Summary of the Snake River Plain Regional Aquifer-System Analysis in Idaho and Eastern Oregon

By G.F. LINDHOLM

REGIONAL AQUIFER-SYSTEM ANALYSIS—SNAKE RIVER PLAIN, IDAHO

U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1408-A

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1996

CONTENTS

	Page
Foreword	III
Abstract	A1
Introduction	2
Objectives of the Snake River Plain RASA	2
Purpose of summary report	3
Previous studies	3
Well- and site-numbering system	4
Description of study area	5
Physiography	5
Climate	5
Hydrologic features	8
Cultural features and economy	8
Geology	9
Geologic units	10
Structure	16
Geohydrology	18
Hydraulic properties	18
Ground-water flow systems	22
Solute geochemistry	27
Upper cold-water system	28
Lower geothermal-water system	31
Water use	31
History of irrigation	32
Irrigation, 1980	33
Other uses, 1980	33
Water-use trends	33
Water budgets, 1980	36
Ground-water budget, eastern Snake River Plain	36
Ground-water budget, western Snake River Plain	37
Temporal changes in the hydrologic system, 1880 –1980	39
Recharge	40
Ground-water discharge	42
Ground-water budgets	44
Ground-water quality	46
Ground-water flow models	48
Eastern plain	48
Western plain	52
References cited	56

ILLUSTRATIONS

PLATE 1. Map showing hydrologic features and data sites in the Snake River drainage basin upstream from Weiser, Idaho **In pocket**

		Page
FIGURE	1. Map showing location of study area	A2
	2. Diagram showing well- and site-numbering system	4
	3. Map showing altitude of land surface	6
	4. Map showing mean annual precipitation, 1931–52	7
	5. Graph showing mean monthly precipitation and air temperature, 1951–80	8
	6. Graph showing profile of Snake River	9
	7. Diagram showing generalized stratigraphy of Snake River basin	11
	8. Map showing generalized geology of Snake River drainage basin upstream from Weiser, Idaho	12
	9. Geologic section *A–A′*, western Snake River Plain	13
	10. Geologic section *B–B′*, eastern Snake River Plain	14
	11. Map showing thickness of Quaternary-Tertiary basalt and electrical resistivity profile C–C′	15
	12. Diagram showing lithologic and gamma ray logs of test hole 7S-15E-12CBA1, 4, and 5, and increases in hydraulic head with depth, May 1982	17
	13. Map showing configuration of water table and general direction of horizontal ground-water movement in upper part of regional aquifer system, March 1980	23
	14. Graph showing decreases in hydraulic head with depth in a recharge area (piezometers 7N-39E-16DBB1, 2, and 3)	24
	15. Map showing irrigated acreage, 1980	25

16. Graph showing increases in hydraulic head with depth in a discharge area (piezometers 7S-15E-12CBA1, 4, and 5) ---- 26
17–19. Diagrams showing:
17. Directions of ground-water movement to Snake River near Thousand Springs ---- 27
18. Effect of sedimentary interbeds on ground-water movement ---- 28
19. Directions of ground-water movement, western Snake River Plain ---- 29
20. Map showing areal distribution of dissolved solids in upper part of regional aquifer system ---- 30
21. Diagram showing conceptual hydrologic model of Snake River basin geothermal system ---- 32
22. Map showing irrigated acreage and other land uses, 1980 ---- 34
23. Map showing estimated ground-water pumpage for irrigation, 1980 ---- 35
24–29. Hydrographs showing:
24. Snake River north-side diversions for irrigation from Lake Walcott and Milner Lake ---- 40
25. Rises in ground-water levels owing to irrigation ---- 41
26. Relation of precipitation to ground-water-level trends ---- 42
27. Long-term ground-water-level trends ---- 43
28. Short-term changes in ground-water levels ---- 44
29. Estimated ground-water discharge to Snake River, eastern Snake River Plain ---- 45
30. Graph showing approximate increases in ground-water-irrigated acreage, eastern Snake River Plain ---- 46
31. Hydrographs showing discharge to American Falls Reservoir from spring-fed creeks, September measurements 46
32. Graphs showing changes in ground-water budget, 1880–1980, main part of eastern Snake River Plain ---- 47
33–36. Hydrographs showing:
33. Estimated cumulative change in ground-water storage, main part of eastern Snake River Plain ---- 48
34. Temporal changes in water-budget components, main part of eastern Snake River Plain ---- 49
35. Estimated cumulative change in ground-water storage and 5-year moving average of precipitation, western Snake River Plain, October–March, 1930–80 ---- 50
36. Surface-water diversions for irrigation, western Snake River Plain ---- 51
37. Diagrams showing generalized geologic section and conceptual model, eastern Snake River Plain ---- 52
38. Map showing model grid and transmissivity of subareas for layer 1 in three-dimensional model, eastern Snake River Plain ---- 53
39. Diagrams showing generalized geologic section and conceptual model, western Snake River Plain ---- 54
40. Map showing model grid and transmissivity of subareas for model layer 1, western Snake River Plain ---- 55

TABLES

Page
TABLE 1. Aquifer-test data, eastern Snake River Plain ---- A19
2. Aquifer-test data, western Snake River Plain ---- 21
3. Water budget, Snake River Plain, water year 1980 ---- 37
4. Ground-water budget, eastern Snake River Plain, water year 1980 ---- 38
5. Ground-water budget, western Snake River Plain, calendar year 1980 ---- 39