |
| G. Techniques to estimate groundwater flow, direction, and velocity | |

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| H. Borehole geophysical investigation techniques | |
| I. Methods to determine hydraulic properties of saturated and unsaturated earth materials | |
| J. Principles of well hydraulics and aquifer properties | |
| K. Techniques to measure well discharge and efficiency | |
| L. The principles of groundwater flow pertaining to confined and unconfined aquifers under pumping and steady state conditions | |
| M. Quality control standards | |
| **III. Evaluation and Analysis**<br><br>**Professional Activities:**<br>**1. Evaluate hydrogeologic data from public and private sources (e.g., land use information, aerial photographs, remote sensing, historical records, online databases)**<br>**2. Interpret aquifer test and other data to characterize hydrogeologic properties, boundaries, heterogeneity, and anisotropy in aquifers**<br>**3. Prepare hydrogeologic inventory and water budget**<br>**4. Assess surface water/groundwater interactions**<br>**5. Characterize nature and extent of contamination**<br>**6. Prepare illustrations and interpret trends from water level and/or quality data**<br>**7. Evaluate fate and transport of contaminants**<br>**8. Evaluate hydrogeologic effects of pumping wells, fluid injection, containment walls, reactive barriers, and subsurface structures on groundwater flow and quality**<br>**9. Evaluate the hydrogeologic aspects of remedial technologies**<br>**10. Estimate potential impact of anthropogenic activities (e.g., agricultural development, mining, energy, pumping) on surface and groundwater quality and supply**<br>**11. Evaluate potential impact of groundwater recharge on water quality**<br>**12. Develop, calibrate, and understand limitations and assumptions of numerical and analytical models** | **38%** |
| **Test questions on these professional activities may include one or more of the following:** | |
| A. Applicable laws, regulations, and policies pertaining to data collected for groundwater use and protection | |
| B. The interpretation of relationships among geologic strata, hydrostratigraphic units, and hydraulic characteristics | |
| C. Data evaluation to establish background conditions in soil and groundwater | |
| D. Potential groundwater contaminants associated with various categories of land use and industrial processes | |
| E. The effects of anthropogenic modifications on subsurface drainage and groundwater flow conditions | |
| F. Statistical methods to evaluate soil or groundwater data | |
| G. Graphical and tabular techniques for analysis and presentation of hydrogeologic data | |

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| H. Methods to determine groundwater flow directions and horizontal and vertical hydraulic gradients | |
| I. Data selection for groundwater potentiometric surface maps | |
| J. Water chemistry evaluation (e.g., stable isotope studies, radiometric dating, major ion distribution, contaminants) | |
| K. Techniques to analyze aquifer test data | |
| L. Unsaturated zone and soil vapor migration principles | |
| M. Causes and effects of land subsidence | |
| N. Procedures for calculating recharge rates | |
| O. Techniques and procedures used for water budget evaluations | |
| P. The interaction between groundwater and surface water | |
| Q. Land use effects on water resources | |
| R. Methods to calculate groundwater flow rates, mass flux, and volume | |
| S. The effects of boundary conditions on water levels during pumping | |
| T. Methods for evaluating changes in groundwater storage | |
| U. Principles and methods to estimate natural attenuation | |
| V. The chemical and biochemical transformation of organic and inorganic compounds | |
| W. Groundwater flow and solute transport modeling principles including their assumptions and limitations | |
| X. Numerical models, including calibration, sensitivity analysis, and uncertainty analysis | |
| Y. The similarities and differences in fractured and porous groundwater flow systems | |
| Z. Wellhead protection areas | |
| AA. Comparative evaluation of hydrogeologic aspects of remedial alternatives | |
| BB. Data evaluation from pilot tests for water supply, dewatering, and remediation | |
| CC. Evaluation of available water supply and sustainable groundwater management | |
| **IV. Application**<br><br>**<u>Professional Activities:</u>**<br>**1. Prepare design recommendations for groundwater production, extraction and injection wells**<br>**2. Design, install and develop wells and piezometers**<br>**3. Develop subsurface monitoring programs**<br>**4. Prepare design recommendations for dewatering or collection systems**<br>**5. Design and implement well rehabilitation programs**<br>**6. Prepare design recommendations for hydrogeologic related projects (e.g., groundwater remediation, groundwater management, aquifer storage, and groundwater replenishment programs)**<br>**7. Develop plans for the destruction of wells and boreholes** | **20%** |
| **Test questions on these professional activities may include one or more of the following:** | |

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| A. Borehole drilling and well construction techniques to prevent cross-contamination | |
| B. Drilling techniques and construction practices for different types of wells | |
| C. Well design (e.g., screen size, filter pack selection, casing type) | |
| D. Well development and testing | |
| E. Procedures for well maintenance and rehabilitation | |
| F. Techniques and regulations for well destruction | |
| G. Hydrogeologic factors and analytical techniques to design a well field for groundwater extraction or injection | |
| H. Soil, soil vapor and groundwater remediation methods, performance and optimization | |
| I. Methods for estimating natural and artificial groundwater recharge | |
| J. Hydrogeologic factors for evaluating the effectiveness of groundwater management actions and groundwater sustainability projects | |
| K. Hydrogeologic requirements pertaining to the investigation, location, and operation of waste disposal and treatment facilities | |