CONTENT SPECIFICATIONS AND REFERENCES FOR
HYDROGEOLOGIST EXAMINATION

I. PROFESSIONAL PRACTICE (5%) – Apply pertinent federal and /or state regulations to hydrogeologist practice.

Tasks

T1. Identify need to perform a contamination assessment based on legal/regulatory requirements.

T2. Identify water rights implications from groundwater information.

T3. Apply knowledge of rules and regulations as it relates to the practice of hydrogeology.

References

- Fetter, C. W. (1980). Applied hydrogeology (2nd ed). Columbus, OH: Merrill Publishing Company, p. 453
- RCW 18.104. Water well construction
- RCW 90.03 Water code
- WAC 173-162. Regulation and licensing of well contractors and operators.
- WAC 173-340 Model Toxics Control Act -- Cleanup.
- WAC 246-290 Group A public water supplies
- Washington State Department of Health (1995). Wellhead protection program guidance document April 1995 DOH Publication 331-018.

II. PROJECT PLANNING (20%) - Establish project objectives and develop scope of hydrogeologic work.

Tasks

T4. Identify needs for water supply protection.
T5. Identify needs for water supply (groundwater and/or soil restoration/remediation).
T6. Identify groundwater management issues and alternatives
T7. Identify potential sources of water supply.
T8. Identify water resource impacts on designated beneficial use.
T9. Develop a conceptual hydrogeologic model.
T10. Identify need for control of groundwater flow direction or head relevant to engineered controls.
T11. Identify consequences of changes to water table or potentiometric surface.
T12. Identify existing site conditions that may constrain investigation approach.
T13. Prepare schedule and identify location for soil and/or groundwater remediation.
T14. Identify type, collection methods, quantity and quality of data needed to achieve project objectives.
T15. Develop a groundwater investigation work plan.

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• American Petroleum Institute (1996). A guide to the assessment and remediation of underground petroleum releases. API Publication 1628 (3rd ed), July 1996. Washington DC: API Publication Services.
• Deutch, W. J. (1997). Groundwater geochemistry: Fundamental and applications to contamination. Boca Raton: Lewis Publishers
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• Environmental Protection Agency (1990). Ground Water, Volume I, Ground Water and Contamination, September 1990 (EPA/625/6-90/0169).
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• USGS LaSala, A. M., Jr., Doty, G. C., & Pearson, E. J., Jr. (1973). A preliminary evaluation of regional ground-water flow in south-central Washington. Open File Report.
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• USGS Molnaar, D. (1988). The Spokane aquifer, Washington: Its geologic origin and water-bearing and water quality characteristics. Denver, CO: USGS Water-Supply Paper 2265.
• Washington State Department of Ecology. Luzier, J. E., & Burt, R. J. (1974). Hydrology of basalt aquifers and depletion of ground water in east-central Washington. Water Supply Bulletin 33, State of Washington, Department of Ecology, Olympia, WA, in cooperation with the U. S. Geological Survey, Washington, DC.

III. DATA ACQUISITION (24%) – Perform surface and subsurface exploration and document groundwater conditions.

Tasks

T16. Identify previous land uses and conditions from photographs, topographic maps, and other available historical sources.
T17. Identify the applicable data for hydrogeologic analysis by reviewing existing documents, records, maps, and well logs.
T18. Evaluate the physical condition and construction of existing wells.
T19. Verify current conditions and site features in the field
T20. Collect soil, rock, and soil gas samples to evaluate surface and subsurface conditions.
conditions.
T22. Prepare field notes to document sample collection, site conditions and deviations from work plan.
T23. Collect samples of sediment or waste to evaluate soil or groundwater conditions.
T24. Collect samples of groundwater or surface water to evaluate groundwater conditions.
T25. Identify lithology, stratigraphy, structure, changes in moisture, water levels, and other properties of geologic materials based on field observations to interpret subsurface conditions.
T26. Measure groundwater levels or free product thickness from wells.
T27. Measure field water quality parameters.
T28. Measure water flow and discharge rates.

References

- American Petroleum Institute (1996). A guide to the assessment and remediation of underground petroleum releases. API Publication 1628 (3rd ed), July 1996. Washington DC: API Publication Services.
- ASTM Designation D 2488-00. Standard practice for description of soils (visual manual procedure).
- ASTM Designation D 4448-01, Standard guide for sampling ground-water monitoring wells, 3-4.
- Deutch, W. J. (1997). Groundwater geochemistry: Fundamental and applications to contamination. Boca Raton: Lewis Publishers
- Driscoll, F. G. (1986). Groundwater and wells (2nd Ed.). St. Paul, MN: Johnson Division.
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- International Fire Code Institute, April 1994. Ecology underground storage tank assessment study guide.
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- RCW 90.44 Regulation of public groundwaters
- USGS National Field Manual for the Collection of Water-Quality Data Techniques of Water-Resources Investigations Book 9 Handbooks for Water-Resources Investigations
- USGS Shelton, Larry R. (1997) Field guide for collecting samples for analysis of volatile organic compounds in stream water for the national water-quality assessment program; Open-File Report 97-401 Sacramento,
- Weight, W. D., & Sonderegger, J. L. (2001). Manual of applied field hydrogeology. New York, NY: McGraw Hill.

IV. DATA EVALUATION (34%) – Interpret data from historic, field, and laboratory sources and evaluate technical and economic feasibility of groundwater projects.

Tasks

T29. Analyze infiltration/percolation data to calculate recharge rates and permeability.
T30. Identify possible recharge/discharge areas from maps, photographs, and historic records.
T31. Prepare interpretive hydrogeologic illustrations.
T32. Construct time-series graphs of water level data.
T33. Calculate vertical and horizontal hydraulic gradients.
T34. Calculate hydraulic parameters from aquifer test data.
T35. Assess well performance from pumping test data.
T36. Determine aquifer parameters based on slug test.
T37. Calculate fate and transport of contaminants in groundwater or vadose zone.
T38. Interpret hydrogeologic boundaries, heterogeneity, and/or anisotropy from single or multi-well tests.
T39. Delineate water resource boundaries and zones from available data or field observations.
T40. Assess surface water/groundwater interactions.
T41. Delineate the nature and extent of groundwater contamination.
T42. Evaluate data to prepare hydrologic inventory/water balance.
T43. Characterize nature and extent of contamination based on laboratory analysis of soil, soil gas or groundwater samples.
T44. Determine interaction between vadose zone and groundwater using physical or chemical parameters.
T45. Interpret trends from water level and/or quality data.
T46. Interpret borehole geophysical logs to determine aquifer stratigraphy and properties.
T47. Estimate contaminant concentrations for use in risk assessment.
T50. Prepare groundwater level/potentiometric contour maps.
T51. Prepare isoconcentration contour map.
T52. Prepare graphical representations of water quality data.
T53. Analyze infiltration/percolation data to calculate recharge rates and permeability.

References

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- Domenico, P. A., & Schwartz, R. W. (1988). Physical and chemical hydrogeology. New York: John Wiley and Sons.
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- Weidemier, T. H., Raifai, H. S., Newell, C. J., & Wilson, J. T. (1999). Natural attenuation of fuels and chlorinated solvents in the subsurface. New York: John Wiley and Sons.

V. DESIGN AND IMPLEMENTATION (17%) – Design monitoring and production wells, and design programs for treatment and production systems.

Tasks

T54. Evaluate remedial technologies for soil, soil gas or groundwater.
T55. Design a resource protection well.
T56. Design a groundwater production well.
T57. Develop cleanup goals for soil or groundwater remediation.
T58. Develop criteria for a groundwater control/remediation system.
T59. Design a monitoring plan for natural attenuation remedy.
T60. Design a monitoring plan for remedial treatment system.
T61. Design a monitoring plan for waste management units.
T62. Design well decommissioning plan.
T63. Design a well field specifying number, location, flow rate, and spacing of wells.
T64. Design a monitoring plan for water supply system.
T67. Design a groundwater injection/recharge system.
T69. Assess performance of a remedial system.
T70. Assess groundwater monitoring program effectiveness.
T71. Assess impacts of water resource protection, development or use on current and future land and water uses.
T72. Design a pumping test plan.
T73. Design a well rehabilitation plan.

References

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• Safe Clean Drinking Water Act, Wellhead Protection Act, EPA.
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• US Army Corps of Engineers (1998). Engineer manual monitoring well design, installation, and documentation at hazardous, toxic, and radioactive waste sites, EM 1110-1-4000.
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