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Revision 0

Regional Groundwater Flow Model for C, K, L, and P Reactor Areas, Savannah River Site, Aiken, South Carolina (U)

Gregory P. Flach, Mary K. Harris, Robert A. Hiergesell,
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September 1999

Prepared by:
Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U.S. Department of Energy Under
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ABSTRACT

A regional groundwater flow model encompassing approximately 100 mi^2 surrounding the C, K, L, and P reactor areas has been developed. The reactor flow model is designed to meet the planning objectives outlined in the *General Groundwater Strategy for Reactor Area Projects* by providing a common framework for analyzing groundwater flow, contaminant migration and remedial alternatives within the Reactor Projects team of the Environmental Restoration Department. The model provides a quantitative understanding of groundwater flow on a regional scale within the near surface aquifers and deeper semi-confined to confined aquifers. The model incorporates historical and current field characterization data up through Spring 1999. Model preprocessing is automated so that future updates and modifications can be performed quickly and efficiently. The CKLP regional reactor model can be used to guide characterization, perform scoping analyses of contaminant transport, and serve as a common base for subsequent finer-scale transport and remedial/feasibility models for each reactor area.

MODEL SUMMARY

The current groundwater flow model for C, K, L, and P reactor areas simulates groundwater flow within the area bounded to the north by Upper Three Runs, to the west by the Savannah River, to the south by Steel Creek and Meyers Branch, and to the east by a line between McQueen Branch and Par Pond. Vertically the model extends from ground surface to the top of the Meyers Branch confining system. The model confirms that groundwater flow in upper aquifers at the Savannah River Site is recharge driven, with streams intercepting flow from higher elevations. The underlying Gordon aquifer is strongly influenced by and discharges to the Savannah River and Upper Three Runs. Nearly all recharge within the CKLP reactor region discharges to streams within or bounding the same area, usually the nearest stream, with the balance entering the Gordon aquifer. Simulated flow directions agree with the conceptual model of groundwater flow. Model calibration targets include groundwater recharge estimates, stream baseflow data and estimates, and water level measurements from more than 1000 wells. Model conductivity values in the Gordon aquifer and confining units are set directly to prior estimates based on field data. For the Upper Three Runs aquifer unit, conductivity values are defined through calibration to the groundwater flow and hydraulic head targets.

The chosen areal grid is 70,000 feet on a side, with a horizontal resolution of 500 square feet. The grid consists of 140 elements along each horizontal axis. The vertical resolution varies depending on hydrogeologic unit and terrain/hydrostratigraphic surface variations. The top

surface of the mesh conforms to the ground surface. The bottom surface of the mesh coincides with the bottom of the Gordon aquifer unit. Interior node layers conform to the other stratigraphic surfaces. The "upper" aquifer zone of the Upper Three Runs aquifer includes the vadose zone and is represented by 3 finite-elements in the vertical direction. The "lower" aquifer zone of the Upper Three Runs aquifer contains 2 finite-elements, while the "tan clay" confining zone of the Upper Three Runs aquifer is represented by a single model element. The Gordon confining unit and Gordon aquifer unit are each assigned to one element, for a total of 8 vertical elements from ground surface to the bottom of the Gordon aquifer. The three-dimensional mesh is therefore $140\times140\times8$ with 156,800 elements or $141\times141\times9$ with 178,929 nodes. The finer vertical resolution in the "upper" zone of the Upper Three Runs aquifer is designed to support subsequent, finer-scale contaminant transport analyses.

Horizontal conductivity in the Gordon aquifer is set to 35 ft/day based on the extensive field data from wells at the SRS and in the region surrounding the site. The vertical conductivity of the Gordon confining unit is set to 10^{-4} ft/day in accordance with field measurements. Conductivity values within Upper Three Runs aquifer zones are set through model calibration to measured water levels. Horizontal conductivity in the "lower" aquifer zone is nominally 5.9 ft/day, and varies from 4 to 20 ft/day. Horizontal conductivity in the "upper" aquifer zone is nominally 8.3 ft/day, and varies from 0.25 to 40 ft/day. Vertical conductivity for the "tan clay" confining zone is nominally 3×10^{-3} ft/day, and varies between 1×10^{-4} and 4×10^{-3} ft/day. A typical ratio of horizontal to vertical conductivity is assumed to be 100 to 1. Approximate soil characteristic curves are adopted for the vadose zone in the numerical model. An effective porosity value of 25% is assumed when computing the pore velocity field.

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1.0 INTRODUCTION

1.1 Background

The Savannah River Site (SRS) is a U.S. Department of Energy (DOE) facility that occupies 300 square miles within Aiken, Barnwell, and Allendale counties in southwestern South Carolina (Figure 1-1). The SRS was set aside in 1950 as a controlled area to produce nuclear materials for national defense. The DOE and its contractors are responsible for the operation of the SRS. Westinghouse Savannah River Company (WSRC) is currently contracted to manage and operate the site.

The SRS operated five reactors to produce special radioactive materials during the Cold War Period. R Reactor was the first production reactor to go on-line, achieving criticality in December 1953. P Reactor achieved criticality in February of 1954, followed by L Reactor in August 1954, K Reactor in October 1954, and C Reactor in March 1955. The reactors produced plutonium-238, plutonium-239, and tritium for uses related to national defense, and also generated special isotopes for non-defense research, medical uses, and space programs. These special isotopes included cobalt-60, polonium-210, uranium-233, curium-244, and californium-252.

The past disposal practices associated with SRS reactor operations created waste units within and adjacent to the five reactor areas. Reactor area waste units include seepage basins, Bingham pump outage pits, burning/rubble pits, rubble piles, acid/caustic basins, coal pile runoff basins, and coal ash basins. WSRC (1997) provides a detailed discussion of these waste units.

The reactor areas lie within five major drainage systems (basins). These include the Fourmile Branch, Pen Branch, Steel Creek, Lower Three Runs and Upper Three Runs basins (Figure 1-2). SRS facilities are normally situated on well-drained, topographically high areas (divides) which separate the basins. This arrangement commonly places the waste units associated with a reactor within both of the adjacent groundwater basins. For example, L-Reactor waste units lie within the Pen Branch and Steel Creek basins and P-Reactor waste units lie within the Steel Creek and Lower Three Runs basins.

1.2 Modeling Objective and Approach

The primary objective of this modeling effort is to establish a regional groundwater flow model to encompass the waste units associated with C, K, L, and P reactor areas. The R-Reactor waste units are addressed in previous modeling efforts (HydroGeoLogic, 1997; 1998) and are not included in this report.

This model provides a basic understanding of the groundwater flow for these areas on a regional scale. This capability is important because of the various groundwater flow directions in the near surface aquifers and deep semi-confined to confined aquifers, and because it enables tracking of contaminant plumes from their source to discharge at the surface, potentially as far as the Savannah River and Upper Three Runs. The model for the reactor areas has been constructed to assist in scoping characterization and remedial activities by providing a common base for smaller-scale models of contaminant transport and remediation scenarios for each of these areas. In addition, the model allows waste units that are in close proximity to one another to be addressed comprehensively. This capability facilitates evaluation of the possibility of commingled plumes and assessment of the effects of one waste unit upon the other.

The model is designed to meet the planning objectives described in Section 4.2 of the *General Groundwater Strategy for Reactor Area Projects* (WSRC, 1997). The model incorporates all available data from geological and hydrological field characterizations into a project database that can be easily updated as additional field data are collected. This is consistent with the interactive approach described in WSRC (1997). The model will be able to incorporate new data as it is collected, allowing quick and cost-effective updates. The model can be evaluated to determine whether the available data are adequate to address a remediation issue. If more data are required, the model can assist in determining the types of data needed and from where they should be collected.

The reactors groundwater flow model uses EarthVision® proprietary software to calculate two-dimensional grids, maps, and cross-sections of the hydrogeology. The groundwater modeling is performed using the Flow And Contaminant Transport (FACT) code. The FACT code is a finite-element code developed by the Savannah River Technology Center (SRTC) (Hamm and others, 1997).

1.3 Description of the Study Area

The SRS is centered 22.5 miles southeast of Augusta, Georgia, approximately 100 miles from the Atlantic Coast within the Upper Atlantic Coastal Plain Physiographic Province. The Savannah River forms the southwest boundary of the SRS (Figure 1-1). The SRS is situated on the Aiken Plateau of the Atlantic Coastal Plain at an approximate elevation of 300 feet above mean sea level (ft msl). Overall, the plateau has a highly dissected surface and is characterized by broad inter-fluvial areas with narrow, steep-sided valleys. Local relief can attain 280 feet (Siple, 1967). The Aiken plateau is generally well drained, although many poorly drained sinks and depressions exist.

The model area, herein referred to as the C, K, L, and P Groundwater Model Area (CKLP GWMA) comprises approximately 100 square miles within the central and southern SRS. The CKLP GWMA has low to moderate topographic relief and drains to the west via perennial and intermittent streams (Figure 1-3). The CKLP GWMA is bounded to the north by Upper Three Runs, to the west by the Savannah River, to the south by Steel Creek and Meyers Branch, and to the east by a line between McQueen Branch and Par Pond (Figure 1-3). Upper Three Runs forms the northern boundary of the study area with an average elevation of 150 ft msl, the Savannah River forms the western boundary with an average elevation between 85 and 90 ft msl, and Steel Creek and Meyers Branch forms the south-southeastern boundary with elevations ranging from 100 to 105 ft msl. Beyond the headwaters of Meyers Branch, the southern boundary extends to Par Pond in the area south of P Area. There is no single natural drainage at the eastern margin of the CKLP GWMA. A line running southeast from McQueen Branch, through the headwaters of Fourmile Branch, to Par Pond (Figure 1-3) defines an eastern boundary.

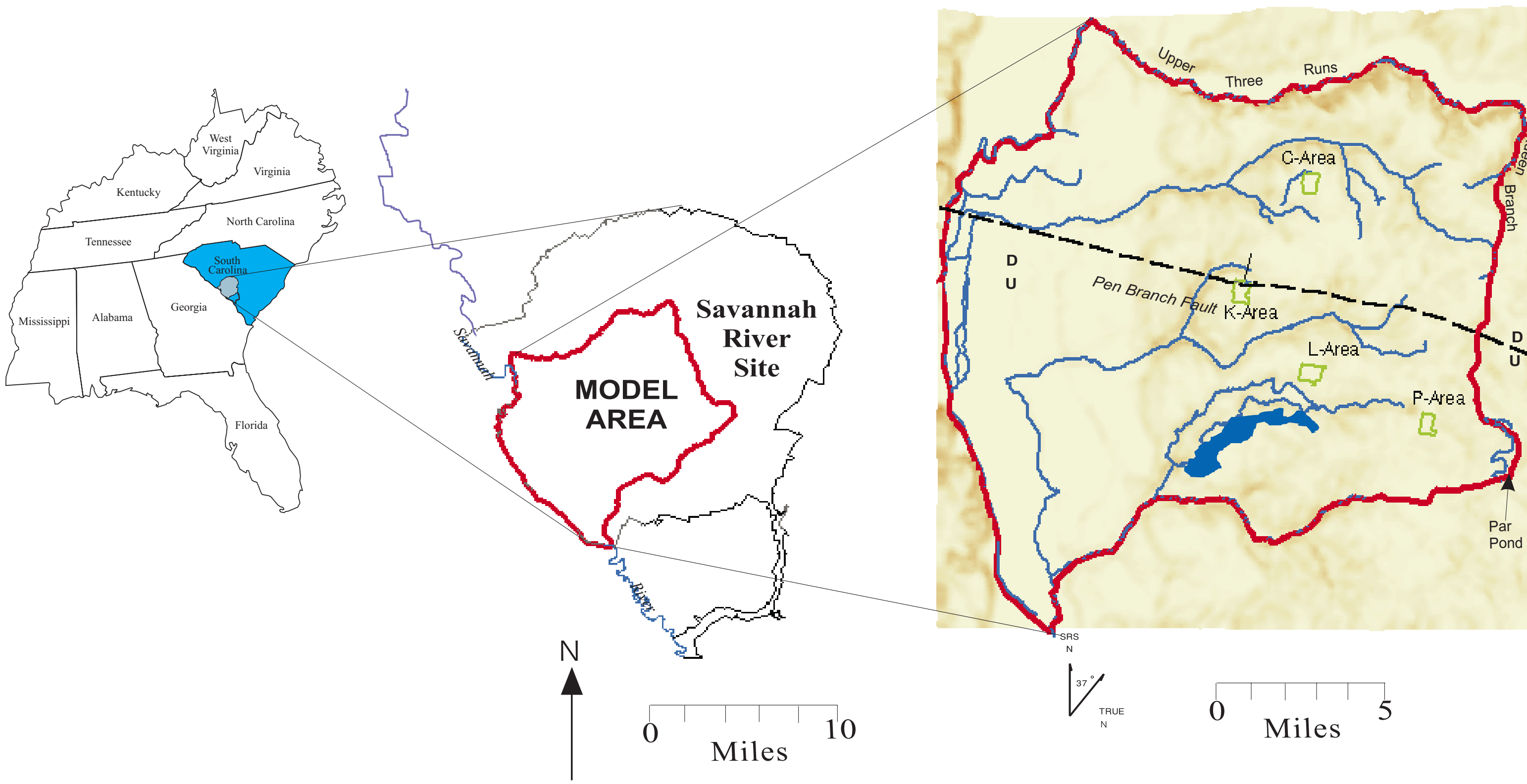


Figure 1-1. Location of the Savannah River Site and Model Areas

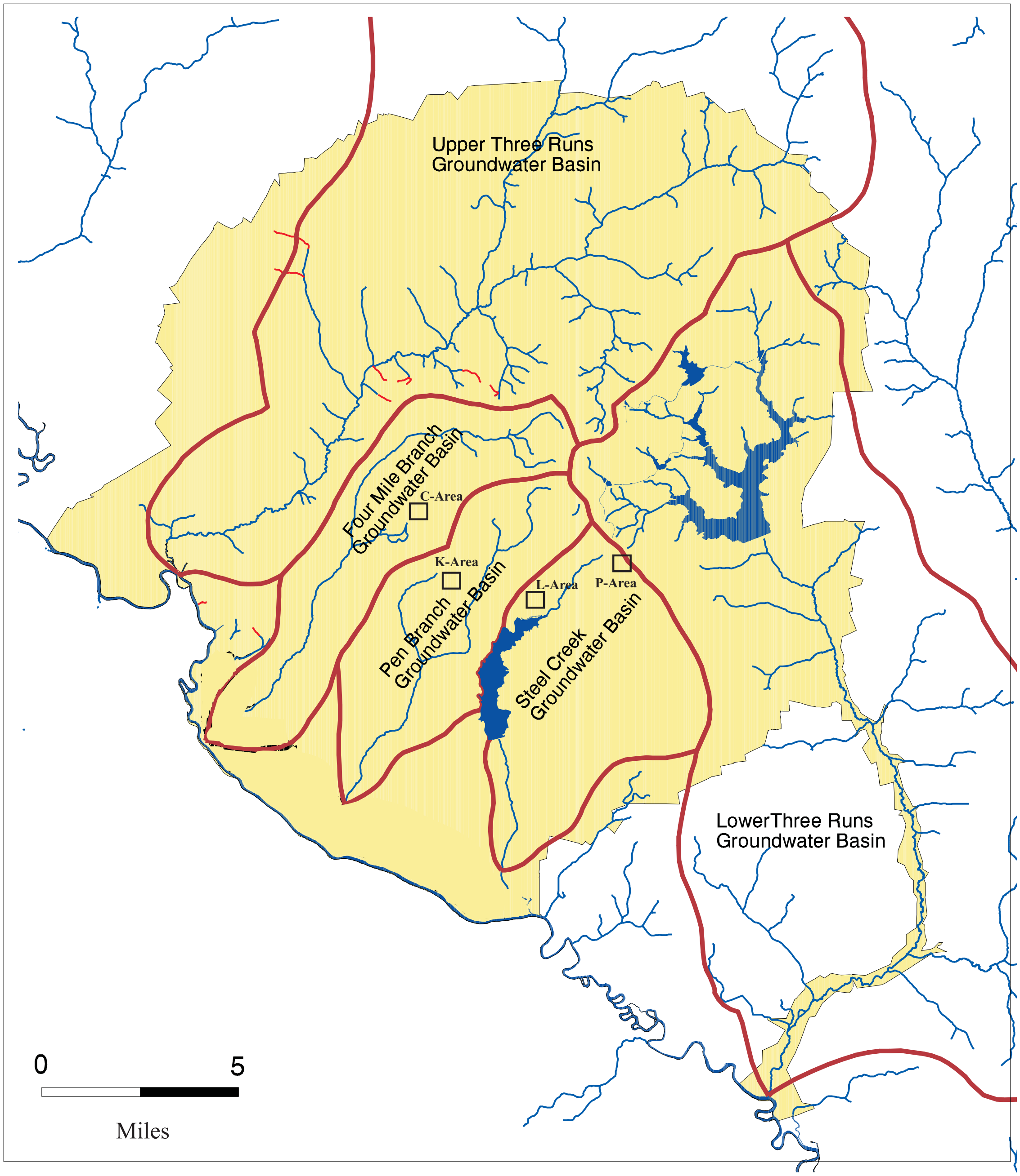


Figure 1-2. Location of Groundwater Basins at the Savannah River Site

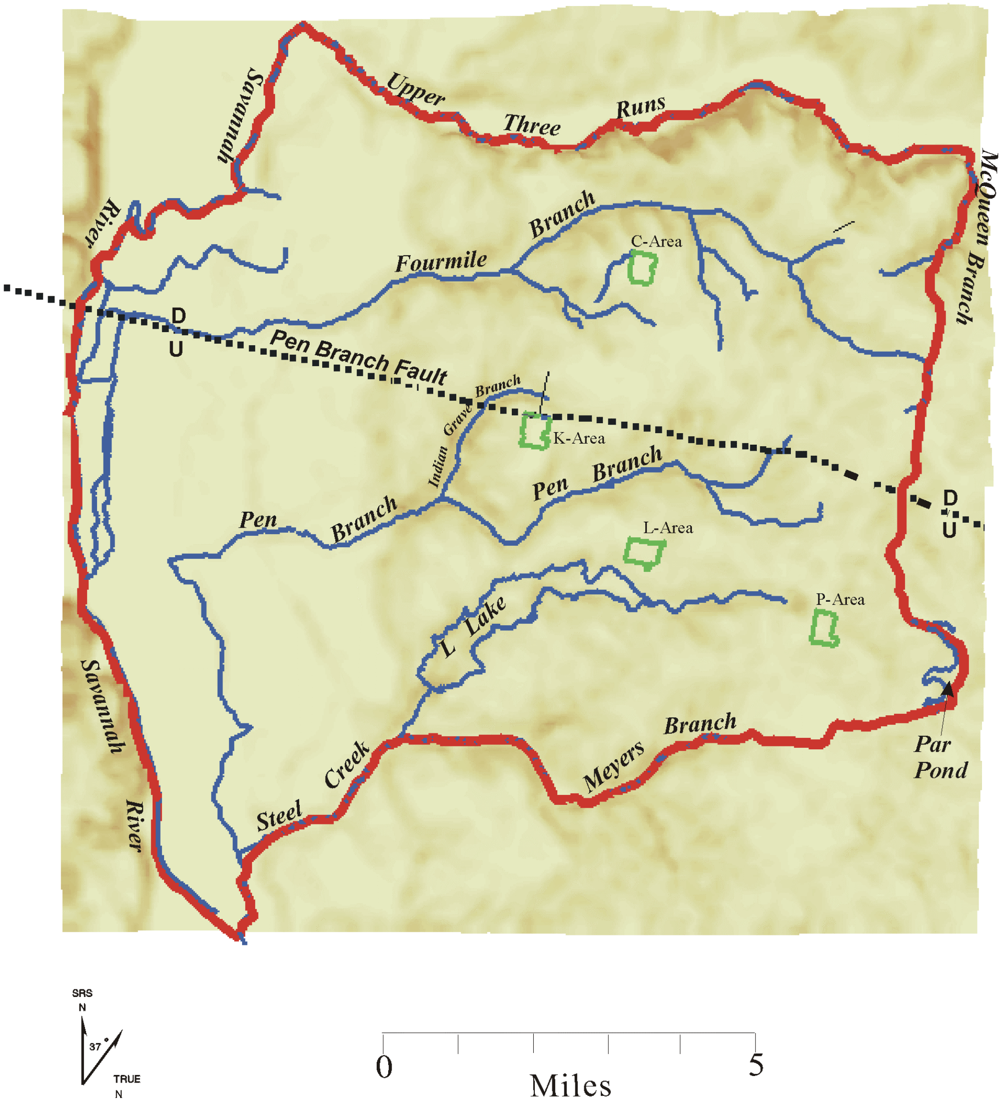


Figure 1-3. Location of Major Streams and Rivers in Model Area. Model Boundary Shown in Red

2.0 HYDROGEOLOGIC DATA AND CONCEPTUAL MODEL

2.1 SRS Geology

The SRS lies within the Atlantic Coastal Plain, a southeast-dipping wedge of unconsolidated and semi-consolidated sediment that extends from its contact with the Piedmont Province at the Fall Line to the edge of the continental shelf. The sediment ranges from Late Cretaceous to Miocene in age and comprises layers of sand, muddy sand, and mud with minor amounts of calcareous sediment (Fallaw and Price, 1995). The Coastal Plain sediment rests unconformably on Triassic-aged sedimentary rock of the Dunbarton Basin and Paleozoic-aged crystalline rock of the Appalachian orogen.

The Pen Branch Fault (PBF) offsets basement rock and Late Cretaceous to Tertiary-aged sediment beneath the CKLP GWMA (Figure 1-1). Seismic studies and stratigraphic correlation indicate that the Pen Branch Fault is a sub-vertical growth fault with down-to-the-northwest movement sense. The PBF probably represents reactivation of a border fault in the basement rock along the north margin of the Dunbarton Basin (Snipes and others, 1993; Stieve, 1994; Stieve and Stephenson, 1995). The part of the CKLP GWMA that is south of the PBF is underlain by Triassic-aged sedimentary rock.

2.2 SRS Hydrostratigraphic Units and Properties

The hydrostratigraphy of the SRS has been the subject of several different classification schemes. This report incorporates the hydrostratigraphic nomenclature currently established for the SRS region by Aadland and others (1995), who present a thorough review and description of the units. Figure 2-1 correlates the hydrostratigraphic nomenclature with the local lithostratigraphy as defined by Fallaw and Price (1995). This report addresses the up-dip part of the Floridan aquifer system and the top of the Meyers Branch confining system as defined by Aadland and others (1995).

The diagram in Figure 2-2 and the cross-sections in Figure 2-3 present the conceptual model used for this study and illustrate the relationship between the hydrostratigraphic units, the topography, and the recent alluvial material deposited in the Savannah River valley. The conceptual model accounts for movement along the PBF and its effect on the hydrostratigraphic units above the Meyers Branch confining system. The model assumes that strain accumulation within thees units is limited to non-brittle deformation of the sediment across the fault zone. The grid calculations made using EarthVision® software use a vertical fault to represent this zone which appears as a discontinuity in Figures 2-2 and 2-3. This

method best approximates the flexure of strata across the fault zone in terms of the EarthVision® grids, which are used as input for the groundwater model. The groundwater model assumes that this flexure does not affect the hydrologic properties of the units.

The lateral and vertical extent of the hydrostratigraphic units and the recent alluvium are very important hydrologically. The topography is a major factor in controlling the distribution of surface water and the configuration of the water table. Major tributaries of the Savannah River incise the hydrostratigraphic units down to the "tan clay" confining zone and, to a lesser extent, to the "lower" aquifer zone of the Upper Three Runs aquifer. The Savannah River and Upper Three Runs cut down into the Gordon aquifer. The depth to which the streams and river incise the underlying hydrostratigraphic units is an important factor in the localized and regional flow systems in the study area. Leeth and Nagle (1996) installed a series of borings along the Savannah River in the vicinity of SRS to determine the shallow subsurface geology of the flood plain and river terraces. Their results were used as a guide in determining the lateral and vertical extent of the alluvium in the CKLP GWMA. The thickness of the recent alluvial material in the river valley varies, and attains a maximum thickness of approximately 50 ft (Leeth and Nagle, 1996). Figures 2-2 and 2-3 depict the conceptual hydrostratigraphic model used for the CKLP GWMA and illustrate the extent to which the Savannah River has incised the hydrostratigraphic units. The Savannah River has cut down into the Gordon aquifer at the northern and southern ends of the valley but does not incise the Meyers Branch confining system within the model area. Figure 2-4 illustrates the base of the Savannah River alluvial valley as an altitude-contour map. The contours in Figure 2-4 define three smaller "valleys" that trend east-west across this surface. These structures represent input from the Upper Three Runs, Fourmile Branch, and Pen Branch tributaries into the main alluvial valley formed by the Savannah River. The isopach map in Figure 2-5 illustrates the thickness of the recent alluvium as used in the CKLP model. The alluvium attains a maximum thickness of between 40 and 50 feet in areas of confluence between major tributaries and the main river channel, and along the west bank of the present-day channel of the Savannah River. The asymmetry in the base of the alluvial valley and the variations in thickness of the alluvium is based on the findings of Leeth and Nagle (1996).

The following sections describe the lithologic characteristics along with the configuration of the tops and thickness of the hydrostratigraphic units mapped for this study. It should be noted that the tops of the hydrostratigraphic units correspond closely with unconformities in the SRS region recognized by Fallaw and Price (1995). All of the altitude contour maps have patterns that are consistent with the south-southeast dip of the Coastal Plain strata in this

region (Fallaw and Price, 1995). Isopach contours indicate variability in thickness, which is related to the varying degrees of erosion at the unconformable surfaces and structural relations with the PBF. Both the altitude contour maps and isopach maps have been constructed to depict down cutting and deposition of recent alluvial material by the Savannah River and its major tributaries. All of the maps exhibit contour patterns that reflect the variability in data density across the area. Directional references given in the following discussion are made with respect to the SRS grid system.

The project database includes permeability data from aquifer pumping tests, borehole permeability tests (slug tests), and laboratory tests of core samples from locations within the CKLP GWMA. Table 2-1 presents a summary of the permeability data collected for this study. The summary incorporates only data from locations for which boundaries of the major hydrostratigraphic units have been established as part of this study. Statistical calculations were made using averaged values from multi-well pumping tests and the average values from wells with results from both rising and falling-head slug tests.

Appendix A presents a summary of the data collection and modeling methods that were utilized for this investigation. Appendix B presents locations of data points, hydrostratigraphic boundaries, and a summary of the two-dimensional grids calculated from the boundaries. Appendix C presents permeability data from locations within the model area. Appendix D lists source documents for the data presented in Appendices B and C and summarized in Table 2-1.

2.2.1 Meyers Branch Confining System

The Meyers Branch confining system (MBCS) defines the base of the Floridan aquifer system beneath the study area. In the CKLP GWMA, the top of the MBCS is delineated by laterally continuous layers of dense, gray to black, clay and sandy clay of the Lang Syne Formation of the Black Mingo Group (Figure 2-1) (Aadland and others, 1991 and 1995).

The configuration of the top of the MBCS is illustrated with altitude contours in Figure 2-6. The MBCS exhibits a relatively gentle dip in a south-southwest direction. The top of this unit shows vertical offset of approximately 40 ft along the PBF. The Savannah River has not incised the MBCS within the CKLP GWMA.

Laboratory tests of 29 undisturbed samples taken from the MBCS indicate that vertical permeability ranges from 4.26E-06 to 3.40E-01 feet per day (ft/day)(Table 2-1). Tests of 27 undisturbed samples yield horizontal permeability values that range from 1.1E-05 to

1.5E+00 ft/day within this unit. These data show an arithmetic mean of 1.36E-02 ft/day for vertical permeability and 8.42E-02 ft/day for horizontal permeability, and a geometric mean of 2.43E-04 ft/day for vertical permeability and 6.64E-04 ft/day for horizontal permeability. The standard deviation is 5.58E-02 for vertical permeability and 3.01E-01 for horizontal permeability.

2.2.2 Floridan Aquifer System

The Floridan aquifer system overlies the MBCS and includes the Gordon aquifer, Gordon confining unit, and Upper Three Runs aquifer within the CKLP GWMA (Figure 2-1). The Upper Three Runs aquifer is recharged primarily by precipitation (Hiergesell, 1998a). Groundwater flow maintains a primarily vertical component from the Upper Three Runs aquifer down into the Gordon aquifer.

2.2.2.1 Gordon Aquifer

The Gordon aquifer constitutes the basal unit of the Floridan aquifer system beneath the CKLP GWMA and is the lowermost unit characterized in this report (Figure 2-1). Within the study area, the Gordon aquifer includes loose sand and clayey sand of the Congaree Formation and, where present, the sandy parts of the underlying Fourmile Branch and Snapp Formations (Figure 2-1), (Harris and others, 1990; Aadland and others, 1991 and 1995). The sand within the Gordon aquifer is yellowish to grayish orange and is sub- to well-rounded, moderately to poorly sorted, and medium- to coarse-grained. Pebbly layers and zones of sand cemented with iron and silica are common. The Gordon aquifer includes rare interbeds of light tan to gray clay that range up to three feet in thickness. Lenses of clay less than 6 inches in thickness are common near the base of this unit. The Gordon aquifer contains a small amount of sporadically distributed calcareous sediment.

The configuration of the top of the Gordon aquifer is illustrated in Figure 2-7. An isopach map is presented in Figure 2-8. The Gordon aquifer exhibits the same structural pattern as the MBCS with a regional dip to the south-southeast. The Gordon aquifer shows vertical offset approximately 40 feet along the PBF. The thickness of this unit is variable, ranging from approximately 60 feet to 160 feet. This variability is believed to be related to structural relations with overlying and underlying units and the presence of unconformities above and below the unit. In addition, the Gordon aquifer is incised along the Savannah River primarily in the vicinity of the PBF and along Upper Three Runs (Figure 2-7).

Laboratory tests of 21 undisturbed samples taken from the Gordon aquifer indicate that vertical permeability within this unit ranges from 3.12E-06 to 3.62E+01 ft/day (Table 2-1). Horizontal permeability values range from 2.44E-05 to 3.26E+01 ft/day within this unit. These data show an arithmetic mean of 1.87E+00 ft/day for vertical permeability and 6.07E+00 ft/day for horizontal permeability and a geometric mean of 2.09E-03 ft/day for vertical permeability and 4.18E-02 ft/day for horizontal permeability. The standard deviation calculated from these data is 7.88E+00 ft/day for vertical permeability and 1.18E+01 ft/day for horizontal permeability.

Results from 50 slug tests conducted on wells screened within the Gordon aquifer indicate permeability ranges from 5.00E-03 to 3.31E+01 ft/day (Table 2-1). The arithmetic mean from these data is 3.75E+00 ft/day and the geometric mean is 9.79E-01 ft/day. The standard deviation calculated from these results is 6.47E+00 ft/day. The permeability results were averaged for wells with both rising and falling-head tests.

Three multi-well pumping tests performed on wells screened within the Gordon aquifer give permeability values that range from 1.86E-04 to 4.50E+01 ft/day (Table 2-1). The arithmetic mean is 2.57E+01 ft/day and the geometric mean is 6.45E-01 ft/day. The standard deviation calculated from these results is 2.32E+01 ft/day.

Ten single-well pumping tests performed on wells screened within the Gordon aquifer give permeability values that range from 8.20E-01 to 1.43E+02 ft/day (Table 2-1). The arithmetic mean is 2.25E+01 ft/day and the geometric mean is 5.00E+00 ft/day. The standard deviation calculated from these results is 4.50E+01 ft/day.

Aadland and others (1995) present additional information on pumping tests conducted within the Gordon aquifer.

2.2.2.2 Gordon Confining Unit

The Gordon confining unit (GCU) separates the Gordon aquifer from the Upper Three Runs aquifer. This unit is commonly referred to as the “green clay” in previous SRS literature and includes sediment of the Warley Hill Formation (Figure 2-1). The unit comprises interbedded silty and clayey sand, sandy clay and clay. The clay is stiff to hard and is commonly fissile. Glauconite is a common constituent and imparts a distinctive greenish cast to the sediment, hence the informal name of “green clay” given to this unit. Zones of silica-cemented sand and clay are present within the GCU in some cores taken from the GSA. Beneath the CKLP GWMA, the GCU includes some calcareous sediment and limestone, primarily calcarenaceous

sand and clayey sand with subordinate calcarenaceous clay, micritic clay, and sandy micrite and limestone.

The GCU dips toward the south-southeast, increasing from approximately 10 feet to 80 feet in thickness (Figures 2-9 and 2-10). The southeastward thickening is primarily due to an increase in the quantity of fine-grained calcareous material within this unit beneath the southern half of the study area. The GCU is incised along the Savannah River to the north and south of the PBF and also incised along the southern boundary of Upper Three Runs (Figure 2-9).

Laboratory tests of 47 undisturbed samples taken from the GCU indicate vertical permeability ranges from 1.14E-06 to 4.27E-01 ft/day (Table 2-1). Tests of 30 undisturbed samples yield horizontal permeability values that range from 5.40E-06 to 1.22E-01 ft/day within this unit. These data show an arithmetic mean of 1.13E-02 ft/day for vertical permeability and 8.97E-03 ft/day for horizontal permeability and a geometric mean of 1.28E-04 ft/day for vertical permeability and 1.65E-04 ft/day for horizontal permeability. The standard deviation calculated from these data is 6.25E-02 ft/day for vertical permeability and 2.83E-02 ft/day for horizontal permeability.

Aadland and others (1995) discuss leakance estimates derived from multiple well pumping tests.

2.2.2.3 Upper Three Runs Aquifer

The Upper Three Runs aquifer (UTRA), as defined in this report, includes all strata from the ground surface to the top of the GCU. The UTRA includes the informally named “upland” unit, Tobacco Road Sand, Dry Branch Formation, Clinchfield Formation, and Santee Limestone (Figure 2-1). For the purposes of hydrostratigraphic analysis, the UTRA is often locally divided into informal “lower” and “upper” aquifer zones which are separated by the “tan clay” confining zone (Figure 2-1). The informal zones are further differentiated into intervals where local hydrologic conditions and model resolution requirements warrant additional hydrogeologic detail.

“Lower” Aquifer Zone. The “lower” aquifer zone (LAZ) of the UTRA beneath the CKLP GWMA consists of dominantly fine-grained, well-sorted sand and clayey sand of the Santee Formation and parts of the Dry Branch Formation which are beneath the “tan clay” confining zone (Figure 2-1). The bulk of the carbonate sediment beneath the CKLP GWMA is contained within the Santee Limestone and lower part of the Dry Branch Formation and is

included in the LAZ. Descriptions of drill core indicate that the carbonate sediment in this vicinity has a significant siliciclastic component, and consists primarily of calcarenaceous sand, micritic sand, shelly sand, with minor amounts of sandy calcarenite and shelly limestone.

Altitude-contour and isopach maps of the LAZ are presented in Figures 2-11 and 2-12. The configuration of the top of the LAZ is similar to that of the GCU. The thickness of the LAZ ranges from approximately 30 feet to 110 feet. The wide range in thickness is attributed primarily to erosion of this unit on the overlying unconformity. The LAZ is deeply incised by Upper Three Runs and the Savannah River within the model area (Figure 2-11).

Laboratory tests of 30 undisturbed samples taken from the LAZ indicate that vertical permeability ranges from 4.54E-06 to 3.42E+00 ft/day (Table 2-1). Tests of 26 undisturbed samples yield horizontal permeability values that range from 1.59E-05 to 1.11E+01 ft/day within this unit. These data show an arithmetic mean of 1.58E-01 ft/day for vertical permeability and 7.07E-01 ft/day for horizontal permeability and a geometric mean of 3.26E-03 ft/day for vertical permeability and 1.31E-02 ft/day for horizontal. The standard deviation calculated from these data is 6.25E-01 ft/day for vertical permeability and 2.20E+00 ft/day for horizontal permeability.

Results from 31 slug tests conducted within the LAZ indicate permeability ranges from 1.30E-01 to 2.44E+01 ft/day (Table 2-1). The arithmetic mean from these data is 3.28E+00 ft/day and the geometric mean is 1.38E+00 ft/day. The standard deviation calculated from these results is 5.60+00 ft/day.

Two multi-well pumping tests of wells screened within the LAZ indicate permeability ranges from 1.23E+00 to 2.10E+00 ft/day (Table 1). The arithmetic mean is 1.67E+00 ft/day and the geometric mean is 1.63E+00 ft/day (Table 1). The standard deviation calculated from these results is 6.13E-01 ft/day.

“Tan Clay” Confining Zone. The “tan clay” confining zone (TCCZ) of the UTRA is equivalent to the “tan clay” zone referred to in previous SRS reports. The includes sediment assigned to the Twiggs Clay and Irwinton Sand Members of the Dry Branch Formation (Figure 2-1). The zone contains light-yellowish tan to orange clay and sandy clay interbedded with clayey sand and sand. Clay layers are dispersed vertically and horizontally throughout the zone and are probably not laterally continuous over distances greater than 100 to 200 feet (Harris and others, 1990; Aadland and others, 1991). Beneath the CKLP GWMA, the TCCZ consists of two sequences of interbedded mud and sand with some calcareous sediment. The

lower sequence contains light green to tan, slightly fissile clay and silty sand that is commonly interbedded with sand, silty sand, and coarse-grained, carbonate gravels. The carbonate gravels consist of oysters and other shell debris that are mixed with mud, sand, and gravel. The lower sequence commonly includes interbeds of relatively dense, well-indurated layers of a matrix-supported, shelly, sandy carbonate mudstone. This material consists of siliciclastic sand, mud, and gravel, shell debris, and other carbonate fragments contained in a matrix of mud-sized carbonate material (micrite).

The upper sequence within the TCCZ consists of interbedded siliciclastic sand and mud. The mud is waxy and commonly fissile, suggesting a very high clay content. The interbedded sand is generally well-sorted and medium-grained, with good interstitial porosity. The interbeds within this sequence vary from less than one to five feet in thickness. The individual layers of sand and mud cannot normally be correlated from core to core, but characteristic geophysical and CPT signatures can be readily identified at most data points, indicating that this interval is laterally continuous.

The configuration of the top of the TCCZ is illustrated in Figure 2-13 and an isopach map of the unit is presented in Figure 2-14. The configuration of the top of the TCCZ is very similar to that of the underlying LAZ. The measured thickness of the TCCZ ranges from approximately 10 feet to 20 feet. The TCCZ is deeply incised by the Savannah River, Upper Three Runs, Fourmile Branch, and Steel Creek and Meyers Branch within the model area (Figure 2-13).

Laboratory tests of 43 undisturbed samples taken from the TCCZ indicate vertical permeability ranges from 3.70E-08 to 2.39E-01 ft/day (Table 2-1). Tests of 29 undisturbed samples yield horizontal permeability values that range from 1.45E-05 to 2.04E-01 ft/day within this unit. These data show an arithmetic mean of 9.96E-03 ft/day for vertical permeability and 1.51E-02 ft/day for horizontal permeability and a geometric mean of 7.68E-05 ft/day for vertical permeability and 2.68E-04 ft/day for horizontal permeability. The standard deviation calculated from these data is 4.00E-02 ft/day for vertical permeability and 4.83E-02 ft/day for horizontal permeability.

“Upper” Aquifer Zone. The “upper” aquifer zone (UAZ) of the UTRA includes all strata from the ground surface to the top of the TCCZ. The UAZ includes the “upland” unit, Tobacco Road Sand, and part of the Dry Branch Formation (Figure 2-1). Massive beds of sand and clayey sand with minor interbeds of clay characterize the UAZ. The sediment within the “upland” unit is commonly very dense and clayey and often contains gravely sand.

The top of the UAZ is defined by the present-day topographic surface. The UAZ may be subdivided into four hydrostratigraphic intervals which are delineated by characteristic log signatures of tip, sleeve, and pore pressure data from the CPT tool. From the bottom up, these intervals include the “transmissive zone”, “AA” interval, “A” interval, and an undifferentiated soils interval (“uu” interval) (Figure 2-1). Altitude-contour and isopach maps of these intervals are presented as Figures 2-15 through 2-21. Each interval bears distinctive CPT log signatures, which are indicative of their overall hydrogeology. These intervals have only been identified on a local basis prior to this report. This study presents the first attempt at correlating these intervals on a regional scale at the SRS.

The “transmissive zone” (TZ) corresponds with the interval of relatively clean sand that is correlative with the upper parts of the Dry Branch Formation (Figure 2-1). Logs of CPT data from this interval typically show very high tip and sleeve values with relatively low tip/sleeve ratios (Figure 2-22). The tip/sleeve ratios from the TZ normally produce very smooth patterns on CPT logs. This is probably indicative of the relatively massive sand layers that constitute this unit. The base of the TZ is commonly found at elevations between 170 and 190 ft msl and is picked where the relatively high friction ratio and pore pressure values of the TCCZ drop to values that are generally less than 2.0, and the tip and sleeve values both demonstrate abrupt increases which are sustained with decreasing depth (Figure 2-22).

Figure 2-15 Presents an altitude contour map for the top of this unit. The map indicates that the TZ follows the regional dip toward the south-southeast. Local high and low areas on this surface generally correlate with highs and lows on the top of the TCCZ (Figure 2-13) The isopach map for the TZ is shown in Figure 2-16. The map indicates a prominent thick area in the eastern half of the central part of the study area. This area corresponds with an isolated low area on the top of the TCCZ (Figure 2-13). The thickness of the TZ varies locally, but generally increases in a southeast direction.

The base of the “AA” interval is delineated from CPT logs where relatively small and constant friction ratio values in the TZ increase abruptly, and the tip and sleeve values both show a significant decrease. The base of the “AA” interval is commonly found at elevations between 220 and 200 (ft msl). Within the “AA” interval, logs of tip and sleeve readings indicate relatively low and generally consistent values which are accompanied by an erratic pattern of highly variable friction ratio readings (Figure 2-22). Logs of tip and sleeve readings from the “AA” interval generally have a “blocky” appearance when compared with tip and sleeve data from the TZ (Figure 2-22). The generally blocky pattern of the tip and sleeve curves and the highly variable and erratic friction ratio curve indicate the “AA” interval consists of a

sequence of interbedded sand, and silty sand, probably of much lower permeability than the underlying TZ. The sediment contained within the "AA" interval is generally correlative with the lower parts of the Tobacco Road Sand (Figure 2-1). A comparison of CPT logs with geologic and geophysical data from the same location indicates that the base of the "AA" interval corresponds with the base of the Tobacco Road Sand.

Figure 2-17 Presents an altitude-contour map of the top of this unit. The contour patterns suggest two ridges and a trough that trend east-west across the area. The axis of the trough trends across the approximate center of the study area. The isopach map (Figure 2-18) suggests the ridges correspond with thicker parts of the unit, and the troughs with areas where the unit is thinner. The "grain" of the isopach contours in Figure 2-18 Follows the trends of the axes of the trough and ridges in Figure 2-17.

The "A" interval is correlative with the upper parts of the Tobacco Road Sand. The base of the "A" interval is delineated on CPT logs where the friction ratio curve changes abruptly from the highly variable values and erratic pattern of the "AA" interval to much smaller values with a "stable" curve pattern (Figure 2-22). This pattern is indicative of a more massively bedded unit with a permeability that is probably somewhat higher than that of the "AA" interval. The tip and sleeve values near the base of the "A" interval are often relatively large, and commonly show a gradual decrease up-section with a corresponding gradual increase in friction ratio values. These log-pattern changes correlate with the fining-upward sequence that is commonly observed in continuous core samples taken from the upper part of the Tobacco Road Sand. Figure 2-22 illustrates this relationship between the CPT log patterns and the lithology changes within this unit. Figures 2-19 and 2-20 present altitude-contour and isopach maps for this interval.

The uppermost UAZ consists of the fluvial sediments of the "upland" unit, recent alluvial material deposited by active stream reaches (outside of the Savannah River) and any local soil horizons which have formed in-situ from any of the lithostratigraphic units. For the purposes of this study, all of these have been grouped into a single "undifferentiated upper soils" ("uu") interval. Figure 2-1 illustrates the relative position of the "uu" interval with respect to the underlying units.

The "uu" interval can usually be identified on CPT logs where the sleeve stress values show a significant increase (up-section). This change accompanied by a drastic and abrupt increase in the friction ratio commonly to sustained values in excess of five (Figure 2-22). Friction ratio values within the "uu" interval generally exhibit an irregular pattern of drastic changes that

often define groups, giving the curve a rough, "blocky" pattern (Figure 2-22). The top of the "uu" interval commonly only contains material that displays very low tip and sleeve values. These readings represent material that is interpreted to be the near-surface soil horizon. Because the "uu" interval includes the sediments assigned to the "upland" unit and surficial soil horizons, it typically appears as a "draping" over the top of the other units, when viewed in three dimensions or in cross-section (Figures 2-2 and 2-3). This is also suggested by the isopach contour patterns for this unit (Figure 2-21).

Laboratory tests of 17 undisturbed samples taken from the UAZ indicate vertical permeability ranges from 5.680E-06 to 2.77E-01 ft/day (Table 2-1). Tests of 14 undisturbed samples yield horizontal permeability values that range from 3.12E-05 to 6.04E+00 ft/day within this unit. These data show an arithmetic mean of 1.90E+00 ft/day for vertical permeability and 1.06E+00 ft/day for horizontal permeability, and a geometric mean of 1.19E-02 ft/day for vertical permeability and 4.02E-02 ft/day for horizontal permeability. The standard deviation calculated from these data is 6.67E+00 ft/day for vertical permeability and 2.10E+00 ft/day for horizontal permeability.

Results from 11 slug tests conducted within the UAZ give permeability values ranging from 6.32E-02 to 1.22E+01 ft/day (Table 2-1). The arithmetic mean from these data is 2.09E+00 ft/day and the geometric mean is 6.76E+00 ft/day. The standard deviation calculated from these results is 3.62E+00 ft/day.

Table 2-2 presents a summary of permeability measurements made on samples taken from locations where the informal intervals within the UAZ have been delineated.

2.3 Hydrogeology

2.3.1 Water Table

The water table aquifer is contained within the UTRA and includes all saturated material from the water table to the top of the GCU. The water table aquifer is commonly divided into the informal UAZ and LAZ, separated by the TCCZ. For this report, no distinction is made for the upper and lower zones because the majority of well data is from the upper zone as there are very few wells screened in the lower part of the water table aquifer within the model area at this time. A water table map of the reactor areas model domain shown in Figure 2-23.

The configuration of the water table is tightly controlled by the local topography and drainage system. Wells are scarce in the reactors area with the majority of the wells located around the

reactor facilities. Therefore, for this project a study was conducted to characterize stream baseflow and supplement water table configuration along Indian Grave Branch and the upper part of Pen Branch within the model domain (Figure 2-24; Appendix E), (Hiergesell, 1998b,c). Water level measurements were obtained from selected wells along with careful examination of flowing reaches of the headwater segments of the streams. The water table map (Figure 2-23) was further refined with this data.

In addition to the regional water table map for the area, Figures 2-25 through 2-28 illustrate the water table configuration in C, K, L, and P reactor areas. For further discussion of the water table in the reactor areas the reader is referred to Hiergesell (1988a).

2.3.2 Gordon Aquifer Potentiometric Surface

The Gordon aquifer is the lowermost aquifer addressed in this study and represents the basal unit of the Floridan aquifer system in the CKLP GWMA (Figure 2-1). Figure 2-29 illustrates the potentiometric surface of the Gordon aquifer in the model domain. Groundwater data from this unit are somewhat limited in the CKLP GWMA. The surface shown in Figure 2-29 incorporates mean water levels from wells screened within the Gordon aquifer and surface elevations from Upper Three Runs and Hollow Creek in areas where the Gordon aquifer meets the land surface (Hiergesell, 1999). The Gordon aquifer discharges to the Upper Three Runs valley to the north-northwest and to the Savannah River valley to the west-southwest.

2.3.3 Hydraulic Head Targets

In addition to construction of potentiometric maps for conceptual understanding of groundwater flow and boundary condition specification (e.g. Figures 2-23 and 2-29), hydraulic head data are valuable model calibration targets. Because steady-state groundwater flow is the focus of this effort, long-term, time-averaged head data are of the greatest interest as targets for model calibration. The primary source of uncertainty in mean water level is the transient fluctuation in individual readings that are on the order of a few feet. Errors in surveys, water-level readings, and other similar measurements are generally very small by comparison.

Water level data for most wells at the SRS are available from the Geochemical Information Management System (GIMS), which can be accessed through the Savannah River Information Network Environment (ShRINE). The data are also published in periodic well inventory and monitoring reports; see Environmental Protection Department and Exploration Resources, Inc. (1996a, b) for example. GIMS archives data obtained through a groundwater monitoring

program administered by the Environmental Monitoring Section (EMS) of the Environmental Protection Department (EPD). The GIMS database is known to contain erroneous entries. Outliers were identified as single readings that deviated from the average value by more than 20 ft and eliminated. With the remaining data, the sample standard deviation of the mean value was computed as (Walpole and Myers, 1978, section 5.5)

$$s_m = \frac{s}{\sqrt{n}} = \frac{1}{\sqrt{n}} \times \left[\frac{1}{n-1} \sum_{i=1}^{n} \left(h_i - \bar{h} \right)^2 \right]^{1/2}$$

Mean values with an uncertainty exceeding 3 ft at 95% confidence ($2s_m > 3$ ft) were eliminated, with the idea that uncertainty in a hydraulic head target should not exceed the calibration goal. Previous models covering relatively small areas of the SRS have generally achieved a root-mean-square residual of 3 ft (e.g. Camp Dresser & McKee, 1989; GeoTrans, 1992; Flach and Harris, 1997). Given the large scale and coarse resolution anticipated for CKLP model, a calibration goal of 3 ft may be too low. Sample standard deviations could not be computed for wells with a single reading, and the single reading was accepted the target for steady-state flow calibration.

Valuable data from wells not included in the EMS monitoring program are also available. The Environmental Science and Technology Department (ES&TD) has monitored the P-series wells and other SRS wells for several years (Hiergesell, 1998). Water level data are also available from Environmental Restoration Department (ERD) documents, such as the RFI/RI/BRA for the CMP Pits (WSRC, 1996). In 1998, piezometer clusters were installed at 17 locations across the reactors area for the purpose of defining water levels in remote areas (Figure 2-30) (WSRC, 1999). The two-piezometer clusters targeted the "upper" and "lower" UTRA. These data supplement the head targets derived from the GIMS database.

Appendix F contains the resulting list of hydraulic head targets. Each well was assigned to the appropriate hydrostratigraphic unit, as defined by the picks and grids presented in Section 2.2. The results are summarized in Table 2-3. Wells assigned to the Gordon aquifer are screened completely within the Gordon aquifer. Wells and piezometers above the Gordon confining unit are assigned to an aquifer zone if at least half the screen lies within that zone. Otherwise, the water level is ignored as model calibration target. There are a total of 1137 targets within the model domain.

2.4 Groundwater Recharge and Discharge

Groundwater flow in upper aquifers at the Savannah River Site is driven by recharge, with streams intercepting flow from areas of higher groundwater elevations (Figures 2-23 and 2-29). Nearly all recharge within the CKLP model area discharges to streams within or bounding the same area, usually the nearest stream. For this type of groundwater flow system, recharge and discharge estimates, coupled with head measurements and confining unit leakance estimates, define the overall horizontal conductivity values of upper aquifers required to calibrate a numerical flow model. Because conductivity data at the model scale are typically non-existent, groundwater flow estimates are important model calibration targets.

At least three independent investigations of surface groundwater recharge have been performed in or near the SRS. Parizek and Root (1986) conducted a detailed hydrologic budget study of the McQueen Branch basin. They estimated average recharge for the basin at 15.6 in/yr. Parizek and Root (1986) computed this value by dividing the total volumetric rate of recharge by the total basin area. The average recharge rate excluding seepage/wetland areas would therefore be somewhat larger. Hubbard (1984, 1986) conducted a multi-year lysimeter study at the SRS burial grounds in the General Separations Area and measured an average recharge of about 16 in/yr for grass cover. Based on lysimeters with small pine trees growing within them, Hubbard (1986) estimated recharge to be 6 in/yr for forested areas. Hubbard (1986) also reported that Denehy and McMahon (1985) measured 15 in/yr of recharge at the Chem-Nuclear site in Barnwell, South Carolina. Parizek and Root (1986) and Looney and others (1987) report that Cahill (1982) estimated recharge to be about 15 in/yr at the Low Level Radioactive Solid Waste Burial Site near Barnwell, South Carolina (Chem-Nuclear). It is unclear from the literature cited here whether the Denehy and McMahon (1985), and Cahill (1982) studies are related, apart from being conducted at the same location.

From these studies, the average recharge over the Savannah River Site is estimated to be about 15 in/yr. The average rate excluding groundwater discharge areas would be somewhat higher. This estimate may be high due to a bias toward analysis of developed areas that tend to be less forested and flatter. The data for forested conditions are difficult to reconcile. Hubbard (1985) estimated recharge at 6 in/yr for forested areas. On the other hand, the vegetation of McQueen Branch basin studied by Parizek and Root (1986) study was 85% evergreen and deciduous forest, and produced an estimate of nearly 16 in/yr. The average of these two estimates is 10 in/yr. Considering that the area of interest in this study is relatively undeveloped and heavily forested, perhaps a reasonable range to consider for groundwater flow modeling sensitivity studies is 10 to 16 in/yr.

To support this and subsequent modeling efforts in the C, K, L and P areas, stream base flow was estimated by analyzing U. S. Geological Survey (USGS) stream gauging station data (Cooney and others, 1998, for example) and measuring stream flow rate under low flow conditions (Hiergesell, 1998b, 1998c). The USGS data provide large-scale estimates of base flow. Complementing these estimates, Hiergesell (1998b, 1998c) measured base flow for small streams. Appendix E-1 describes the simple hydrograph separation techniques that were used to estimate the long-term average rate of groundwater discharge to large-scale stream reaches within the CKLP reactor area. Appendix E-2 presents the data of Hiergesell (1998). Selected results from these studies are summarized in Tables 2-4 and 2-5. Table 2-5 emphasizes the larger stream flows around C-area and K-area because these reactors areas are currently of most interest. Hiergesell (1998b, 1998c) also estimated the point of effluence along small streams and refined an ARC/INFO USGS coverage of live stream reaches, as illustrated by Figure 2-31.

The Pen Branch and Fourmile Branch base flow estimates are the most reliable calibration targets. For Meyers Branch and Upper Three Runs, there is added uncertainty in the fraction of base flow that can be attributed to the modeled area. The Steel Creek and Upper Three Runs estimates are based on the difference of large numbers compared to the baseflow estimate. Base flow estimates for these reaches have higher uncertainty as well. The more reliable base flow calibration targets may have an uncertainty of 15 to 25% (Appendix E). The Steel Creek base flow estimate is negative and indicates a losing reach, perhaps reflecting artificial flow to L-Lake to maintain a historic level of 190 ft msl. The Indian Grave Branch and Pen Branch field measurements in Table 2-5 are not consistent with the baseflow estimate for all of Pen Branch in Table 2-4. The measured flow in Pen Branch below its confluence with Indian Grave Branch (15.8 cfs) exceeds the estimated base flow for the entire stream (13.3 cfs). The discrepancy is likely due to uncertainties and measurement errors in both analyses, or that base flow conditions were not present on December 18, 1997.

2.5 Conceptual Model of Groundwater Flow

From Figure 2-23, groundwater flow in the Upper Three Runs aquifer is seen to be driven by recharge, with nearby streams intercepting flow from higher elevations. The underlying Gordon aquifer is strongly influenced by the Savannah River and Upper Three Runs, which appear to completely drain the aquifer and function as no-flow lines (Figure 2-29). Except for reactor area outfalls and the lower portion of L Lake, surface water bodies gain from groundwater discharge. Aadland and others (1995, Plate 17) gives the leakance of the Crouch Branch confining unit (of the Meyers Branch confining system) as roughly 3×10^{-6} day^{-1}, which corresponds to 0.13 in/yr for every 10 ft of head difference. The head difference across the Crouch Branch confining unit is centered near zero (Aadland and others, 1995, Figure 30). Flow across the unit is therefore a small fraction of total recharge, and could probably be neglected. A representative leakance coefficient for the Gordon confining unit in the study area appears to be roughly 10^{-5} day^{-1} (Aadland and others, 1995, Plate 13). The head difference across the Gordon confining is highly variable due to large variation in the water table. Supposing a head difference of 50 ft for example, the Darcy velocity through the unit would be 2.2 in/yr or 15% of surface recharge. Therefore, groundwater flow in the Gordon aquifer appears to be influenced significantly by recharge from the overlying UTR aquifer, and lateral flow into the model domain, mainly from the east. L-Lake and Par Pond are major lakes that have an important influence on nearby groundwater flow. The Site Utilities Department well database on ShRINE indicates that no more than three producing wells are screened in the Gordon aquifer (905-136G, 905-126G, and 905-103G). These wells serve small facilities and have a maximum capacity of 25 gpm or less. Considering that actual usage would be much lower, the impact of these wells is insignificant at the regional scale. The impact of the Pen Branch fault on confining unit leakance is uncertain.

Solute groundwater contamination originating in the C, K, L or P areas is expected to be confined to the Upper Three Runs and Gordon aquifers. Most surface recharge discharges to the nearest stream, with the balance entering the Gordon aquifer. As groundwater in the Gordon aquifer flows toward the Savannah River or Upper Three Runs, the gradient between the Crouch Branch and Gordon aquifers becomes upward ensuring ultimate discharge to the Savannah River or Upper Three Runs. Contamination is not expected to enter the Crouch Branch aquifer.

2.6 Hydrologic Properties

In addition to the unit-specific hydraulic conductivity data discussed above, soil characteristic curves, effective porosity, and specific storage data are needed for model development. The steady-state hydraulic head and Darcy velocity fields in the saturated zone are affected only by horizontal and vertical hydraulic conductivity, making these remaining properties less critical to model development. Soil characteristic curves (capillary suction and relative permeability as a function of water saturation) affect the flow solution in unsaturated regions. Effective porosity affects groundwater "particle" tracing results, which rely on the pore velocity field. Specific storage affects transient flow only, and then only in confined aquifer systems for practical purposes. Characterization data available for defining these hydraulic properties in the model are identified below. Given the general scarcity and uncertainty in the data, generic estimates to be applied model-wide are appropriate.

2.6.1 Soil Characteristic Curves

Relative permeability and capillary suction head as a function of water saturation are referred to as soil characteristic curves. These relationships are difficult to measure accurately, and testing is expensive. Very little data are available for SRS unconsolidated sediments. O'Brien & Gere (1991) obtained a small set of water retention (capillary suction versus saturation) data for M-Area sediment samples. The data have been plotted by Flach and others (1996, Figures 11 and 12). Yu and others (1993) obtained both relative permeability and water retention data for remolded GSA sediments to be used for Environmental Restoration construction projects. Recently, Amidon (1996) obtained water retention data from 3 undisturbed soil samples collected from the vadose zone around the Burial Grounds Complex. According to Looney and others (1987), Gruber (1981, 1983) and Parizek and Root (1986) measured soil water content in the vadose zone and suggested the average water content is approximately 30% (water volume/total volume). Given the scarcity of the data and lacking a specific need for accurate vadose zone modeling in a regional scale model, a simplified approach for defining soil characteristic curves is taken as shown in Figure 2-32. The curves are chosen to align with data for sandy sediments as opposed to clayey sediments (see Flach and others (1996), Figures 11 and 12). The relative permeability at residual saturation is set to 0.1 instead of zero to avoid slow convergence. These "pseudo-soil" characteristic curves are adequate for transporting water and contaminants through the vadose zone to the water table, provided detailed, accurate information about the unsaturated zone is not needed. The most important aspect of these curves is the assumed residual saturation value (40%), which

has the strongest effect on average vadose zone saturation. Groundwater travel times through the vadose zone are affected by saturation through pore velocity.

2.6.2 Effective (Kinematic) Porosity

Aadland and others (1995, p. 44) analyzed laboratory data from 83 selected sediment samples taken from various low permeability beds within the Upper Three Runs aquifer. For 28 “clayey to very clayey, often silty, sand” samples the total porosity averaged 40%. For 55 “sandy, often silty clay, and clay” samples, the average total porosity is 41%. Aadland and others (1995, Table 3) also calculated the total porosity of the sandy portions of the Upper Three Runs aquifer using the Beard and Weyl (1973) method, and arrived at an average total porosity of 35%. For the Gordon aquifer, the result is 34% (Aadland and others, 1995, Table 7). More recently, Smits and others (1997) compiled a database of porosity measurements for the General Separations Area. The arithmetic average of these values, mostly from low permeability samples, is 45%. From these data and analyses, total porosity in aquifer zones appears to average about 40%.

An “effective” porosity value, smaller than the total porosity, is commonly used for transport simulations and particle tracing related to contaminant migration. As discussed by De Marsily (1986, Chapter 2), two types of porosity are commonly and unfortunately referred to as “effective porosity”. The first is specific yield or drainage porosity of an unsaturated soil, ω_d, and the second is kinematic porosity of a saturated medium, ω_c. Section 2.3.3 of De Marsily (1986) summarizes which porosity (total included) to use for which application. For saturated-zone particle tracing and transport simulations, the kinematic porosity is appropriate and the focus of effective porosity discussions in this report.

An effective porosity can be used to account for regions of relatively immobile water, ranging from grain-sized “dead-end” pores to macro-scale clay intervals, which do not effectively participate in contaminant transport. The presence of immobile water does not necessarily dictate the use of an effective porosity (De Marsily, 1986, p. 259). If the solute contaminant perfectly penetrates the immobile water (K’=1, C’=C in De Marsily (1986)) (or there is no immobile water), then total porosity is appropriate (ω). On the other hand, if a model block contains sub-regions of immobile water that a solute will not penetrate (K’=0, C’=0), then a lower, “effective” porosity is appropriate (kinematic, ω_c).

Effective porosity can be estimated by assuming that only the largest scale regions of relatively immobile water are not effectively penetrated by contaminant. At smaller scales, contaminant

is able to effectively diffuse into regions of immobile water. Macro-scale regions of immobile water can reasonably be defined as sediment intervals with more than 25% mud. For the General Separations Area, 32% of the nearly 40,000 ft of sediment core contains greater than 25% mud, based on analysis of the lithologic data compiled by Smits and others (1997). This suggests that as low as 68% of a typical aquifer is effectively available for contaminant transport, and that effective porosity is approximately 25% (68% of 40% total porosity). This estimate may be a conservative (low) estimate for effective conductivity, because in reality some contamination would penetrate the lower conductivity intervals. This value is consistent with the recommendations of Looney and others (1987, p. 39), who recommend assuming an effective porosity of 0.2 for risk calculations. Transport sensitivity studies should consider an effective porosity range of approximately 20% to 40%.

2.6.3 Specific Storage

Specific storage is relevant only to transient flow simulations, and therefore has no effect on the steady-state results presented in later sections. Specific storage is defined by (Freeze and Cherry, 1979, p. 59)

$$S_s = \rho g(\alpha + \eta\beta)$$

where

S_s	specific storage
ρ	density of water (~1000 kg/m^3)
g	gravitational acceleration (9.8 m/s^2)
α	compressibility of porous medium
η	total porosity
β	compressibility of water ($4.4\text{x}10^{-10}$ m^2/N)

Compressibility ranges from 10^{-6} to 10^{-8} m^2/N for clay and from 10^{-7} to 10^{-9} m^2/N for sand (Freeze and Cherry, 1979, Table 2.5). Assuming a nominal compressibility value of 5×10^{-8} m^2/N and a total porosity of 40% yields $1.5\text{x}10^{-4}$ ft^{-1} for specific storage.

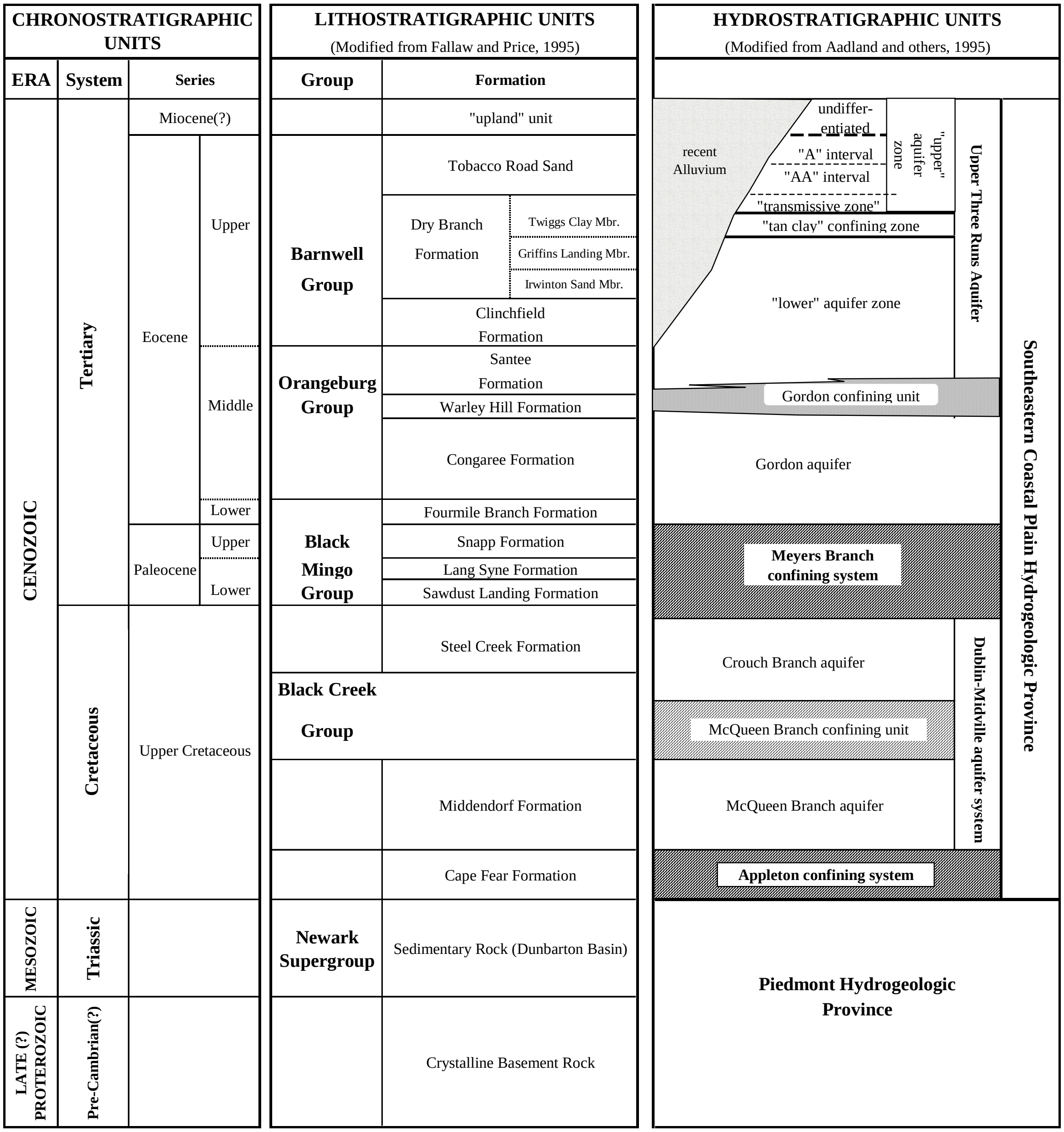


Figure 2-1. Comparison of Lithostratigraphic and Hydrostratigraphic Units at SRS

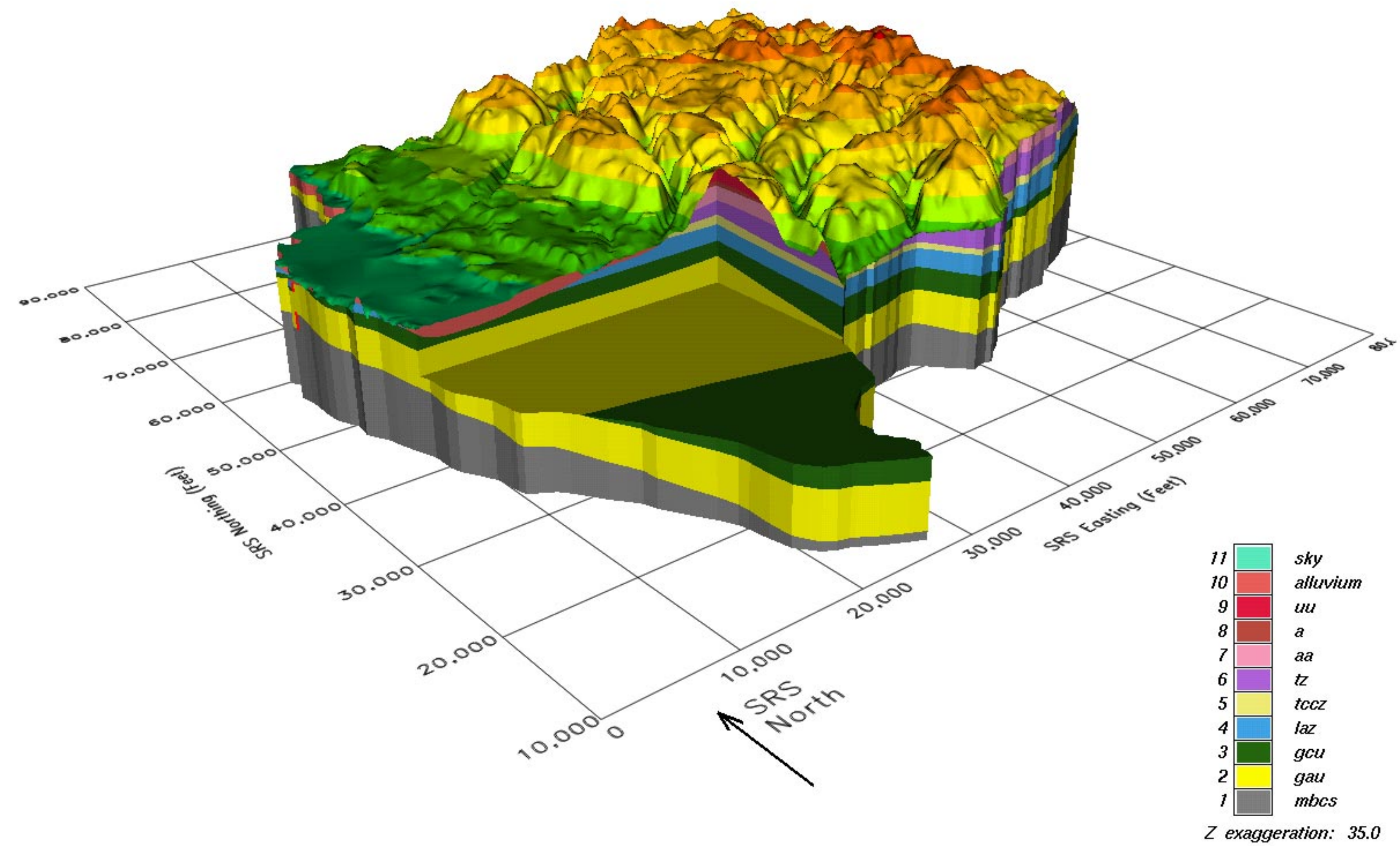


Figure 2-2. Conceptual Hydrostratigraphic Model

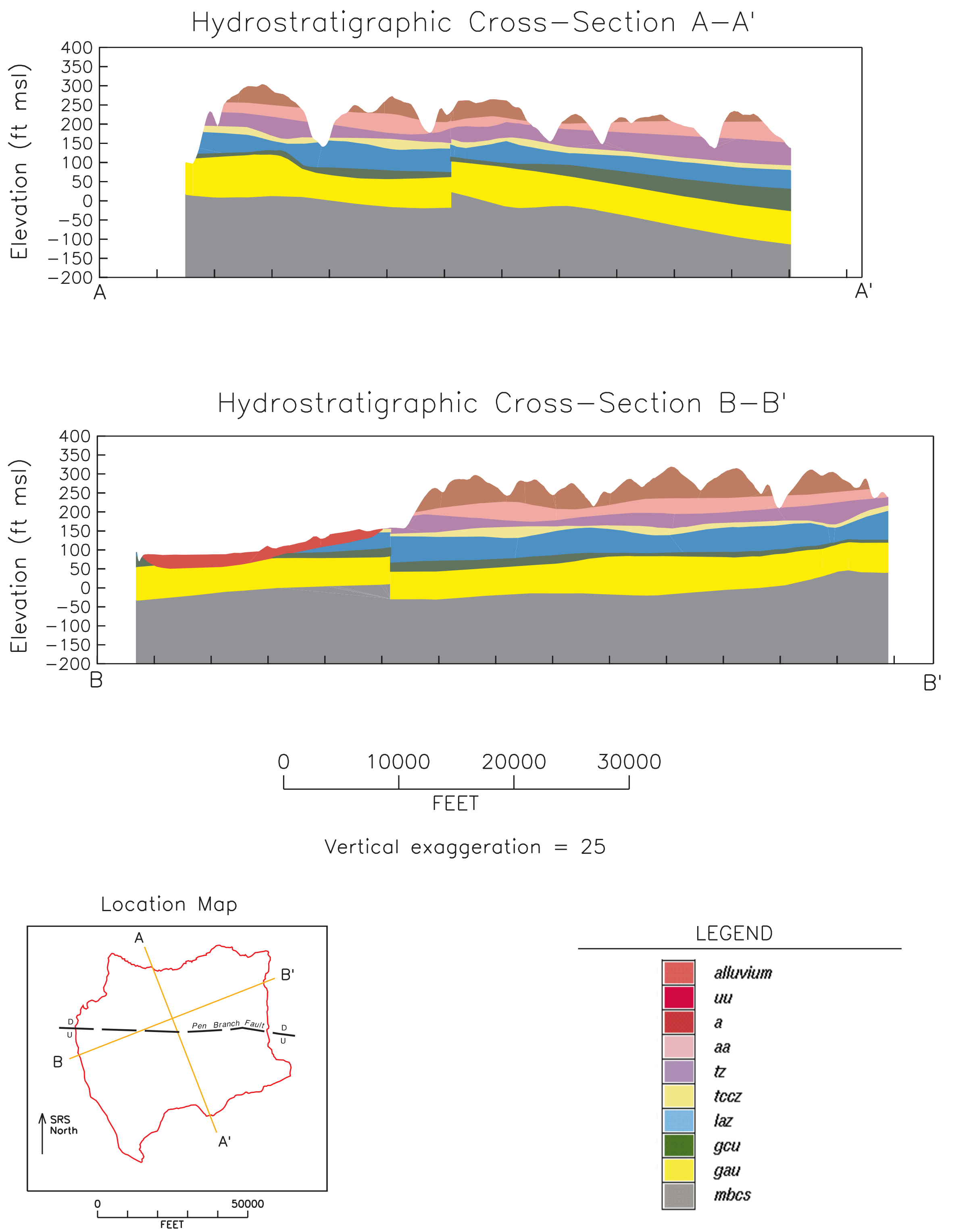


Figure 2-3. Hydrostratigraphic Cross-Sections

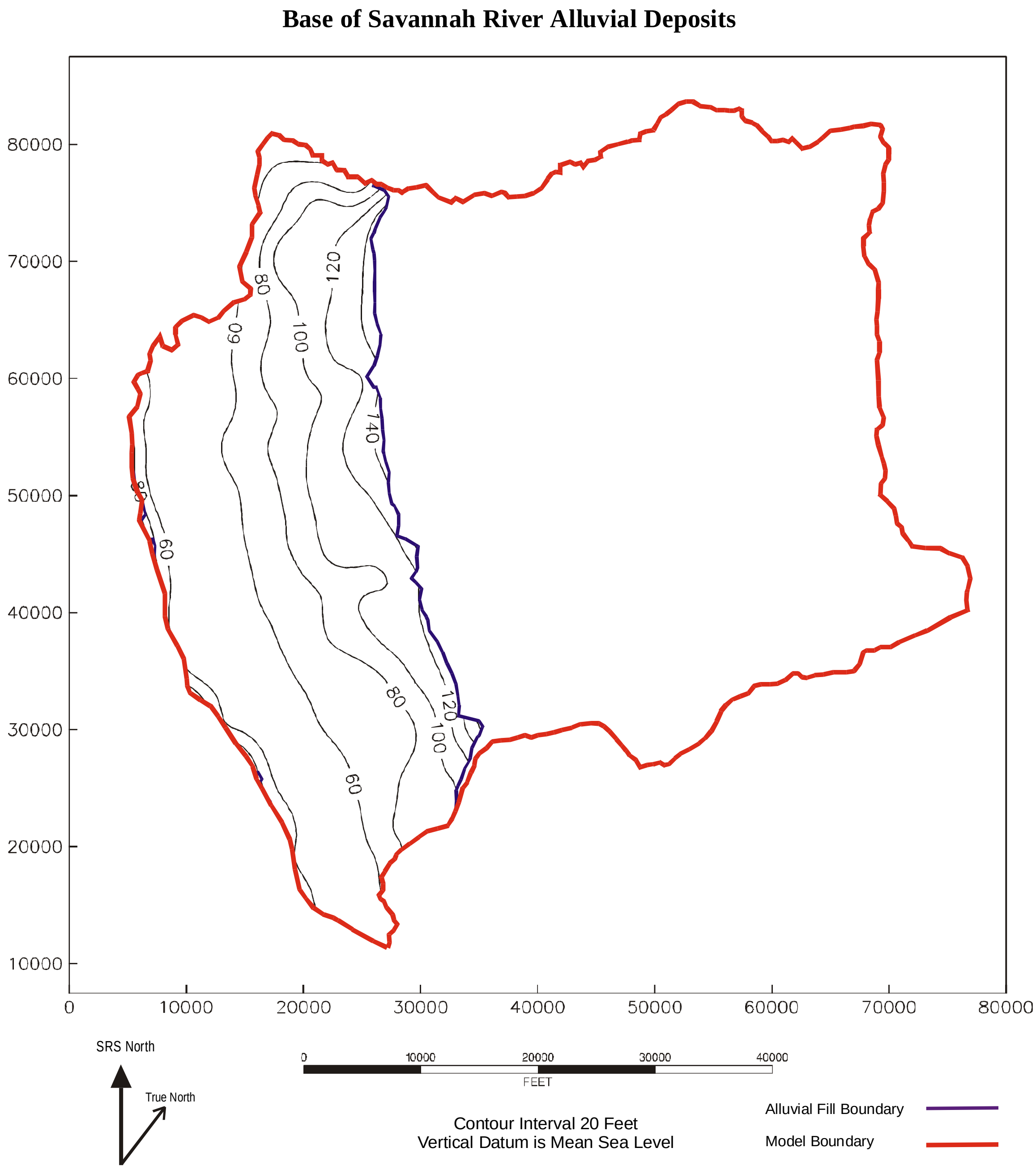


Figure 2-4. Base of Savannah River Alluvial Deposits

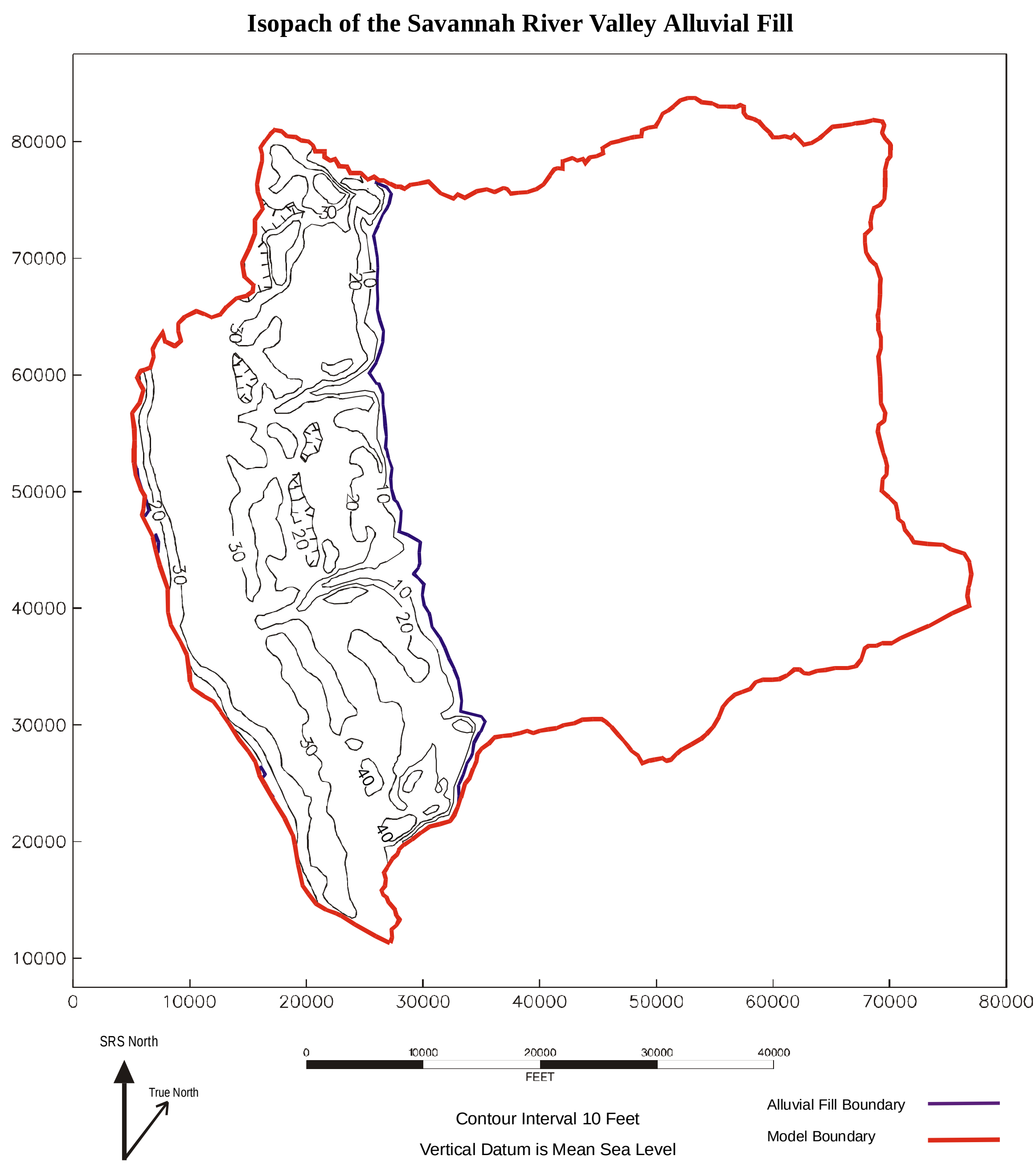


Figure 2-5. Isopach of the Savannah River Valley Alluvial Fill

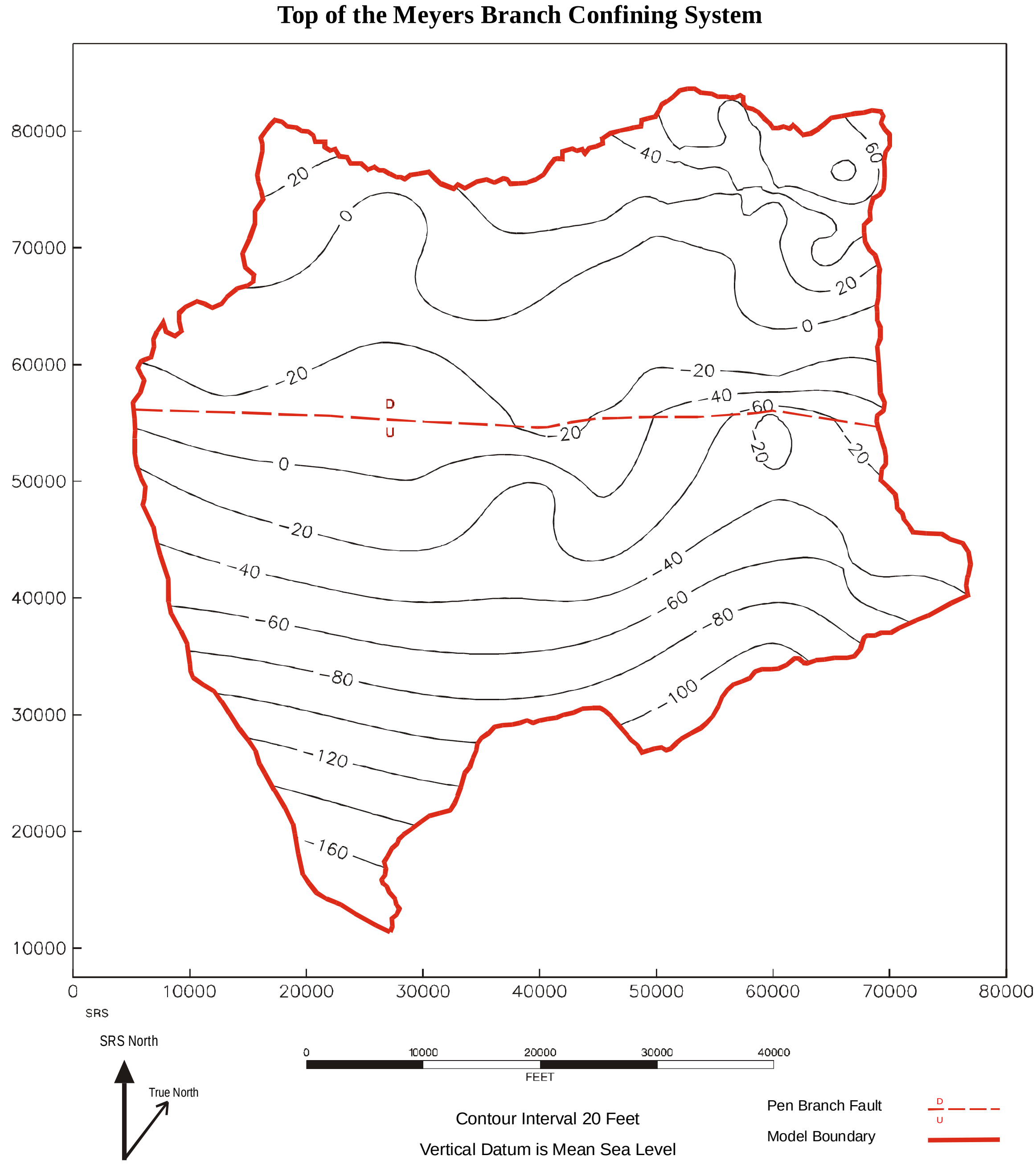


Figure 2-6. Altitude-Contour Map of the Top of the Meyers Branch Confining System

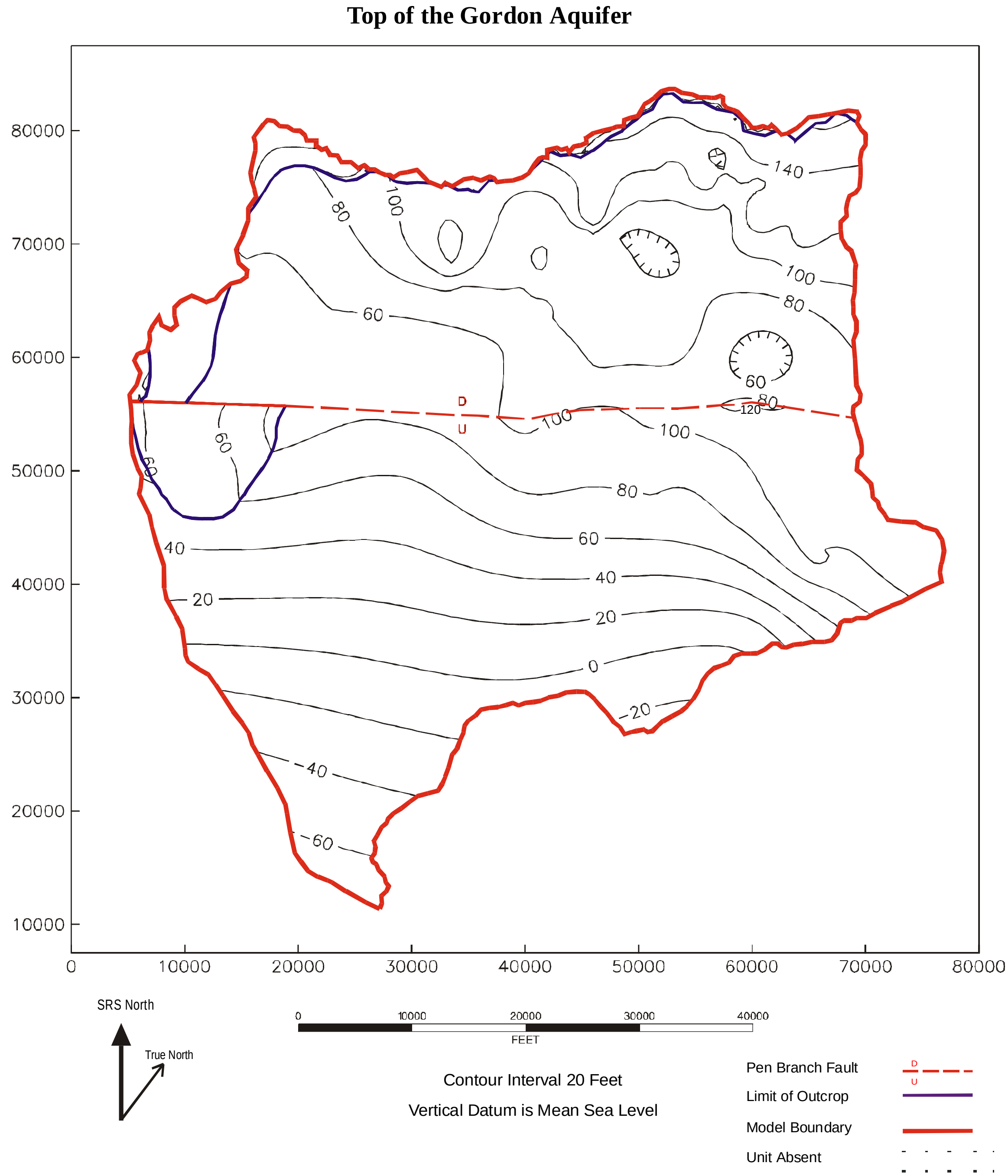


Figure 2-7. Altitude-Contour Map of the Top of the Gordon Aquifer

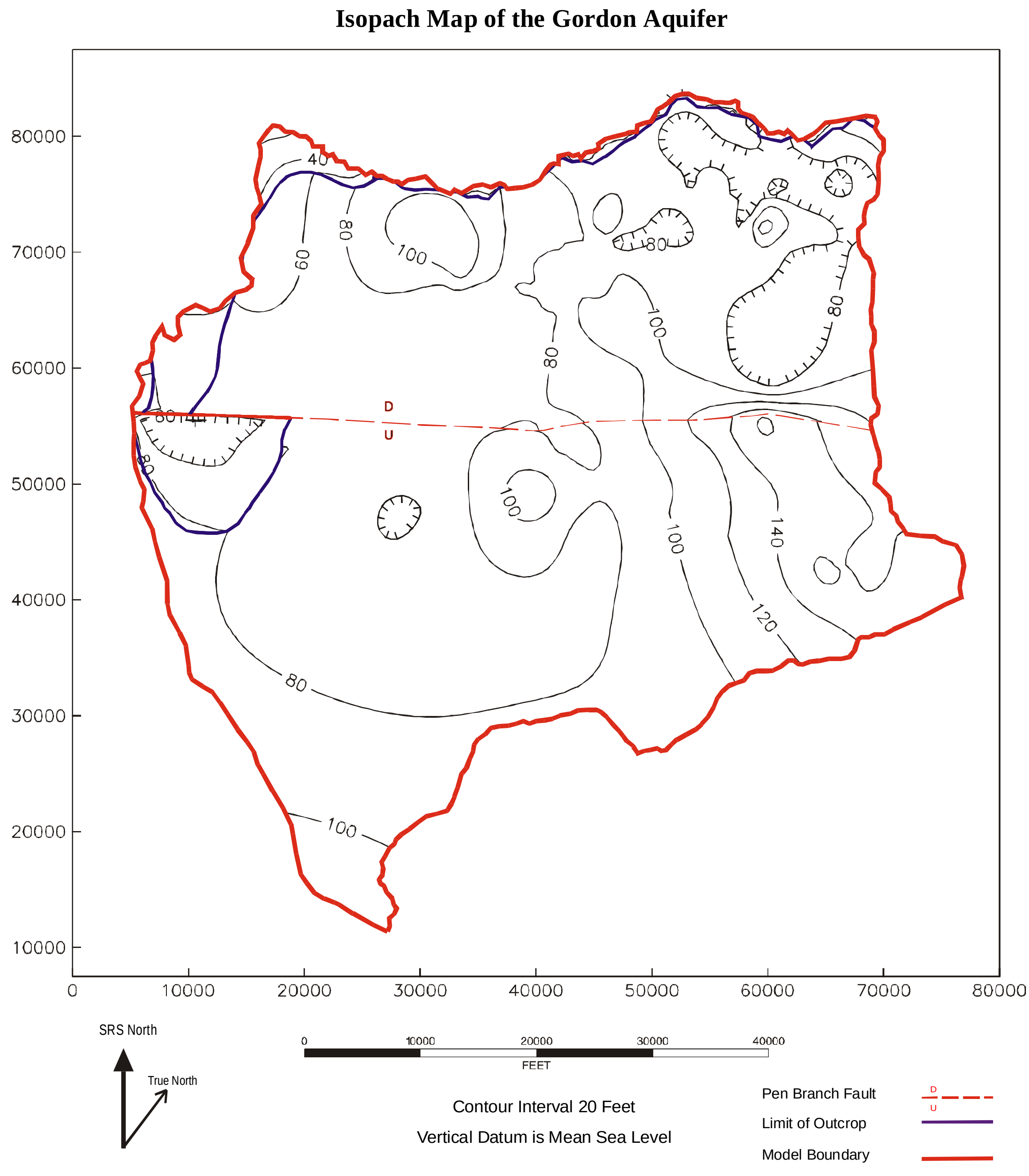


Figure 2-8. Isopach Map of the Gordon Aquifer

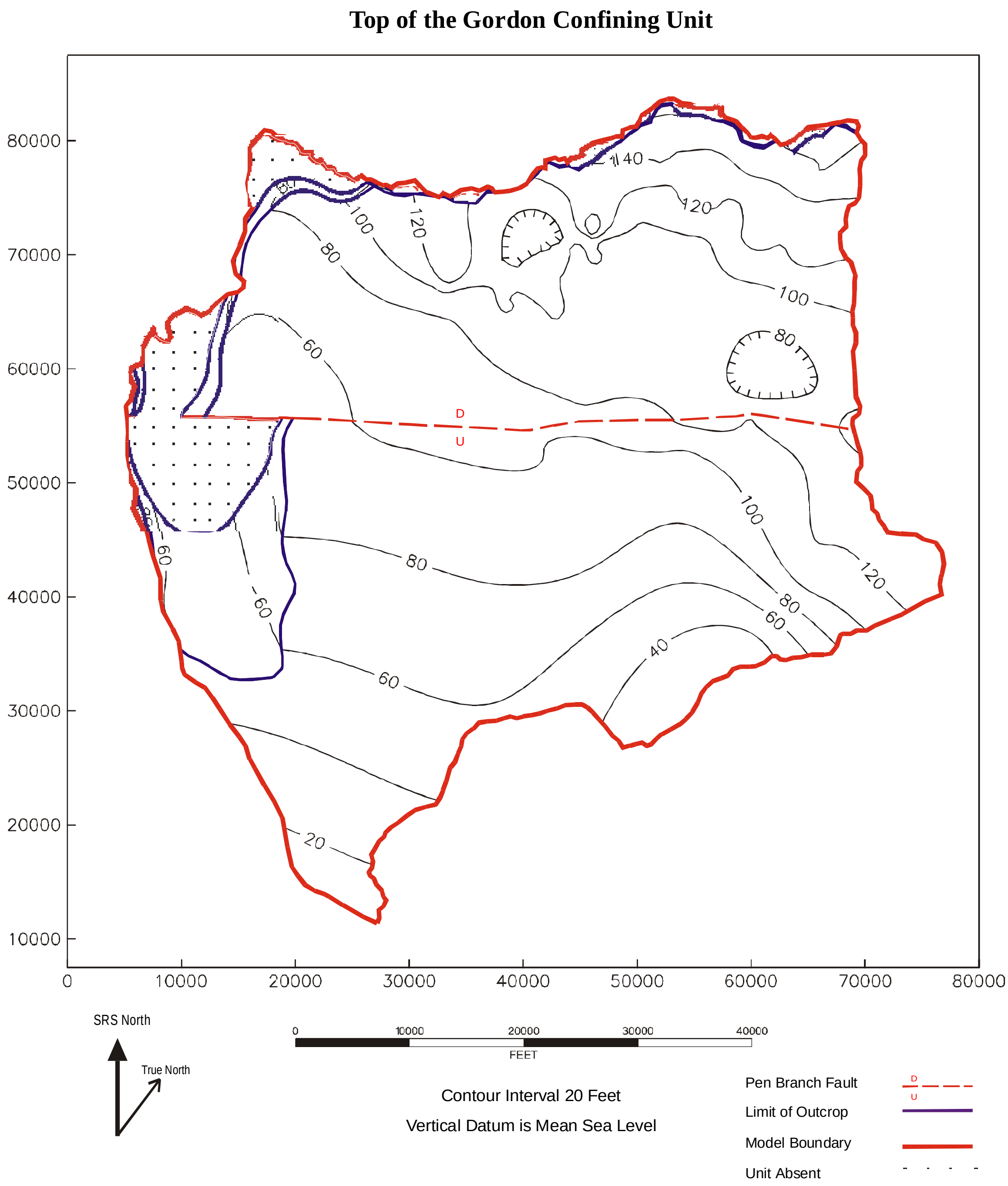


Figure 2-9. Altitude-Contour Map of the Top of the Gordon Confining Unit

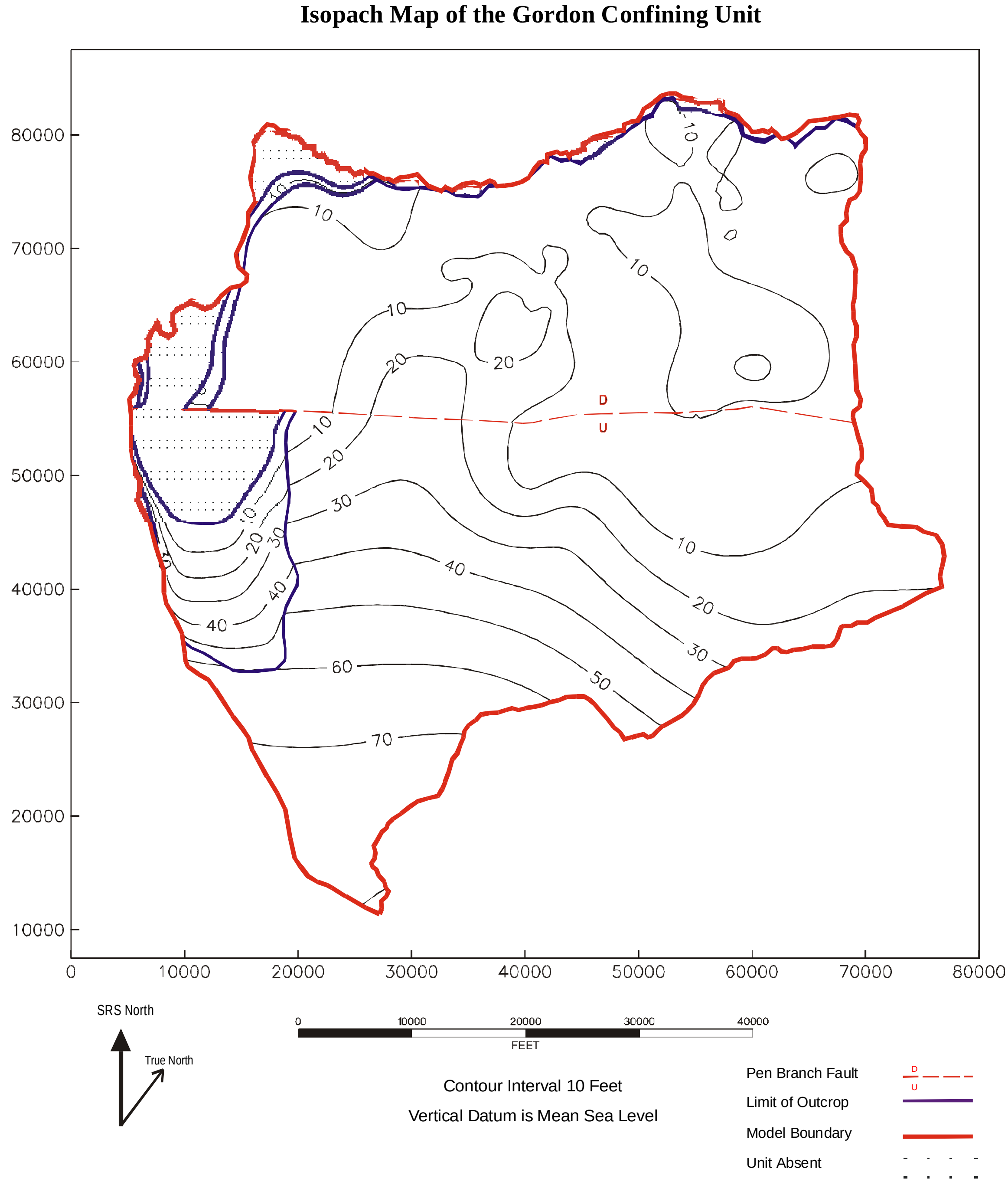


Figure 2-10. Isopach Map of the Gordon Confining Unit

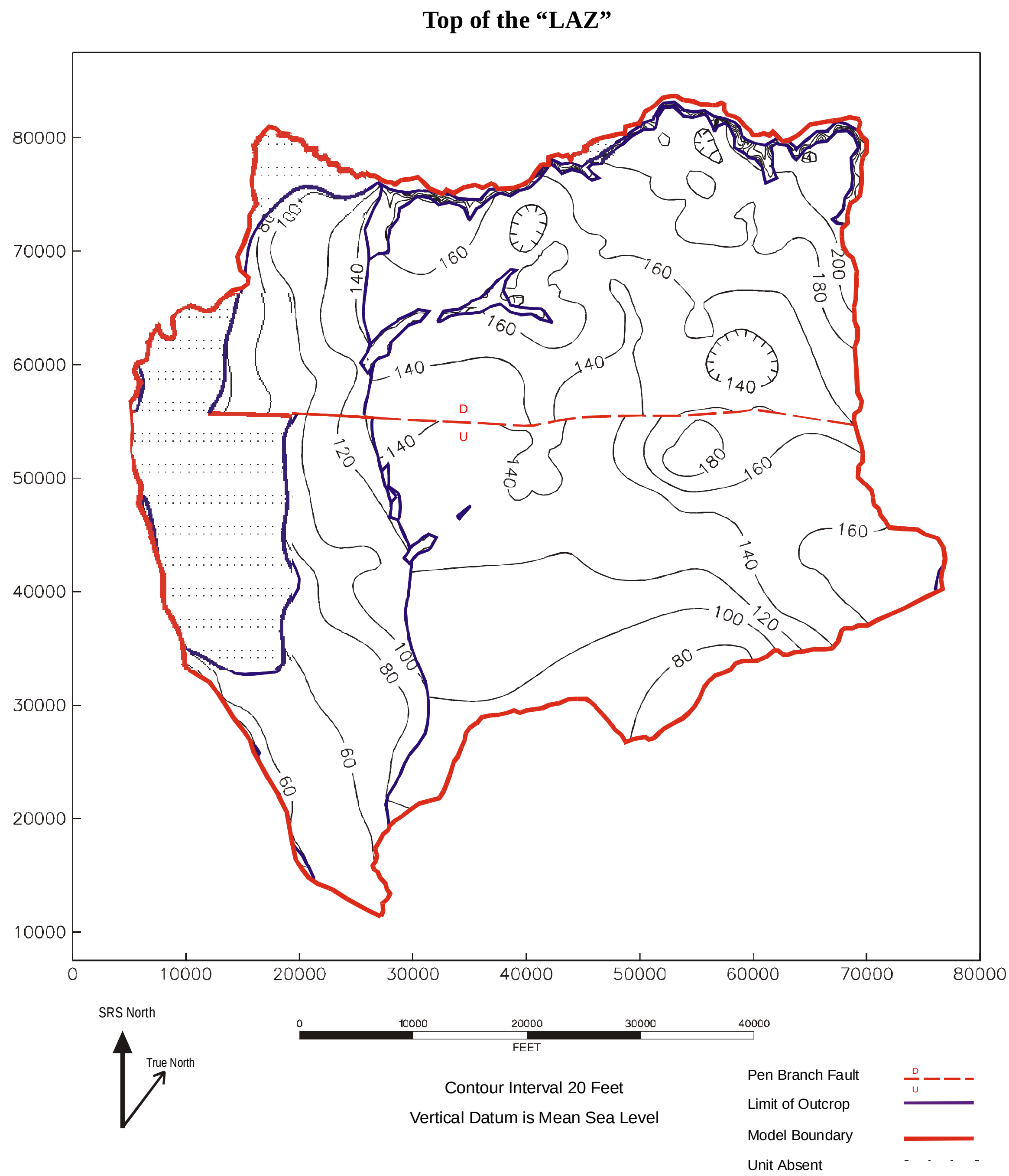


Figure 2-11. Altitude-Contour Map of the Top of the "Lower" Aquifer Zone

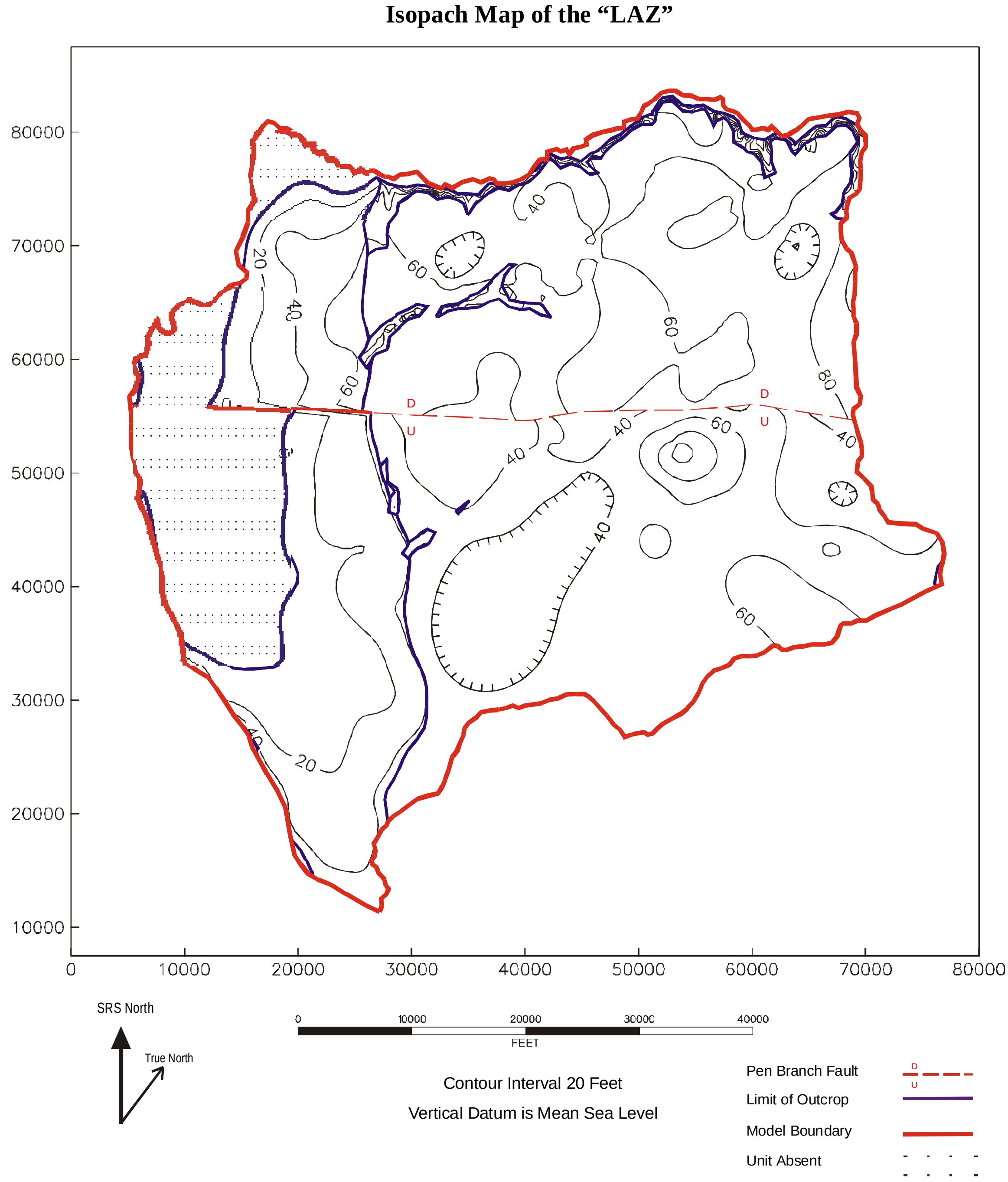


Figure 2-12. Isopach Map of the "Lower" Aquifer Zone

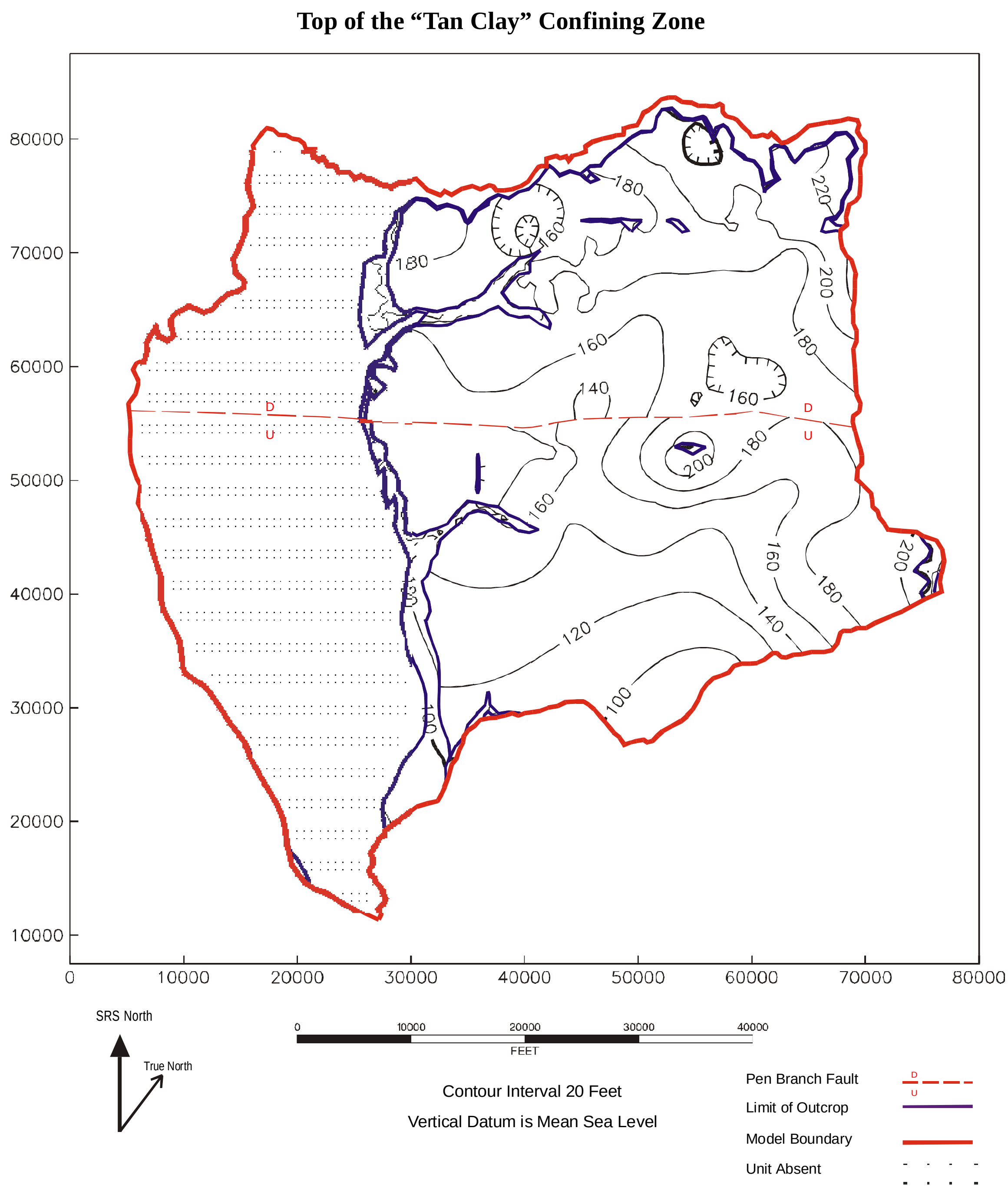


Figure 2-13. Altitude-Contour Map of the Top of the "Tan Clay" Confining Zone

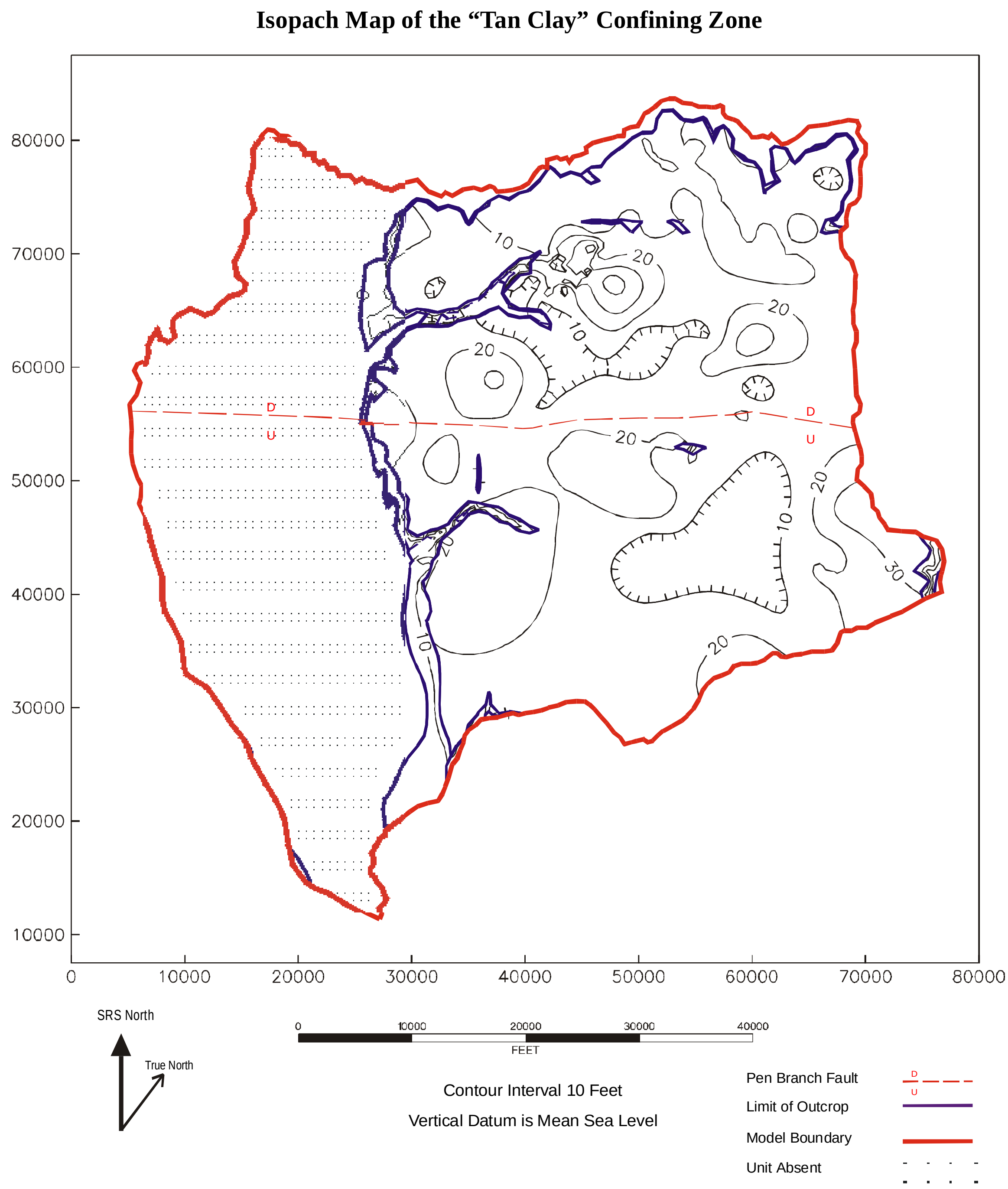


Figure 2-14. Isopach Map of the "Tan Clay" Confining Zone

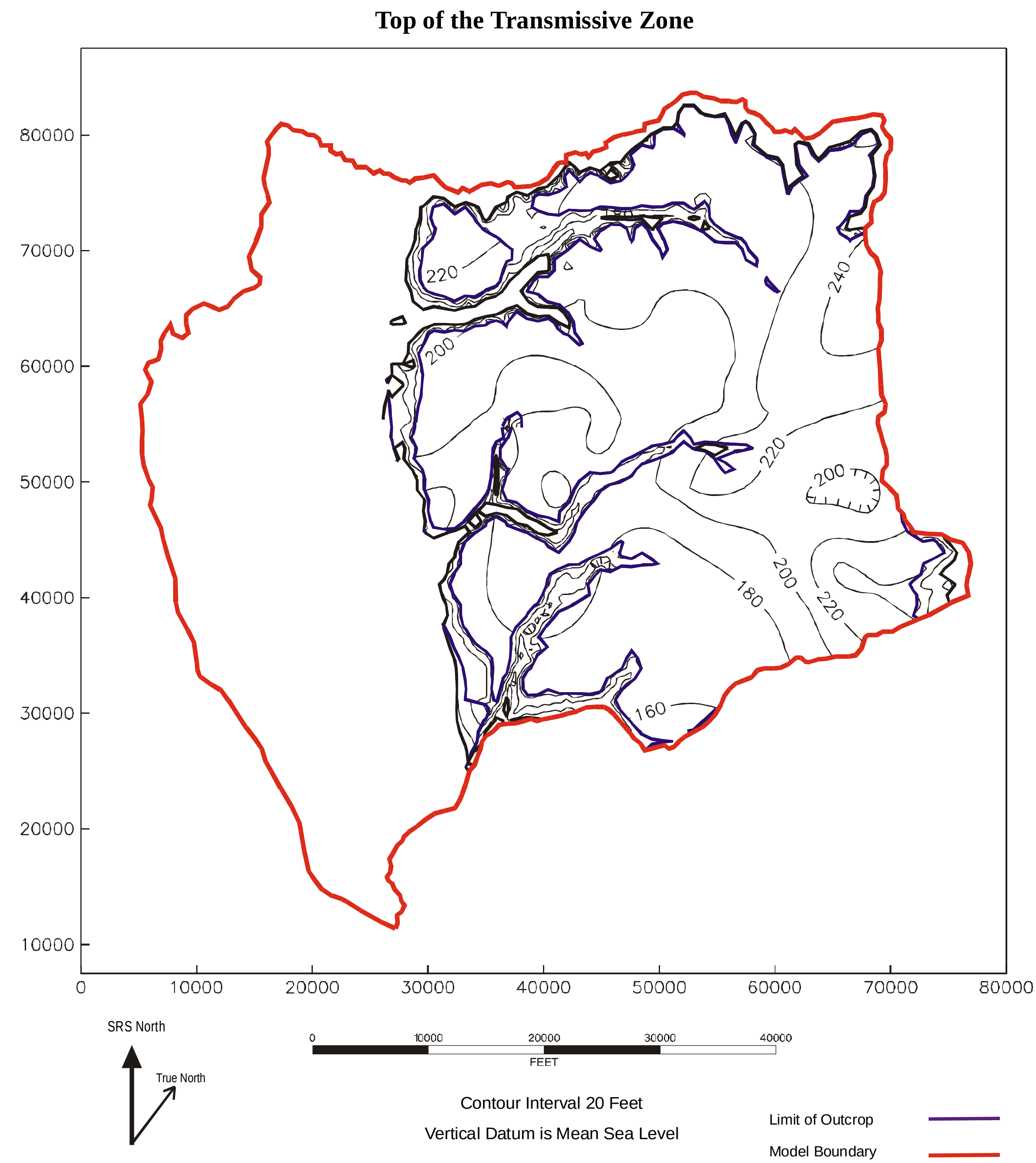


Figure 2-15. Altitude-Contour Map of the Top of the "Transmissive Zone"

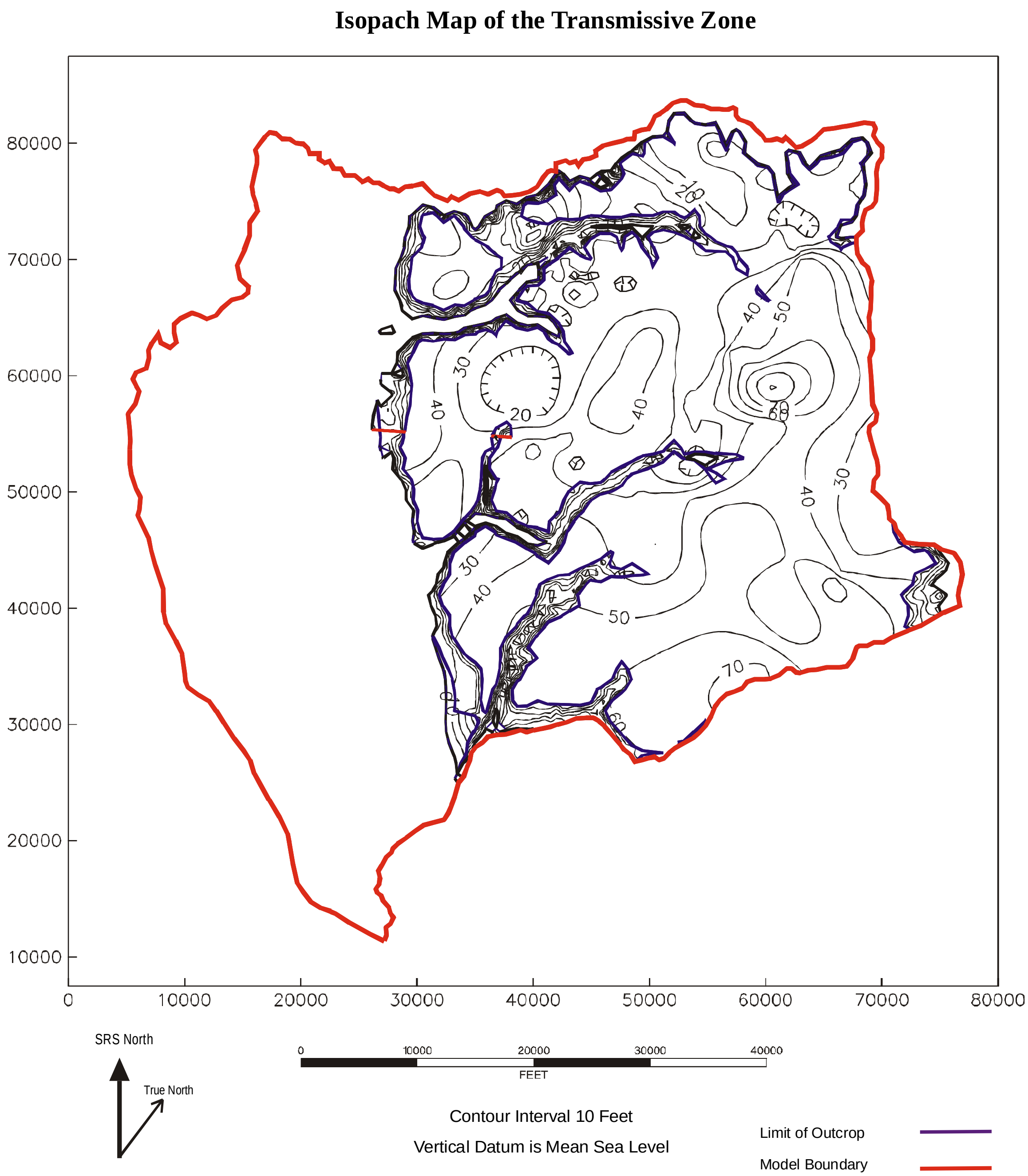


Figure 2-16. Isopach Map of the "Transmissive Zone"

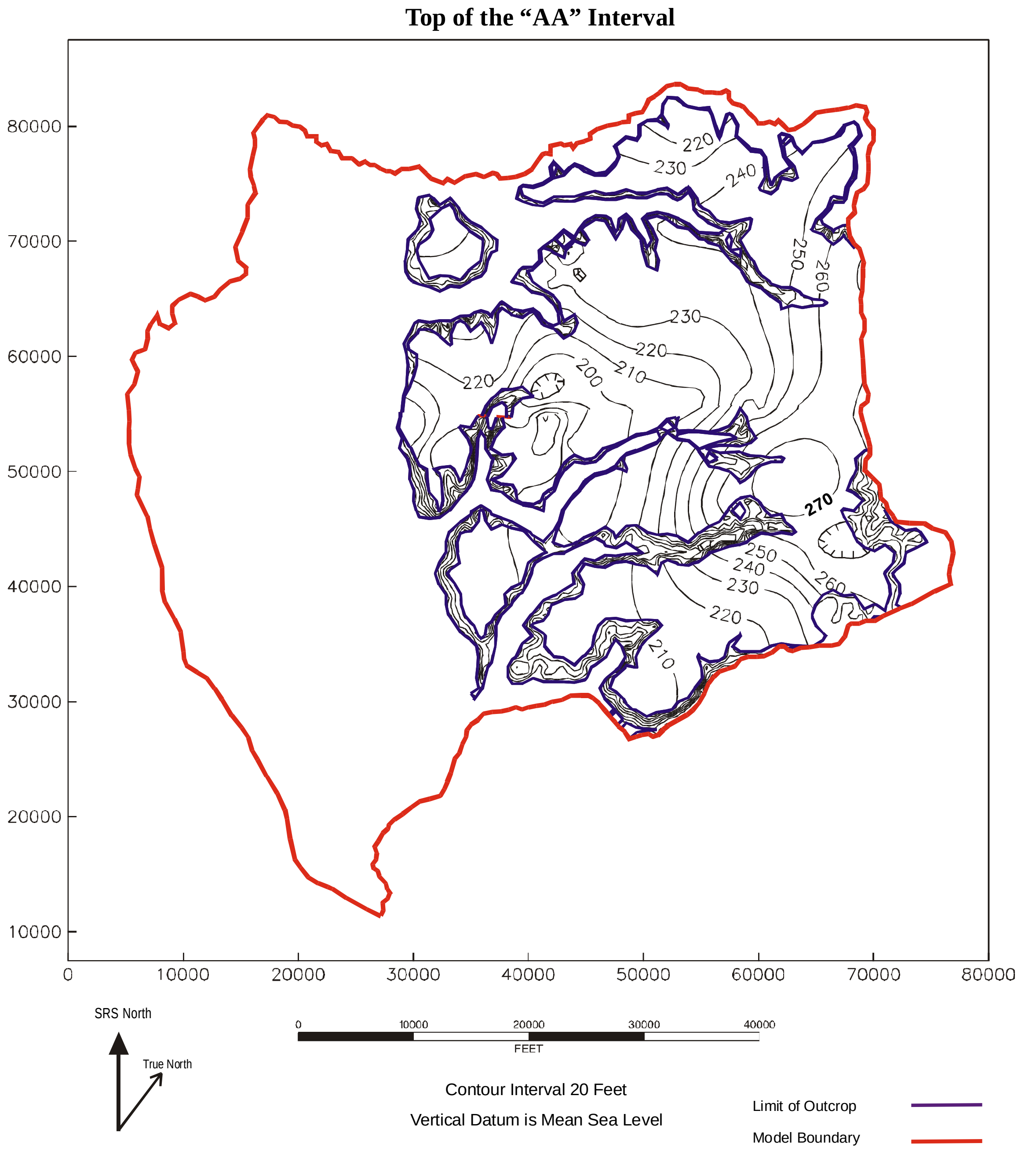


Figure 2-17. Altitude-Contour Map of the Top of the “AA” Interval

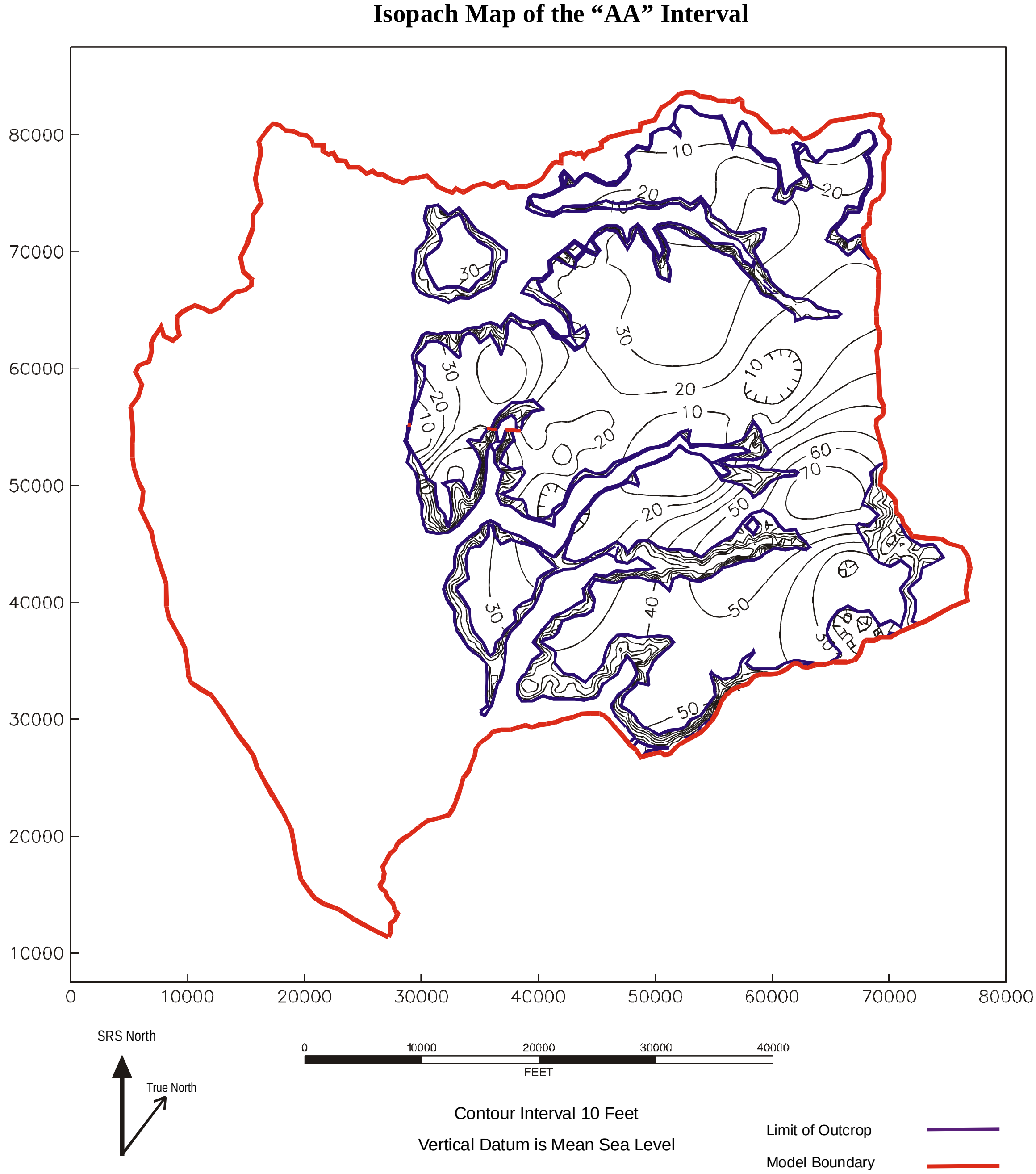


Figure 2-18. Isopach Map of the "AA" Interval

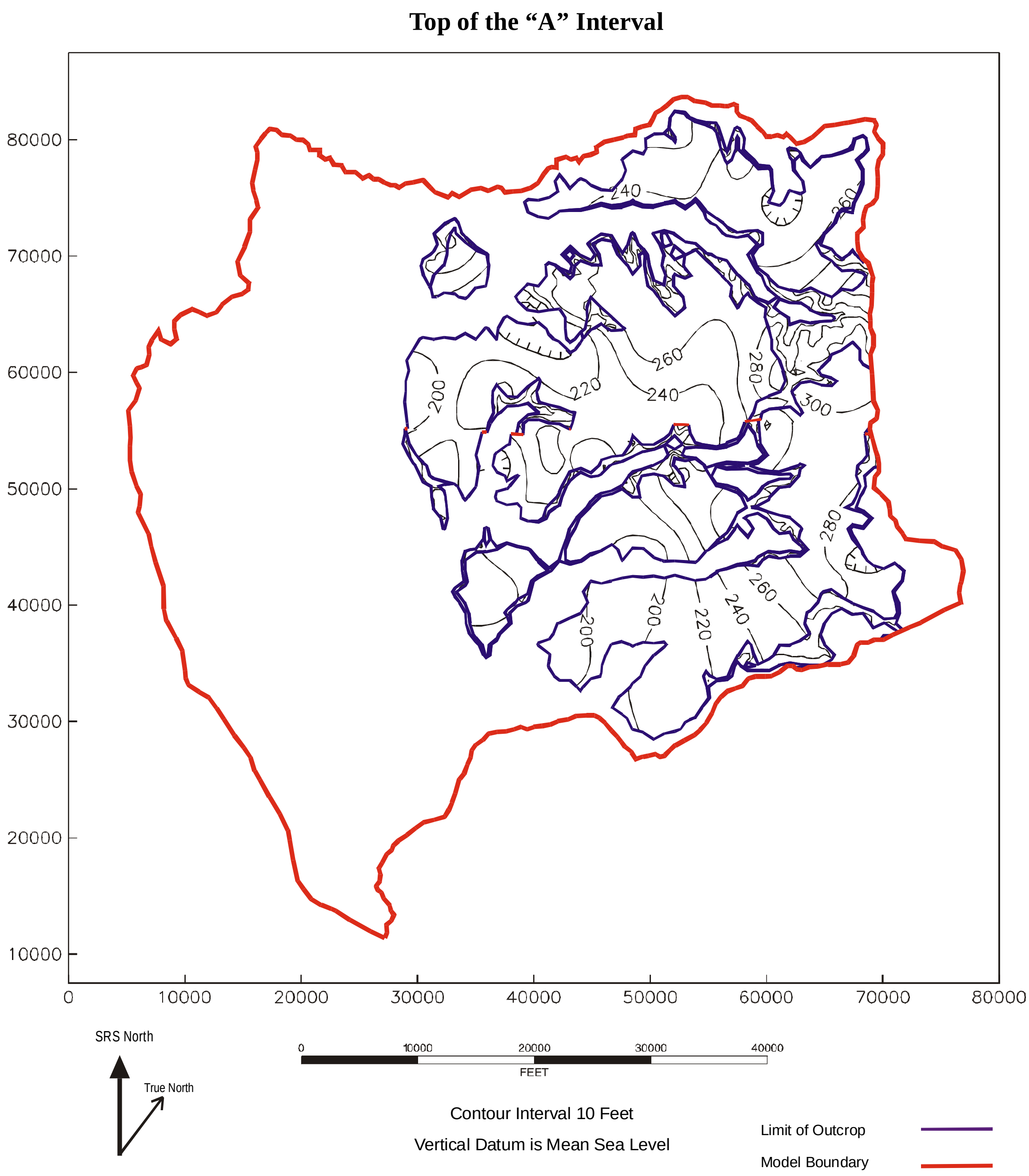


Figure 2-19. Altitude-Contour Map of the Top of the "A" Interval

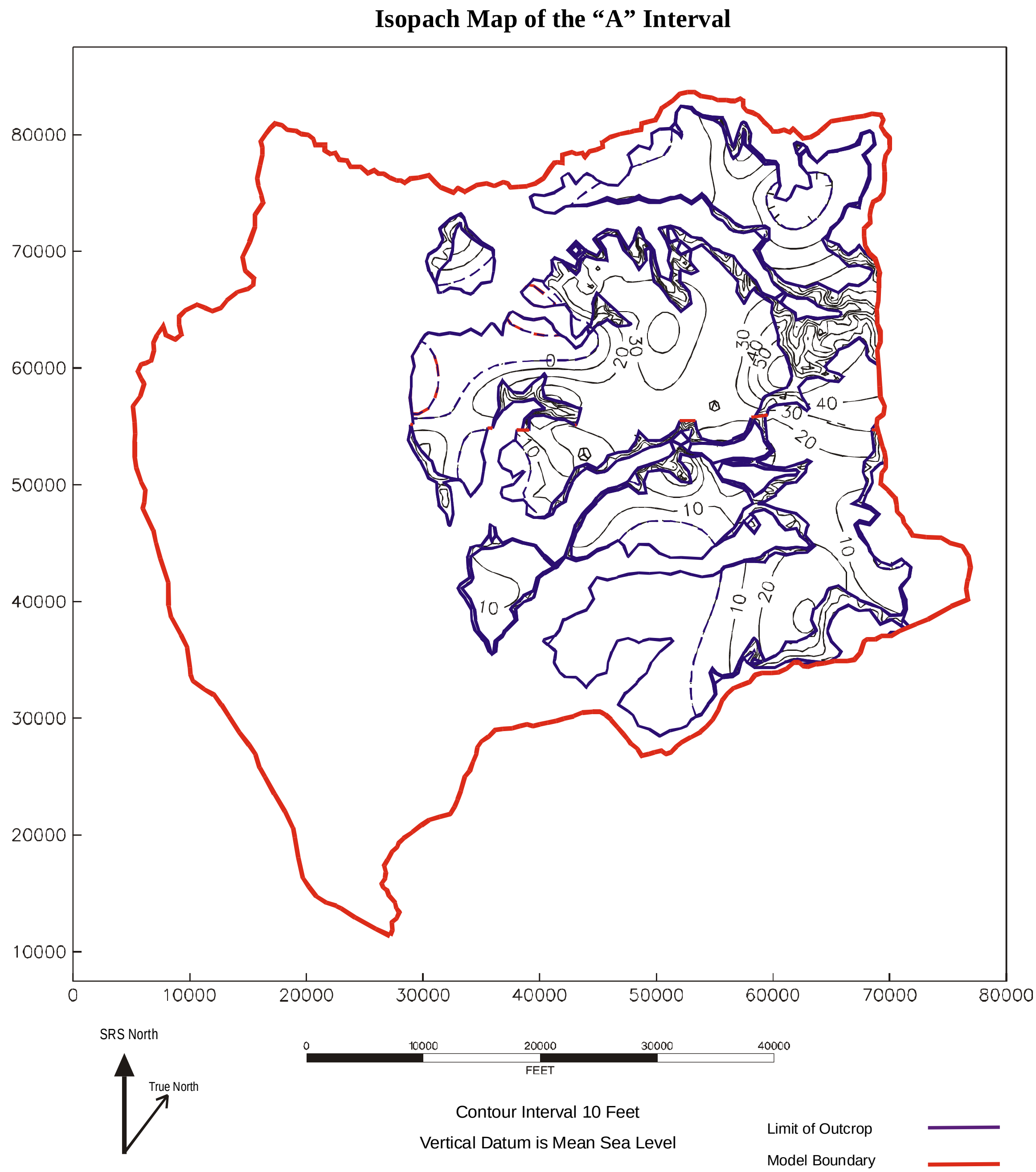


Figure 2-20. Isopach Map of the "A" Interval

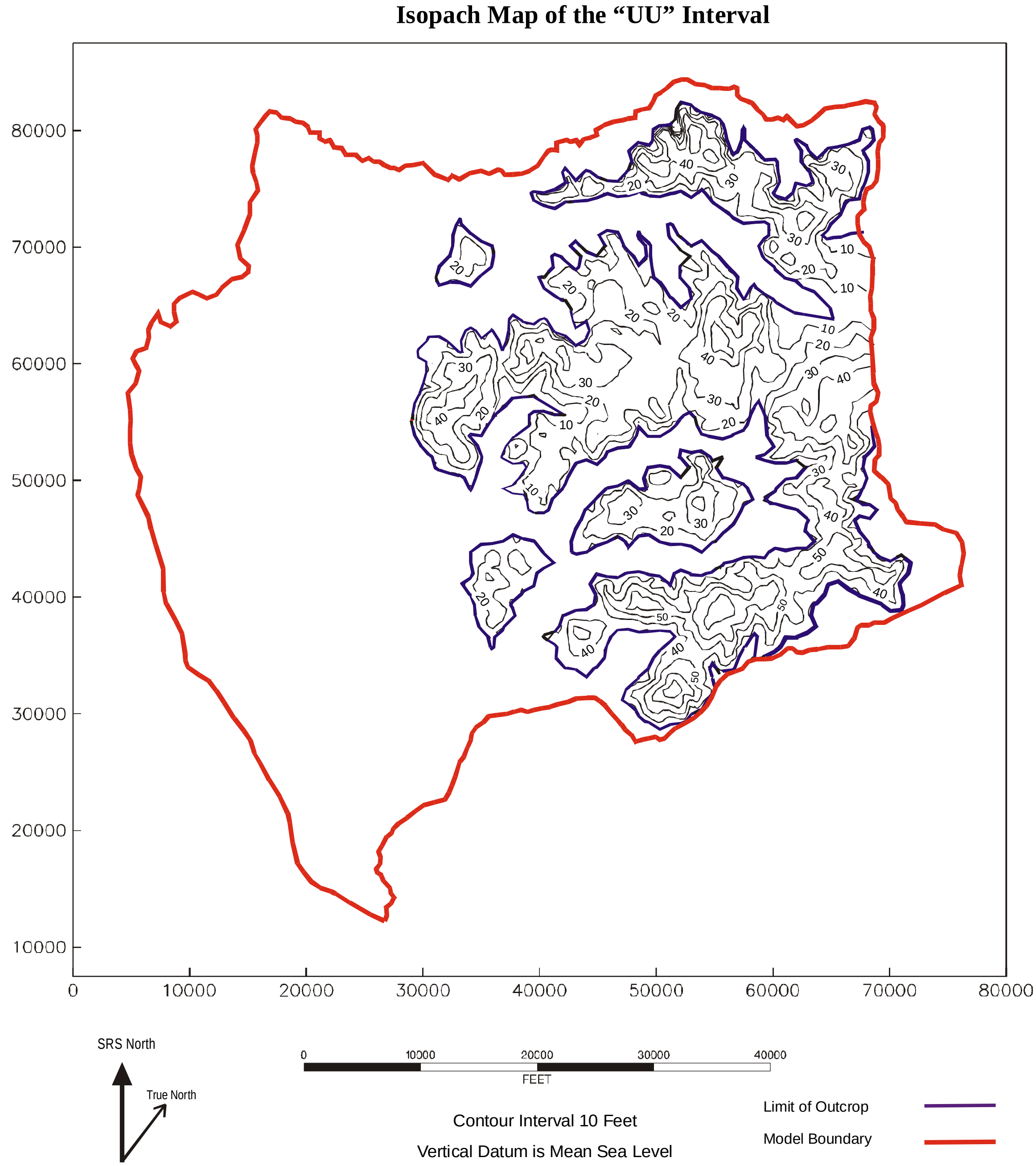


Figure 2-21. Isopach Map of the "UU" Interval

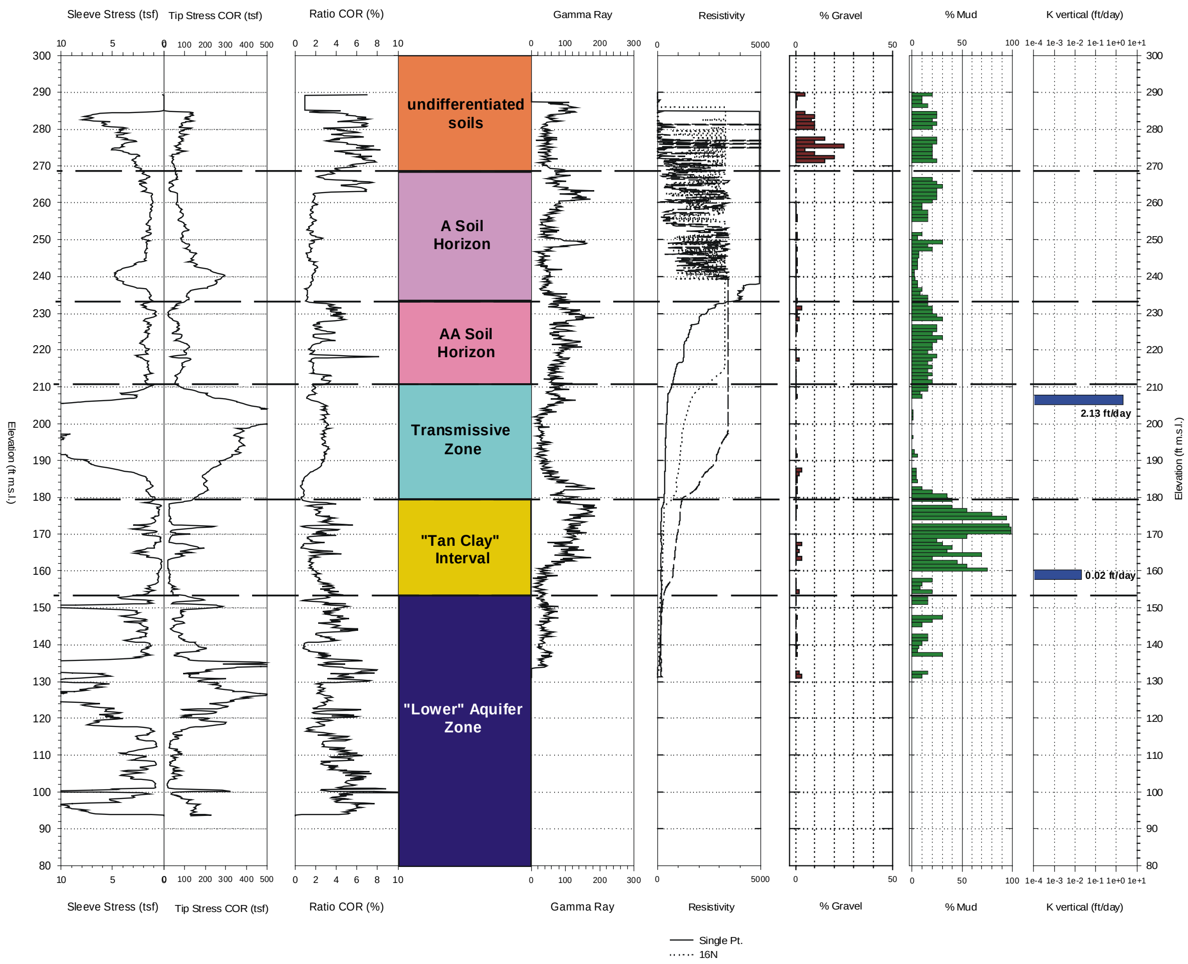


Figure 2-22. Composite Log for CRSB-6 and CSB-2C

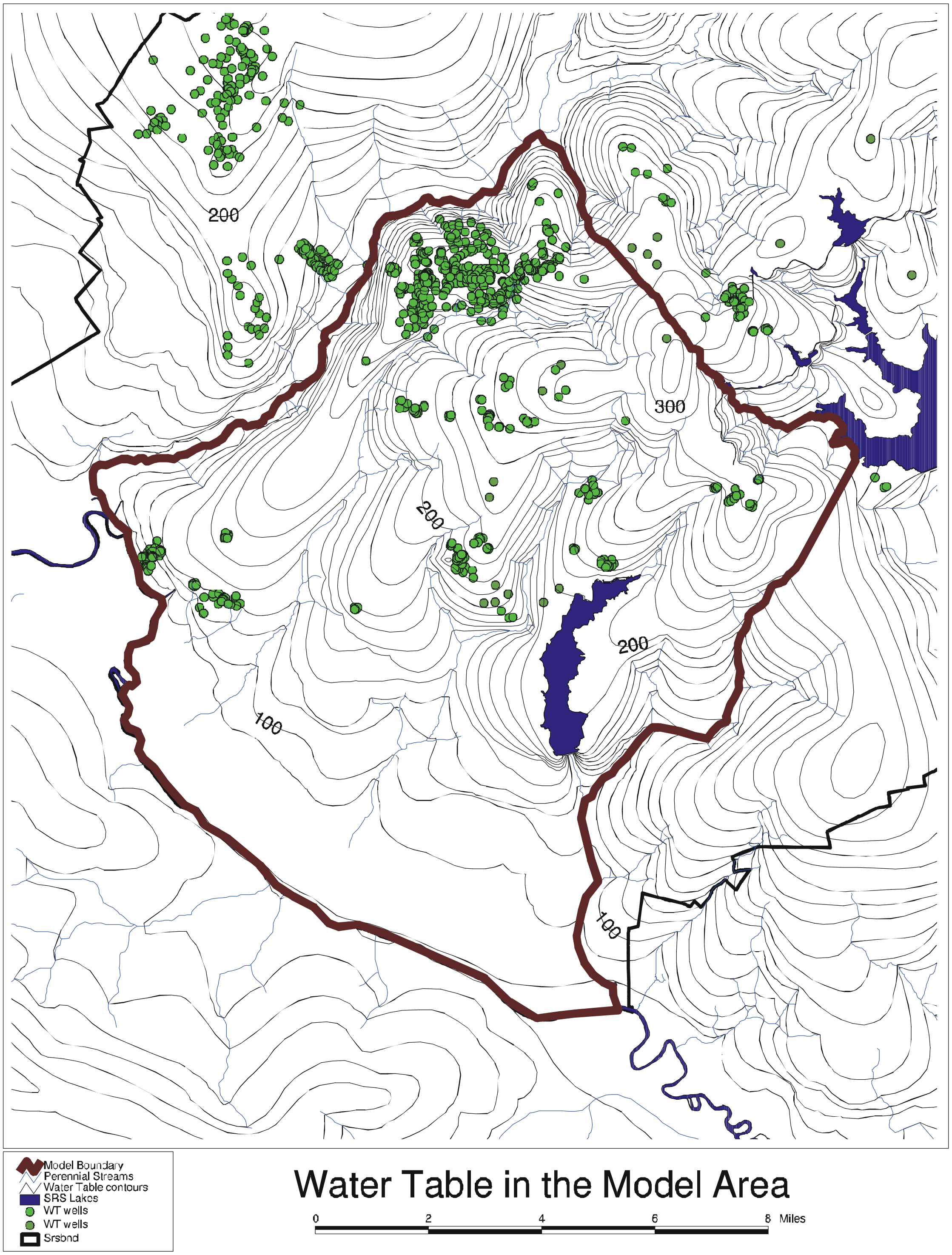


Figure 2-23. Water Table Map of CKLP Model Area

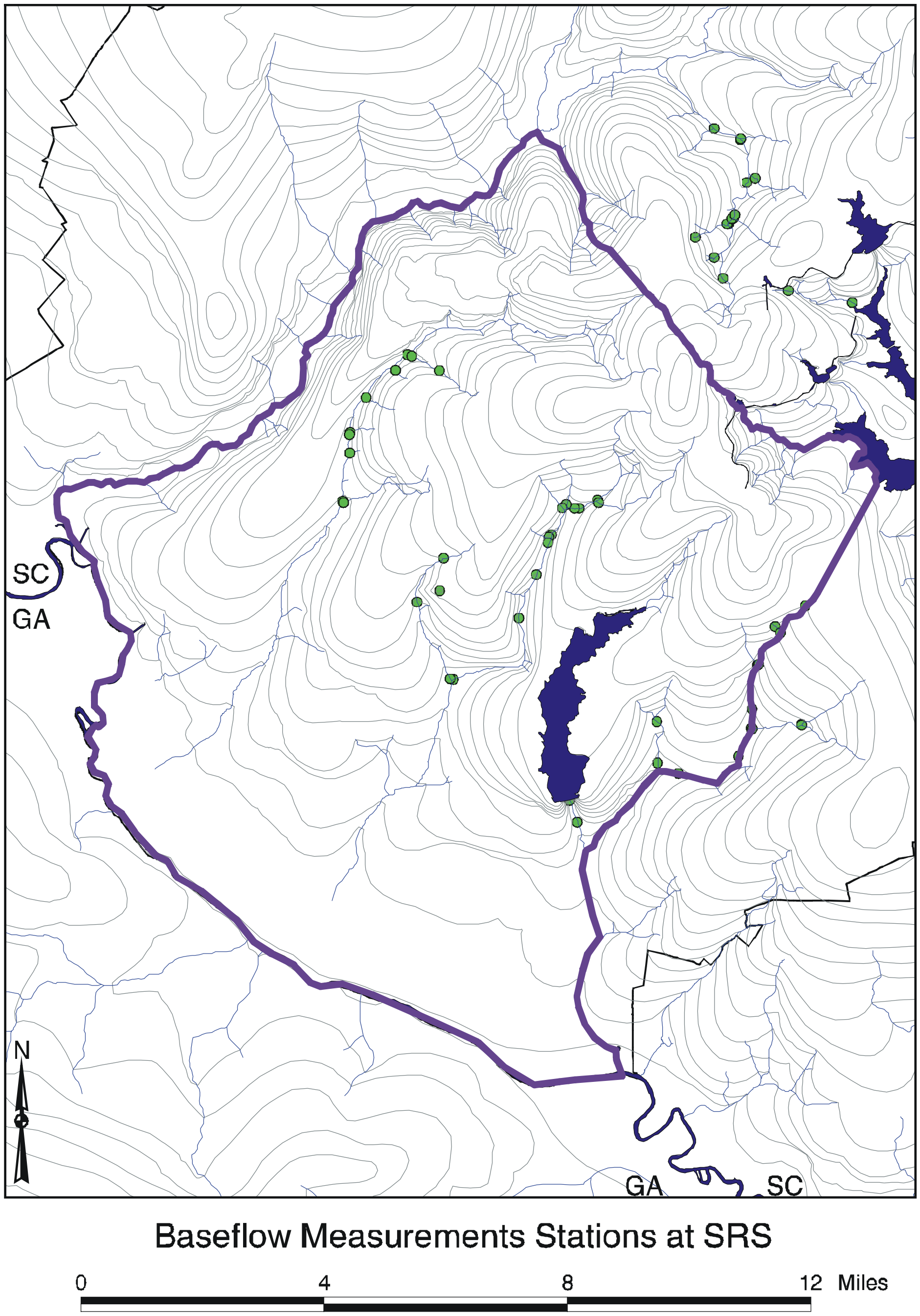


Figure 2-24. Location of Stream Baseflow Measurements for 1998 Field Study

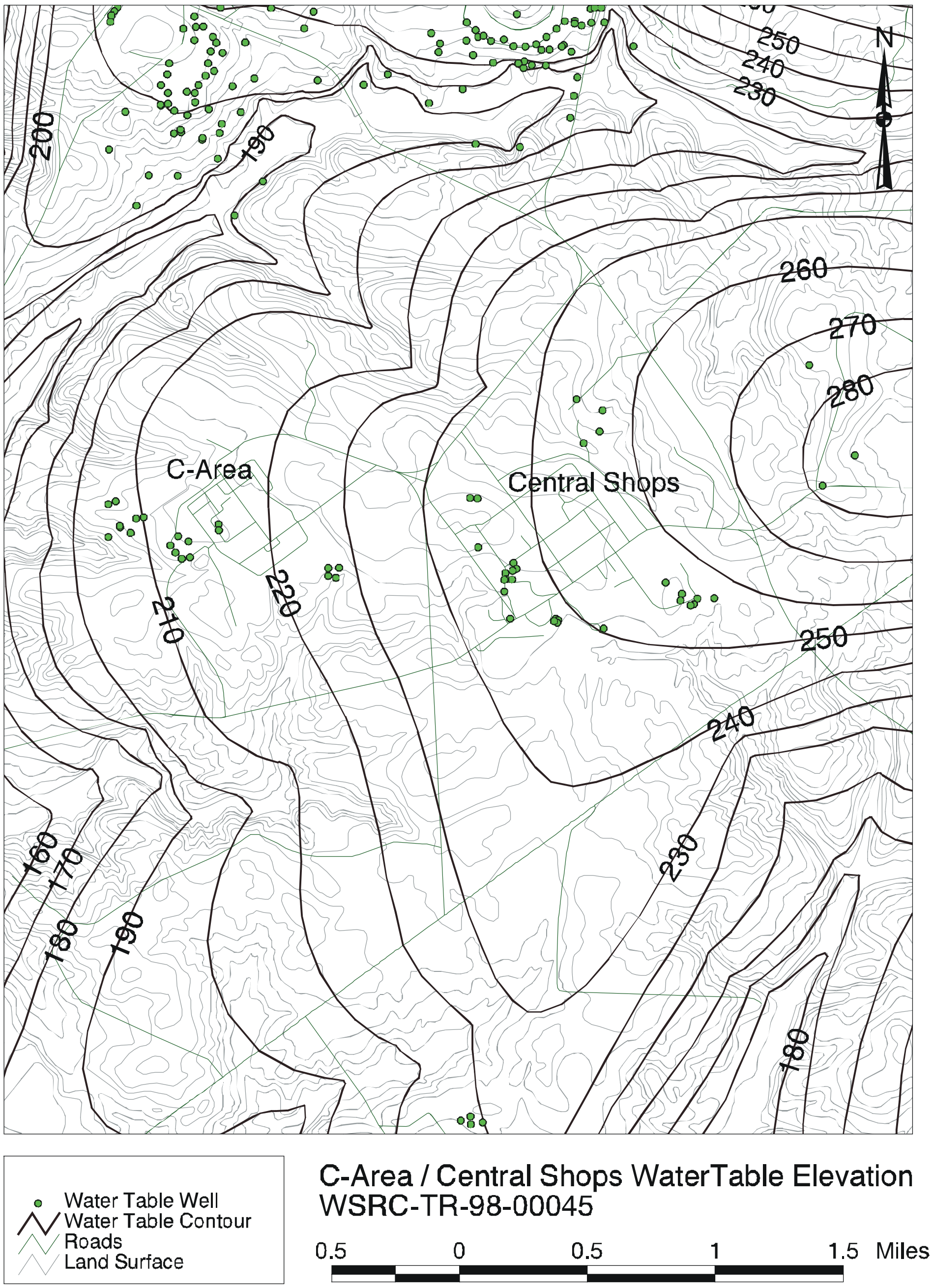


Figure 2-25. Water Table Map for C Reactor Area

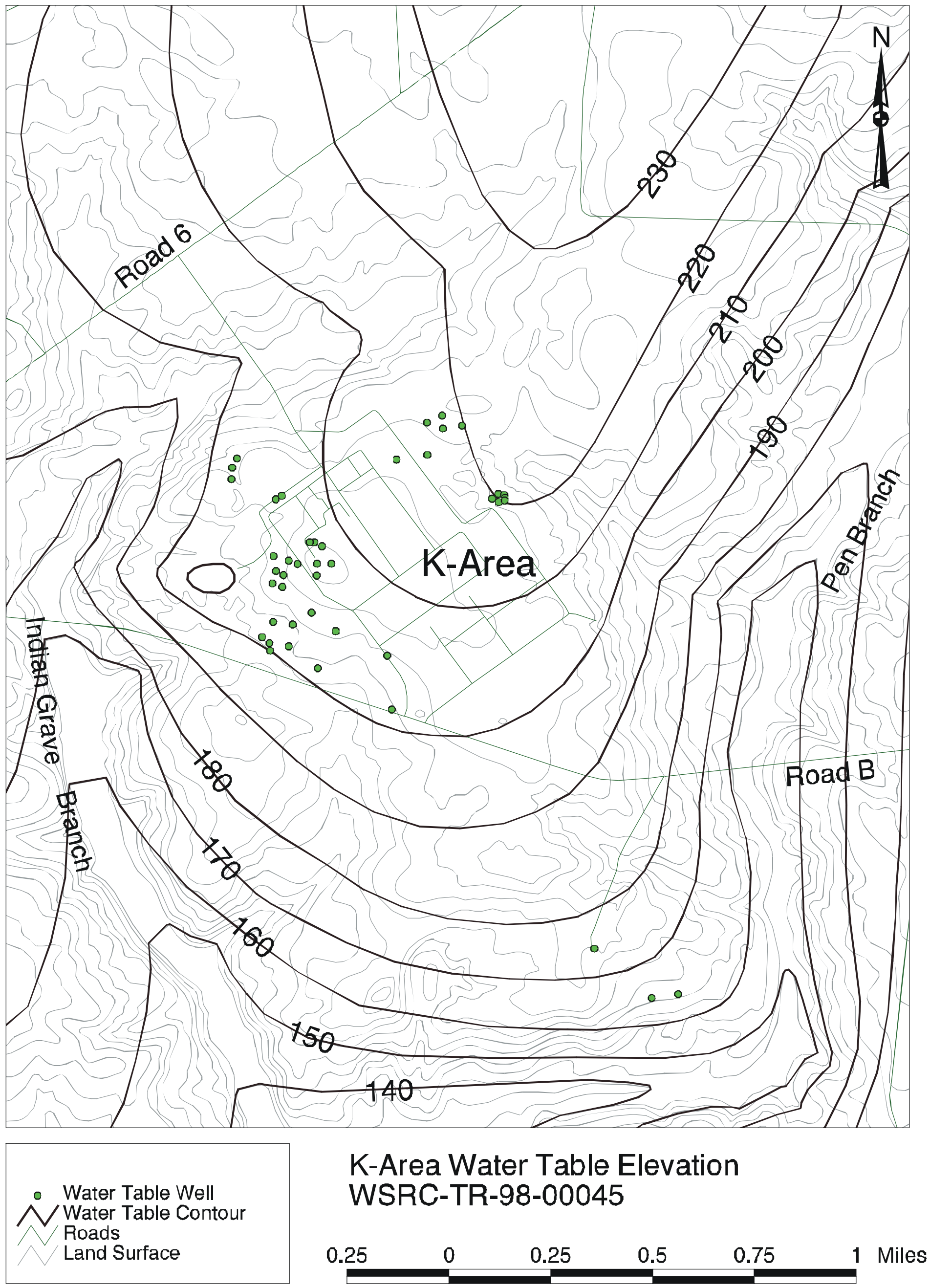


Figure 2-26. Water Table Map for K Reactor Area

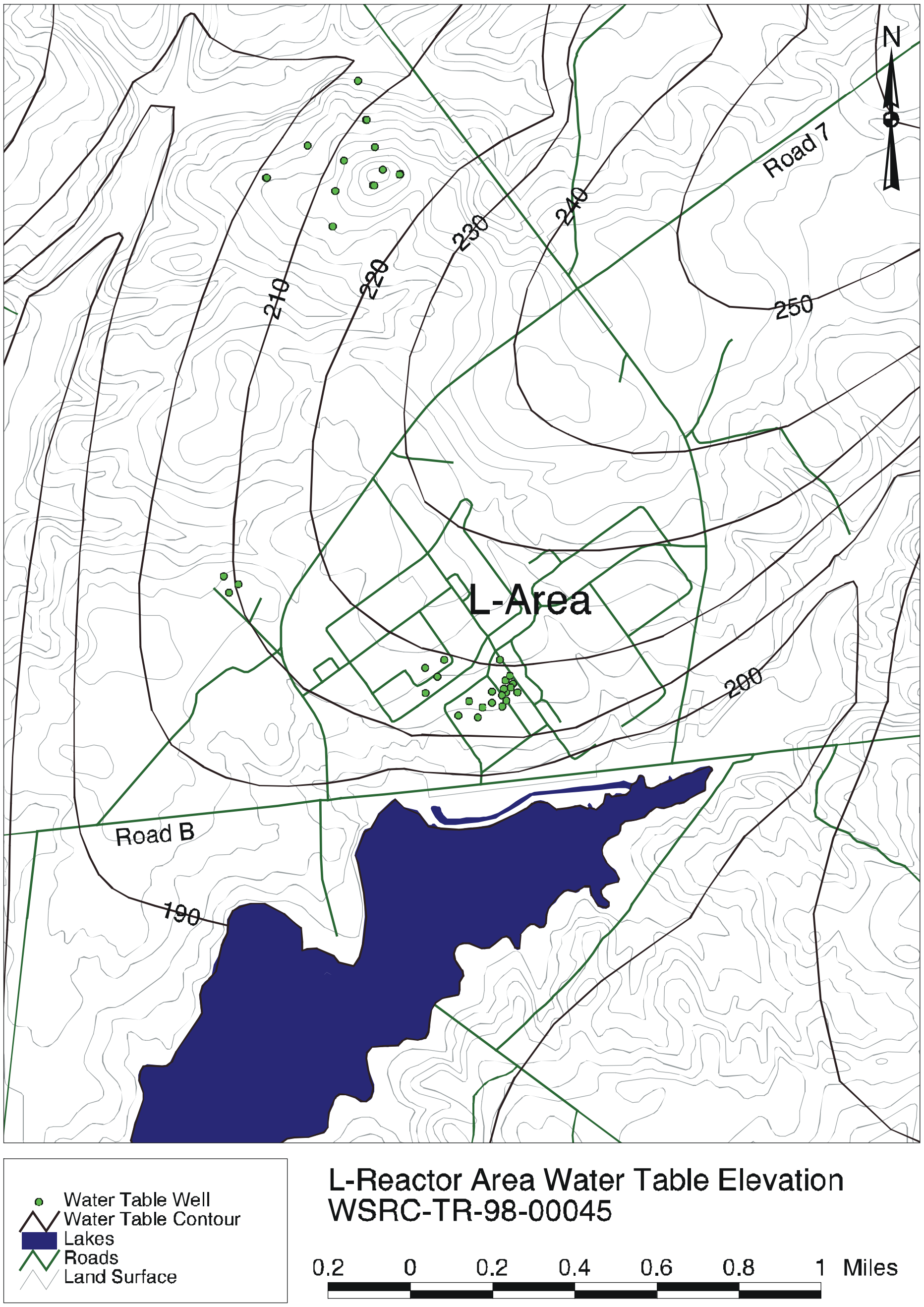


Figure 2-27. Water Table Map for L Reactor Area

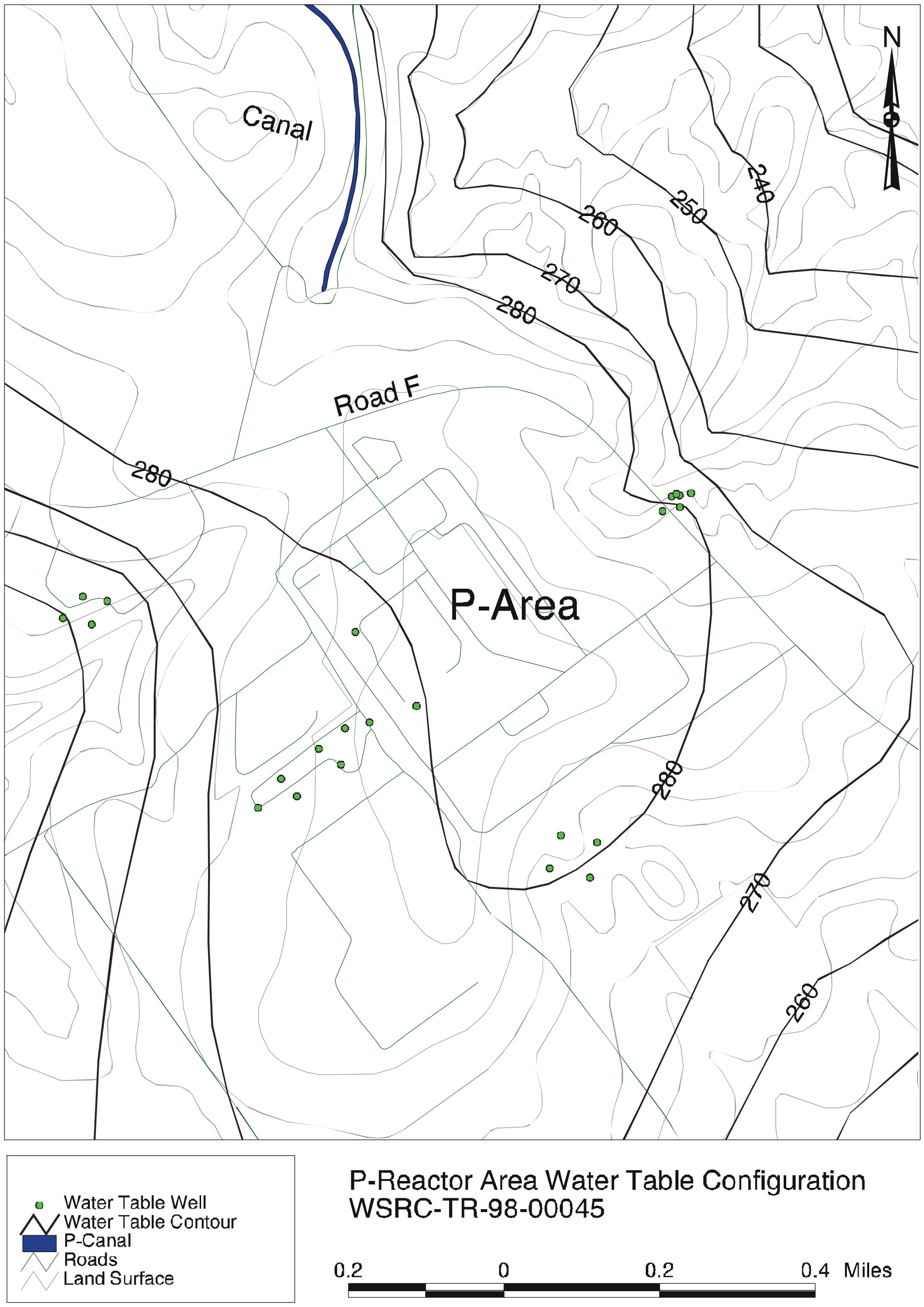


Figure 2-28. Water Table Map for P Reactor Area

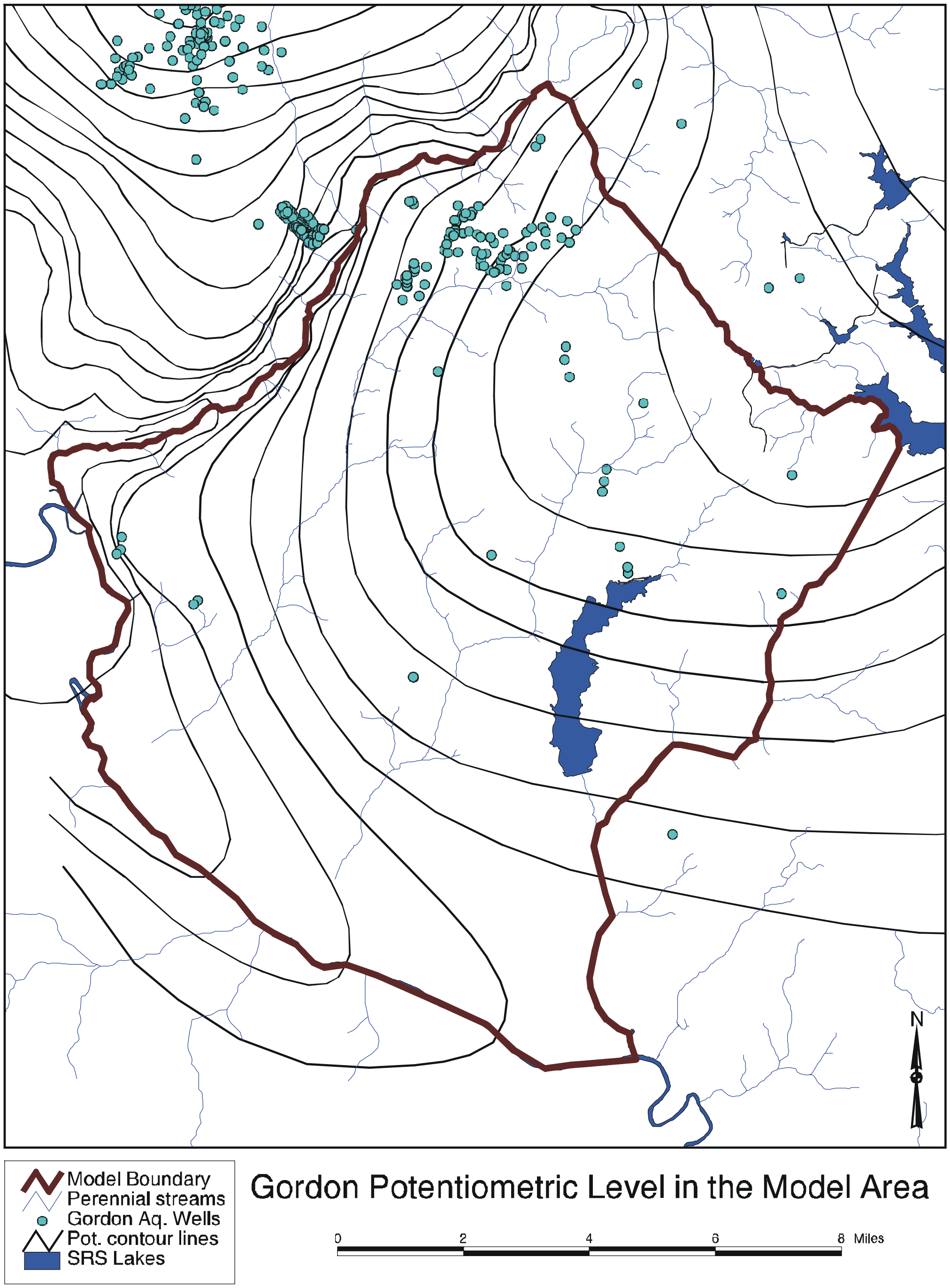


Figure 2-29. Gordon Potentiometric Surface in the CKLP Model Area

Reactor Area (RGW) Piezometers

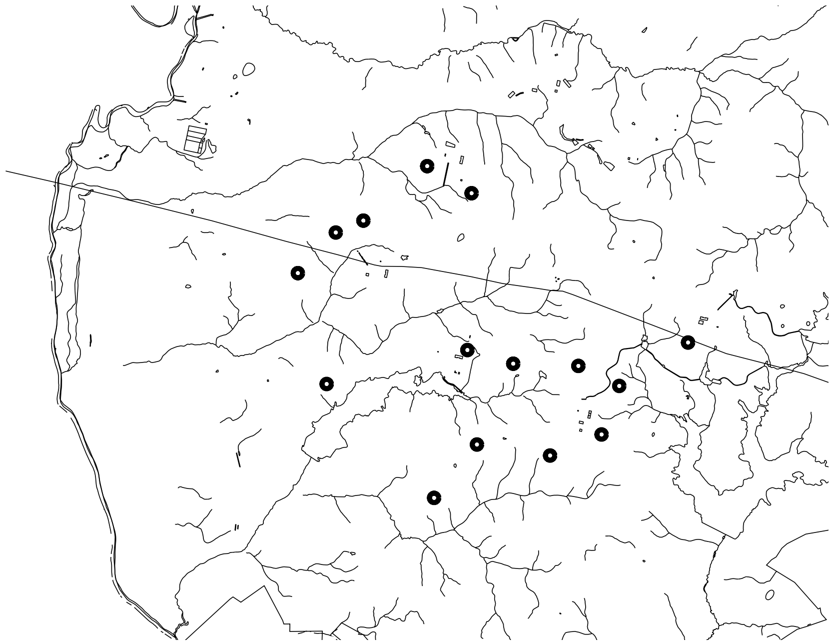


Figure 2-30. Locations of Reactor Area Piezometers Installed in 1998

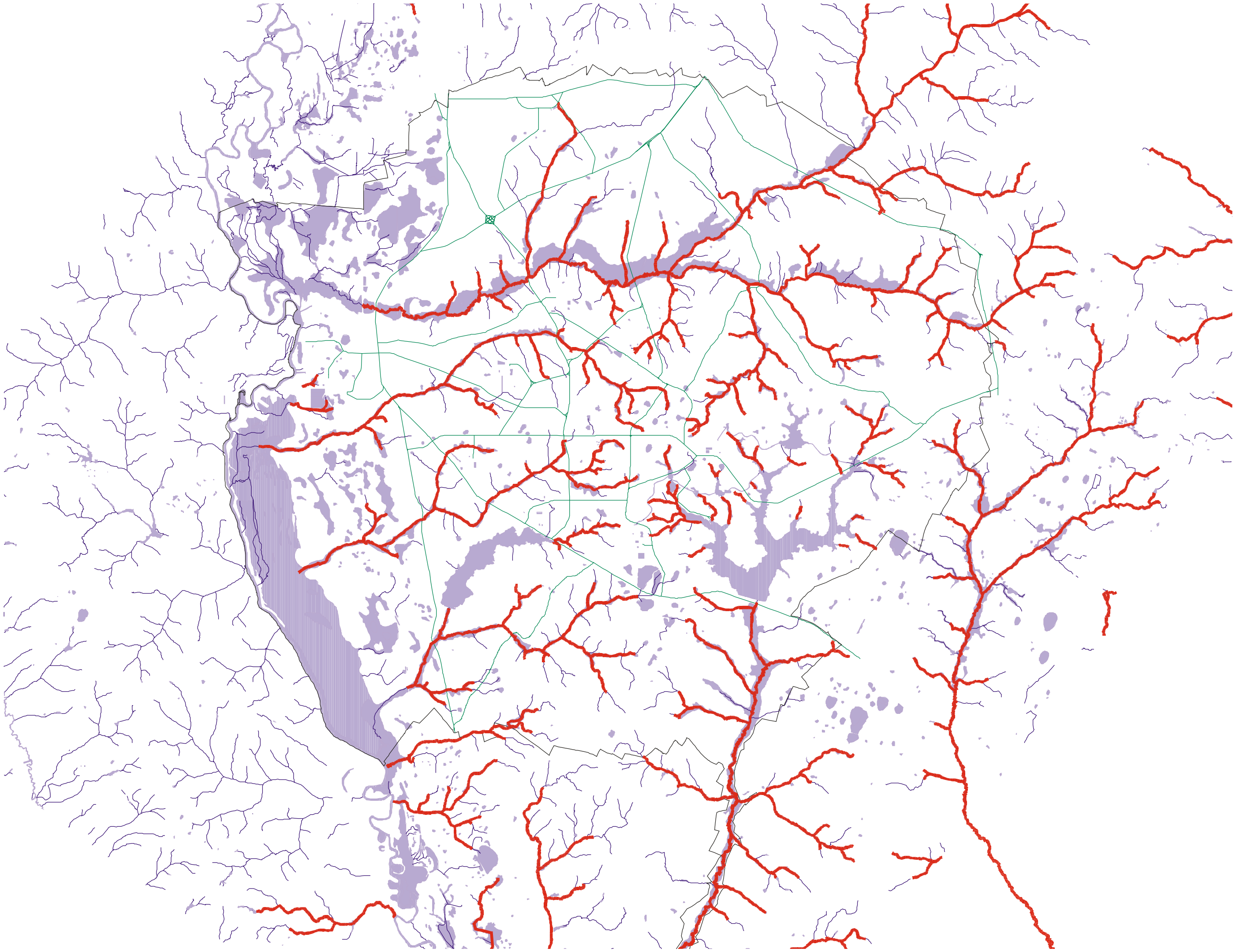


Figure 2-31. Map of Live (Perennial) Stream Reaches as Determined by Field Observations

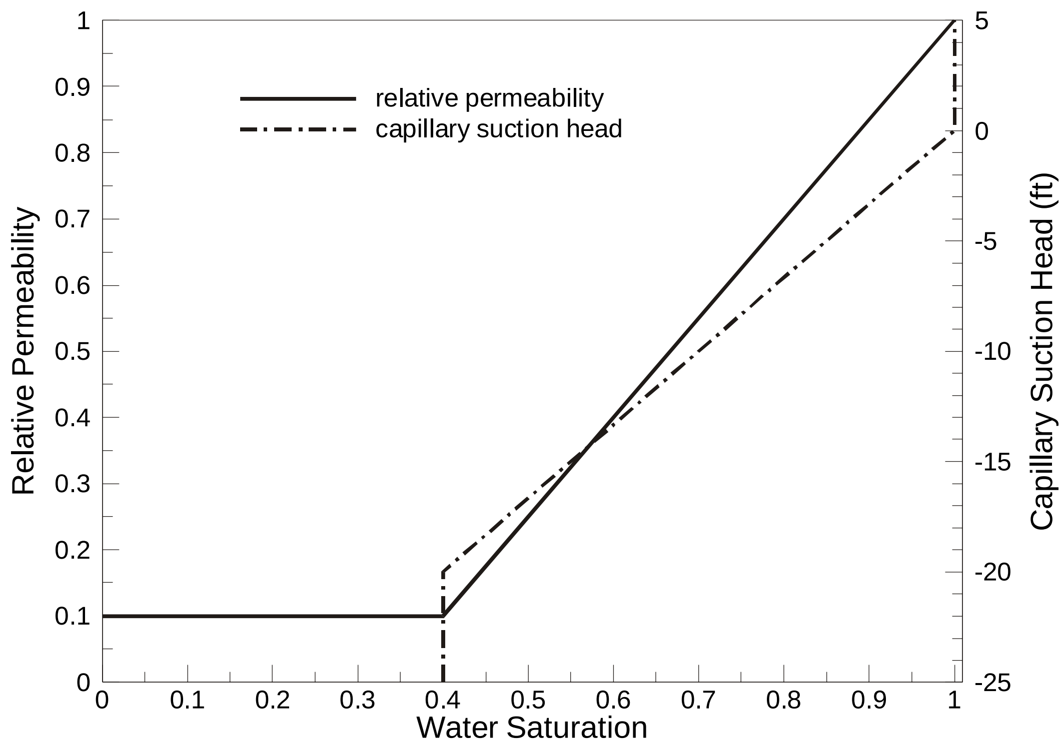


Figure 2-32. Approximate Soil Characteristic Curves

Table 2-1. Summary of Permeability Measurements

	Laboratory Tests (feet/day)		Slug Tests	Pumping Tests (feet/day)	
Hydrostratigraphic Unit	Vertical	Horizontal	**(feet/day)**	Multi-Well	Single-Well
"upper" aquifer zone					
Number of Results	17	14	11	0	0
Minimum	5.68E-06	3.12E-05	6.32E-02	-	-
Maximum	2.77E+01	6.04E+00	1.22E+01	-	-
Arithmetic Mean	1.90E+00	1.06E+00	2.09E+00	-	-
Geometric Mean	1.19E-02	4.02E-02	6.76E-01	-	-
Standard Deviation	6.67E+00	2.10E+00	3.62E+00	-	-
"tan clay" confining zone					
Number of Results	43	29	2	0	0
Minimum	3.70E-08	1.45E-05	3.60E-01	-	-
Maximum	2.39E-01	2.04E-01	5.27E+00	-	-
Arithmetic Mean	9.96E-03	1.51E-02	2.82E+00	-	-
Geometric Mean	7.68E-05	2.68E-04	1.38E+00	-	-
Standard Deviation	4.00E-02	4.83E-02	3.47E+00	-	-
"lower" aquifer zone					
Number of Results	30	26	31	2	1
Minimum	4.54E-06	1.59E-05	1.30E-01	1.23E+00	1.68E+00
Maximum	3.42E+00	1.11E+01	2.44E+01	2.10E+00	-
Arithmetic Mean	1.58E-01	7.07E-01	3.28E+00	1.67E+00	-
Geometric Mean	3.26E-03	1.31E-02	1.38E+00	1.63E+00	-
Standard Deviation	6.25E-01	2.20E+00	5.60E+00	6.13E-01	-
Gordon Confining Unit					
Number of Results	47	30	1	0	0
Minimum	1.14E-06	5.40E-06	2.04E+01	-	-
Maximum	4.27E-01	1.22E-01	-	-	-
Arithmetic Mean	1.13E-02	8.97E-03	-	-	-
Geometric Mean	1.28E-04	1.65E-04	-	-	-
Standard Deviation	6.25E-02	2.83E-02	-	-	-
Gordon Aquifer					
Number of Results	21	21	50	3	10
Minimum	3.12E-06	2.44E-05	5.00E-03	1.86E-04	8.20E-01
Maximum	3.62E+01	3.26E+01	3.31E+01	4.50E+01	1.43E+02
Arithmetic Mean	1.87E+00	6.07E+00	3.75E+00	2.57E+01	2.25E+01
Geometric Mean	2.09E-03	4.18E-02	9.79E-01	6.45E-01	5.00E+00
Standard Deviation	7.88E+00	1.18E+01	6.47E+00	2.32E+01	4.50E+01
Meyers Branch Confining System					
Number of Results	29	29	0	0	0
Minimum	4.26E-06	1.11E-05	-	-	-
Maximum	3.40E-01	1.50E+00	-	-	-
Arithmetic Mean	1.36E-02	8.42E-02	-	-	-
Geometric Mean	2.43E-04	6.64E-04	-	-	-
Standard Deviation	5.58E-02	3.01E-01	-	-	-

Table 2-2. Summary of Permeability Measurements from Intervals within the "Upper" Aquifer Zone

	Laboratory Tests (feet/day)		Slug Tests	Pumping Tests (feet/day)	
Hydrostratigraphic Unit	Vertical	Horizontal	**(feet/day)**	Multi-Well	Single-Well
"uu" interval					
Number of Results	0	0	0	0	0
Minimum	-	-	-	-	-
Maximum	-	-	-	-	-
Arithmetic Mean	-	-	-	-	-
Geometric Mean	-	-	-	-	-
Standard Deviation	-	-	-	-	-
"A" interval					
Number of Results	1	1	0	0	0
Minimum	1.85E-03	2.04E-02	-	-	-
Maximum	-	-	-	-	-
Arithmetic Mean	-	-	-	-	-
Geometric Mean	-	-	-	-	-
Standard Deviation	-	-	-	-	-
"AA" interval					
Number of Results	3	2	0	0	0
Minimum	5.68E-06	3.12E-05	-	-	-
Maximum	2.13E+00	2.69E-04	-	-	-
Arithmetic Mean	7.10E-01	1.50E-04	-	-	-
Geometric Mean	9.48E-04	9.16E-05	-	-	-
Standard Deviation	1.23E+00	1.68E-04	-	-	-
Transmissive Zone					
Number of Results	3	1	0	0	0
Minimum	4.80E-04	9.60E-04	-	-	-
Maximum	3.98E-01	-	-	-	-
Arithmetic Mean	1.58E-01	-	-	-	-
Geometric Mean	2.45E-02	-	-	-	-
Standard Deviation	2.11E-01	-	-	-	-
undifferentiated					
Number of Results	10	10	0	0	0
Minimum	5.40E-04	3.41E-03	-	-	-
Maximum	2.77E+01	6.04E+00	-	-	-
Arithmetic Mean	2.97E+00	1.49E+00	-	-	-
Geometric Mean	2.47E-02	2.11E-01	-	-	-
Standard Deviation	8.70E+00	2.38E+00	-	-	-

Table 2-3. Summary of Hydraulic Head Targets

Aquifer Unit or Zone	Category	Number of Hydraulic Head Targets
Gordon	1	126
"lower" UTRA	2	344
transmissive	3	180
“AA”	4	308
“A” and “uu”	5	179

Table 2-4. Base Flow Estimates Based on Hydrograph Separation of USGS Gauging Station Data

Stream Reach	Estimated Base Flow (cfs)	Estimated Fraction of Reach within CKLP Model	Base flow Target (cfs)
Meyers Branch (headwaters to Road 9)	9.5	1/3	3.2
Steel Creek (above Road B to Road A; includes L-Lake)	-2.2	1	-2.2
Pen Branch (headwaters to Road A13; includes Indian Grave Branch)	13.3	1	13.3
Fourmile Branch (headwaters to Road A12)	14.1	1	14.1
Upper Three Runs (Road C to Road A)	8.9	1/2	4.5

Source: Appendix E-1

Table 2-5. Base Flow Estimates Based on a Single Field Measurement under Low-Flow Conditions

Stream Reach	Field Measurement	Date
Caster Creek	2.9	7Dec98
Central Shops outfall creek	0.76	9Dec98
Indian Grave Branch (excluding K-18 outfall flow)	5.5 - 0.7 = 4.8	18Dec97
Indian Grave above Road B (excluding K-18 outfall flow)	3.0 - 0.7 = 2.3	18Dec97
Pen Branch above Indian Grave Branch	11	18Dec97
Pen Branch above Road B	1.9	15Oct97

Source: Appendix E-2

3.0 Groundwater Flow Model Development

The process used to transform the hydrogeologic data and conceptual model into a numerical groundwater flow model is presented in this Section.

3.1 Code Selection and Description

The subsurface Flow and Contaminant Transport (FACT) code was selected for numerical flow simulations. FACT is a variably saturated, three-dimensional, finite-element groundwater flow and solute contaminant transport code developed by the Savannah River Technology Center (SRTC) (Hamm and Aleman, 1999). FACT is an outgrowth of the SAFT3D code developed jointly by HydroGeoLogic, Inc. and SRTC (Huyakorn and others, 1991). Version 2.0 of FACT was selected for the study so that more accurate head and particle tracking solutions could be obtained by replacing the influence coefficient algorithm used in Version 1.1 with more accurate Gaussian quadrature available in Version 2.0. Other distinguishing features of FACT include efficient memory management and numerical algorithms that make large grids feasible, and user-friendly boundary conditions. For example, the combination recharge/drain boundary condition automatically determines whether a surface node should receive recharge or be discharging groundwater, based on the head solution. The software has undergone extensive verification and validation (V&V) testing, and has been used successfully to model other areas of the SRS. The reader is referred to the *FACT User's Manual* for a more thorough description of the code (Hamm and Aleman, 1999). FACT was selected primarily because

1) the variably saturated formulation enables explicit modeling of the vadose zone, which may be important for subsequent modeling of contaminant transport or remedial actions using the present model or a derivative

2) the code meets the software Quality Assurance requirements of 1Q, 20-1

3) the authors have a strong working knowledge of the code

4) the source code is available.

3.2 Model Configuration and Mesh

As described in Section 2.5, groundwater recharge over the greater CKLP GWMA is thought to potentially travel as deep as the Gordon aquifer before discharging to the Savannah River, Upper Three Runs, or tributaries. Therefore contamination originating from C, K, L and P

reactor facilities is expected to be confined to the Upper Three Runs and Gordon aquifer units between Upper Three Runs on the north, Steel Creek/Meyers Branch on the south, the Savannah River on the west, and an eastern line running from McQueen Branch to Par Pond. As shown in Figures 3-1 and 3-2, these are the boundaries chosen for the CKLP model. The rivers and streams bordering the selected domain also provide natural no-flow boundary conditions according to the conceptual model, and further motivation for choosing model boundaries as shown in Figure 3-1.

The chosen areal grid is 70,000 ft on each side, with a resolution of 500 square feet(Figure 3-1). The mesh resolution is a compromise between the need to resolve topographic features that drive groundwater flow in the UTR aquifer, and computer memory, run-time, and storage limitations. There are 140 elements along the east-west and north-south model coordinate axes. The vertical resolution varies depending on hydrogeologic unit and stratigraphic variations (Figure 3-2). The top surface of the mesh conforms to the ground surface. The bottom surface of the mesh coincides with the bottom of the Gordon aquifer unit. Interior node layers conform to the other stratigraphic surfaces. The Pen Branch Fault is represented in the finite-element mesh as a gradual "bend" in hydrostratigraphic units, rather than the discontinuity shown in Figure ???, to be more consistent with the conceptual model of the fault. The Pen Branch Fault appears in Figure 3-2 between Indian Grave Branch and Pen Branch. The “upper” aquifer zone of the UTR aquifer unit is represented with 3 finite-elements in the vertical direction that conform to the transmissive, AA and A/uu horizons. The vadose zone is included in the model. The “tan clay” confining zone is modeled with a single element. The “lower” aquifer zone is subdivided into 2 finite-elements of equal size. The Gordon confining and aquifer units each contain one element, for a total of 8 vertical elements from ground surface to the bottom of the Gordon aquifer. The three-dimensional mesh size is therefore $140\times140\times8=156{,}800$ elements or $141\times141\times9=178{,}929$ nodes. The transmissive, AA and A/uu horizons within the “upper” UTR aquifer zone were explicitly modeled to improve model calibration and better support subsequent contaminant transport analyses compared to the previous model of Flach and others (1998). The prior effort only modeled these zones in K-area.

3.3 Boundary Conditions

The entire top surface of the mesh is assigned a combination recharge/drain boundary condition, except for the area covered by L Lake and Par Pond (Figure 3-3). This FACT code option automatically specifies a recharge boundary condition for nodes with a computed head below ground elevation, and a drain boundary condition for nodes with a computed head

above ground surface, which is physically correct. The reader is referred to the FACT code manual for detailed information on how this boundary condition is numerically implemented in FACT (Hamm and Aleman, 1999). Surface drain coefficients are set to 1.0 day^{-1} model wide. The selected drain coefficient is sufficiently large to ensure that computed head will be only slightly greater than ground elevation in discharge areas. Streams and rivers can be represented with the FACT recharge/drain boundary condition, instead of general head or river boundary condition, because they are gaining according to the conceptual model. For gaining surface bodies, the FACT recharge/drain, general head, river, and drain boundaries all function as drains and are equivalent. The maximum local recharge rate is generally specified as 12.5 in/yr based on model calibration (to be discussed), which is consistent with the estimated range of 10 to 16 in/yr for recharge developed in Section 2.4. Over the General Separations Area, recharge is set to 15 in/yr to reflect site-specific estimates of 15 in/yr recharge, less than average forest cover, and to be consistent with Flach and Harris (1997). However, recharge is set to 1.5 in/yr for capped areas within the Burial Ground Complex (E area).

The entire bottom surface of the mesh is assigned a general head boundary condition to account for flow into or out of the model domain across the Crouch Branch confining unit (Meyers Branch confining system). A leakance coefficient of 3×10^{-6} d^{-1} is assumed based on Plate 17 of Aadland and others (1995). This value is supported by a scoping SRTC regional flow model for which model calibration indicates the leakance should be about 5×10^{-6} d^{-1}. Head distribution in the Crouch Branch aquifer is also taken from Plate 45 of Aadland and others (1995). General head boundary conditions are also specified for L Lake and Par Pond. L Lake is assumed to have a constant pool of 190 ft and a drain coefficient of 1000 d^{-1}. The drain coefficient is large enough that the lake and underlying aquifer have the same head along their boundary. Par Pond is similarly modeled as having a constant pool of 200 ft and drain coefficient of 1000 d^{-1}. Process water outfalls are not modeled because these features are too small to effectively resolve with a 500-ft finite-element size.

Boundary nodes between the top and bottom surfaces of the mesh are assigned either a no-flow or prescribed head boundary condition. Consistent with the conceptual model, boundary nodes underlying major streams and rivers are assigned no-flow boundary conditions because no groundwater is assumed to cross beneath these features. No-flow boundary conditions are also specified in the vadose zone. Where no-flow boundary conditions are inappropriate in the saturated zone, head is prescribed consistent with the potentiometric maps presented in Figures 2-14 and 2-20. For the Gordon aquifer, the result is

no flow conditions along the west (Savannah River) and north (Upper Three Runs) boundaries, and prescribed head along the east and south boundaries as shown in Figure 3-4. For the Upper Three Runs aquifer, head is prescribed from the headwaters of McQueen Branch south to Par Pond, and from the headwaters of Meyers Branch east to Par Pond (Figure 3-5). Elsewhere, no flow boundary conditions are specified for this unit.

3.4 Material Properties

Horizontal conductivity in the Gordon aquifer is set to 35 ft/day based on the extensive field data from both on and off the Savannah River Site reviewed in section 2.2.2.1 and by Aadland and others (1995). The vertical conductivity of the Gordon confining unit is set to 10^{-4} ft/day in accordance with the field data summarized in section 2.2.2.2 and by Aadland and others (1995). Conductivity values in the Upper Three Runs aquifer unit are set through model calibration to well water level data, according to the procedure described in the next section. The ratio of horizontal to vertical conductivity is typically assumed to be 100:1. Because the Pen Branch Fault is assumed to exist in the model domain as a gradual bending of hydrostatigraphic units, the Gordon confining unit and “tan clay” confining zone are assumed to have the same leakance along the Pen Branch Fault as surrounding sediment. Model calibration to measured heads provided no evidence to the contrary. The approximate soil characteristic curves shown in Figure 2-23 are adopted for the numerical model. An effective porosity value of 25% is assumed for the purpose of computing a pore velocity field that may be used later for particle tracing. The assumed porosity value is consistent with the general recommendation of Looney and others (1987, p. 39). However, the value does not affect the steady-state head and Darcy velocity solutions, or set precedence for subsequent transport simulations. For specific storage a nominal value of 10^{-4} ft^{-1} is input to the FACT code, and would only be important for transient flow simulations within a confined aquifer.

In C-area, initial groundwater pathlines originating from the C-Reactor Seepage Basin (CRSB) did not agree with the tritium plume movement observed from Cone Penetration Test (CPTu) concentration data, for any reasonable variation in horizontal and vertical conductivities. Subsequently, CPTu lithologic data were used to identify dominant confining intervals and zones of high horizontal conductivity within the Upper Three Runs aquifer, as described in Appendix G. In summary, the CPTu data indicate that, on the north side of Caster Creek, the “tan clay” confining zone largely disappears as a confining zone and a deeper confining zone appears within the lower zone of the Upper Three Runs aquifer. The underlying confining zone is interpreted to be a calcareous wackestone/mudstone based on the CPTu signature of low tip and sleeve resistance with high pore pressure. Also, the

"transmissive zone" is significantly more conductive south of the CRSB. To best represent these features given the coarse vertical resolution of the numerical flow model, element layer 5 was redefined to coincide with the lower calcareous zone instead the tan clay near Caster Creek in C-area. Simulated groundwater flow paths were then in much better agreement with observed plume migration from the CRSB and C-area Burning/Rubble Pit (CBRP). Figures 3-6 and 3-7 illustrate the changes to the simulated flow paths that result from these refinements.

3.5 Calibration Process

Groundwater recharge and discharge estimates, monitoring well water level data, large-scale measurements of hydraulic conductivity, previous modeling efforts, and a general knowledge of groundwater flow directions and timing were used as targets for calibrating the CKLP flow model. The main parameters selected for calibration adjustment are recharge, horizontal conductivity in aquifer zones and vertical conductivity in confining zones within the Upper Three Runs aquifer, because the model is sensitive to these parameters, and each has significant uncertainty. Other input parameters have less impact on the steady-state flow results and/or lower uncertainty, and were set to their initial best-estimate value throughout calibration. For example, horizontal conductivity in the Gordon aquifer is relatively well known from extensive field-scale tests conducted both on and off the SRS. Therefore, the horizontal conductivity of the Gordon aquifer can be set to 35 ft/day, and held fixed during model calibration. The overall calibration procedure involves 4 sequential, steps:

1) Set model recharge to a value consistent with the prior estimate, and such that simulated discharge agrees with prior baseflow estimates.

2) Adjust Gordon confining unit vertical conductivity to achieve agreement with measured head in the Gordon aquifer, while still agreeing with prior estimates.

3) For the Upper Three Runs aquifer, simultaneously adjust horizontal conductivity in the "lower" and "upper" aquifer zones and vertical conductivity in the "tan clay" confining zone to achieve agreement with head data in these zones.

4) Add zonal variation to unit conductivity values within the Upper Three Runs aquifer as needed to achieve better agreement with head targets.

In practice, the above procedure is iterated during calibration. The model is most sensitive to recharge, as this parameter drives groundwater flow according to the conceptual model

(Section 2.5). As discussed in Section 2.4, average recharge is thought to lie within the range of 10 to 16 in/yr. Taking the best-estimate value as the mid-point of the range, 13 in/yr, the uncertainty would be plus or minus 25%. The uncertainty of stream base-flow targets ranges from ±15% to 25% (Appendix E). In step 1, equal weight is given to satisfying recharge and discharge targets because these data have similar reliability.

Next in importance is leakance through the Gordon confining unit, which is adjusted in step 2. Groundwater flow in the Gordon aquifer is controlled by recharge through the Gordon confining unit, flow across the east and south model boundaries, and horizontal conductivity. Because the head boundary conditions and horizontal conductivity are relatively well known for this unit, Gordon confining unit vertical conductivity is adjusted to achieve agreement with head targets.

With recharge and Gordon confining unit vertical conductivity fixed through steps 1 and 2, horizontal conductivity in the "upper" and "lower" aquifer zones and vertical conductivity in the "tan clay" become the next calibration parameters. The model is sensitive to these parameters, which are highly uncertain relative to other factors (e.g. boundary conditions). Zonal variation in conductivity is invoked as a last resort to achieving adequate agreement with head targets. In C-area CPTu lithologic data are used to guide specification of conductivity zones as described in Appendix G.

The goal of the calibration process is to achieve as good of agreement with prior targets as possible, without resorting to unjustifiable zonal variation in conductivity or other parameters. A lower estimate for achievable calibration accuracy is the uncertainty level in the target data. That is, one should not expect to match calibration targets better than the "noise" level in the data. As discussed in Section 2.3.3, head targets that are a result of time averaging have a "2-sigma" uncertainty less than or equal to 3 ft, with most being well below 3 ft (Appendix F). However, there are also a significant number of one-time head readings that have much larger uncertainty, typically ±5 ft, that inflate average uncertainty. The recharge and stream base flow targets have an uncertainty of roughly ±25% (Section 2.4; Appendix E). Previous models covering portions of the SRS have generally achieved a root-mean-square head residual of 3 ft or so (e.g. Camp Dresser & McKee, 1989; GeoTrans, 1992; Flach and Harris, 1997). Given the large scale, coarse mesh resolution, and relative uniformity of the conductivity field desired in the present model, a calibration goal of 3 ft is too low, especially for the more heterogeneous aquifer zones. A more reasonable calibration goal for root-mean-square residual or mean-absolute residual is 5 ft. A reasonable calibration goal for the largest head residual is sometimes defined as 5-10% of the total head variation in the modeled system.

For the Gordon aquifer, the total variation is about 120 ft (Figure 2-20) suggesting a calibration goal of 6 to 12 ft for the maximum residual. For the Upper Three Runs aquifer, the total variation is about 330 ft (Figure 2-14) for a calibration goal of 16 to 33 ft.

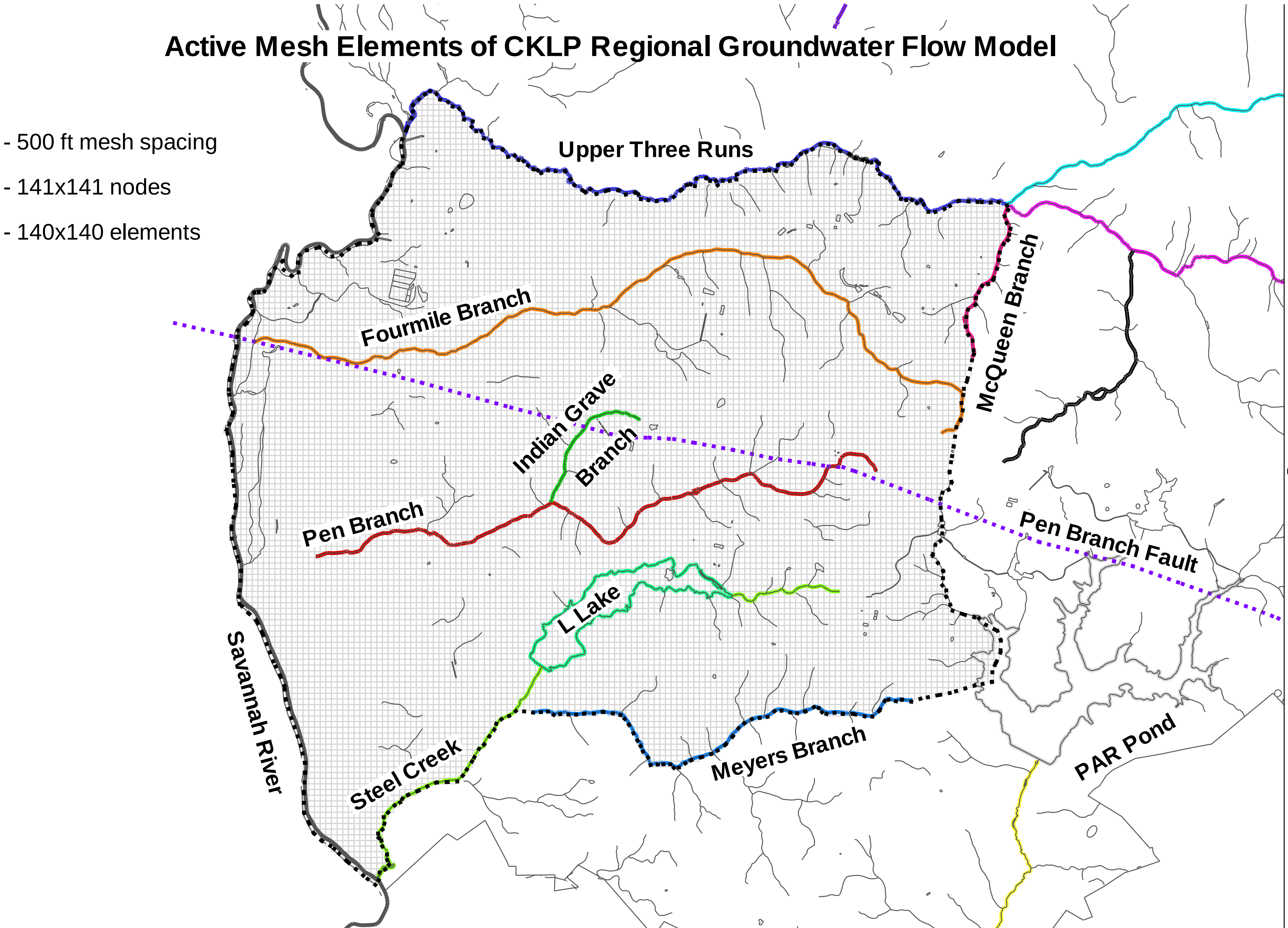


Figure 3-1. Plan View of Model Domain and Finite-Element Mesh

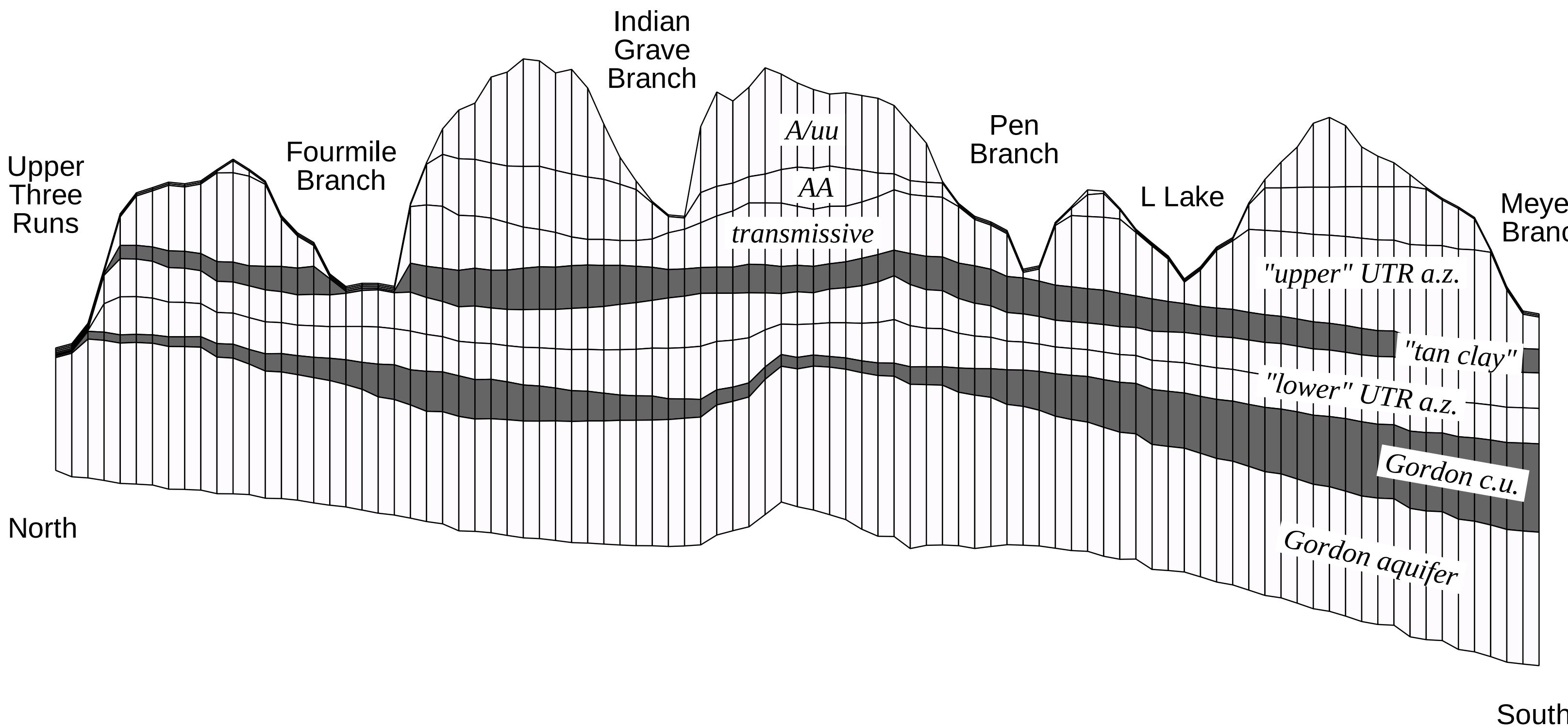


Figure 3-2. Typical Cross-Sectional Slice through Finite-Element Mesh

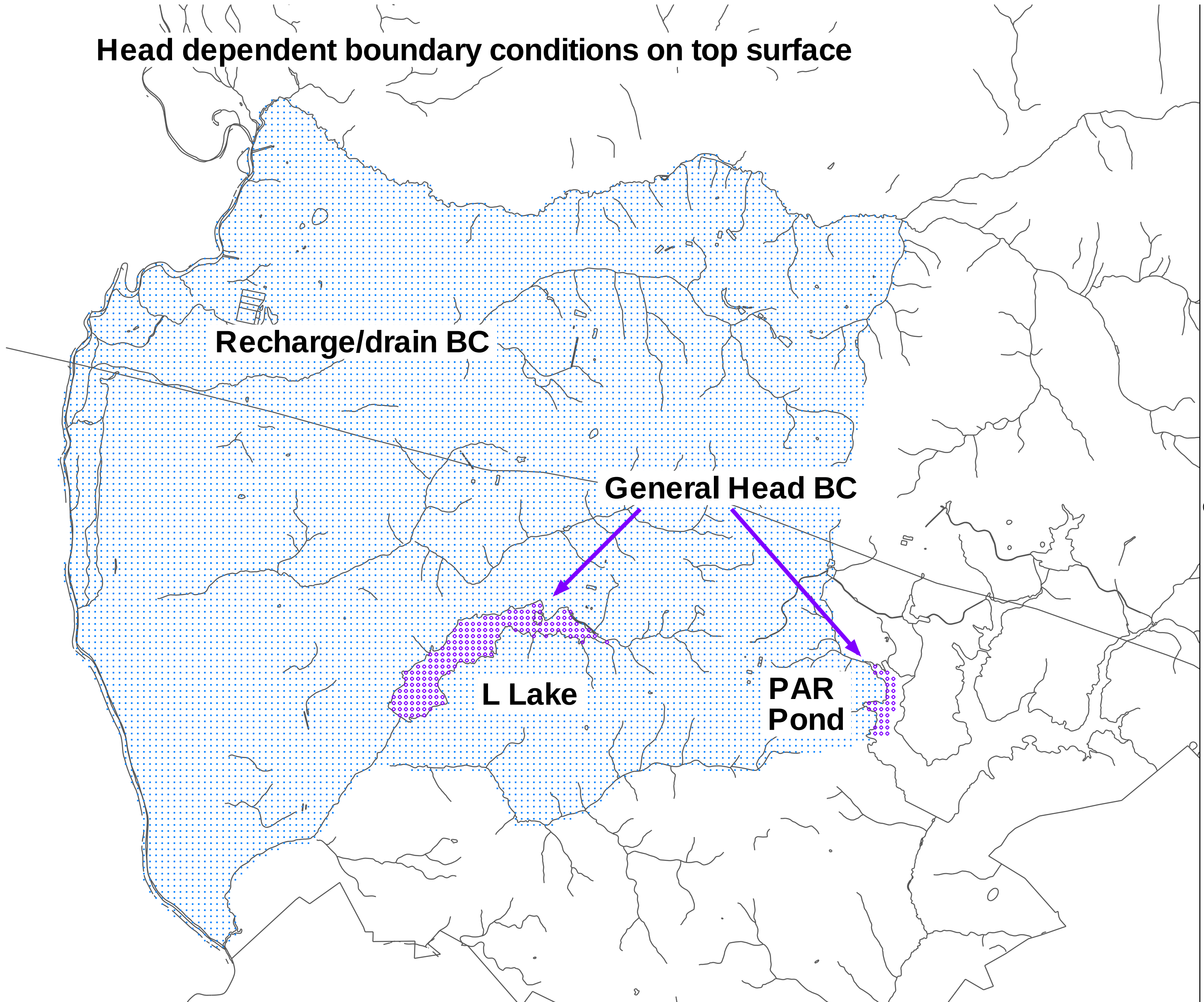


Figure 3-3. Top Surface Boundary Conditions

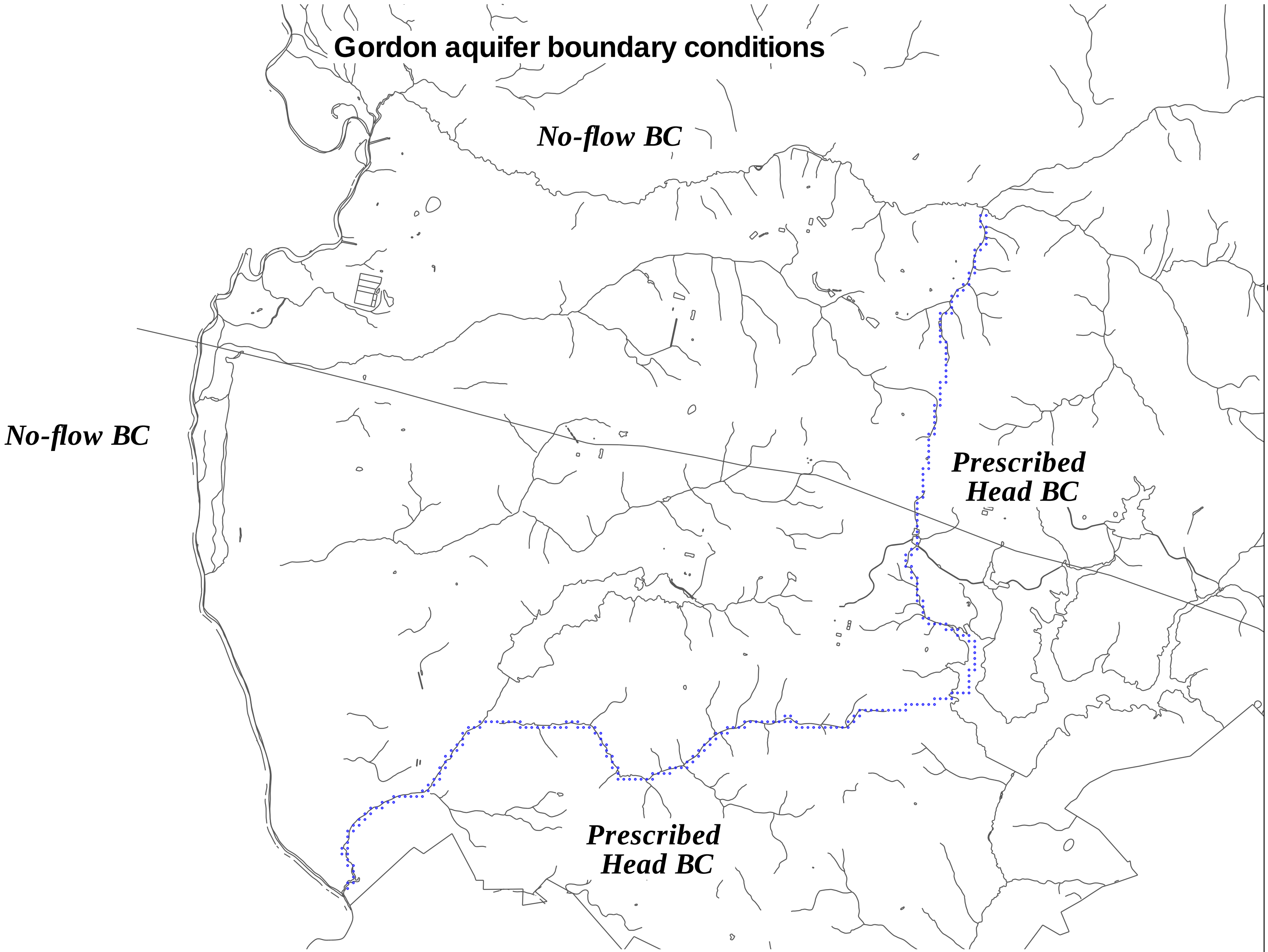


Figure 3-4. Boundary Conditions for Gordon Aquifer between the Top and Bottom Nodal Layers

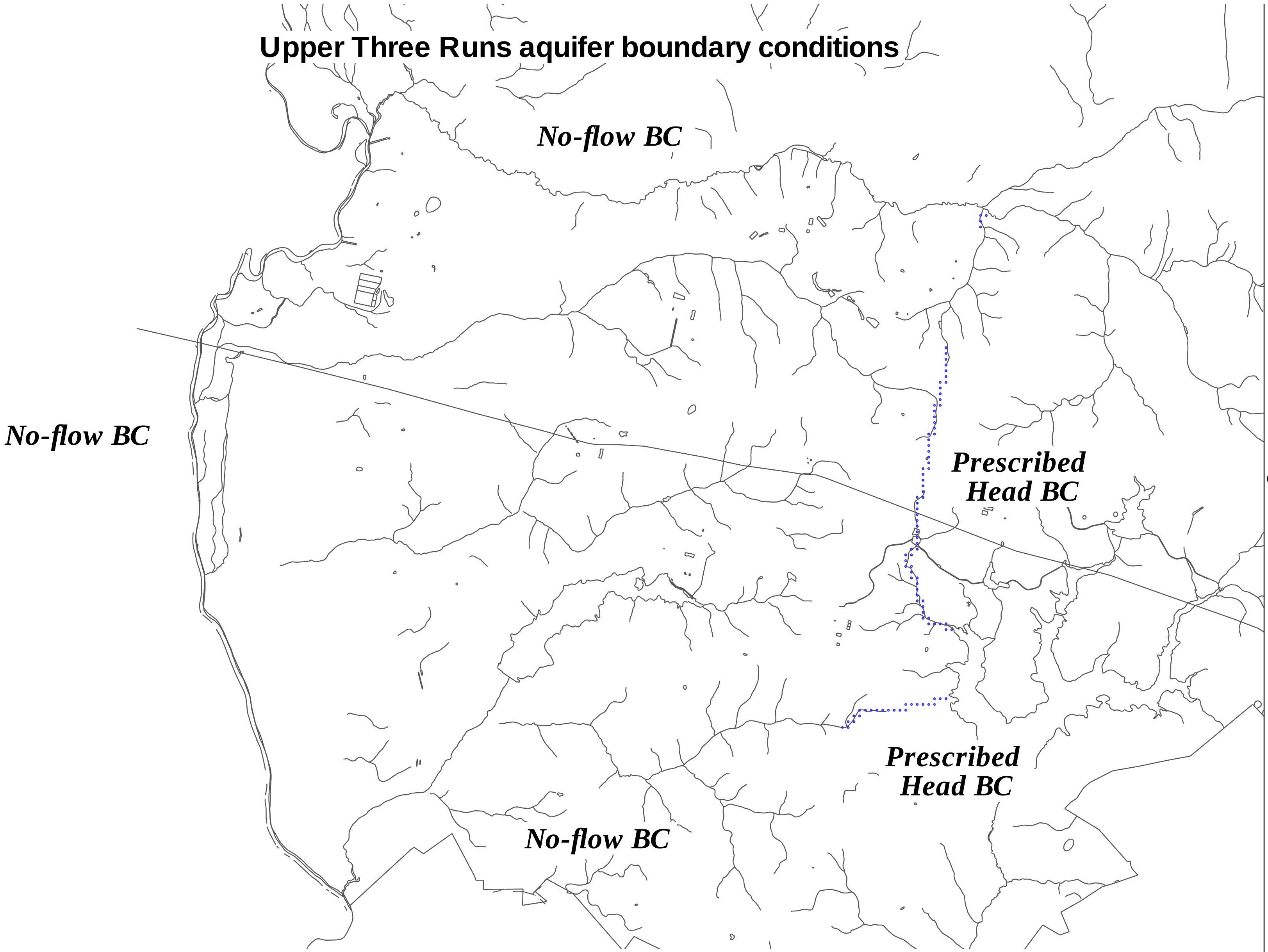


Figure 3-5. Boundary Conditions for Upper Three Runs Aquifer between the Top and Bottom Nodal Layers

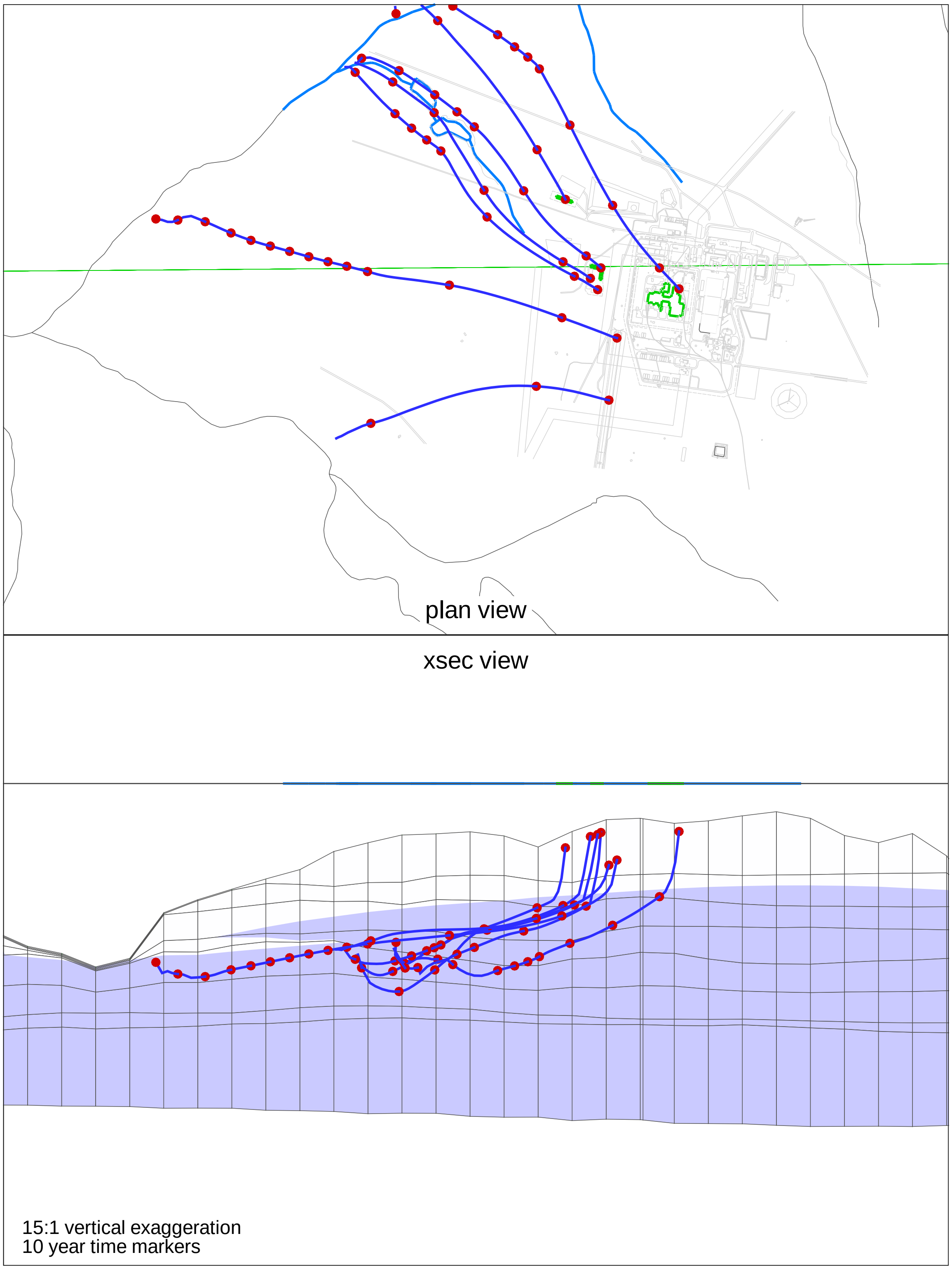


Figure 3-6. Predicted Groundwater Flow Paths Prior to Refinement of "Tan Clay" Model Layer in C-Area near Caster Creek

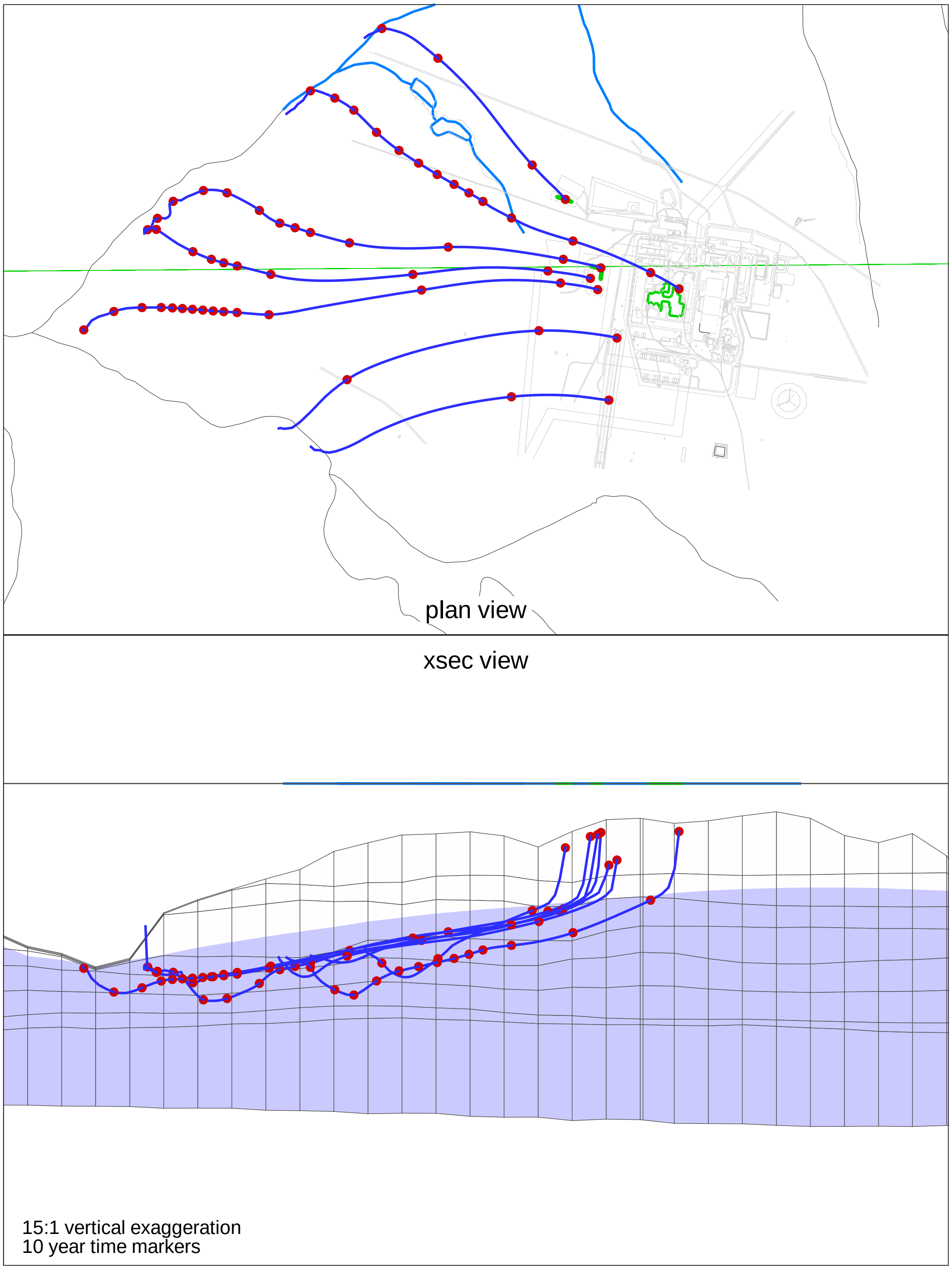


Figure 3-7. Predicted Groundwater Flow Paths after Refinement of "Tan Clay" Model Layer in C-Area near Caster Creek

4.0 GROUNDWATER FLOW MODEL RESULTS

4.1 Calibration Results

Table 4-1 summarizes the calibration results for groundwater flow targets. The maximum rate of local recharge is set to 12.5 in/yr in the FACT recharge/drain boundary condition, except for the General Separations Area (Section 3.3). The modeled rate is 17% lower than the prior estimate of 15 in/yr, but very close to the midpoint of the uncertainty range (13 in/yr). Based on total area, which includes the Savannah River flood plain and other wetland areas, the average recharge rate is 9.0 in/yr.

Excellent agreement is observed for Pen Branch and Fourmile Branch base flow, the most reliable targets. For Meyers Branch, the agreement is acceptable, being within the estimated confidence interval. Simulated base flow to Upper Three Runs between Road C and Road A is 40% higher than the prior estimate, but still within the uncertainty interval. A possible explanation is that Upper Three Runs receives significantly more base flow from the south side (model side), due to significantly steeper terrain and aquifer head gradients compared to the north side. The prior estimate is based on the assumption that base flow should be partitioned equally to each side. The model predicts L-Lake to be losing overall, in qualitative agreement with the fact that make-up water is required to maintain a historic level of 190 ft. However, a large discrepancy is noted for the combined baseflow for Steel Creek and L Lake. The data suggests a large net loss of 2.2 ft^3/s for this reach. While the model predicts L Lake to be losing at a rate of 0.3 ft^3/s, Steel Creek gains at a rate of 4.1 ft^3/s for a net gain of 3.8 ft^3/s. A likely explanation is large uncertainty in the hydrograph estimate due to taking the difference of several numbers that are large compared to the balance. The small portion of Par Pond within the model domain is simulated to be gaining, as would be expected for an area away from the dam. Overall, the calibration goals for large-scale groundwater flow are met.

Also shown in Table 4-1 is a comparison to selected single-time field measurements. Excellent agreement is observed in C-area for Caster Creek and a creek receiving outfall from Central Shops. For K-area, the agreement between predicted and measured stream flow is poor. As noted in Section 2.4, the measured flow in Pen Branch below its confluence with Indian Grave Branch (15.8 cfs, Table 2-4) exceeds the estimated base flow for the entire stream (13.3 cfs, Table 2-3). Possibly the stream flow measurements in K-area are biased high. Conversely, the large gain along Pen Branch between Road B and Indian Grave Branch

may be due to groundwater discharge induced by nearby L Lake. The model may be underestimating the flow from L Lake to Pen Branch.

Table 4-2 summarizes the calibration results for hydraulic head targets. Figure 4-1 graphically compares simulated head with measured head for each aquifer zone. Figures 4-2 through 4-6 illustrate the spatial distribution of head residuals. Appendix F contains a detailed listing of head residual information. The root-mean-square residual is 5.45 ft, which is acceptable compared to the calibration goal of 5 ft. The mean-absolute residual, which gives lower weight to outliers, is 4.0 ft and well within the calibration goal. The residuals are largely unbiased, although the lower aquifer zone of the Upper Three Runs aquifer is biased high by more than 1 ft.

Agreement is excellent in the Gordon aquifer, except for 5 double-digit outliers. At TNX Area, the simulated heads for TBG-5B and P-26A are 13 to 16 ft low, while the residual at nearby XSB-1A is only -0.1 ft. The scale of the model appears to be too large to reproduce the sudden change in head in this area. In K Area, simulated head at P-25B is 14 ft low. A possible explanation is that the Gordon aquifer is experiencing high recharge through the Pen Branch Fault. Northeast of P-25B, the residual for PW-83N is +10 ft. Here the large discrepancy may be due to the target value being a single reading that is not reflective of the long-term average water level. In the General Separations Area, the measured water level at BGO-10A is 13 ft higher than the model prediction. However at BGO-10AA which is screened deeper, the agreement is excellent. The average Gordon aquifer residual is biased slightly low by 0.7 ft.

Large residuals are observed within the “lower” aquifer zone of the Upper Three Runs aquifer in the C-Area vicinity. In this area, the “lower” aquifer zone is interpreted to contain zones of calcareous sediment with low-permeability. These zones may serve to elevate the hydraulic head beneath the “tan clay” confining zone. These zones are largely unaccounted for in the model and may explain the large residuals. Other areas, such as the Chemicals, Metals and Pesticides (CMP) Pits, also contain double digit residuals. The discrepancies are likely caused by the heterogeneity in the “lower” aquifer zone that is not represented in the model. This heterogeneity is due to the fact that data points within the “lower” aquifer zone are relatively scarce and very widespread in areas outside of the General Separations Area. The overall mean-absolute residual is 5.1 ft, and acceptable compared to the calibration goal of 5 ft.

Head residuals are generally lower in the “upper” aquifer zone of the Upper Three Runs aquifer containing the “transmissive” zone, “AA horizon” and “A/uu horizon” (Table 4-2).

Excellent agreement is observed in C-area and K-area, where additional characterization data has been obtained over the last year. As with the lower zone, the larger residuals are a result of uncertainty in the geology of specific areas due to observed areas of heterogeneity in the UTRA. The average residuals for the “transmissive” zone and “AA horizon” are well within the calibration goal. The average “A/uu horizon: residual is slightly higher than desired.

Table 4-3 summarizes the calibration results for hydraulic conductivity. Figures 4-7 through 4-14 show variation in conductivity for each model layer in plan view. Horizontal conductivity is shown for the transmissive zones, and vertical conductivity for confining zones. Figure 4-15 illustrates a typical north-south vertical slice, in this case passing through K Area. The calibrated values are consistent with field data (Section 2.2) and previous groundwater flow models (e.g. HSI GeoTrans, 1998, Figure 4-6; HydroGeoLogic, 1998, Table 6.5; Flach, 1998, Table 4; Flach and Harris, 1997; GeoTrans, 1993, Table 4.1; GeoTrans, 1992, Table 3.6; Camp Dresser & McKee, 1989, Table 3-3).

4.2 Nominal Simulation

Figures 4-16 through 4-18 illustrate simulated hydraulic head averaged over the entire thickness of the Gordon aquifer and “lower” and “upper” aquifer zones. Simulated head in the aquifer zone containing the water table is shown in Figure 4-19, and Figure 4-20 illustrates simulated water table elevation. For comparison to Figure 4-15, see Figure 2-20 which shows the Gordon potentiometric surface as based on measured water levels. The estimated water table based directly on head data is shown in Figure 2-14, and can be compared to Figures 4-17 through 4-20. Figures 4-21 through 4-23 illustrate flow directions that are vertically averaged over the entire thickness of the aquifer zones. Figure 4-24 shows simulated seepage faces, and Figure 4-25 illustrates rates of recharge and discharge. Figures 4-24 and 4-25 can be compared to Figure 2-21, which is based on field observations. Example particle tracing results are shown in Figure 4-26. A water balance for the model is depicted in Figure 4-27.

4.3 Uncertainty Analysis

Uncertainty in the nominal model can be estimated by varying the input parameters within their uncertainty range, and in a correlated manner such that agreement with calibration targets is preserved as much as possible. The nominal model is sensitive to recharge, which drives overall groundwater flow in this system, and Gordon confining unit (GCU) vertical conductivity (K_V), which controls recharge to the Gordon aquifer (equal to leakance from the Upper Three Runs aquifer). Both of these input parameters have significant uncertainty.

Table 4-4 summarizes four variations of these two parameters within their estimated range of uncertainty. For each uncertainty case, the model is recalibrated to maintain agreement with the prior head targets by adjusting conductivity values in the Upper Three Runs aquifer, and Gordon aquifer if necessary. Table 4-5 summarizes the calibration results for each sensitivity case.

Uncertainty cases 1 and 2 involve perturbations to the maximum local recharge rate of ±20%. As seen in Table 4-5, the results for cases 1 and 2 show equivalent agreement to hydraulic head targets compared to the nominal or base case. For higher recharge (case 1), predicted base flows are biased high for Pen Branch and Fourmile Branch, the most reliable targets. For lower recharge (case 2), simulated base flows are low for these streams. Horizontal conductivities in the "upper" and "lower" UTRA aquifer zones were adjusted by +30% and -26% to compensate for the recharge variations in cases 1 and 2, respectively. The resulting K_h values for the uncertainty cases remain well within the data uncertainty range. No changes were made to the Gordon aquifer unit horizontal conductivity, or vertical conductivity in confining units/zones.

Uncertainty cases 3 and 4 involve increases and decreases to Gordon vertical conductivity by a factor of 5. For these cases, adjustment to Gordon aquifer unit horizontal conductivity was also required to maintain agreement with head targets, to the extent possible. Despite model recalibration, uncertainty cases 3 and 4 show significantly poorer agreement to calibration targets compared to the nominal case. For higher Gordon confining unit leakance, head residuals are large, and Pen Branch and Fourmile Branch base flows are significantly biased low. Horizontal conductivities for both the Gordon and UTR aquifers are barely credible. For lower Gordon confining unit leakance, head residuals are similar to the base case, and uncertainty cases 1 and 2. Simulated base flows for Pen Branch and Fourmile Branch are biased high. Reasonable horizontal conductivities are obtained for the UTR aquifer. However, the Gordon aquifer horizontal conductivity is significantly low compared to field data.

More detailed information about each uncertainty analysis case is presented in Appendix H. In the appendix, model results in various forms are reproduced for each uncertainty case for comparison to the nominal results (Figures 4-1 through 4-14, 4-16 through 4-20, 4-25 and 4-26).

The uncertainty results presented here are generic. For specific applications of the model, additional uncertainty analysis should be performed, tailored to the sub-region and output

parameter(s) of interest. For example, uncertainty cases 5 and 6 shown parenthetically in Table 4-4 would be useful for investigating uncertainty in plume migration, because they effectively provide upper and lower bounds on horizontal flow rates. Similarly, effective porosity should be considered for groundwater travel time and transport uncertainty analysis, because pore velocity is inversely proportional to this parameter. Specifically, transport sensitivity runs should include total porosity for an upper estimate (~40%), and a conservative (low) estimate for effective porosity (~25%).

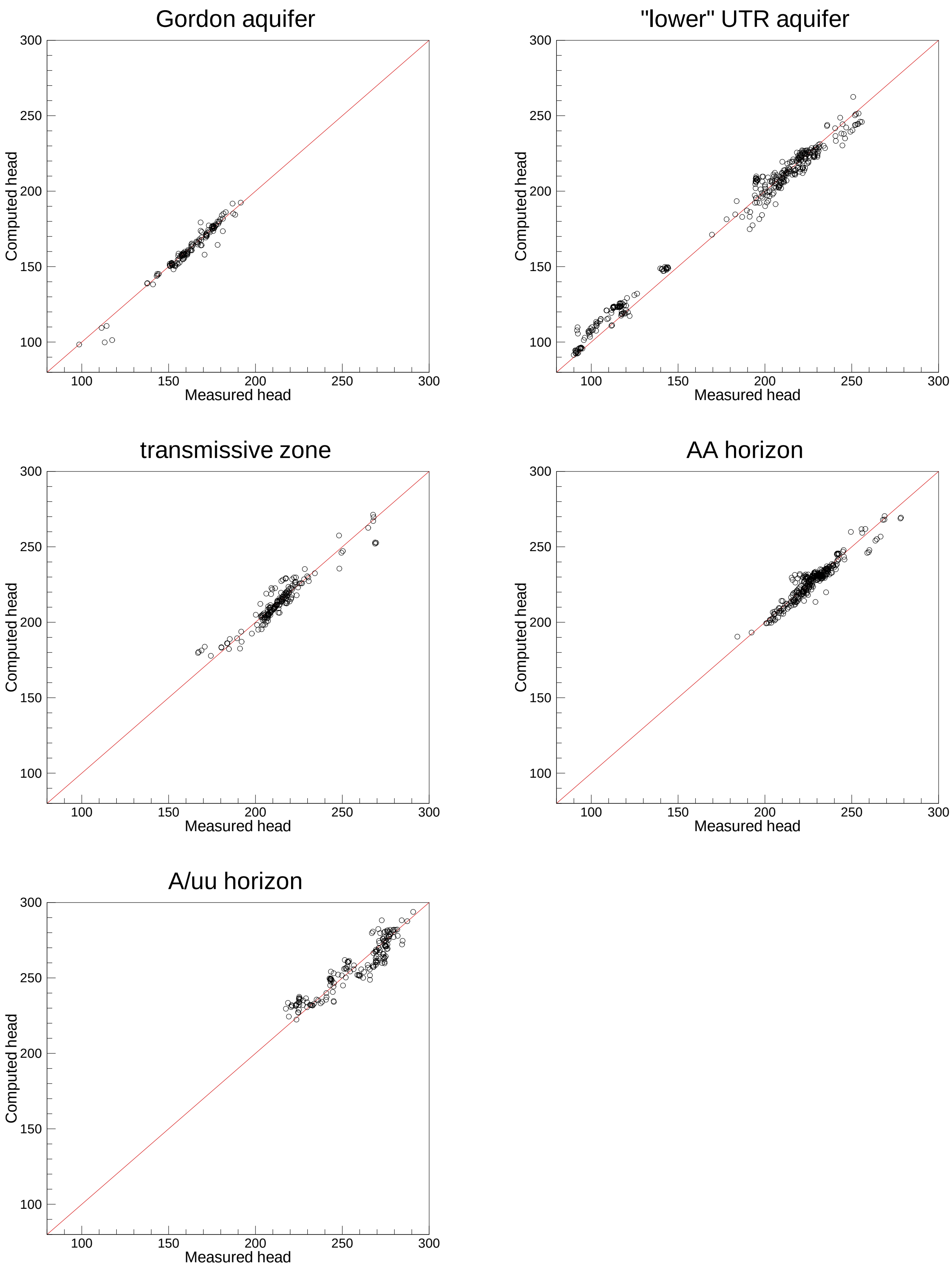


Figure 4-1. Simulated versus Measured Head for Each Aquifer Zone

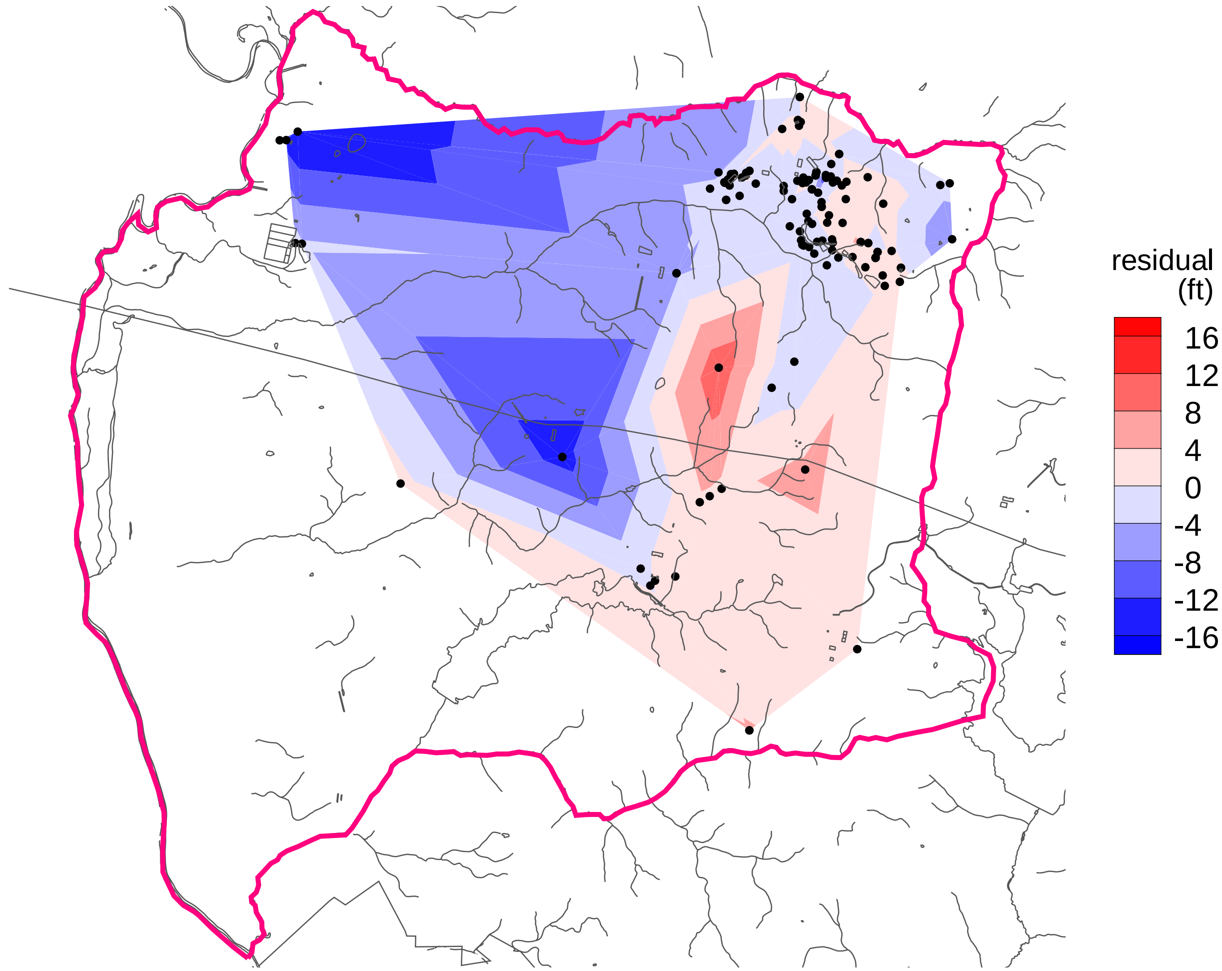


Figure 4-2. Head Residuals in the Gordon Aquifer

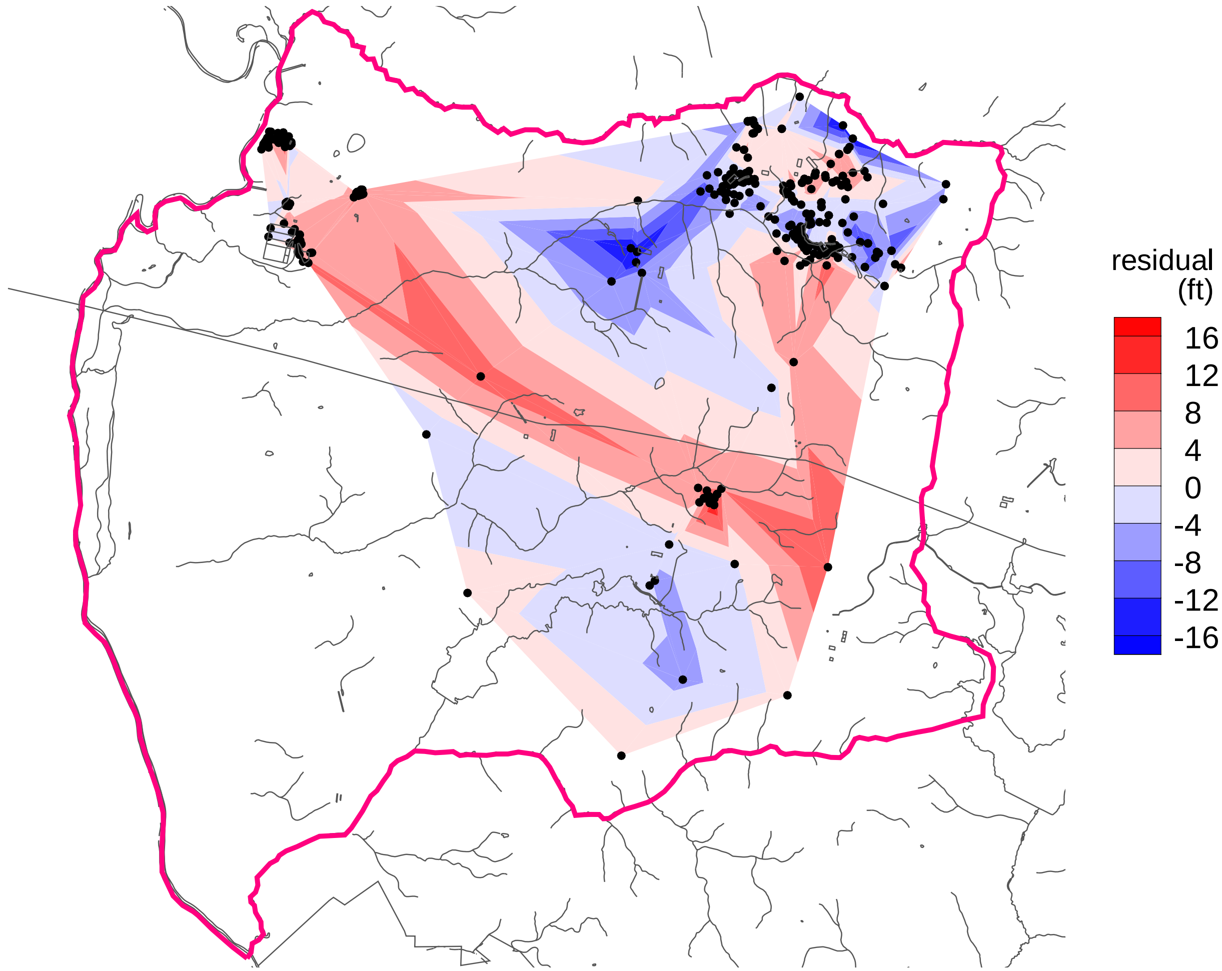


Figure 4-3. Head Residuals in the Lower UTR Aquifer Zone

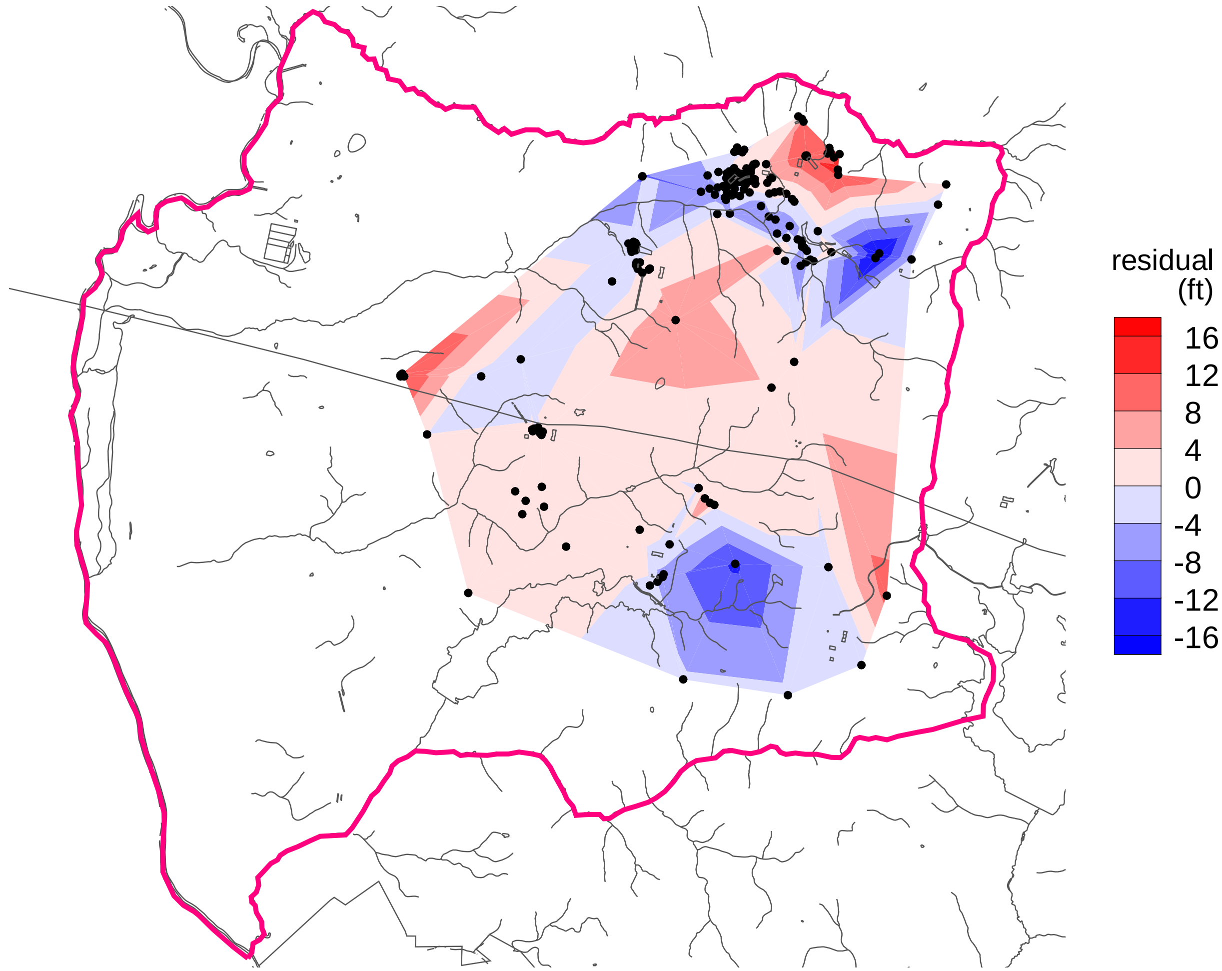


Figure 4-4. Head Residuals in the Transmissive Zone (Upper UTR Aquifer Zone)

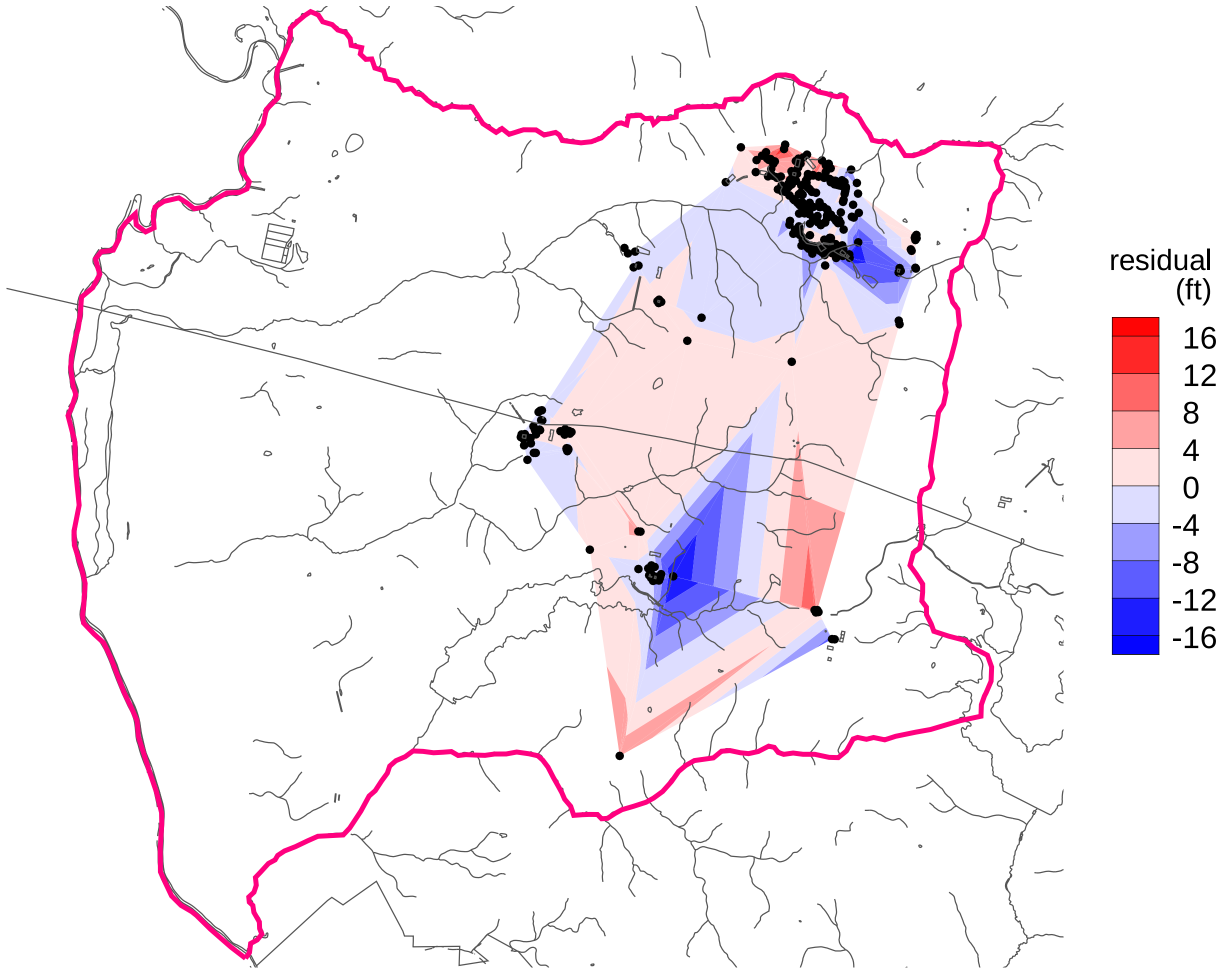


Figure 4-5. Head Residuals in the AA Horizon (Upper UTR Aquifer Zone)

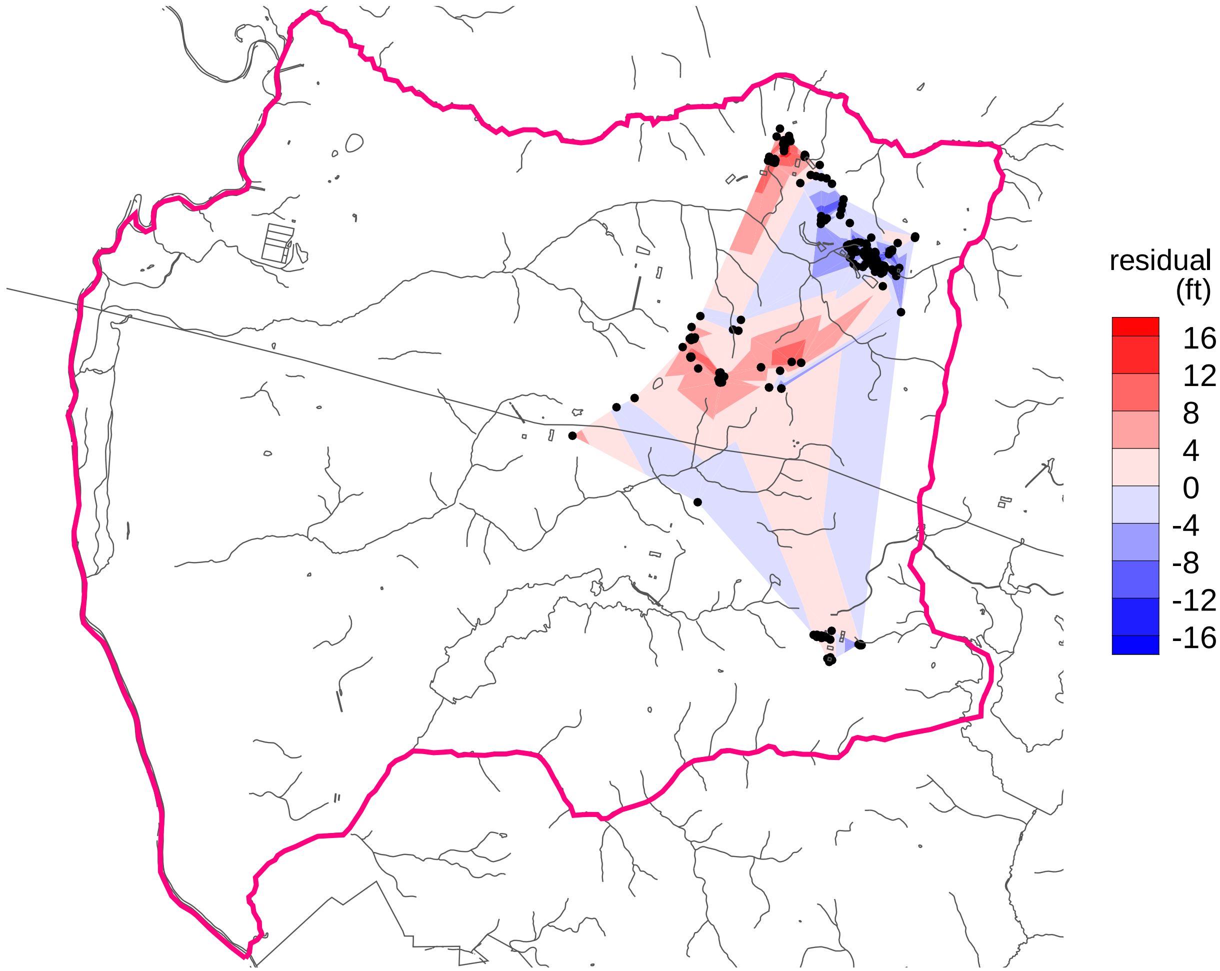


Figure 4-6. Head Residuals in the A/UU Horizon (Upper UTR Aquifer Zone)

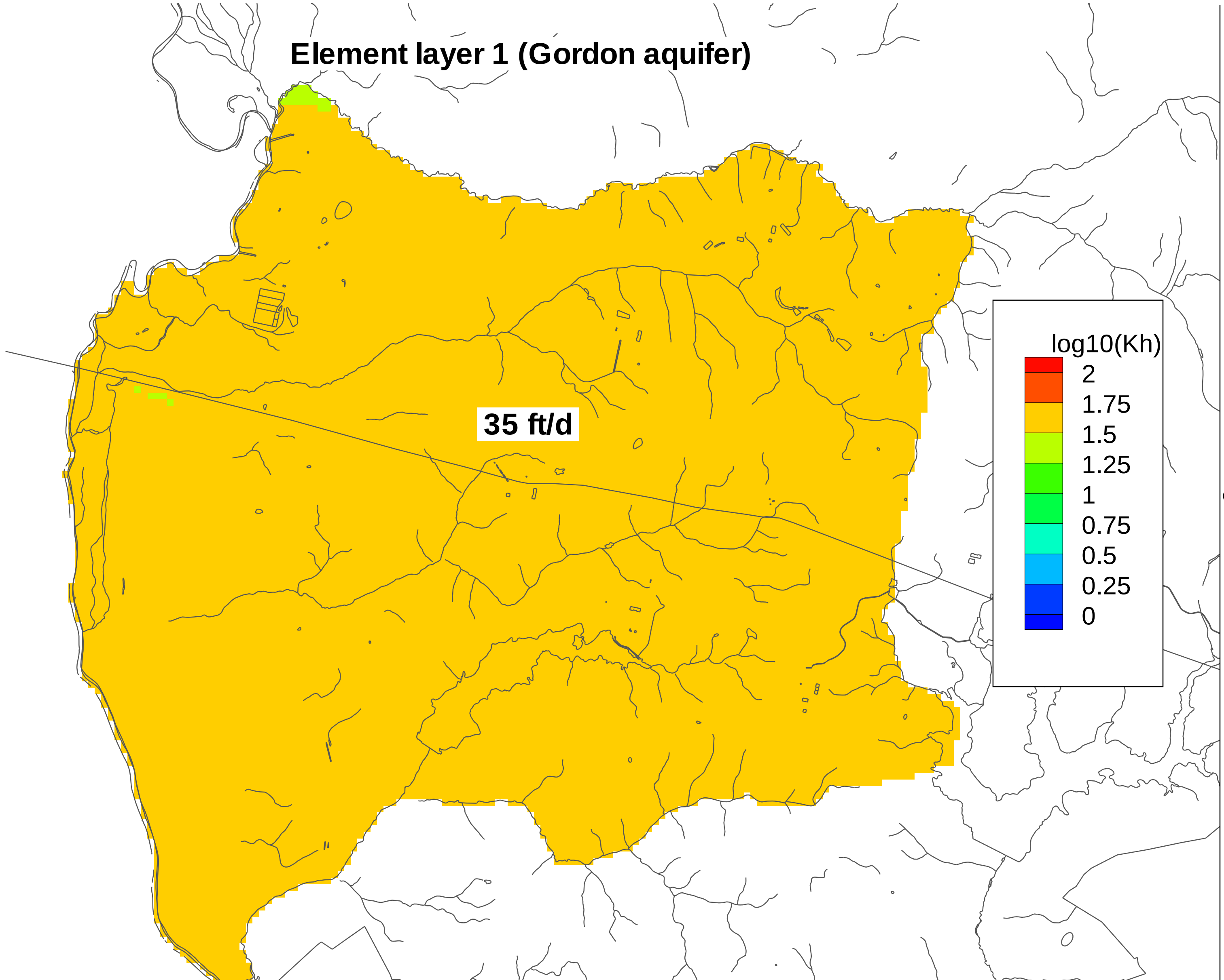


Figure 4-7. Horizontal Conductivity in Element Layer 1 (Gordon Aquifer Except in Outcrop Zones)

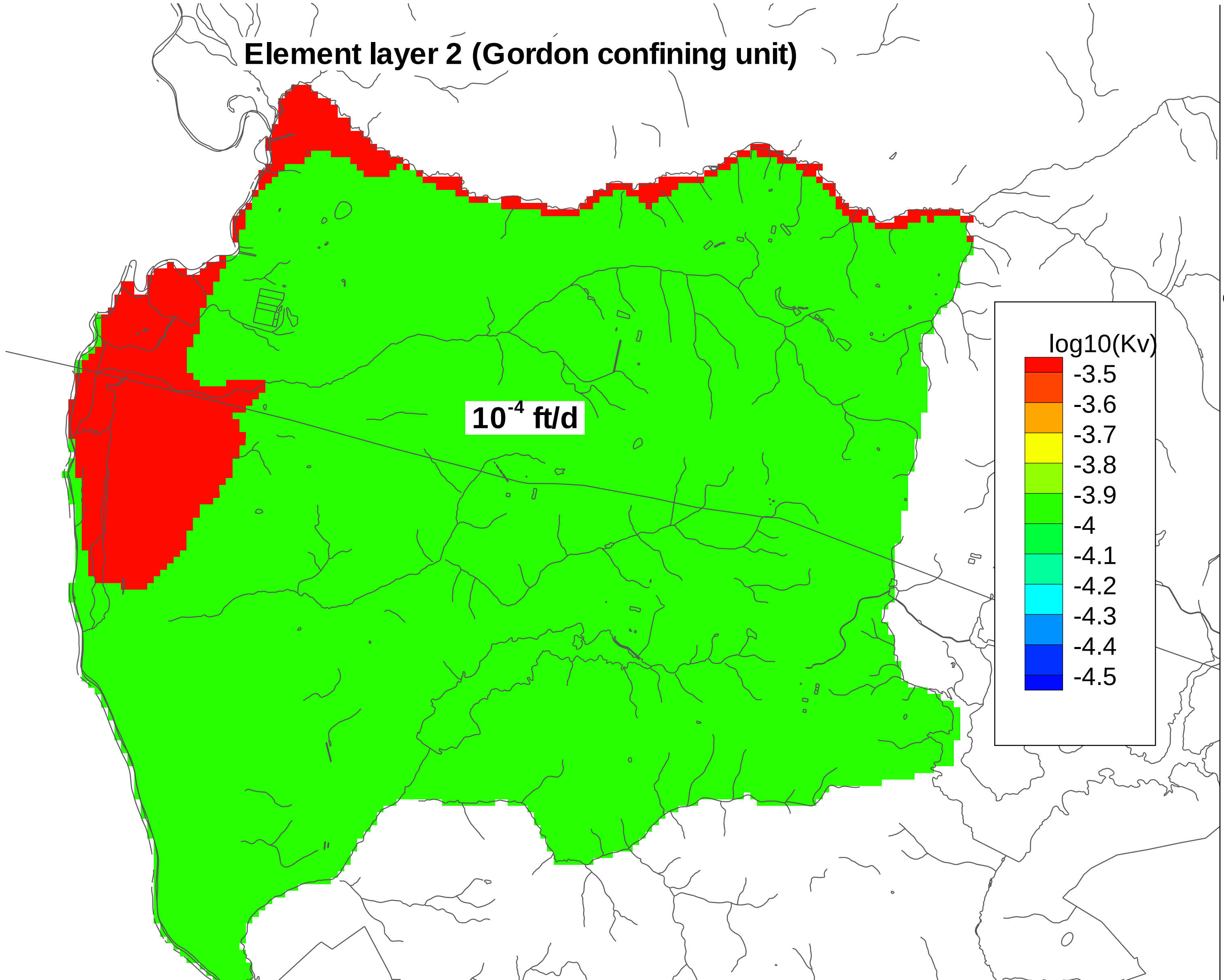


Figure 4-8. Vertical Conductivity in Element Layer 2 (Gordon Confining Unit Except in Outcrop Zones)

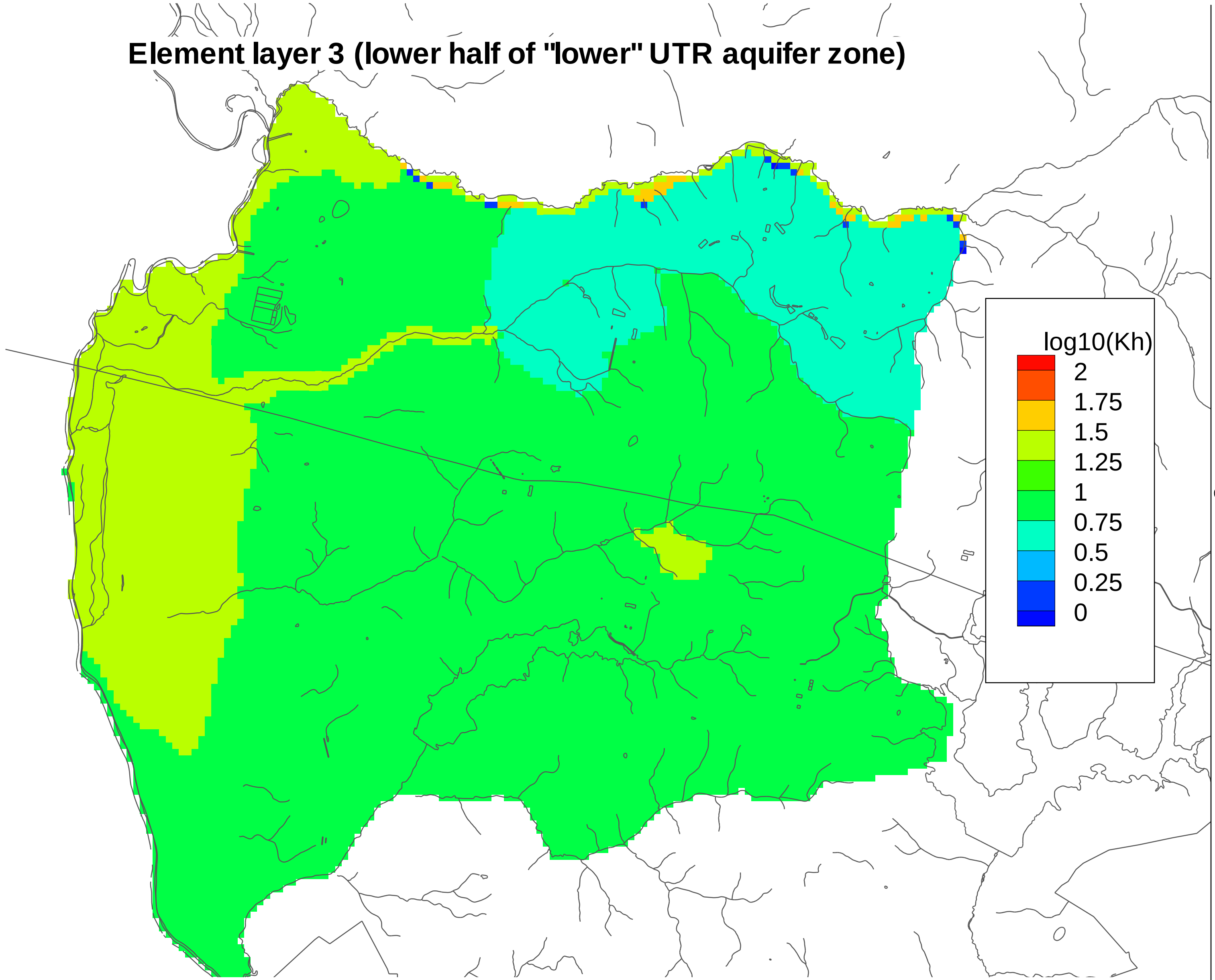


Figure 4-9. Horizontal Conductivity in Element Layer 3 (Lower Half of Lower UTR Aquifer Zone Except in Outcrop Zones)

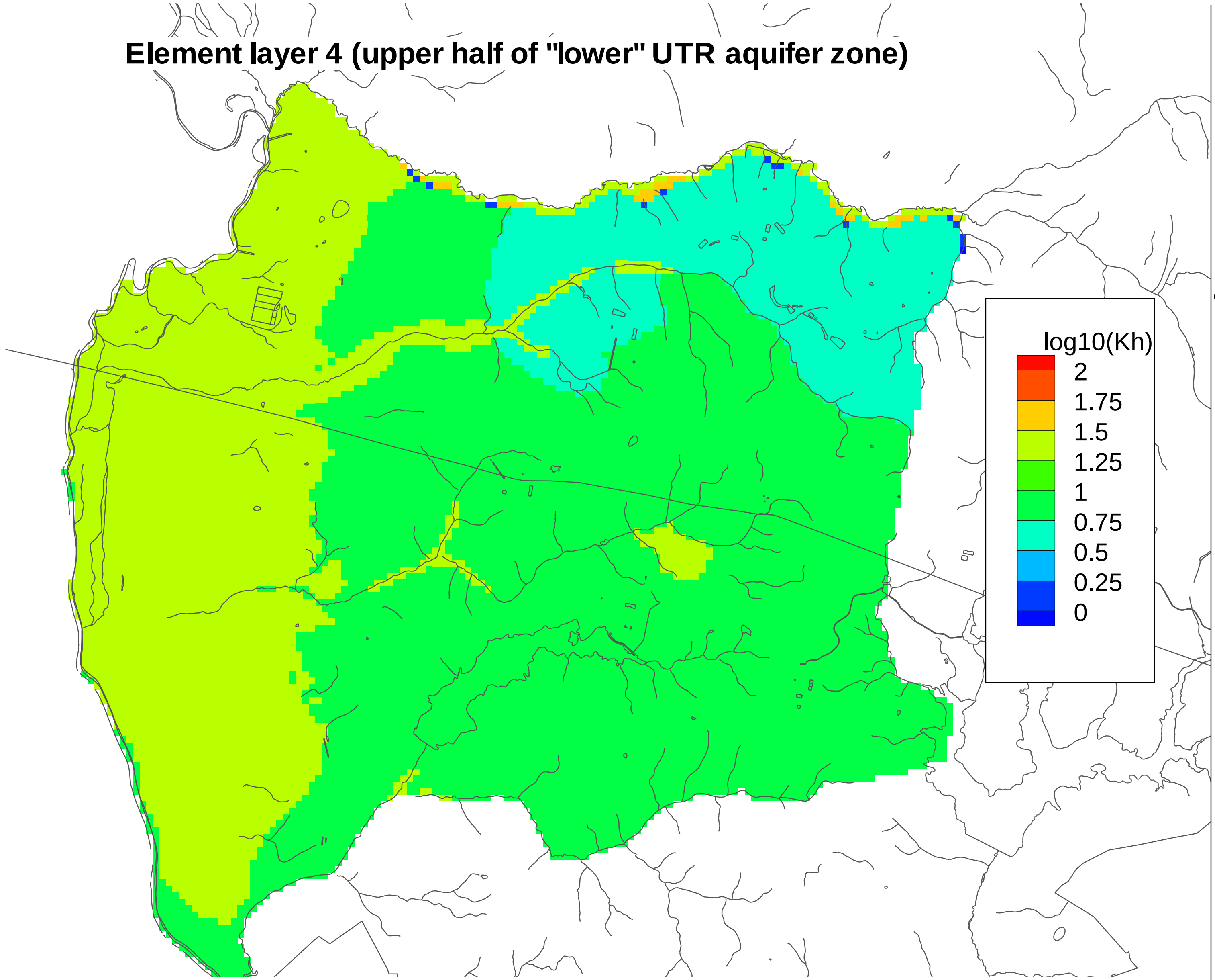


Figure 4-10. Horizontal Conductivity in Element Layer 4 (Upper Half of Lower UTR Aquifer Zone Except in Outcrop Zones)

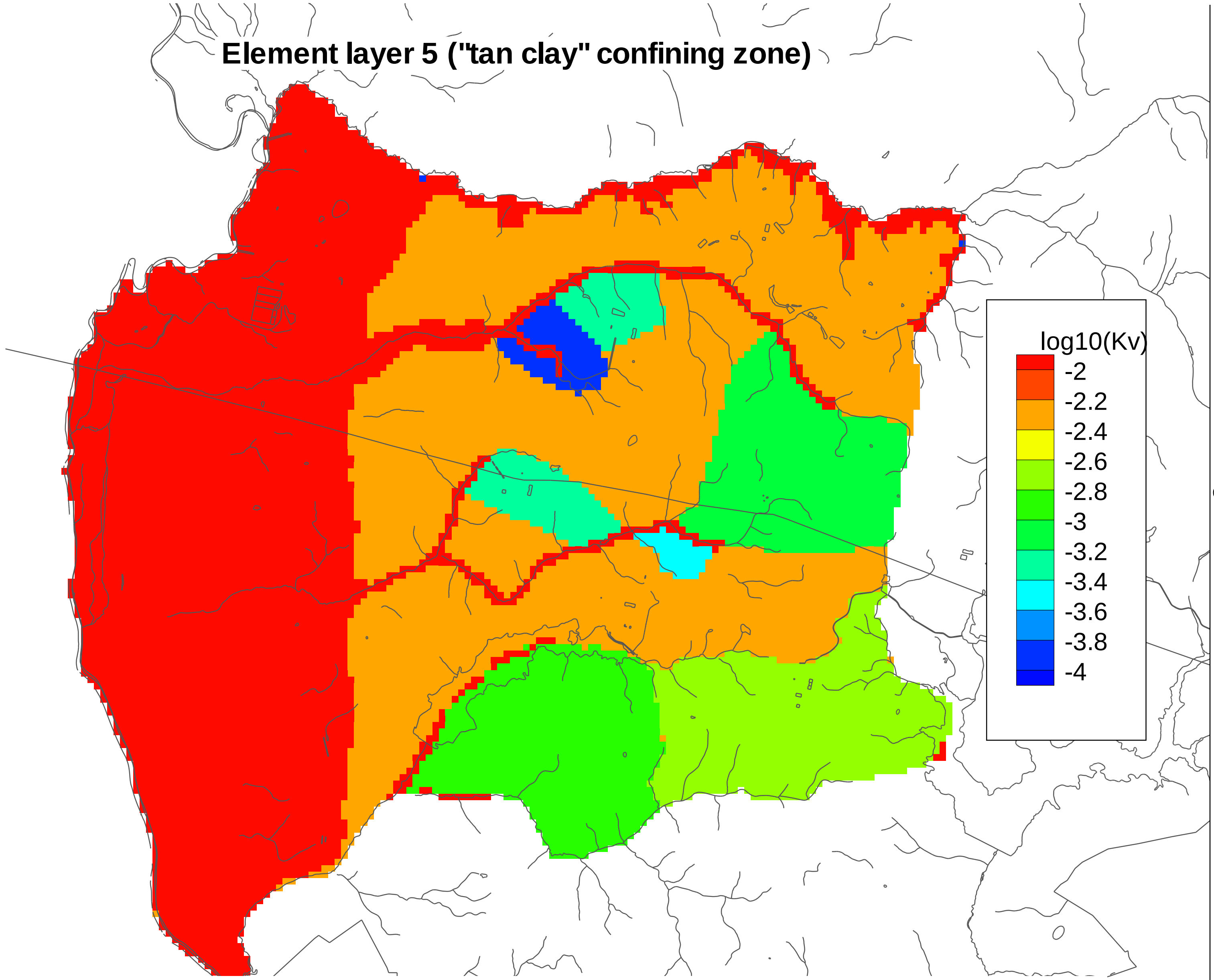


Figure 4-11. Vertical Conductivity in Element Layer 5 (Tan Clay Confining Zone Except in Outcrop Zones)

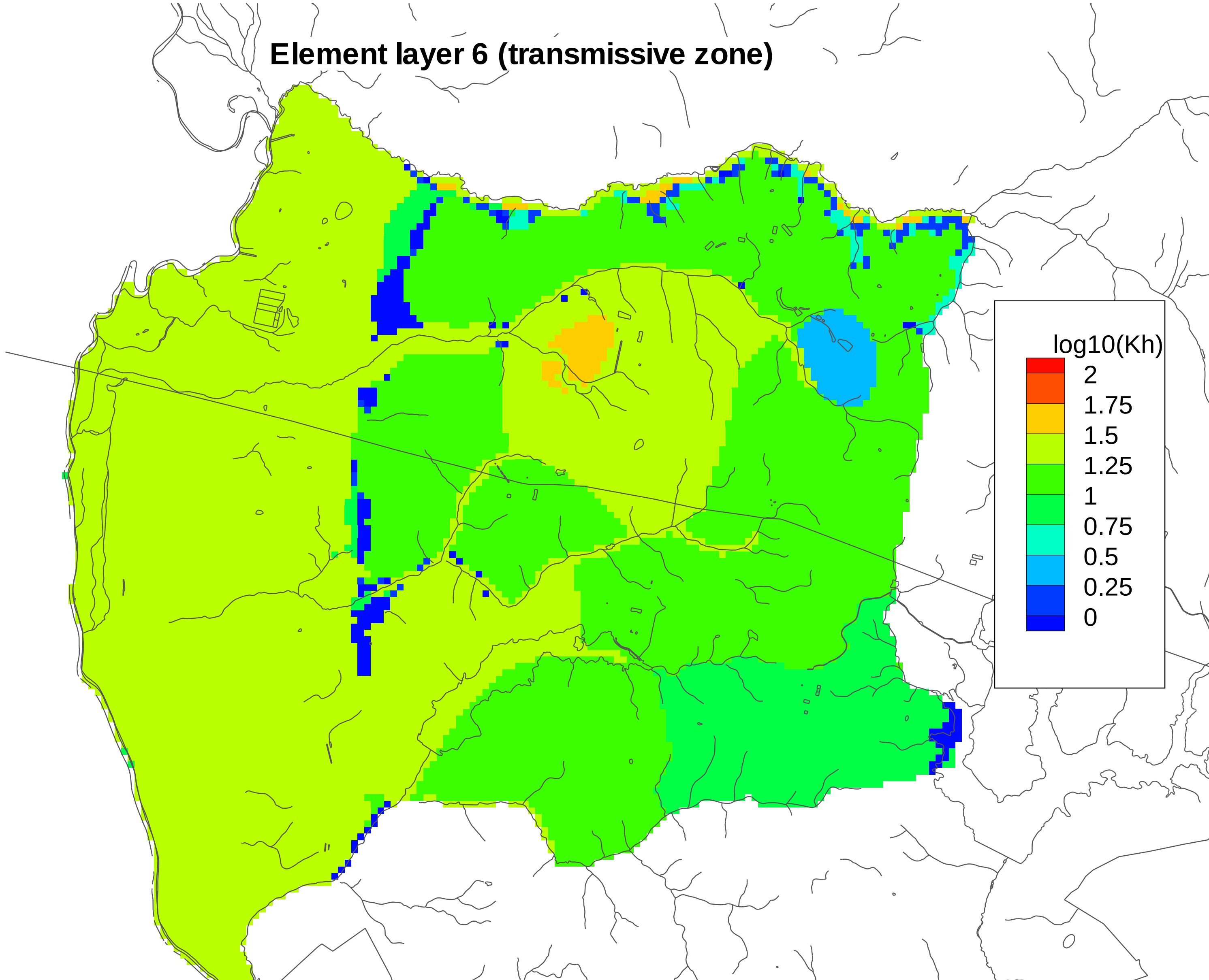


Figure 4-12. Horizontal Conductivity in Element Layer 6 (Transmissive Zone Except in Outcrop Zones)

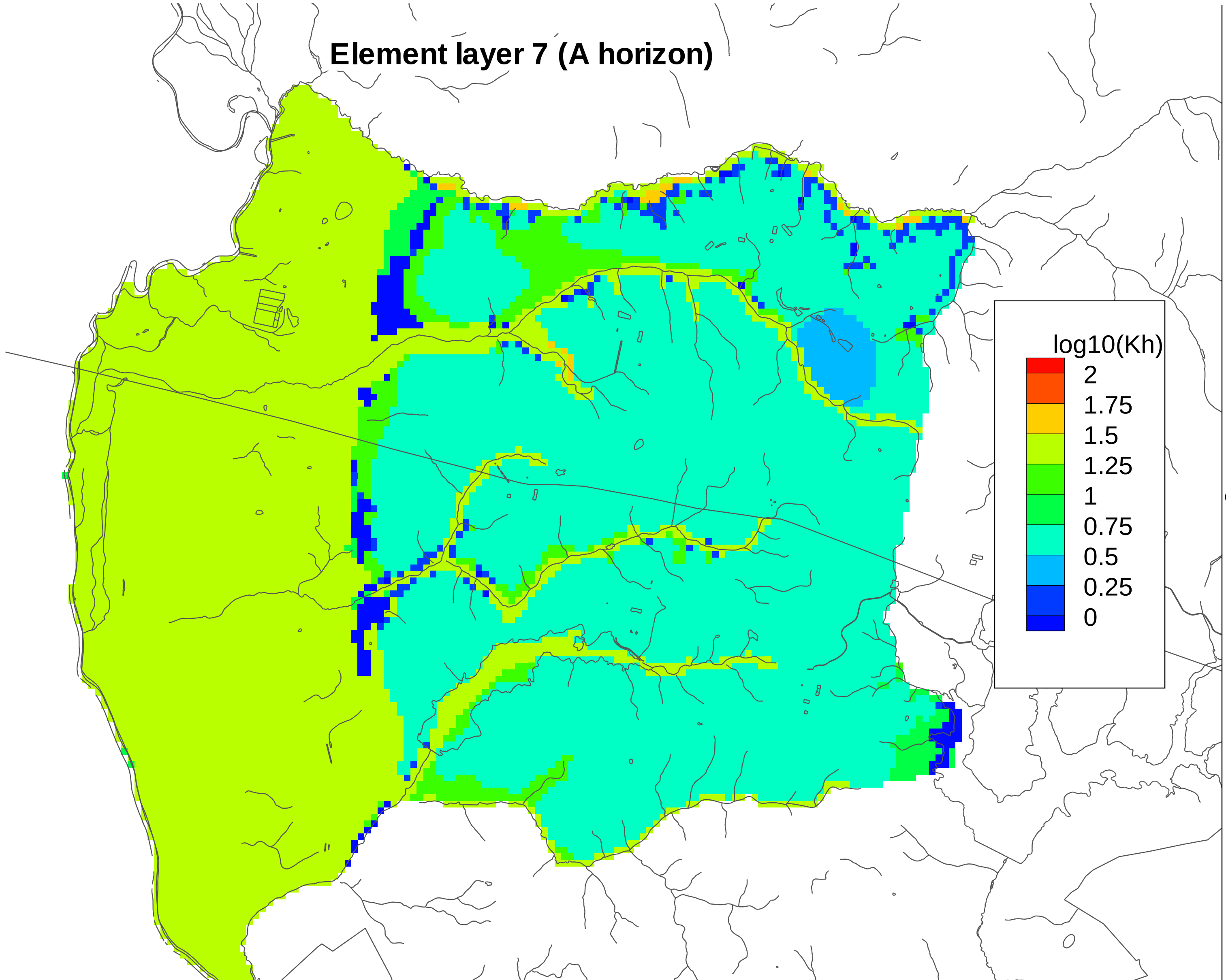


Figure 4-13. Horizontal Conductivity in Element Layer 7 (AA Horizon Except in Outcrop Zones)

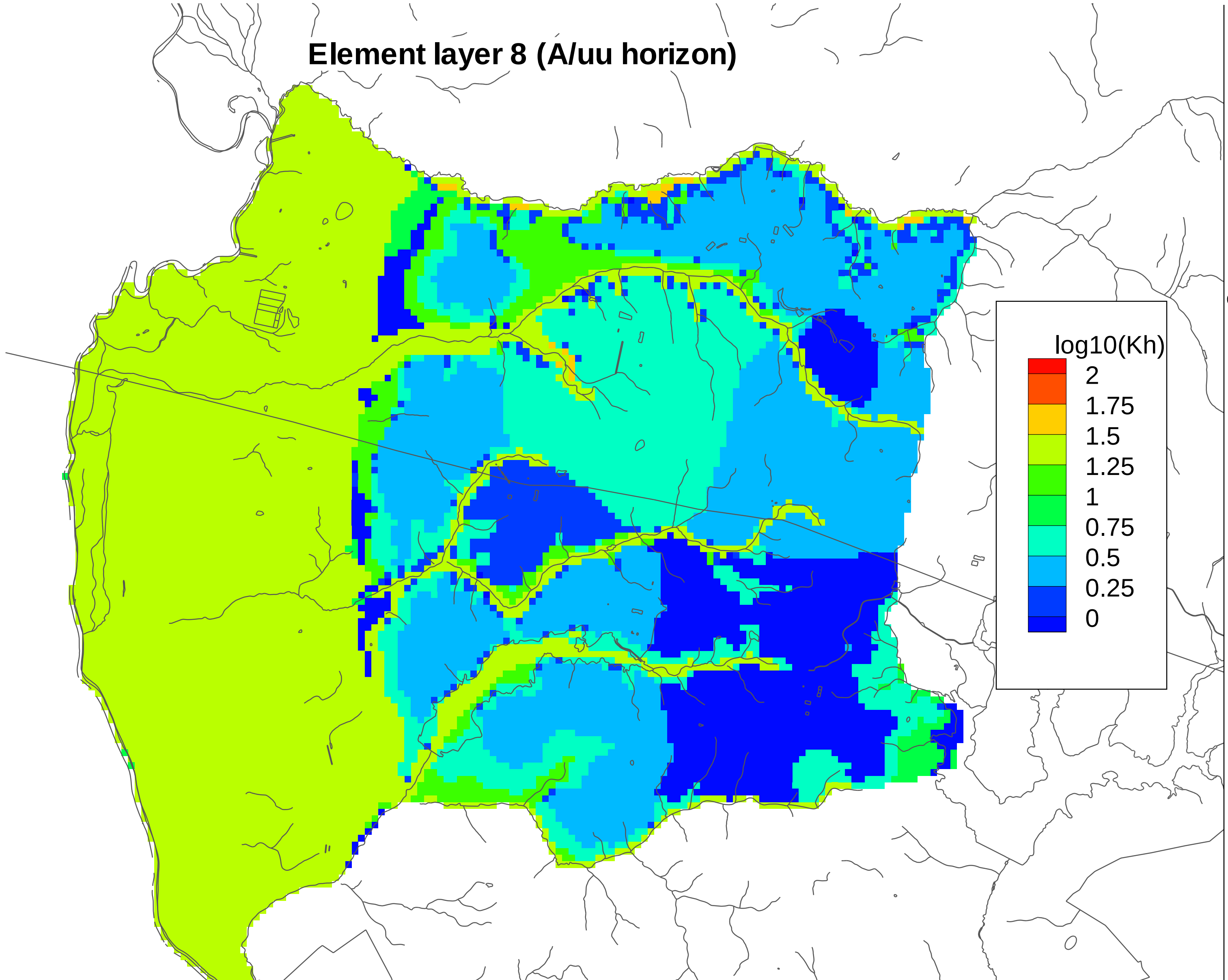


Figure 4-14. Horizontal Conductivity in Element Layer 8 (A/UU Horizons Except in Outcrop Zones)

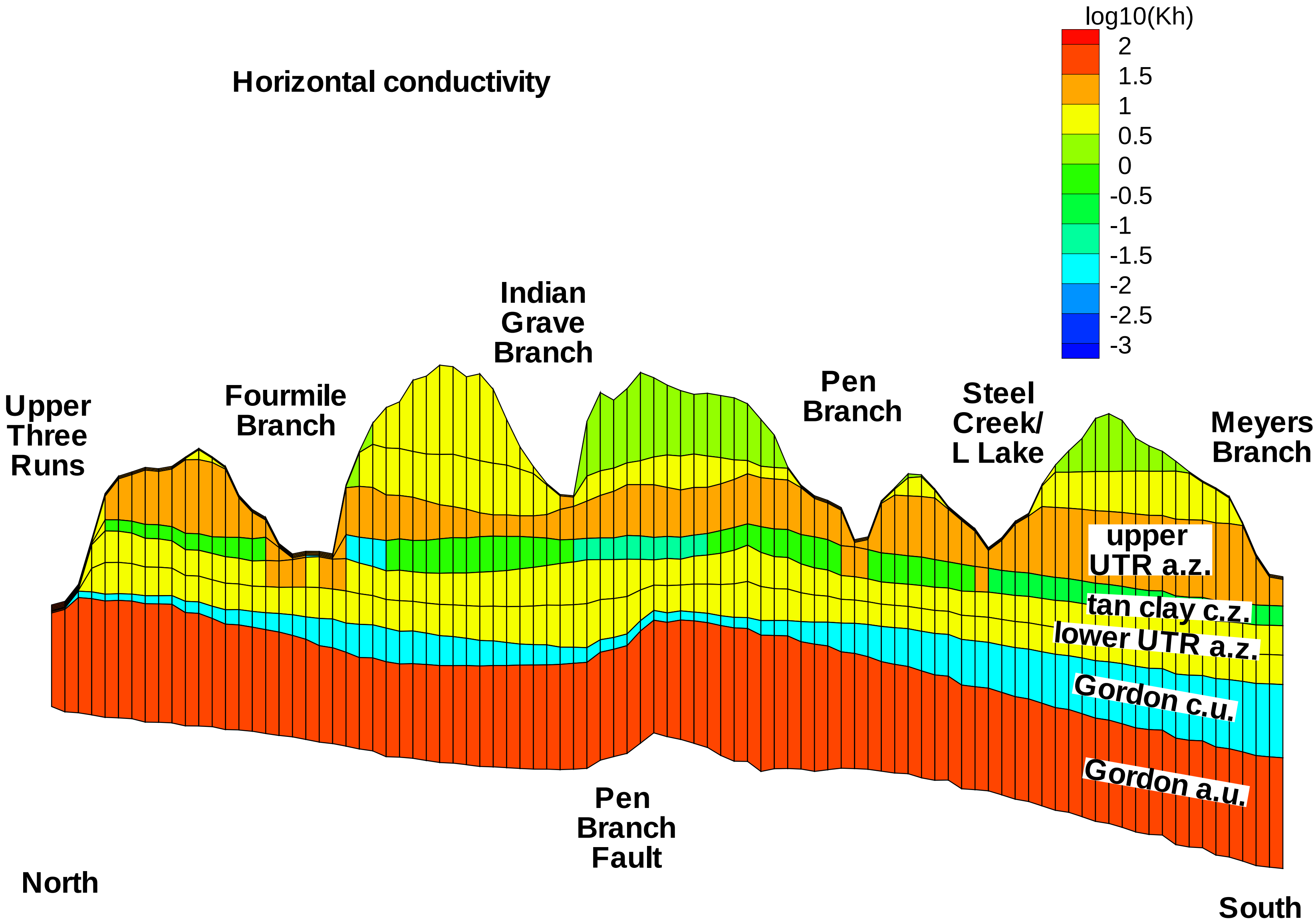


Figure 4-15. Horizontal Conductivity along a Cross-Section Through K-Area

Simulated hydraulic head in Gordon aquifer

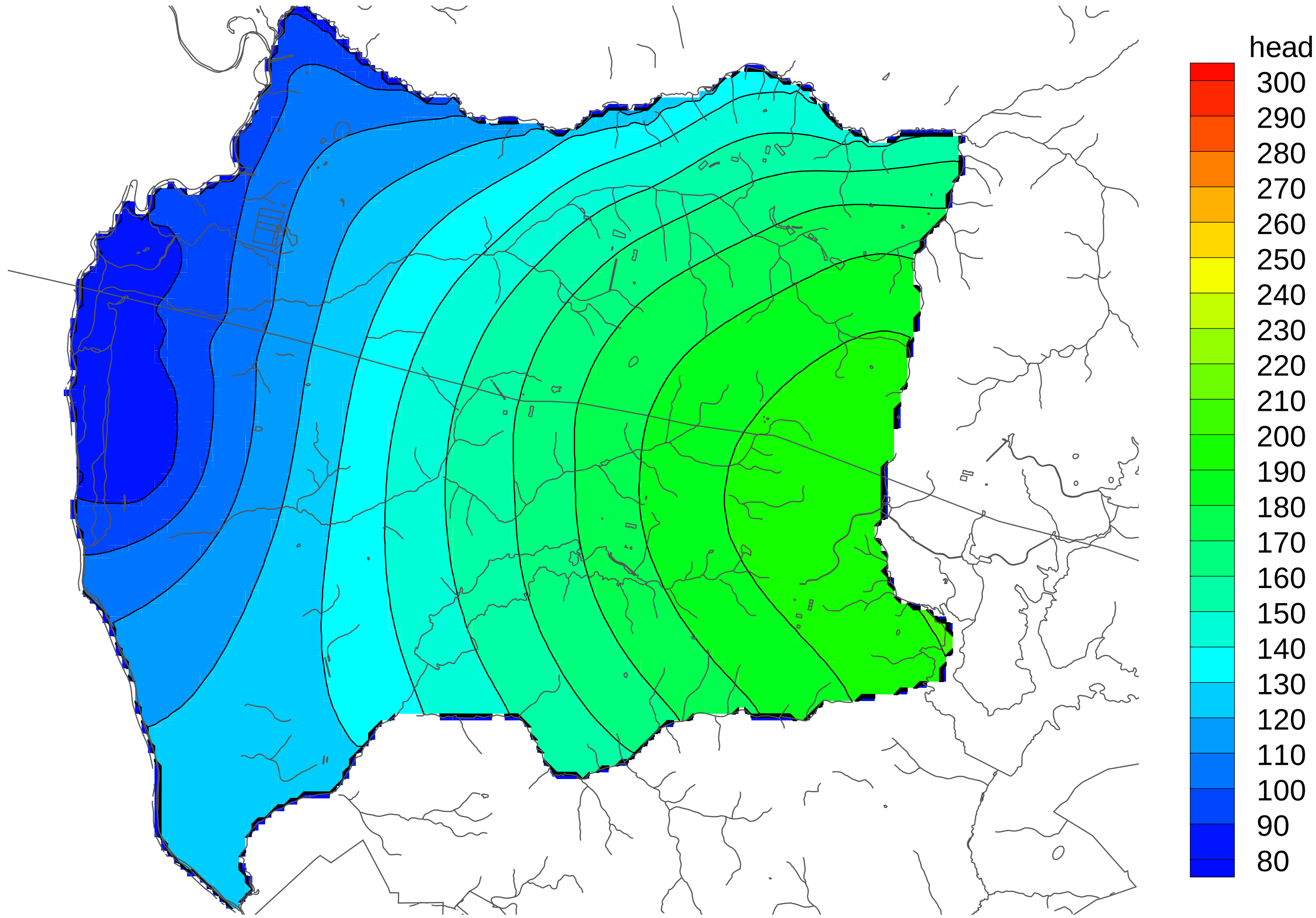


Figure 4-16. Simulated Hydraulic Head in the Gordon Aquifer

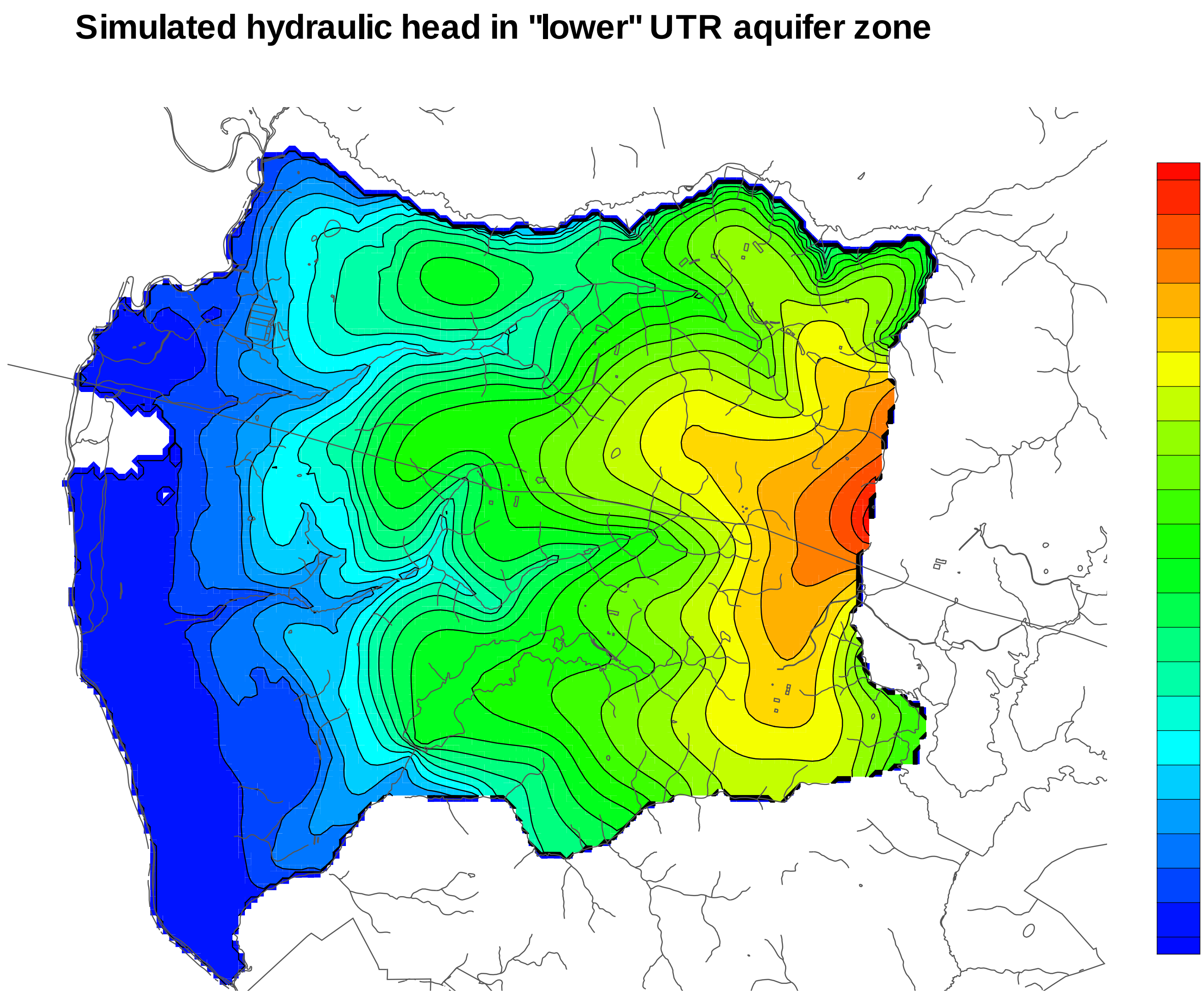


Figure 4-17. Simulated Hydraulic Head in the Lower UTR Aquifer

Simulated hydraulic head in "upper" UTR aquifer zone

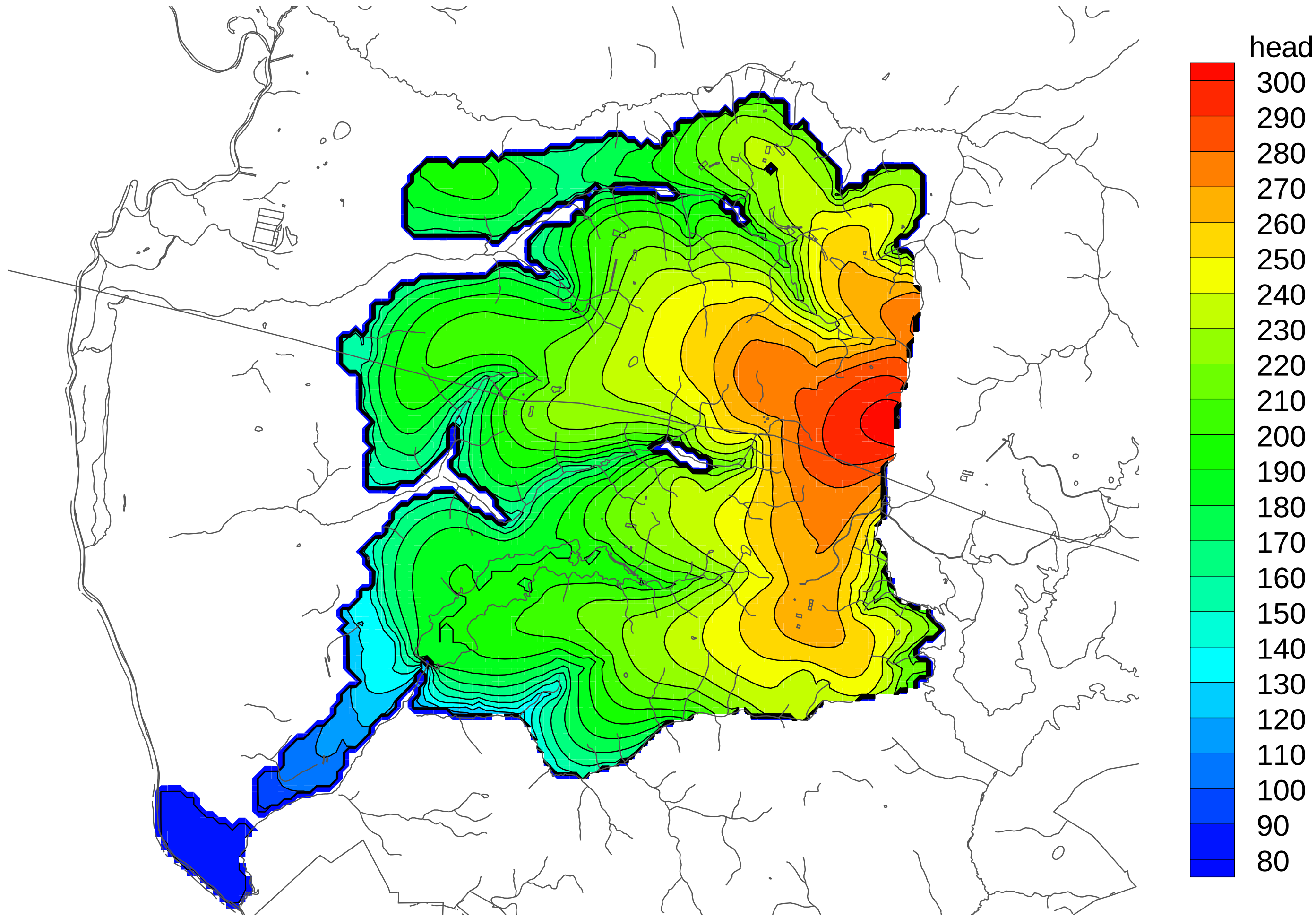


Figure 4-18. Simulated Hydraulic Head in the Upper UTR Aquifer

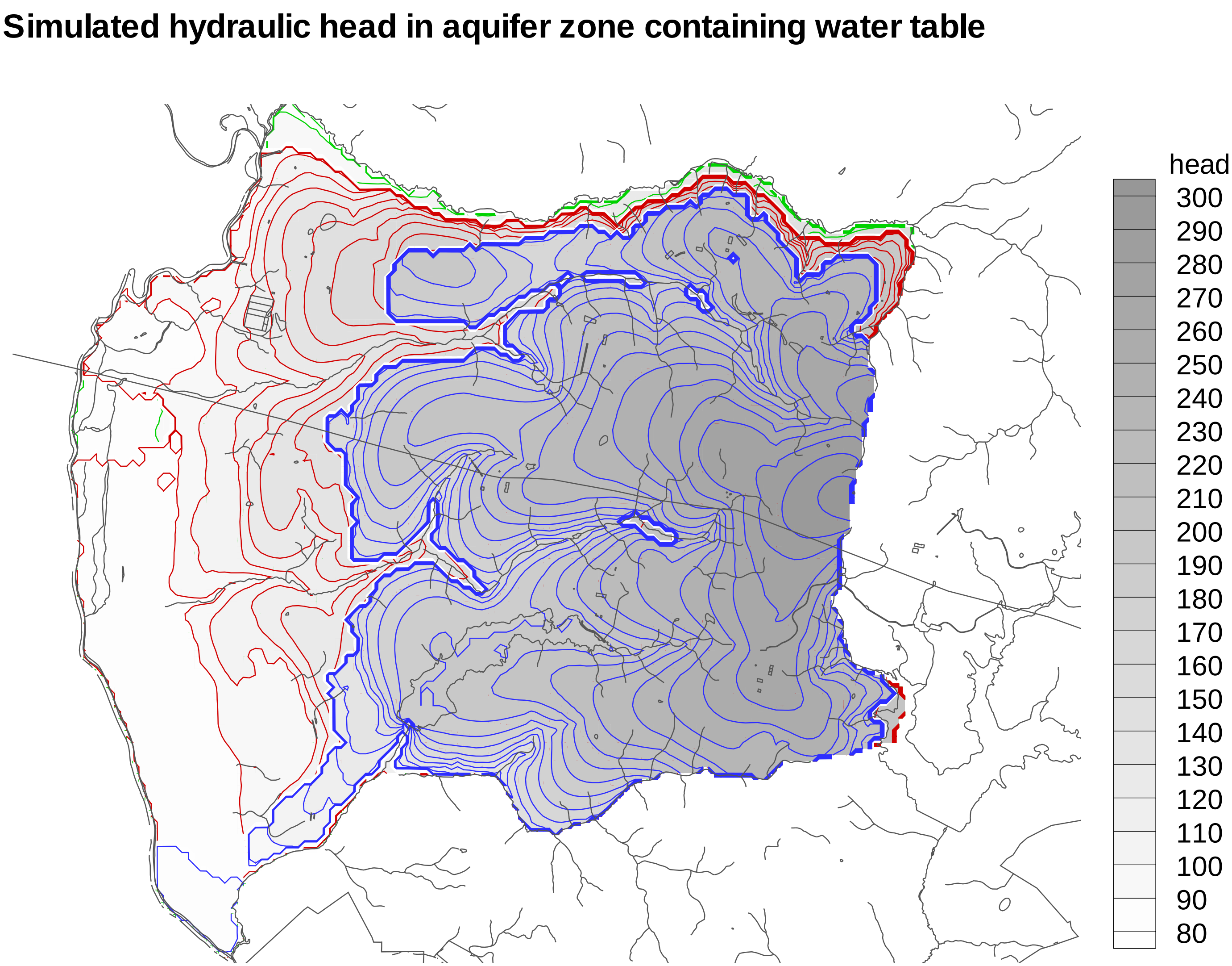


Figure 4-19. Simulated Hydraulic Head in the Aquifer Zone Containing the Water Table

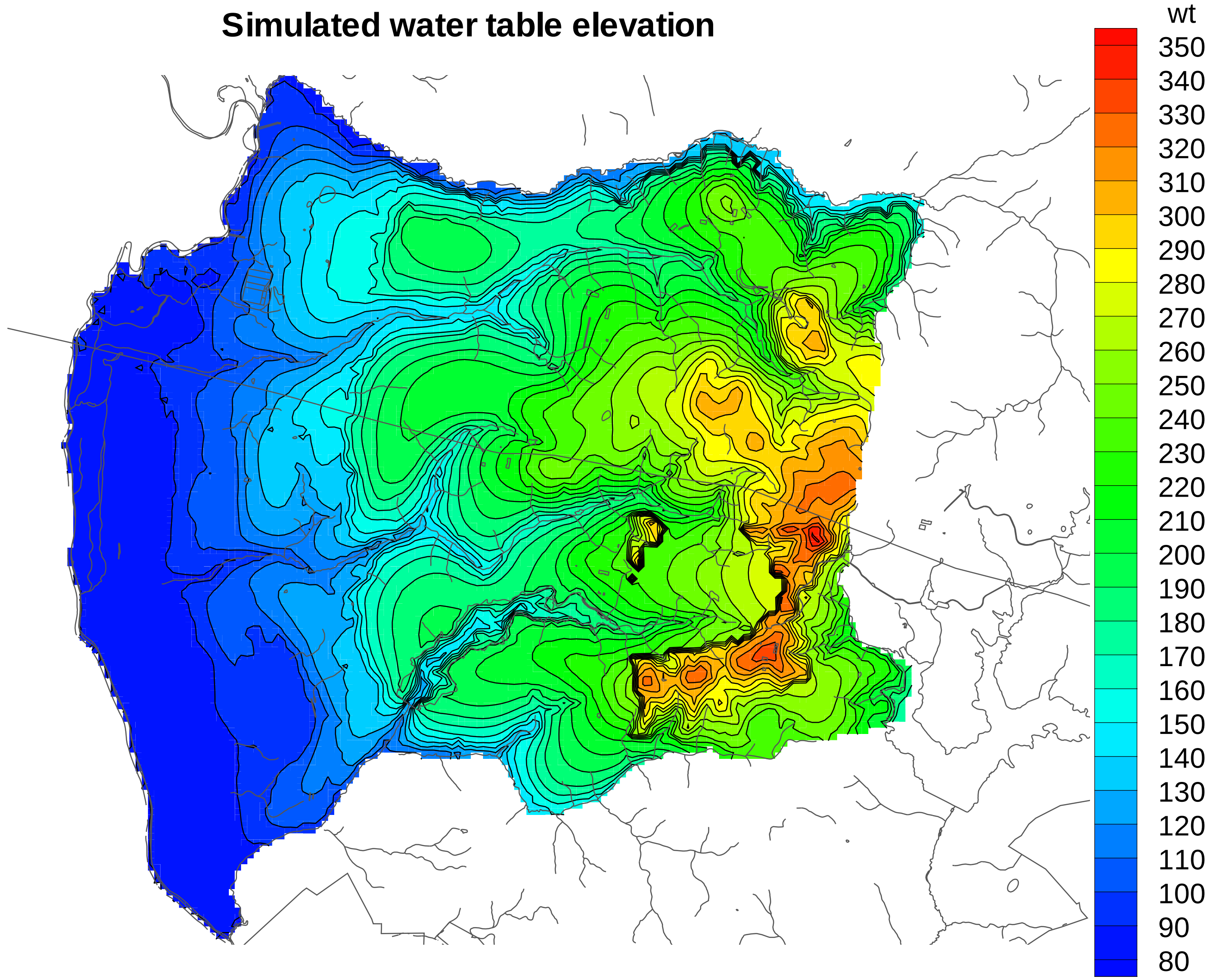


Figure 4-20. Simulated Water Table Elevation

Groundwater flow directions in Gordon aquifer unit

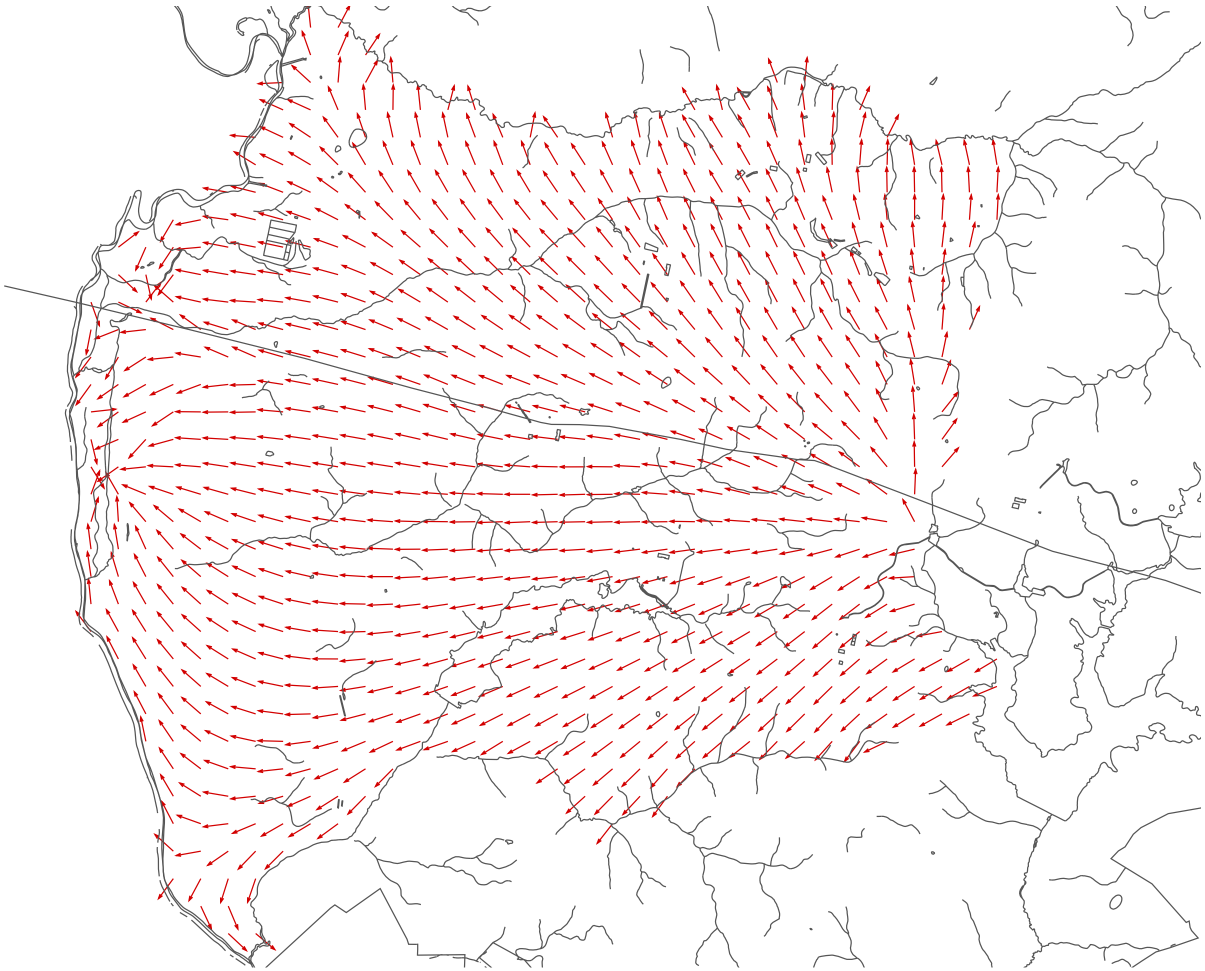


Figure 4-21. Simulated Flow Directions in the Gordon Aquifer

Groundwater flow directions in "lower" UTR aquifer zone

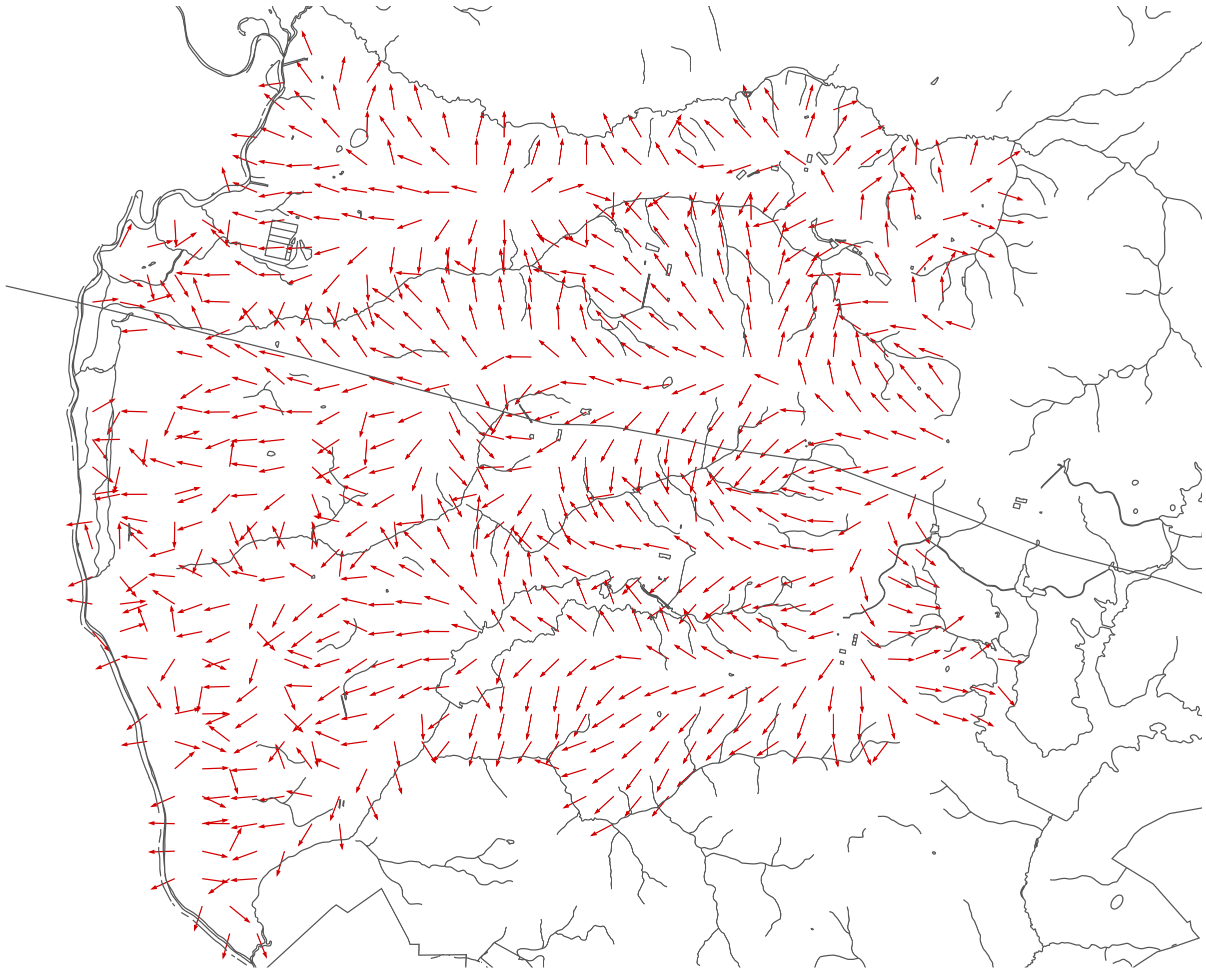


Figure 4-22. Simulated Flow Directions in the Lower UTR Aquifer

Groundwater flow directions in "upper" UTR aquifer zone

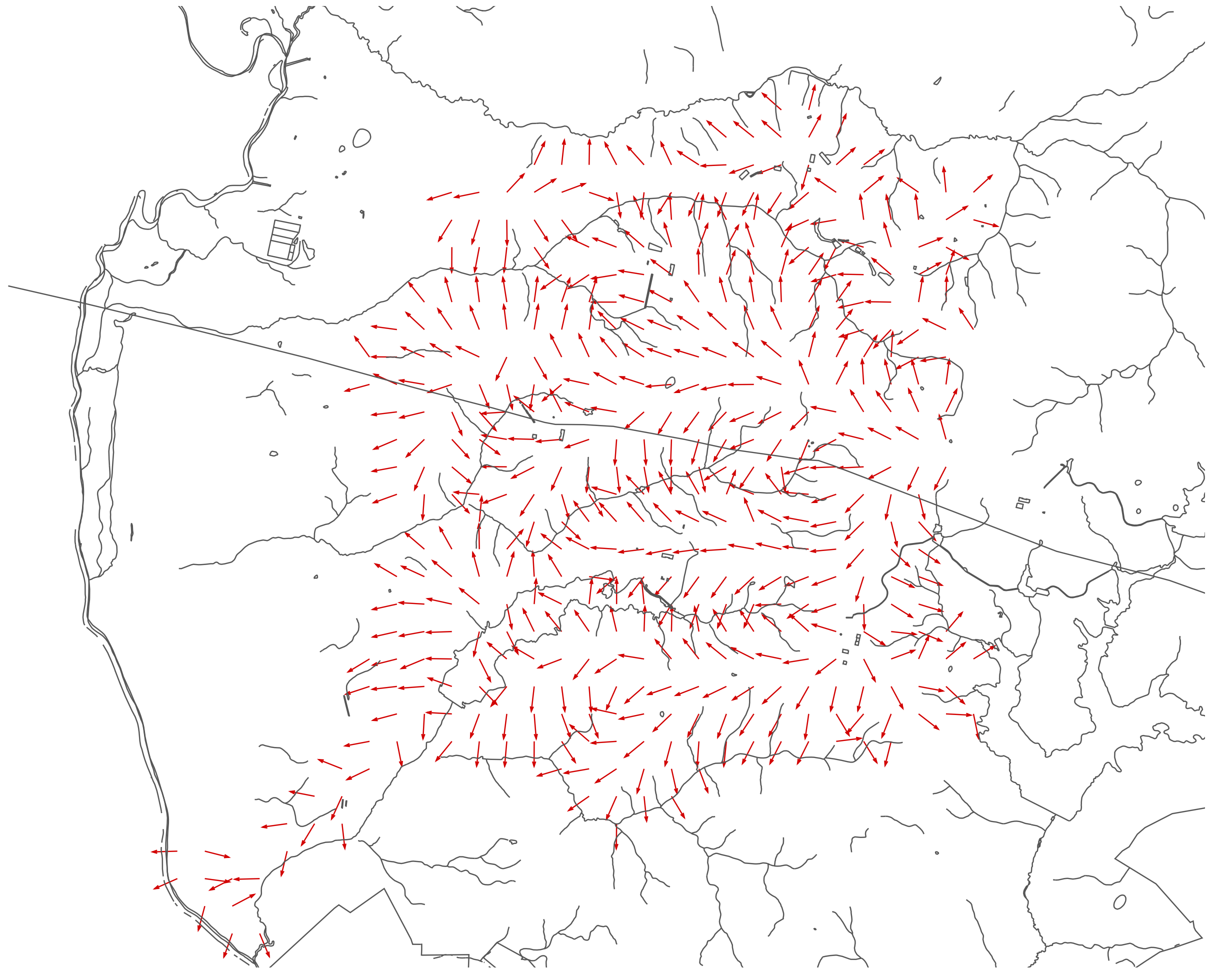


Figure 4-23. Simulated Flow Directions in the Upper UTR Aquifer

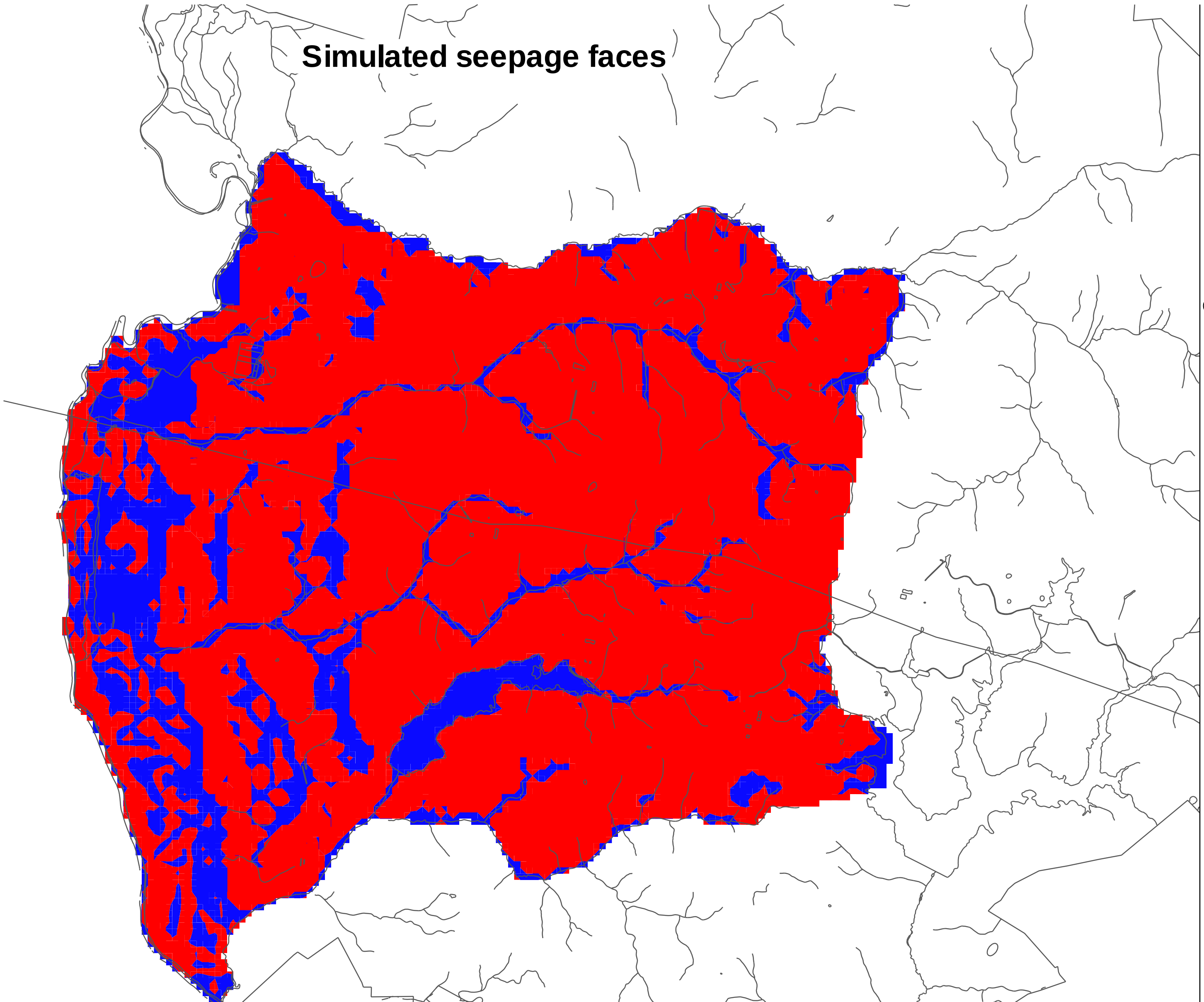


Figure 4-24. Simulated Seepage Faces

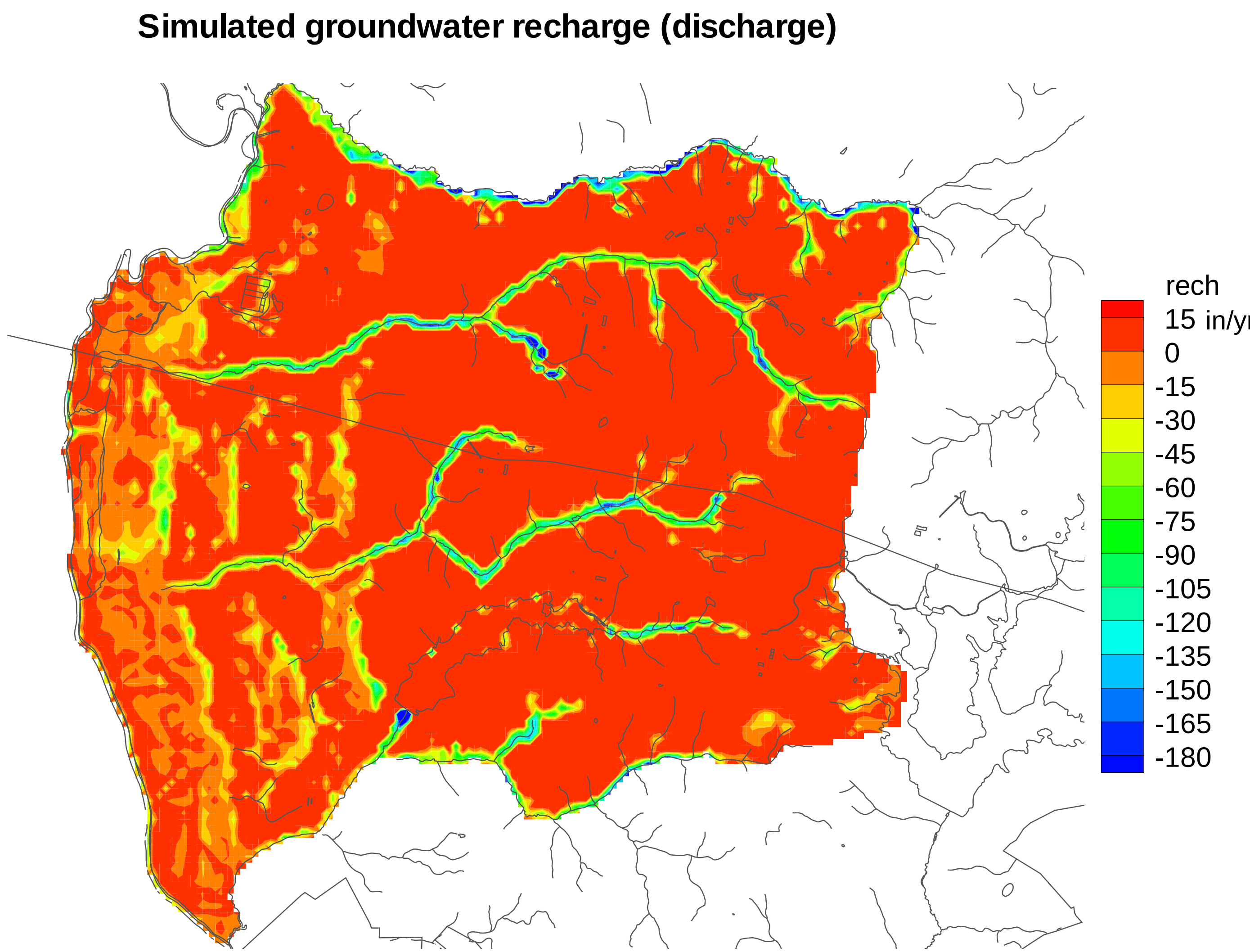


Figure 4-25. Simulated Rates of Recharge and Discharge

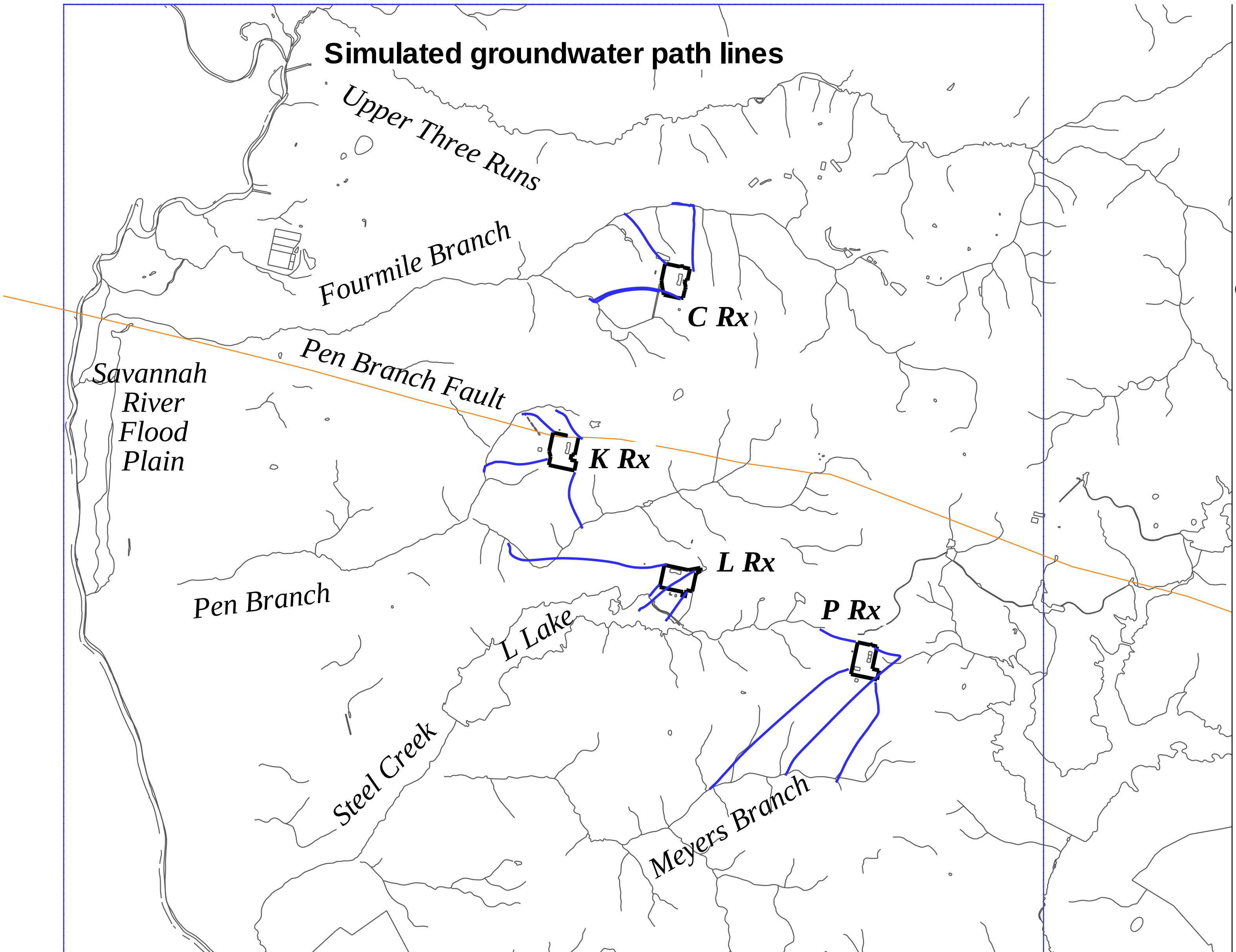
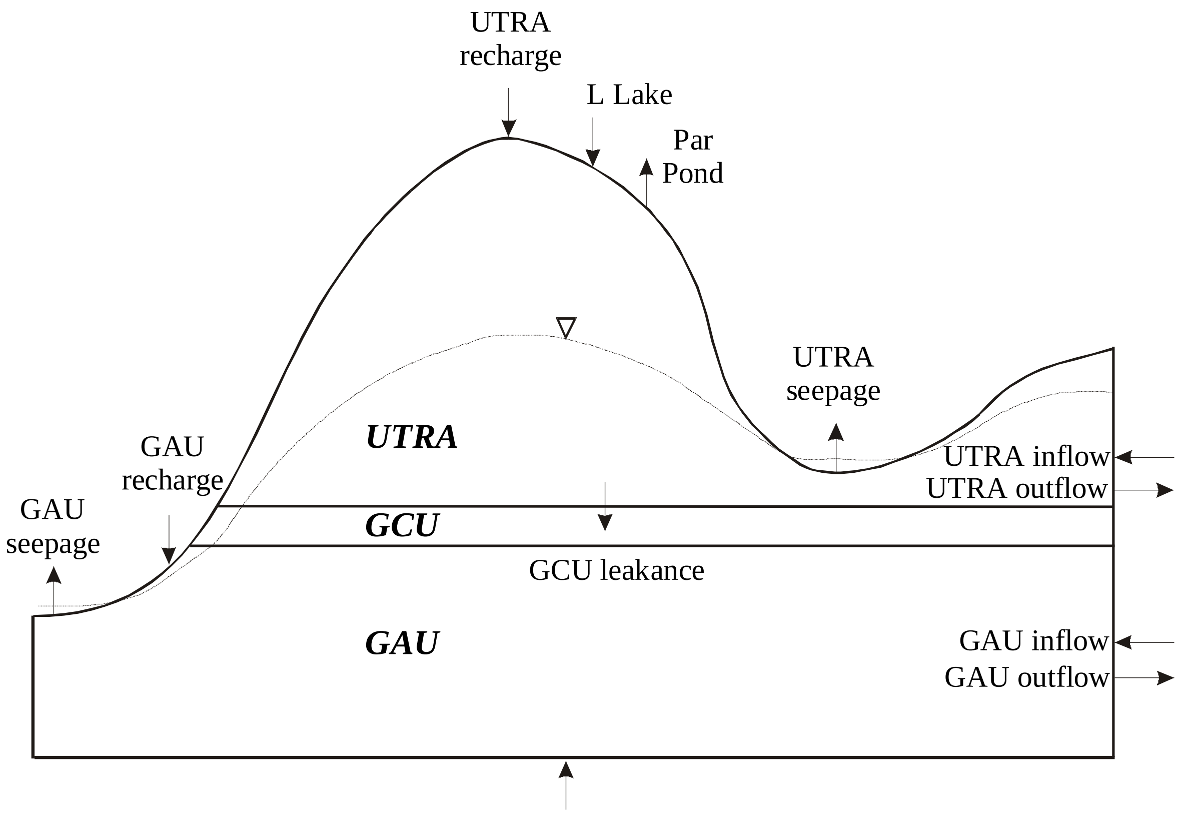


Figure 4-26. Example Particle Tracing Results



Flow component	Entire model	UTR aquifer	Gordon aquifer
Recharge	+79.9694	+78.3983	+1.5711
Seepage	-80.7454	-64.3827	-16.3627
In flows (head BCs)	+104.9055	+0.5450	+104.3605
Out flows (head BCs)	-106.6514	-2.2367	-104.4148
L Lake	+0.2734	+0.2734	N/A
Par Pond	-0.1225	-0.1225	N/A
Gordon c.u. leakage	N/A	-12.4745	+12.4745
Meyers Br. c.s. leakage	+2.3717	N/A	+2.3717
Net total flow	**+0.0007**	**+0.0003**	**+0.0003**

Figure 4-27. Water Balance

Table 4-1. Calibration Summary for Groundwater Flow Targets

Flow target	**Prior estimate**	**Range or Uncertainty**	**Model value** (in/yr for recharge; ft^3/s otherwise)	**Difference**
Surface recharge	15 in/yr	10 – 16 in/yr	12.5 max. local (9.0 based on total area)	–17%
Meyers Branch base flow (headwaters to Road 9)	3.2	±20 – 25%	2.4	–25%
Steel Creek base flow (above Road B to Road A; includes L-Lake)	–2.2 (losing reach)	±40 – 45% or more	3.1 (drain BCs: +4.0 gen. head BCs: -0.9)	+5.3 ft^3/s
Pen Branch base flow (headwaters to Road A13; includes Indian Grave Branch)	13.3	±15 – 20%	13.5	+2%
Fourmile Branch base flow (headwaters to Road A12)	14.1	±15 – 20%	14.7	+4%
Upper Three Runs base flow (Road C to Road A)	4.5	±35 – 40% or more	6.0	+33%
L Lake	-	-	–0.9 (losing lake)	-
Par Pond (portion within model)	-	-	0.1	-
Caster Creek	2.9	-	2.7	-7%
Central Shops outfall creek	0.76	-	0.72	-5%
Indian Grave Branch (excluding K-18 outfall)	4.8	-	2.6	-45%
Indian Grave above Road B (excluding K-18 outfall)	2.3	-	1.0	-56%
Pen Branch above Indian Grave Branch	11	-	7.3	-34%
Pen Branch above Road B	1.9	-	5.3	+3.4 ft^3/s

Table 4-2. Calibration Summary for Hydraulic Head Targets

Measure (ft)	**Gordon aquifer**	**“lower” UTR aquifer**	**trans-missive zone**	**AA horizon**	**A/uu horizons**	**Overall**
RMS difference	3.4	6.3	5.2	4.0	7.0	5.45
Average difference	-0.7	+1.4	-0.2	-0.3	-0.0	-
Median difference	-0.2	+1.3	-0.40	-0.70	+0.40	-
Average |difference|	2.0	5.1	3.6	2.9	5.8	-
Maximum difference	-16.2	+17.7	-16.8	-15.6	-17.1	-

Table 4-3. Calibration Summary for Hydraulic Conductivity

Hydrostratigraphic Unit	K_h Average (ft/day)	K_h Range (ft/day)	K_v Average (ft/day)	K_v Range (ft/day)
Gordon aquifer	35	-	0.035	-
Gordon confining unit	0.01	-	1×10^{-4}	-
"lower" UTR aquifer zone	5.9	4 - 20	0.058	0.004 - 0.1
"tan clay" UTR confining zone	0.3	0.01 - 0.4	3×10^{-3}	1×10^{-4} - 4×10^{-3}
"upper" UTR aquifer zone:	8.3	-	0.064	-
Transmissive zone	13	3 - 40	0.13	0.03 - 0.4
AA horizon	4.4	2 - 5	0.044	0.02 - 0.05
A horizon and above	2.1	0.25 - 5	0.021	0.0025 - 0.05
Alluvium	20	-	0.2	-

Table 4-4. Summary of Uncertainty Cases

	GCU Kv		
Recharge	5×10^{-4} ft/day	10^{-4} ft/day	2×10^{-5} ft/day
15 in/yr	-	Case 1	(Case 5)
12.5 in/yr	Case 3	Nominal	Case 4
10 in/yr	(Case 6)	Case 2	-

Table 4-5. Calibration Summary for Uncertainty Cases

Calibration measure	Nominal	Case 1	Case 2	Case 3	Case 4
Overall RMS head residual (ft)	5.45	5.48	5.45	9.59	5.62
Gordon aquifer RMS head residual (ft)	3.4	3.3	3.5	3.4	3.1
"lower" UTRA RMS head residual (ft)	6.3	6.6	6.1	11.6	6.8
"upper" UTRA RMS head residual (ft)					
transmissive	5.2	5.2	5.4	11.1	5.5
AA	4.0	4.0	4.1	7.5	4.4
A/uu	7.0	6.8	7.2	10.0	6.4
Meyers Branch base flow residual (cfs)	-0.8	-0.2	-1.3	-2.1	-0.4
Steel Creek base flow residual (cfs)	+5.3	+6.0	+4.7	+4.2	+5.3
Pen Branch base flow residual (cfs)	+0.2	+3.2	-2.8	-5.3	+2.2
Fourmile Branch base flow residual (cfs)	+0.6	+3.9	-2.8	-6.9	+3.1
Upper Three Runs base flow residual (cfs)	+1.5	+2.2	+0.9	+6.1	-0.4
Nominal Gordon aquifer unit, Kh (ft/d)	35	35	35	96	8.8
Nominal "lower" UTR aquifer zone, Kh (ft/day)	5.9	7.7	4.4	0.7	7.8
Nominal "tan clay" UTR confining zone, Kv (ft/day)	3×10^{-3}	3×10^{-3}	3×10^{-3}	6×10^{-2}	1×10^{-3}
Nominal "upper" UTR aquifer zone, Kh (ft/day)	8.3	11	6.2	1.6	11.1

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5.0 SUMMARY AND RECOMMENDATIONS

Important attributes of the baseline CKLP model are:

- The present baseline model is current with available characterization data from the reactor areas through Spring 1999. All the characterization data has been incorporated into a project database that can be easily updated as additional field data is obtained.
- Both the vadose and saturated zones are simulated in the model
- The Upper Three Runs aquifer is sub-divided into several vertical mesh layers that include the "transmissive" zone, "A horizon" and "A/uu horizons".
- The alluvial valley has been included in the model to realistically illustrate the extent to which the Savannah River has incised the hydrostratigraphic units. The Savannah River has cut down to the Gordon aquifer at the northern and southern ends of the valley but does not incise the Meyers Branch confining system within the model area.
- The model is based on the FACT code

Important implications of the CKLP model:

- The model meets the planning objectives of the *General Groundwater Strategy for Reactor Area Projects* (WSRC, 1997) by providing a common framework for analyzing groundwater flow, contaminant migration and remedial alternatives across ERD programs
- The CKLP groundwater flow model provides a good understanding of the groundwater flow regime for these reactor areas on a regional scale. The model is suited to assist in scoping characterization and remedial activities by providing a common base for the subsequent finer scale transport and remedial/feasibility models for each of these areas.
- The model has been constructed to incorporate new data as it is collected, providing quick and cost-effective updates.

Recommendations for future refinements to the CKLP model are:

- Pump tests in non-contaminated areas are needed for each reactor area in order to provide direct, field scale, conductivity measurements. In addition, previous conductivity measurements derived from slug tests and pump tests should be reviewed to determine data quality and validity of the measurements.

- Additional research on the baseflow data for Upper Three Runs between Road C and Road A, Steel Creek and L Lake, and Pen Branch are needed to understand the surface water hydrology on a regional basis.
- Further evaluation of the high and low head residuals for both the Upper Three Runs and Gordon aquifers is needed by looking at the hydrostratigraphy and well screen intervals in greater detail. Additional well data and further understanding of the heterogeneity of the "lower" aquifer zone of the Upper Three Runs aquifer would improve the model.

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APPENDIX A. DATA COLLECTION AND HYDROGEOLOGIC MODEL METHODOLOGY

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APPENDIX A. DATA COLLECTION AND HYDROGEOLOGIC MODEL METHODOLOGY

Hydrogeologic Data Collection

Data utilized in this analysis include local grid coordinates and elevations of SRS and off-site wells, geophysical logs, drill-core descriptions, and logs of soil properties taken using cone penetrometer technology (CPT). The study included collecting permeability data from the recent and historical literature. These data originate from the results of different types of tests. These include aquifer-pumping tests, borehole permeability ("slug") tests, and laboratory tests performed on undisturbed samples.

Project Database

The project database used for the C, K, L, and P groundwater model area (CKLP GWMA) is designed to support groundwater modeling conducted by the Environmental Sciences Section (ESS) of the Savannah River Technology Center (SRTC) such as that described in Flach, and Harris (1997). The scope of the groundwater modeling project database (GWMPD) for the CKLP GWMA includes the area bounded by Savannah River Site (SRS) local grid coordinates 10,000 to 85,000 feet North and 0 to 100,000 feet East.

The primary function of GWMPD is to record and report hydrogeologic parameters within the context of their spatial position and hydrostratigaphic assignment. The database is designed to accommodate geologic, geotechnical, geophysical, and stratigraphic data from any type of sampling location (site type). Current site types include soil borings, wells, and cone-penetrometer test (CPT) sites. Hydrogeologic data fall within three main categories: 1) field data collected during drilling and sampling; 2) Field analyses of borehole and aquifer permeability; and 3) laboratory analyses of core and undisturbed samples. The GWMPD also records "subjective" data such as stratigraphic analyses ("picks" for unit boundaries) in addition to the "objective" measurements described above.

The database is compiled in Paradox® software and incorporates a relational structure, which defines unique data locations (sites) by their coordinates and elevations. The sites are used as the key field by which different types of data are related. The unique site identifiers allow multiple data types to be associated with a single data site. The database is constructed so that revisions made to the "subjective" data (hydrostratigraphic "picks") are documented. The database records and dates each revision to the picked boundaries, and automatically regenerates updated output files for re-loading into EarthVision®. This aspect of the database

facilitates data evaluation and revision, and provides a means by which to maintain a history of the “subjective” data set.

The GWMPD maintains a bibliographic record of all documents reviewed and summarized for data, which are incorporated into the database. The database also records whether the documents serve as original sources for the data they contain, or summarize data extracted from previous reports. For example, a report that lists permeability values for undisturbed samples and includes copies of the laboratory reports in an appendix would be considered a “source” document. Similarly, a report that tabulates slug test results from several wells as average hydraulic conductivity values, and does not provide the test parameters or details of the individual analyses would be considered a “summary” document for those slug test results.

Data Qualification

Boundaries or “picks” for hydrostratigraphic units beneath the CKLP GWMA were established by the same method used in WSRC-RP-96-0399 for the General Separations Area (Smits and others, 1997). Because the CKLP GWMA includes the GSA modeling area, the picks were used to correlate hydrostratigraphic boundaries from within the GSA to cores in the remainder of the model area. The GWMPD uses the hydrostratigraphic nomenclature described in Aadland and others (1995). A rigorous Quality Review of the data was performed, comparing the core descriptions and geophysical logs with the list of unit boundaries. Geologists made refinements to these boundaries to ensure internal consistency between the unit boundaries and the lithology of the hydrostratigraphic units.

Hydrostratigraphic horizons include tops of the Meyers Branch confining system (MBCS), Gordon aquifer (GAU), Gordon confining unit (GCU), “lower” aquifer zone (LAZ), “tan clay” confining zone (TCCZ), and the informal intervals identified within the “upper” aquifer zone of the Upper Three Runs aquifer. These informal intervals include the “transmissive zone” and the “AA”, “A”, and “uu” intervals as originally identified in (WSRC, 1997)

Hydrogeologic Model

Hydrostratigraphic Methods

Hydrostratigraphic unit boundaries for the CKLP GWMA are based on a recent hydrostratigraphic analysis of the GSA. The CKLP GWMA includes the model area that was used for the recent GSA hydrostratigraphic model (Smits and others, 1997). The current

CKLP model correlates the hydrostratigraphic picks made in the GSA with the cores in the remainder of the CKLP GWMA. Boundaries are determined through evaluation of:

Geophysical data. Gamma-ray logs in combination with resistivity logs are used to evaluate the potential confining properties of the strata. In general, low resistivity and high gamma-ray values indicate clay-rich sediment that impedes the flow of ground water.

Core description data. Core descriptions are used (in conjunction with the geophysical logs) to select boundaries between confining and transmissive units. Percentage of mud and estimated porosity are the primary criteria used. If core recovery is good, the foot-by-foot description is an excellent tool for determining the vertical extent of a confining or transmissive lithology.

CPT data. Logs of CPT data were used to delineate boundaries between the informal intervals within the “upper” aquifer zone. The boundaries were picked from logs of the tip stress, sleeve stress, friction ratio, and pore pressure readings. The logs were used to identify curve patterns that are characteristic of each interval.

The GWMPD was used to prepare a hydrogeologic model of the CKLP GWMA. The model was constructed with EarthVision® software. EarthVision® processes sets of spatial and property data by calculating minimum-tension grids to contour a “best fit” of the data. The grids can contour data in 3 dimensions (x,y,z), such as the top of a geologic unit, as two-dimensional grids, or contour data in 4-dimensions: x,y,z, and a “property.” An example of a property might be the variation of the percentage of mud within a geologic unit.

Two-Dimensional Grid Calculation

Data for hydrostratigraphic unit tops were exported from the Paradox® database into EarthVision®. After minor format changes, the data was processed by an algorithm which produces a two-dimensional grid of the unit top surface. The two-dimensional grids were calculated so as to incorporate effects of the Pen Branch Fault. The off-set is assumed to be a consistent, vertical displacement along the trace of the fault. The south side of the fault is displaced up relative to the north side. The Pen Branch Fault is assumed to only affect the units beneath the “upper” aquifer zone of the Upper Three Runs aquifer. The top of the TCCZ is the shallowest horizon in the model that is displaced by the fault.

The EarthVision® model utilizes digitized x,y,z data for all U.S. Geological Survey topographic coverage of the GSA. The data was processed in the same manner as the data

for the unit boundaries to produce a grid representing the topography of the study area. The high density of data points in this data set produced a two-dimensional grid of exceptional accuracy and detail. This grid was then used in subsequent grid calculation to determine the extent of the hydrostratigraphic units that crop out in the study area.

Geologic Structure Builder

Altitude-Contour Maps

Altitude-contour maps were constructed for the top of each hydrostratigraphic using the two-dimensional grids calculated from the scattered data for the unit tops. The maps are plotted using the *Contour and Basemap* module of EarthVision®. Contour intervals are chosen by individual data sets so as to convey the information clearly and concisely, but virtually any level of detail is possible. An effort was made to keep the contour interval to within one-tenth of the range of the z-values. This serves to minimize the number of contour lines, yet generally maintains a level of detail suitable for interpretation of the map.

Isopach Maps

Two-dimensional grids of unit thickness (isopach grids) were calculated by first comparing the two-dimensional grids of the unit base and unit top with the two-dimensional grid of the topography. Isopach maps of vertical unit thickness were calculated from comparison of the two-dimensional grids of the unit base and unit top. A value was then written to the corresponding nodes of the resultant grid (the isopach grid) equal to the vertical distance between the base and upper surface of the unit.

The resultant two-dimensional isopach grids were contoured using EarthVision® in the same fashion as the structure-contour maps.

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APPENDIX B. HYDROSTRATIGRAPHIC DATA

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Appendix B-1: Locations of Sites within the Model Area

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
131C-100	68535.42	42328.12	261.62	Bechtel, 1998
131C-104	68301.83	41995.84	276.91	Bechtel, 1998
131C-105	70348.82	41250.71	169.83	Bechtel, 1999
131C-49	69151.44	43419.4	254.29	Bechtel, 1999
131C-51	69313.87	43526.89	264.97	Bechtel, 1999
131C-54	69970.8	42952.3	247.06	Kirr, 1998
131C-55	69923.3	43145.9	245.01	Kirr, 1998
131C-59	69874.5	42563.4	227.7	Kirr, 1998
131C-60	69691	42639.3	218.2	Kirr, 1998
131C-63	69158.7	42902.8	211.14	Kirr, 1998
131C-64	68969.9	42859.4	211.86	Kirr, 1998
131C-67	68968.3	43829	265.82	Kirr, 1998
131C-68	69068.1	43824.3	267.66	Kirr, 1998
131C-80	70125.53	42073.82	205.72	Bechtel, 1998
131C-81	70172.54	42140.63	217.85	Bechtel, 1998
131C-82	70261.44	42225.03	232.96	Bechtel, 1998
131C-83	70325.16	42299.17	240.51	Bechtel, 1998
131C-84	70387.3	42379.51	241.87	Bechtel, 1998
131C-85	70466.62	42439.04	237.49	Kirr, 1998
131C-91	69542.49	41626.7	233.65	Bechtel, 1998
131C-93	69366.69	41518.62	241.89	Kirr, 1998
131C-95	69199.12	41402.24	241.27	Bechtel, 1998
131C-96	68789.08	42627.2	243.22	Bechtel, 1999
131C-98	68661.72	42487.58	250.98	Bechtel, 1998
131C-R1	68682.8	44316	271	WSRC, 1997
131C-R2	68734.7	44066.1	266.8	WSRC, 1997
131C-R3	68882.9	43994.5	268.8	WSRC, 1997
131C-R4	68863.3	44197.3	285.6	WSRC, 1997
131C-R5	68830.8	44359.6	289	WSRC, 1997
131C-R6	69031.6	44274	276	WSRC, 1997
BGO-10A	76805.18	57050.92	299.1	WSRC, 1996d
BGO-10AA	76997.88	56990.54	298.8	WSRC, 1996d
BGO-12A	76804.63	56250.68	311.4	WSRC, 1996d
BGO-14A	76377.54	55838.32	300.2	WSRC, 1996d
BGO-16A	75756.95	56194.15	302.8	WSRC, 1996d
BGO-18A	75599.89	56699.67	292.9	WSRC, 1996d
BGO-20AA	74953.76	57114.81	280.88	Rust, 1996
BGO-25A	76158.5	55668.08	294.7	WSRC, 1996d
BGO-26A	76144.6	55014.2	285.1	WSRC, 1996d
BGO-27C	75666.3	54671.4	273.9	WSRC, 1996d
BGO-29A	75560	54103.5	262.1	WSRC, 1996d

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
BGO-31C	74978	54816.2	271.1	WSRC, 1996d
BGO-33C	74479.7	55681.4	277.4	WSRC, 1996d
BGO-35C	73953.9	56545.7	271.4	WSRC, 1996d
BGO-37C	73498.2	57279.2	284.3	WSRC, 1996d
BGO-39A	73572.52	57821.93	293.7	WSRC, 1996d
BGO-3A	75561.7	58806.8	288.7	WSRC, 1996d
BGO-3D	75351.3	58809.2	290.8	WSRC, 1996d
BGO-41A	76469.52	55403.69	298.3	WSRC, 1996d
BGO-42C	76404.71	55522.27	295.9	WSRC, 1996d
BGO-43AA	77066.01	56268.64	312.2	WSRC, 1996d
BGO-44AA	76757.02	57880.51	283.3	WSRC, 1996d
BGO-45A	75830.03	54550.14	276.9	WSRC, 1996d
BGO-46B	75012.1	54444.65	263.4	WSRC, 1996d
BGO-47A	74728.83	54914.04	264.8	WSRC, 1996d
BGO-48C	74599.64	55124.38	274.7	WSRC, 1996d
BGO-49A	73902.78	56205.08	269.1	WSRC, 1996d
BGO-50A	75201.16	54179.77	253.5	WSRC, 1996d
BGO-51AA	74113.1	57867	287.2	WSRC, 1996d
BGO-52AA	74638	57178.1	281.6	WSRC, 1996d
BGO-53AA	76065	55431.5	288.9	WSRC, 1996d
BGO-5C	76476.9	58794.5	294.2	WSRC, 1996d
BGO-6A	76487.2	58316.8	283.8	WSRC, 1996d
BGO-6B	76553.24	58346.46	284.5	WSRC, 1996d
BGO-8A	76569	57618.3	281.3	WSRC, 1996d
BGO-9AA	76975.69	57371.94	282.8	WSRC, 1996d
BGT-1	76700.6	59178.4	282.9	WSRC, unknown
BGT-10	79104.6	59507.2	215.2	WSRC, unknown
BGT-11	79566.9	59697.7	222.5	Rust, 1996
BGT-12	77291.2	58045.9	284.2	WSRC, unknown
BGT-13	77488.9	58074	287.8	WSRC, unknown
BGT-14	77984	58143.4	280.7	WSRC, unknown
BGT-15	78479.2	58212.8	277.5	WSRC, unknown
BGT-16	78974.1	58283.5	250.7	WSRC, unknown
BGT-17	79469.7	58350	240.7	WSRC, unknown
BGT-18	79965.3	58416.5	216.5	Rust, 1996
BGT-2	76957.6	59607.2	276.4	WSRC, unknown
BGT-20	80956.4	58549.6	159.5	Rust, 1996
BGT-21	77280.7	56952.5	294.2	WSRC, unknown
BGT-22	77860.3	56970.3	281	Rust, 1996
BGT-23	78279.7	56997	270	WSRC, unknown
BGT-24	78779.2	57019.2	265.8	WSRC, unknown

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
BGT-25	79278.7	57041.4	264.8	WSRC, unknown
BGT-27	80277.7	57085.9	256.9	WSRC, unknown
BGT-28	80777.2	57108.1	258.3	Rust, 1996
BGT-29	81276.7	57130.4	243	WSRC, unknown
BGT-3	77197.6	60045.9	275.7	Rust, 1996
BGT-30	81726.3	57150.4	219	WSRC, unknown
BGT-31	77229	56189.8	308.76	WSRC, unknown
BGT-32	77791.4	56121.1	310.12	WSRC, unknown
BGT-33	78404.5	56037.2	290.42	WSRC, unknown
BGT-34	78803.9	56027.5	286.76	WSRC, unknown
BGT-35	79305.8	55929.9	267.73	WSRC, unknown
BGT-36	79801.9	55867.5	261.36	WSRC, unknown
BGT-37	80298	55805	251.6	WSRC, unknown
BGT-38	80870.5	55733	240.14	WSRC, unknown
BGT-39	81290.2	55680.3	241.88	WSRC, unknown
BGT-4	77437.6	60484.5	259.2	WSRC, unknown
BGT-40	77297.2	55644.4	332.32	WSRC, unknown
BGT-41	77734.8	55490.1	328.37	WSRC, unknown
BGT-42	78240.7	55313.1	310.92	WSRC, unknown
BGT-43	79655.9	54816	277.08	WSRC, unknown
BGT-44	80127.7	54650.4	276.2	WSRC, unknown
BGT-45	80461.7	54533.1	285.28	WSRC, unknown
BGT-46	76714.3	55355	310	WSRC, unknown
BGT-47	77051.85	54986.57	317.32	Rust, 1996
BGT-48	77135.7	54895.1	314.33	WSRC, unknown
BGT-49	76203.9	54946.3	297.26	WSRC, unknown
BGT-5	77677.6	60924.1	225.7	Rust, 1996
BGT-50	76359.3	54756.2	296.27	WSRC, unknown
BGT-51	75519.8	54505.7	272.64	WSRC, unknown
BGT-53	75837.68	53422.04	278.25	Rust, 1996
BGT-54	75941.7	52889.1	279.96	WSRC, unknown
BGT-56	73521.2	56265.8	262.94	WSRC, unknown
BGT-57	73268.5	56104.2	259.35	WSRC, unknown
BGT-58	73406.9	57399.6	285.76	WSRC, unknown
BGT-59	72802.6	57123.2	281.88	WSRC, unknown
BGT-6	77254.8	58746.7	282.2	WSRC, unknown
BGT-60	73120.6	58057.2	291.42	WSRC, unknown
BGT-61	72911.77	58490.09	284.3	Rust, 1996
BGT-62	72854.4	58608	282.03	WSRC, unknown
BGT-63	73319.4	59146.3	293.67	WSRC, unknown
BGT-63A	73646.4	58768.1	290.79	WSRC, unknown

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
BGT-64	73013.7	59500	283.25	WSRC, unknown
BGT-66	74476.6	60033.7	244.04	WSRC, unknown
BGT-67	74443.06	60426.74	242.03	Rust, 1996
BGT-7	77717.8	58935.7	276.4	WSRC, unknown
BGT-8	78161.5	59118.6	249.3	WSRC, unknown
BGT-9	78642.3	59316.7	226	Rust, 1996
BGX-11D	75300.7	59581.4	273.8	WSRC, 1996d
BGX-1A	76831.89	58590.35	289.1	WSRC, 1996d
BGX-2B	77203.4	58256.5	289.2	WSRC, 1996d
BGX-4A	77879.2	57215.6	288.8	WSRC, 1996d
BGX-7D	78349.3	58312.8	277.1	WSRC, 1996d
BGX-9D	76936	59522.1	277.4	WSRC, 1996d
BRR-1D	77365.2	50588.2	293.8	WSRC, 1996d
BRR-3D	77398.3	50203.5	289.5	WSRC, 1996d
BRR-6B	77054.6	51100	293.9	WSRC, 1996d
BRR-7B	77575.4	50707.5	289.6	WSRC, 1996d
BRR-8B	77634.7	50116.5	276.7	WSRC, 1996d
CCP-1A	66659.2	46981.3	287.1	WSRC, 1996d
CFD-1	55486.64	54875.37	268.8	WSRC, 1994
CFD-18	56297.09	54935.66	248.3	WSRC, 1994
CFD-5	55769.51	54803.57	257.8	WSRC, 1994
CMP-1-CP	52470.6	53252.6	248.9	WSRC, 1998
CMP-30B	51729.8	53166.9	286.5	WSRC, 1996d
CMP-32B	52220	54052.8	251.7	WSRC, 1996d
CMP-4B-CP	52688.5	53280.3	241.8	WSRC, 1998
CMP-6A-CP	52853.3	53105.7	238.4	WSRC, 1998
CPC-1	66855.77	47183.78	285.1	WSRC, 1990b
CRP-5D	68549.46	44515.25	274.5	WSRC, 1996d
CRP-9D	69156.7	44243.2	268.4	WSRC, 1996d
CRSB-1	66908.216	45003.778	278.2	Bechtel, 1999
CRSB-101	68802.14	43999.56	275.6	Gregg, 1998a
CRSB-11	67613.71	44513.8	276.71	Bechtel, 1998
CRSB-14	67305.06	44515.82	275.55	Bechtel, 1998
CRSB-16	67308.39	44827.9	282.56	Bechtel, 1998
CRSB-17	67809.74	44718.16	281.01	Bechtel, 1999
CRSB-18	68199.61	44399.48	273.78	Rucker, 1999a
CRSB-20	67799.39	44399.56	274.21	Rucker, 1999a
CRSB-21	67599.5	44399.5	272.85	Rucker, 1999a
CRSB-24	68003.84	44792.46	277.2	Bechtel, 1999
CRSB-26	67873.31	45225.52	291.63	Bechtel, 1999
CRSB-28	67576.46	45225.76	289.26	Bechtel, 1998

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
CRSB-30	67280.39	45223.19	285.4	Bechtel, 1999
CRSB-31	67123.9	45211	284.43	Bechtel, 1999
CRSB-32	67008.52	44392.01	274.13	Bechtel, 1998
CRSB-35	67825.67	43793.81	257.4	Bechtel, 1998
CRSB-36	67621.82	43785.52	265.62	Bechtel, 1998
CRSB-37	67423.56	43790.49	270.47	Bechtel, 1998
CRSB-4	67312.06	44995.71	282.76	Bechtel, 1998
CRSB-40	68601.07	43409.99	227.33	Bechtel, 1998
CRSB-43	67994.55	43410.39	258.5	Gregg, 1998a
CRSB-45	67594.3	43410.39	270.6	Gregg, 1998a
CRSB-5	67505.55	44990.65	288.3	Bechtel, 1998
CRSB-50	69193.96	43418.21	255.61	Bechtel, 1998
CRSB-52	68799.02	43405.07	233.14	Bechtel, 1998
CRSB-54	68652.6	43191.69	224.72	Bechtel, 1999
CRSB-55	68684.99	43004.6	229.14	Bechtel, 1999
CRSB-56	68719.98	42804.2	232.54	Bechtel, 1998
CRSB-57	68810.63	42405.28	248.17	Bechtel, 1998
CRSB-58	68845.93	42209.69	253.86	Bechtel, 1998
CRSB-6	67653.75	44996.22	289.386	Bechtel, 1998
CRSB-60	68927.513	41797.987	257.035	Bechtel, 1998
CRSB-61	68964.11	41602.18	257.28	Bechtel, 1998
CRSB-63	69026.42	41190.06	240.38	Bechtel, 1998
CRSB-64	69107.78	40798.67	229.92	Bechtel, 1998
CRSB-65	69183.31	40519.91	214.8	Bechtel, 1999
CRSB-86	69352.73	42845.6	206.55	Bechtel, 1998
CRSB-88	68423.77	43795.59	253.2	Bechtel, 1998
CRSB-89	68404.15	43986.53	260.61	Bechtel, 1998
CRSB-90	68404.94	44200.19	268.39	Bechtel, 1998
CRSB-91	68389.78	44400.57	273.1	Bechtel, 1998
CRSB-92	67802.7	44995.83	287.5	Kirr, 1998
CRSB-93	67950.27	44983.57	286.84	Bechtel, 1998
CRSB-94	68103.96	44994.65	283.34	Bechtel, 1999
CRSB-95	68252.96	44995.67	280.37	Bechtel, 1998
CRSB-96	68401.76	44995.96	282.76	Bechtel, 1998
CRSB-97	68718.65	44544.45	276.75	Bechtel, 1998
CRSB-98	68851.71	44548.8	275.11	Bechtel, 1998
CRSB-99	68994.32	44547.07	274.44	Bechtel, 1998
CSB-101	66002.48	44868.43	281.2	Rucker, 1999b
CSB-102	65984.05	43109.96	283.5	Rucker, 1999b
CSB-103	64510.41	44149.64	257.6	Rucker, 1999b
CSB-104	63455.35	43787.85	224.9	Rucker, 1999b

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
CSB-105	63628.93	42549.54	212.1	Rucker, 1999b
CSB-106	64261.04	41634.09	183.8	Rucker, 1999b
CSB-107	64785.48	42446.08	220.7	Rucker, 1999b
CSB-108	65154.15	40531.22	196.7	Rucker, 1999b
CSB-109	65351.75	39098.64	172.9	Rucker, 1999b
CSB-110	66382.03	38102.37	184.6	Rucker, 1999b
CSB-111	66888.08	38022.32	172.1	Rucker, 1999b
CSB-112	67195.7	38892.52	195.3	Rucker, 1999b
CSB-113	67729.39	39311.45	210.4	Rucker, 1999b
CSB-114	68278.36	40206.45	196	Rucker, 1999b
CSB-116	67598.91	42794.74	274.7	Rucker, 1999b
CSB-117	67218.22	42698.32	276.5	Rucker, 1999b
CSB-118	66802.15	42707.65	277.8	Rucker, 1999b
CSB-119	67398.77	42193.79	268.3	Rucker, 1999b
CSB-120	66998.48	42197.24	282.8	Rucker, 1999b
CSB-121	66601.65	42197.24	274.2	Rucker, 1999b
CSB-122	65679.58	41120.9	222.9	Rucker, 1999b
CSB-123	65585.04	41352.9	224.2	Rucker, 1999b
CSB-2C	67608.88	44973.31	289.9	WSRC, 1996d
CSB-3C	67762.9	44617.79	280.9	WSRC, 1996d
CSB-47	67185.49	43419.51	282.7	Bechtel, 1998
CSB-47A	68006.2	44200.2	268.9	ARA, 1999
CSB-48	69597.68	43418.61	259.8	Bechtel, 1998
CSB-48A	68205.2	44199.8	270.1	ARA, 1999
CSB-56	68602.13	43999.43	267	Rucker, 1999a
CSB-58	68028.13	41577.12	235.5	Rucker, 1999a
CSB-59	67751.28	41295.09	231.2	Rucker, 1999a
CSB-60	67502.28	40980.25	247	Rucker, 1999a
CSB-61	67245.08	40668.7	252.2	Rucker, 1999a
CSB-62	67014.1	40344.02	240.9	Rucker, 1999a
CSB-63	66792.95	40014.43	227.1	Rucker, 1999a
CSB-64	66530.84	39707.79	212.7	Rucker, 1999a
CSB-65	66173.72	39517.58	195.6	Rucker, 1999a
CSB-66A	65783.83	39622.52	191.7	Rucker, 1999a
CSD-4D	63143.8	50058.9	306.5	WSRC, 1996d
E-26	61550	59580	314.3	D'Appolonia, 1980
E-4	58770	60440	315.4	D'Appolonia, 1980
FAC-1SB	78138	55243	312.2	WSRC, 1992b
FCH-1	79488.82	52843.11	316.8	WSRC, 1993a
FCH-2	78500	52599.59	288.7	WSRC, 1993a

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
FCH-3	78059.22	52087.22	307.2	WSRC, 1993a
FCH-4	77514.56	52021.03	297.5	WSRC, 1993a
FCH-5	76992.12	51667.65	284.2	WSRC, 1993a
FCH-6	76410.33	51245.7	291.5	WSRC, 1993a
FIW-1MC	76165.3	51354.4	293.3	WSRC, 1996d
FIW-2MA	75930.8	51184.5	290.5	WSRC, 1996d
FNB-1A	80154.5	54288.8	282.4	WSRC, 1996d
FNB-3A	80557.2	54116.6	282.2	WSRC, 1996d
FSB-100A	75534.4	50958.4	283.8	WSRC, 1996d
FSB-101A	75719	51191.3	282.9	WSRC, 1996d
FSB-112A	74231.4	48809.1	227	WSRC, 1996d
FSB-113A	74167.5	51068.1	221.3	WSRC, 1996d
FSB-114A	75297.4	52046.6	250	WSRC, 1996d
FSB-115C	72515.5	49736	205.8	WSRC, 1996d
FSB-116C	72725.5	50645.9	200.5	WSRC, 1996d
FSB-120A	75538.9	49175.7	278	WSRC, 1996d
FSB-121C	75155.7	48413.1	254.4	WSRC, 1996d
FSB-122C	73881.8	48195	216	WSRC, 1996d
FSB-123C	74566.7	51750.5	236.3	WSRC, 1996d
FSB-1TA	75649.1	51658.3	275.4	WSRC, 1996d
FSB-76A	76131.9	51391.6	291.5	WSRC, 1996d
FSB-78A	74757.7	50172.8	270.5	WSRC, 1996d
FSB-79A	73664.5	50149.6	216.1	WSRC, 1996d
FSB-87A	75601.7	50115.8	285.6	WSRC, 1996d
FSB-89C	75553.2	51345.2	279.1	WSRC, 1996d
FSB-91C	75213.3	50953.5	277	WSRC, 1996d
FSB-93C	74897.3	50458.3	274	WSRC, 1996d
FSB-95C	74971.7	50016.7	281.8	WSRC, 1996d
FSB-96A	74882.2	49778.7	277.7	WSRC, 1996d
FSB-97A	75171.2	49965.7	283.8	WSRC, 1996d
FSB-98A	75389.8	50121.6	280.7	WSRC, 1996d
FSB-99A	75675.6	50314.8	285.3	WSRC, 1996d
FSB-PC	74090.2	50140	230.8	WSRC, 1996d
GAPWR-TW-1	51036.5	1544.1	219	Falls and others, 1998
HAA-1TA	69892.2	62953.3	290.2	WSRC, 1996d
HAA-2AA	70925.4	61285.1	291.4	WSRC, 1996d
HAA-3AA	71488	60201.9	274.5	WSRC, 1996d
HAA-4AA	72223.2	61929.6	299.2	WSRC, 1996d
HAA-6AA	71441	63860.2	279.8	WSRC, 1996d
HC-03AA	54483.32	42333.62	263.8	WSRC, 1996d
HC-12A	73187	59504	287.3	WSRC, 1996d

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
HCA-4AA	72513.7	62942.5	308.6	WSRC, 1996d
HCH-1	72796.38	60923.42	284	WSRC, 1993a
HCH-2	72519.61	60091.79	270.9	WSRC, 1993a
HCH-3	71998.82	59917.33	264	WSRC, 1993a
HCH-4	72449.59	59139.93	269.9	WSRC, 1993a
HCH-5	71810.36	59331.53	255	WSRC, 1996d
HIW-1BD	72564.6	58342.2	275.8	WSRC, 1996d
HIW-1MC	72500	58471.8	272.3	WSRC, 1996d
HIW-2A	73249.7	56753	276.3	WSRC, 1996d
HIW-2MC	73226.4	56698.4	269	WSRC, 1996d
HIW-4MC	73160.1	56570.1	263.4	WSRC, 1996d
HIW-5MC	73557.9	56498.9	266.1	WSRC, 1996d
HMD-1C	78731.7	56973.3	262.7	WSRC, 1996d
HMD-2C	79665.8	57269.7	259.3	WSRC, 1996d
HMD-3C	79578.7	57745.2	257.2	WSRC, 1996d
HMD-4C	79160.4	58188.5	248.5	WSRC, 1996d
HPC-1	70395.4	62493.6	293.5	WSRC, 1996d
HPT-1A	74847.1	60587	232.9	WSRC, 1996d
HPT-2A	75061.8	60200.5	257.8	WSRC, 1996d
HSB-101C	72001.9	58604.4	256.3	WSRC, 1996d
HSB-103C	71593.9	58323.6	245.2	WSRC, 1996d
HSB-104C	71376.8	58082.6	245.5	WSRC, 1996d
HSB-105C	71447.3	57883.8	247.2	WSRC, 1996d
HSB-106C	71720.9	57651.5	250.7	WSRC, 1996d
HSB-107C	71698.5	57432	259.3	WSRC, 1996d
HSB-109C	71684.8	56895.6	259.4	WSRC, 1996d
HSB-110C	71779.3	56680.7	253.4	WSRC, 1996d
HSB-111C	71919.4	56501.9	253.7	WSRC, 1996d
HSB-112C	72156.4	56417.4	252.6	WSRC, 1996d
HSB-113C	72312.3	56160.4	258.7	WSRC, 1996d
HSB-115C	72653.2	56043.2	266.8	WSRC, 1996d
HSB-117A	72733.6	55170.1	234.8	WSRC, 1996d
HSB-118A	72696.4	55775.6	245	WSRC, 1996d
HSB-119A	73082.5	56100.2	254.8	WSRC, 1996d
HSB-120A	73395.1	56431.9	266	WSRC, 1996d
HSB-121A	72024.8	57389.6	272.3	WSRC, 1996d
HSB-122A	72195.9	57747.4	269.4	WSRC, 1996d
HSB-123A	72189.8	58124.8	263.6	WSRC, 1996d
HSB-124A	72199.6	58514.6	263.9	WSRC, 1996d
HSB-132C	71472.4	58787.7	238.3	WSRC, 1996d
HSB-139A	71127.4	57365.4	231.5	WSRC, 1996d

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
HSB-140A	70050.3	56535.4	234	WSRC, 1996d
HSB-141A	71213.6	59168.7	252.6	WSRC, 1996d
HSB-142C	73119	53505.3	201.6	WSRC, 1996d
HSB-143C	73738.2	52773.2	220.1	WSRC, 1996d
HSB-144A	71892.1	56200.5	233.6	WSRC, 1996d
HSB-145C	71098.9	57769	233.7	WSRC, 1996d
HSB-146A	70478.9	58454	249.5	WSRC, 1996d
HSB-148C	70151.5	55344.2	248.9	WSRC, 1996d
HSB-151C	72997.9	54014.9	211.6	WSRC, 1996d
HSB-152C	72012	54346.7	212.1	WSRC, 1996d
HSB-65A	72436.2	58436	270.7	WSRC, 1996d
HSB-68A	71526.9	56892.1	247.4	WSRC, 1996d
HSB-69A	71549.4	56465.1	234.1	WSRC, 1996d
HSB-83A	71648.6	58606.1	234.9	WSRC, 1996d
HSB-84A	71586.2	56359.1	226.7	WSRC, 1996d
HSB-85A	73791.9	58943.4	292.1	WSRC, 1996d
HSB-86A	72520.2	55985.9	260	WSRC, 1996d
HSB-PC	72119.31	55650.03	227.8	WSRC, 1996d
HSB-TB	72394	58696.1	267.1	WSRC, 1996d
HSL-6AA	72692.6	60555.7	274.6	WSRC, 1996d
HSL-8AA	72729.4	61113.8	286.7	WSRC, 1996d
IDB-2A	77284.4	75391.1	302.4	WSRC, 1996d
IDP-3A	85104.3	3778.11	282.2	WSRC, 1996d
IDQ-3A	80553.7	35854	203.2	WSRC, 1996d
KAC-9D	53197.8	42588.1	260.2	WSRC, 1996d
KPT-1	56460.7	40978.6	205.2	Gregg, 1998b
KPT-2	54110.9	43845.9	258.2	Gregg, 1998b
KPT-3	52641.2	43434	225.5	Gregg, 1998b
KPT-4	50028.8	41172.3	258.9	Gregg, 1998b
KPT-5	47731.6	39198.3	225.1	Gregg, 1998b
KPT-6	49191.9	39297.1	232.8	Gregg, 1998b
KPT-7	49340.5	37721.3	211.8	Gregg, 1998b
KPT-8	51888.2	39652.9	238.6	Gregg, 1998b
KPT-9	52456.1	36726.3	204.9	Gregg, 1998b
L3-CPT-PG-9	54369	41344	270	ARA, 1992
LAC-5DL	45365.4	51352	239.8	WSRC, 1996d
LAC-6DL	45272.8	51188.1	239.8	WSRC, 1996d
LAC-7DL	45097.1	51118.4	239.4	WSRC, 1996d
LAC-8DL	45096.6	51300.9	234	WSRC, 1996d
LCO-5A	44987	50866	230	WSRC, 1996d
LCO-5DL	44974.5	50887.5	230.3	WSRC, 1996d

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
LCO-8DL	45586.1	51380.6	243.4	WSRC, 1996d
LFW-10SB	83162.5	46137.5	168.4	WSRC, 1991e
LWN-1SB	68131.9	33690.8	282.5	WSRC, 1996d
LWN-2SB	66548.6	34739.1	231	WSRC, 1996d
LWN-3SB	66900.2	32092.1	245.7	WSRC, 1996d
LWR-2SB	71766	45998.8	248.1	WSRC, 1996d
LWR-3SB	71243.3	47068.9	249.1	WSRC, 1996d
LWR-4SB	70051.6	46749.6	293.8	WSRC, 1996d
LWR-8CC	70409.4	45803	280.3	WSRC, 1996d
LWR-9SB	71658.83	45406.62	238.2	WSRC, 1996d
M12-17	62294.6	56405.83	325.5	Law Environmental, 1991
M121A	62170.7	56819.9	303.7	WSRC, 1996d
M12A-29	60637.63	56403.41	321	Law Environmental, 1991
MWD-1A	69592.8	75121.9	327.5	WSRC, 1996d
MWD-C3	69734.7	75249.03	322.5	ARA, 1996
MWD-C5	69835.55	74766.97	328.7	ARA, 1996
NPN-1A	66632.1	70856.2	335.9	WSRC, 1996d
OFS-1SB	74967.5	54032.6	261.6	Amidon, 1995
OFS-2SB	74671	53848	257.5	Amidon, 1995
OFS-3SB	74270	54579	258.1	Amidon, 1995
OFS-4SB	73874	55188	258.7	Amidon, 1995
OFS-5SB	73623	54298	228.7	Amidon, 1995
P-13TA	35600	60000	252.4	WSRC, 1996d
P-14TA	72444.9	76439.6	294.4	WSRC, 1996d
P-18TA	67578.5	47652.7	296.9	WSRC, 1996d
P-19TA	55295.9	60034.6	297.4	WSRC, 1996d
P-20TA	56094.1	76768.1	287.7	WSRC, 1996d
P-21TA	24674.6	40739.2	207	WSRC, 1996d
P-22TA	20593.4	73555.3	215.4	WSRC, 1996d
P-23TA	48063.3	30931.3	181.5	WSRC, 1996d
P-24TA	43096.2	66565.2	313.3	WSRC, 1996d
P-25TA	52493.6	42261	265.1	WSRC, 1996d
P-26TA	71958.6	18051.5	152.2	WSRC, 1996d
P-27TA	70382	64022.9	274.1	WSRC, 1996d
P-28TA	79284.3	55441.1	285.6	WSRC, 1996d
P4-CPT-4	54221	40213	270	ARA, 1992
PBF-3	58766.62	60380.36	316.65	Harris, 1997
PBF-4	58148.66	29985.13	208.1	Harris, 1997

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
PBF-5	53591.29	30319.43	240.6	Harris, 1997
PBF-6	55621.75	12814.48	92.5	Harris, 1997
PBF-7	55420.69	59568.97	285.42	Harris, 1997
PBF-8	55744.48	59812.89	292.01	Harris, 1997
PCL-12	58948	37745	265.8	Gregg, 1998b
PCL-13	57115	35125	274.2	Gregg, 1998b
PCL-14	52068	32090	250.3	Gregg, 1998b
PCL-15	41222	37515	242.1	Gregg, 1998b
PCL-16	65993	43146	282.8	Gregg, 1998b
PCL-17	64174	48343	291	Gregg, 1998b
PCL-1A	60442	80332	317.7	Gregg, 1998b
PCL-2	60238	76070	304.4	Gregg, 1998b
PCL-3A	53512	74103	300	Gregg, 1998b
PCL-4	48651	63191	331.7	Gregg, 1998b
PCL-5	47475	67894	284.3	Gregg, 1998b
PCL-6	42040	67118	312.6	Gregg, 1998b
PCL-7B	38735	62254	295.7	Gregg, 1998b
PCL-8	47839	51358	254.7	Gregg, 1998b
PCL-9	47441	56410	288.1	Gregg, 1998b
PPC-1	42727.22	66137.83	313.3	WSRC, 1990b
RCP-1A	56968.1	74238.3	294.8	WSRC, 1996d
RSF-1	58505.3	74869.4	300.8	WSRC, 1996d
RSF-2	57670.4	74628.6	300.3	WSRC, 1996d
RSF-3	57621.4	75206.7	304.8	WSRC, 1996d
SDS-21	78951	67087	251	WSRC, 1993b
SDS-22	76887	66304	283	WSRC, 1993b
SSW-1	71223.25	33206.83	311.3	WSRC, 1989
SSW-2	72230.42	28236.98	167.3	WSRC, 1996d
SSW-3	70517.63	40532.31	178.7	WSRC, 1989
SW-24CP	74671	53848	257.5	Amidon, 1995
T18N1A	57015.7	45553.2	258.4	WSRC, 1996d
T18S1A	46111.5	43897.6	233.5	WSRC, 1996d
T18W1A	48773.1	40275.2	244.4	WSRC, 1996d
USGS-MP	98367.1	-8045.7	245	Falls and others, 1998
VG-1	11543.5	17064.2	156.6	Bechtel, 1982
VG-7	28828.3	5392.8	250.6	Bechtel, 1982
VG-8	-12412.6	22580.5	103.7	Bechtel, 1982
YSC-1A	78039.9	65438.93	268.9	WSRC, 1996d
YSC-1C	78186.24	65855.46	272.5	WSRC, 1996d
YSC-2A	78311.53	66100.08	281.7	WSRC, 1996d
YSC-3SB	77680	65920	277	WEGS, 1990

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
YSC-4A	77050.08	65883.5	287.5	WSRC, 1996d
YSC-5A	74295.9	67134.9	273	WSRC, 1996d

Notes:

ft.-feet
ft m.s.l.-feet above mean sea level
1-Detailed description of references in Appendix D

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
131C-100	261.6	241.0	21			226	36
131C-104	276.9	258.0	19	237	40	220	57
131C-105	169.8						
131C-49	254.3	240.0	14	224	30	212	42
131C-51	265.0	238.0	27	226	39	214	51
131C-54	247.1	232.0	15	219	28	208	39
131C-55	245.0	228.0	17	217	28	203	42
131C-59	227.7					203	25
131C-60	218.2					209	9
131C-63	211.1						
131C-64	211.9						
131C-67	265.8	248.0	18	220	46	209	57
131C-68	267.7	244.0	24	225	43	216	52
131C-80	205.7						
131C-81	217.9					209	9
131C-82	233.0					217	16
131C-83	240.5					217	24
131C-84	241.9					224	18
131C-85	237.5					222	15
131C-91	233.7					217	17
131C-93	241.9					221	21
131C-95	241.3	226.0	15			222	19
131C-96	243.2	227.0	16			216	27
131C-98	251.0	230.0	21			216	35
131C-R1	271.0	250.0	21	232	39	209	62
131C-R2	266.8	251.0	16	224	43	201	66
131C-R3	268.8	251.0	18	226	43	213	56
131C-R4	285.6	250.0	36	228	58	211	75
131C-R5	289.0	257.0	32	231	58	212	77
131C-R6	276.0	251.0	25	219	57	205	71
BGO-10A	299.1						
BGO-10AA	298.8						
BGO-12A	311.4						
BGO-14A	300.2						
BGO-16A	302.8						
BGO-18A	292.9						
BGO-20AA	280.9						
BGO-25A	294.7						
BGO-26A	285.1						
BGO-27C	273.9						
BGO-29A	262.1						
BGO-31C	271.1						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGO-33C	277.4						
BGO-35C	271.4						
BGO-37C	284.3						
BGO-39A	293.7						
BGO-3A	288.7						
BGO-41A	298.3						
BGO-42C	295.9						
BGO-43AA	312.2						
BGO-44AA	283.3						
BGO-45A	276.9						
BGO-46B	263.4						
BGO-47A	264.8						
BGO-48C	274.7						
BGO-49A	269.1						
BGO-50A	253.5						
BGO-51AA	287.2						
BGO-52AA	281.6						
BGO-53AA	288.9						
BGO-5C	294.2						
BGO-6A	283.8						
BGO-6B	284.5						
BGO-8A	281.3						
BGO-9AA	282.8						
BGT-1	282.9						
BGT-10	215.2						
BGT-11	222.5						
BGT-12	284.2						
BGT-13	287.8						
BGT-14	280.7						
BGT-15	277.5						
BGT-16	250.7						
BGT-17	240.7						
BGT-18	216.5						
BGT-2	276.4						
BGT-20	159.5						
BGT-21	294.2						
BGT-22	281.0	265.0	16	234	47	212	69
BGT-23	270.0						
BGT-24	265.8						
BGT-25	264.8						
BGT-27	256.9						
BGT-28	258.3	250.0	8			230	28

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGT-29	243.0						
BGT-3	275.7						
BGT-30	219.0						
BGT-31	308.8						
BGT-32	310.1						
BGT-33	290.4						
BGT-34	286.8						
BGT-35	267.7						
BGT-36	261.4						
BGT-37	251.6						
BGT-38	240.1						
BGT-39	241.9						
BGT-4	259.2						
BGT-40	332.3						
BGT-41	328.4						
BGT-42	310.9						
BGT-43	277.1						
BGT-44	276.2						
BGT-45	285.3						
BGT-46	310.0						
BGT-47	317.3						
BGT-48	314.3						
BGT-49	297.3						
BGT-5	225.7						
BGT-50	296.3						
BGT-51	272.6						
BGT-53	278.3						
BGT-54	280.0						
BGT-56	262.9						
BGT-57	259.4						
BGT-58	285.8						
BGT-59	281.9						
BGT-6	282.2						
BGT-60	291.4						
BGT-61	284.3	256.0	28	242	42	210	74
BGT-62	282.0						
BGT-63	293.7						
BGT-63A	290.8						
BGT-64	283.3						
BGT-66	244.0						
BGT-67	242.0	232.0	10			209	33
BGT-7	276.4						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGT-8	249.3						
BGT-9	226.0						
BGX-11D	273.8						
BGX-1A	289.1						
BGX-2B	289.2						
BGX-4A	288.8						
BGX-7D	277.1						
BGX-9D	277.4						
BRR-1D	293.8						
BRR-3D	289.5						
BRR-6B	293.9						
BRR-7B	289.6						
BRR-8B	276.7						
CCP-1A	287.1	267.0	20	232	55	205	82
CFD-1	268.8	237.0	32				
CFD-18	248.3	228.0	20	208	40	198	50
CFD-5	257.8						
CMP-1-CP	248.9	238.0	11				
CMP-30B	286.5	262.0	25			245	42
CMP-32B	251.7	230.0	22				
CMP-4B-CP	241.8	236.0	6				
CMP-6A-CP	238.4					222	16
CPC-1	285.1	267.0	18	230	55	187	98
CRP-5D	274.5	264.0	11	232	43	192	83
CRP-9D	268.4						
CRSB-1	278.2	258.0	20	229	49	201	77
CRSB-101	275.6	256.0	20	231	45	205	71
CRSB-11	276.7	254.0	23	227	50	204	73
CRSB-14	275.6	252.0	24	235	41	207	69
CRSB-16	282.6	251.0	32	234	49	212	71
CRSB-17	281.0	261.0	20	231	50	207	74
CRSB-18	273.8	253.0	21	227	47	204	70
CRSB-20	274.2	257.0	17	228	46	203	71
CRSB-21	272.9	243.0	30	228	45	204	69
CRSB-24	277.2	264.0	13	238	39	217	60
CRSB-26	291.6	267.0	25	241	51	220	72
CRSB-28	289.3	256.0	33	228	61	205	84
CRSB-30	285.4	253.0	32	240	45	217	68
CRSB-31	284.4	248.0	36	235	49	214	70
CRSB-32	274.1	230.0	44	225	49	195	79
CRSB-35	257.4	237.0	20	221	36	196	61
CRSB-36	265.6	240.0	26	224	42	199	67

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
CRSB-37	270.5	251.0	19	236	34	209	61
CRSB-4	282.8	253.0	30	233	50	218	65
CRSB-40	227.3					196	31
CRSB-43	258.5	246.0	13	228	31	203	56
CRSB-45	270.6	257.0	14	238	33	216	55
CRSB-47	282.7	241.0	42	220	63	197	86
CRSB-48	259.8	247.0	13	236	24	226	34
CRSB-5	288.3	255.0	33	229	59	209	79
CRSB-50	255.6	231.0	25	223	33	213	43
CRSB-52	233.1			213	20	191	42
CRSB-54	224.7					204	21
CRSB-55	229.1					204	25
CRSB-56	232.5					212	21
CRSB-57	248.2	227.0	21			213	35
CRSB-58	253.9	237.0	17			219	35
CRSB-6	289.4	269.0	20	233	56	206	83
CRSB-60	257.0	240.0	17			218	39
CRSB-61	257.3	243.0	14	228	29	215	42
CRSB-63	240.4					221	19
CRSB-64	229.9					217	13
CRSB-65	214.8					209	6
CRSB-86	206.6						
CRSB-88	253.2	233.0	20	214	39	189	64
CRSB-89	260.6	237.0	24	210	51	192	69
CRSB-90	268.4	243.0	25	219	49	201	67
CRSB-91	273.1	253.0	20	236	37	203	70
CRSB-92	287.5	269.0	19	236	52	215	73
CRSB-93	286.8	261.0	26	236	51	215	72
CRSB-94	283.3	268.0	15	237	46	214	69
CRSB-95	280.4	268.0	12	239	41	207	73
CRSB-96	282.8	248.0	35	234	49	203	80
CRSB-97	276.8	254.0	23	229	48	203	74
CRSB-98	275.1	253.0	22	229	46	209	66
CRSB-99	274.4	254.0	20	229	45	212	62
CSB-101	281.2	274.0	7	237	44	209	72
CSB-102	283.5	256.0	28	228	56	206	78
CSB-103	257.6	239.0	19	224	34	202	56
CSB-104	224.9	209.0	16			198	27
CSB-105	212.1					200	12
CSB-106	183.8						
CSB-107	220.7					197	24
CSB-108	196.7						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
CSB-109	172.9						
CSB-110	184.6						
CSB-111	172.1						
CSB-112	195.3						
CSB-113	210.4					200	10
CSB-114	196.0						
CSB-116	274.7	255.0	20	232	43	207	68
CSB-117	276.5			244	33	221	56
CSB-118	277.8	258.0	20	224	54	202	76
CSB-119	268.3			228	40	202	66
CSB-120	282.8	248.0	35	225	58	202	81
CSB-121	274.2	254.0	20	234	40	213	61
CSB-122	222.9	197.0	26				
CSB-123	224.2	210.0	14			204	20
CSB-2C	289.9	269.0	21	235	55	206	84
CSB-3C	280.9	250.0	31	233	48	202	79
CSB-47	282.7	253.0	30	238	45	210	73
CSB-47A	268.9	263.0	6	244	25	220	49
CSB-48	259.8	247.0	13	236	24	216	44
CSB-48A	270.1	252.0	18	236	34	210	60
CSB-56	267.0	246.0	21	242	25	212	55
CSB-58	235.5	222.0	14			214	22
CSB-59	231.2	221.0	10				
CSB-60	247.0	234.0	13	221	26	209	38
CSB-61	252.2	238.0	14	224	28	210	42
CSB-62	240.9	231.0	10	228	13	217	24
CSB-63	227.1	213.0	14			204	23
CSB-64	212.7	192.0	21				
CSB-65	195.6						
CSB-66A	191.7	179.0	13				
CSD-4D	306.5	279.0	28	232	75	194	113
E-26	314.3						
E-4	315.4						
FAC-1SB	312.2						
FCH-1	316.8						
FCH-2	288.7						
FCH-3	307.2						
FCH-4	297.5						
FCH-5	284.2						
FCH-6	291.5						
FIW-1MC	293.3						
FIW-2MA	290.5						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
FNB-1A	282.4						
FNB-3A	282.2						
FSB-100A	283.8						
FSB-101A	282.9						
FSB-112A	227.0						
FSB-113A	221.3						
FSB-114A	250.0						
FSB-115C	205.8						
FSB-116C	200.5						
FSB-120A	278.0						
FSB-121C	254.4						
FSB-122C	216.0						
FSB-123C	236.3						
FSB-1TA	275.4						
FSB-76A	291.5						
FSB-78A	270.5						
FSB-79A	216.1						
FSB-87A	285.6						
FSB-89C	279.1						
FSB-91C	277.0						
FSB-93C	274.0						
FSB-95C	281.8						
FSB-96A	277.7						
FSB-97A	283.8						
FSB-98A	280.7						
FSB-99A	285.3						
FSB-PC	230.8						
GAPWR-TW-1	219.0						
HAA-1TA	290.2	260.0	30	247	43	221	69
HAA-2AA	291.4						
HAA-3AA	274.5						
HAA-4AA	299.2						
HAA-6AA	279.8						
HC-03AA	263.8	237.0	27	225	39	201	63
HC-12A	287.3						
HCA-4AA	308.6						
HCH-1	284.0						
HCH-2	270.9						
HCH-3	264.0						
HCH-4	269.9						
HCH-5	255.0						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
HIW-1BD	275.8						
HIW-1MC	272.3						
HIW-2A	276.3						
HIW-2MC	269.0						
HIW-4MC	263.4						
HIW-5MC	266.1						
HMD-1C	262.7						
HMD-2C	259.3						
HMD-3C	257.2						
HMD-4C	248.5						
HPC-1	293.5						
HPT-1A	232.9						
HPT-2A	257.8						
HSB-101C	256.3						
HSB-103C	245.2						
HSB-104C	245.5						
HSB-105C	247.2						
HSB-106C	250.7						
HSB-107C	259.3						
HSB-109C	259.4						
HSB-110C	253.4						
HSB-111C	253.7						
HSB-112C	252.6						
HSB-113C	258.7						
HSB-115C	266.8						
HSB-117A	234.8						
HSB-118A	245.0						
HSB-119A	254.8						
HSB-120A	266.0						
HSB-121A	272.3						
HSB-122A	269.4						
HSB-123A	263.6						
HSB-124A	263.9						
HSB-132C	238.3						
HSB-139A	231.5						
HSB-140A	234.0						
HSB-141A	252.6						
HSB-142C	201.6						
HSB-143C	220.1						
HSB-144A	233.6						
HSB-145C	233.7						
HSB-146A	249.5						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
HSB-148C	248.9						
HSB-151C	211.6						
HSB-152C	212.1						
HSB-65A	270.7						
HSB-68A	247.4						
HSB-69A	234.1						
HSB-83A	234.9						
HSB-84A	226.7						
HSB-85A	292.1						
HSB-86A	260.0						
HSB-PC	227.8						
HSB-TB	267.1						
HSL-6AA	274.6						
HSL-8AA	286.7						
IDB-2A	302.4						
IDP-3A	282.2	245.0	37	232	50	204	78
IDQ-3A	203.2	186.0	17				
KAC-9D	260.2	234.0	26	217	43	187	73
KPT-1	205.2			186	19	176	29
KPT-2	258.2	222.0	36	205	53	178	80
KPT-3	225.5	206.0	20	199	27	182	44
KPT-4	258.9	226.0	33			207	52
KPT-5	225.1	205.0	20				
KPT-6	232.8	221.0	12	212	21	196	37
KPT-7	211.8					191	21
KPT-8	238.6						
KPT-9	204.9	186.0	19			172	33
L3-CPT-PG-9	270.0	246.0	24	235	35	201	69
LAC-5DL	239.8						
LAC-6DL	239.8						
LAC-7DL	239.4						
LAC-8DL	234.0						
LCO-5A	230.0	197.0	33				
LCO-5DL	230.3						
LCO-8DL	243.4						
LFW-10SB	168.4						
LWN-1SB	282.5						
LWN-2SB	231.0						
LWN-3SB	245.7						
LWR-2SB	248.1						
LWR-3SB	249.1						
LWR-4SB	293.8						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
LWR-8CC	280.3	266.0	14	237	43	207	73
LWR-9SB	238.2						
M12-17	325.5						
M121A	303.7						
M121A	303.7						
M12A-29	321.0	245.0	76	224	97	199	122
MWD-1A	327.5	290.0	38	267	61	209	119
MWD-C3	322.5	289.0	34	264	59	210	113
MWD-C5	328.7	290.0	39	264	65	210	119
NPN-001	335.9	319.0	17	273	63	253	83
NPN-1A	335.9						
OFS-1SB	261.6						
OFS-2SB	257.5						
OFS-3SB	258.1						
OFS-4SB	258.7						
OFS-5SB	228.7						
P-13TA	252.4						
P-14TA	294.4						
P-18TA	296.9	263.0	34	234	63	204	93
P-19TA	297.4	255.0	42			225	72
P-20TA	287.7	250.0	38	238	50	204	84
P-21TA	207.0	188.0	19			151	56
P-22TA	215.4					155	60
P-23TA	181.5					156	26
P-24TA	313.3	260.0	53	250	63	235	78
P-25TA	265.1	251.0	14	221	44	183	82
P-26TA	152.2						
P-27TA	274.1						
P-28TA	285.6	230.0	56	216	70	206	80
P4-CPT-4	270.0	238.0	32	211	59	199	71
PBF-3	316.7	300.0	17			234	83
PBF-4	208.1	182.0	26				
PBF-5	240.6	214.0	27	194	47	190	51
PBF-6	92.5						
PBF-7	285.4	269.0	16	250	35	221	64
PBF-8	292.0	258.0	34	237	55	216	76
PCL-12	265.8	241.0	25	223	43	174	92
PCL-13	274.2	235.0	39	219	55	182	92
PCL-14	250.3	232.0	18	224	26	168	82
PCL-15	242.1	223.0	19	212	30	188	54
PCL-16	282.8	258.0	25	228	55	194	89
PCL-17	291.0	265.0	26	236	55	202	89

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		base of "uu"		"AA" Interval		Transmissive Zone	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
PCL-1A	317.7	292.0	26	257	61		
PCL-2	304.4	250.0	54	230	74	206	98
PCL-3A	300.0	250.0	50	228	72	208	92
PCL-4	331.7	290.0	42	278	54	199	133
PCL-5	284.3	270.0	14	266	18	199	85
PCL-6	312.6	275.0	38	266	47	242	71
PCL-7B	295.7	259.0	37	228	68	193	103
PCL-8	254.7	228.0	27	217	38	192	63
PCL-9	288.1	271.0	17	260	28	208	80
PPC-1	313.3	285.0	28	263	50	245	68
RCP-1A	294.8	273.0	22	243	52	208	87
RSF-1	300.8						
RSF-2	300.3						
RSF-3	304.8	251.0	54	223	82	210	95
SDS-21	251.0						
SDS-22	283.0						
SSW-1	311.3	281.0	30	255	56	230	81
SSW-2	167.3						
SSW-3	178.7						
SW-24CP	257.5	242.0	16			221	37
T18N1A	258.4						
T18S1A	233.5	213.0	21	197	37	186	48
T18W1A	244.4	208.0	36			197	47
USGS-MP	245.0						
VG-1	156.6						
VG-7	250.6						
VG-8	103.7						
YSC-1A	268.9	247.0	22			237	32
YSC-1C	272.5						
YSC-2A	281.7						
YSC-3SB	277.0						
YSC-4A	287.5						
YSC-5A	273.0						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
131C-100	261.6	194	68	166	96
131C-104	276.9	187	90	161	116
131C-105	169.8			170	0
131C-49	254.3	186	68		
131C-51	265.0	180	85		
131C-54	247.1				
131C-55	245.0				
131C-59	227.7				
131C-60	218.2	181	37	147	71
131C-63	211.1	180	31		
131C-64	211.9	182	30	166	46
131C-67	265.8	181	85		
131C-68	267.7	184	84		
131C-80	205.7	174	32	149	57
131C-81	217.9	174	44	151	67
131C-82	233.0	174	59		
131C-83	240.5	171	70	142	99
131C-84	241.9	170	72	152	90
131C-85	237.5	170	67	151	86
131C-91	233.7	178	56	144	90
131C-93	241.9	180	62	143	99
131C-95	241.3	187	54	147	94
131C-96	243.2	183	60	166	77
131C-98	251.0	179	72	162	89
131C-R1	271.0	181	90		
131C-R2	266.8				
131C-R3	268.8	183	86		
131C-R4	285.6	181	105		
131C-R5	289.0	184	105		
131C-R6	276.0	168	108		
BGO-10A	299.1	209	90	207	92
BGO-10AA	298.8	219	80	207	92
BGO-12A	311.4	199	112	186	125
BGO-14A	300.2	220	80	212	88
BGO-16A	302.8	196	107	183	120
BGO-18A	292.9	194	99	199	94
BGO-20AA	280.9	206	75	194	87
BGO-25A	294.7	212	83	201	94
BGO-26A	285.1	219	66	205	80
BGO-27C	273.9	199	75	192	82
BGO-29A	262.1	196	66	185	77

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGO-31C	271.1	198	73	188	83
BGO-33C	277.4	200	77	191	86
BGO-35C	271.4	204	67	197	74
BGO-37C	284.3	199	85	191	93
BGO-39A	293.7	204	90	202	92
BGO-3A	288.7	198	91	189	100
BGO-41A	298.3	217	81	208	90
BGO-42C	295.9	216	80	209	87
BGO-43AA	312.2	195	117	187	125
BGO-44AA	283.3	222	61	199	84
BGO-45A	276.9	207	70	201	76
BGO-46B	263.4	199	64	193	70
BGO-47A	264.8	198	67	190	75
BGO-48C	274.7	198	77	192	83
BGO-49A	269.1	201	68	192	77
BGO-50A	253.5	194	60	184	70
BGO-51AA	287.2	205	82	194	93
BGO-52AA	281.6	207	75	197	85
BGO-53AA	288.9	223	66	216	73
BGO-5C	294.2	218	76	201	93
BGO-6A	283.8	210	74	195	89
BGO-6B	284.5	203	82	192	93
BGO-8A	281.3	213	68	199	82
BGO-9AA	282.8	224	59	211	72
BGT-1	282.9	222	61	208	75
BGT-10	215.2	201	14	194	21
BGT-11	222.5	228	-5	223	0
BGT-12	284.2	225	59	214	70
BGT-13	287.8	224	64	216	72
BGT-14	280.7	215	66	209	72
BGT-15	277.5	209	69	201	77
BGT-16	250.7				
BGT-17	240.7				
BGT-18	216.5	222	-5	217	0
BGT-2	276.4	213	63	198	78
BGT-20	159.5				
BGT-21	294.2	223	71	216	78
BGT-22	281.0	200	81	178	103
BGT-23	270.0	216	54	210	60
BGT-24	265.8	227	39	220	46
BGT-25	264.8	229	36	224	41
BGT-27	256.9	217	40	207	50

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGT-28	258.3	212	46	190	68
BGT-29	243.0	219	24	215	28
BGT-3	275.7	212	64	198	78
BGT-30	219.0				
BGT-31	308.8	220	89	215	94
BGT-32	310.1	237	73	234	76
BGT-33	290.4	239	51	223	67
BGT-34	286.8	228	59	218	69
BGT-35	267.7	217	51	212	56
BGT-36	261.4	226	35	215	46
BGT-37	251.6	222	30	215	37
BGT-38	240.1				
BGT-39	241.9				
BGT-4	259.2	213	46	204	55
BGT-40	332.3	209	123	203	129
BGT-41	328.4	224	104	219	109
BGT-42	310.9	224	87	219	92
BGT-43	277.1	205	72	201	76
BGT-44	276.2	214	62	209	67
BGT-45	285.3	218	67	209	76
BGT-46	310.0	213	97	205	105
BGT-47	317.3	214	103	210	107
BGT-48	314.3	217	97	209	105
BGT-49	297.3	222	75	214	83
BGT-5	225.7	214	12	206	20
BGT-50	296.3	221	75	214	82
BGT-51	272.6	193	80	186	87
BGT-53	278.3	200	78	191	87
BGT-54	280.0	205	75	196	84
BGT-56	262.9	182	81	175	88
BGT-57	259.4	179	80	169	90
BGT-58	285.8	192	94	190	96
BGT-59	281.9	182	100	173	109
BGT-6	282.2	218	64		
BGT-60	291.4	186	105	176	115
BGT-61	284.3	186	98	176	108
BGT-62	282.0	190	92	176	106
BGT-63	293.7	195	99	189	105
BGT-63A	290.8	198	93	194	97
BGT-64	283.3	195	88	188	95
BGT-66	244.0	195	49	188	56
BGT-67	242.0	197	45	180	62

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGT-7	276.4	212	64	199	77
BGT-8	249.3	221	28	217	32
BGT-9	226.0	210	16	205	21
BGX-11D	273.8	193	81	177	97
BGX-1A	289.1	211	78	198	91
BGX-2B	289.2	216	73	198	91
BGX-4A	288.8	225	64	213	76
BGX-7D	277.1	225	52	220	57
BGX-9D	277.4	207	70	202	75
BRR-1D	293.8	195	99		
BRR-3D	289.5	208	82	194	96
BRR-6B	293.9	178	116	166	128
BRR-7B	289.6	202	88	190	100
BRR-8B	276.7	205	72	200	77
CCP-1A	287.1	176	112	162	125
CFD-1	268.8	188	81	178	91
CFD-18	248.3	164	84	150	98
CFD-5	257.8	180	78	173	85
CMP-1-CP	248.9	214	35		
CMP-30B	286.5	209	78	197	90
CMP-32B	251.7	220	32	198	54
CMP-4B-CP	241.8	212	30	194	48
CMP-6A-CP	238.4	202	36	180	58
CPC-1	285.1	164	121	154	131
CRP-5D	274.5	187	88	139	136
CRP-9D	268.4	163	105		
CRSB-1	278.2	172	106	153	125
CRSB-101	275.6	179	97	145	131
CRSB-11	276.7	170	107	155	122
CRSB-14	275.6	170	106	151	125
CRSB-16	282.6	181	102		
CRSB-17	281.0	174	107	156	125
CRSB-18	273.8	173	101	137	137
CRSB-20	274.2	172	102	153	121
CRSB-21	272.9	170	103	152	121
CRSB-24	277.2	186	91	162	115
CRSB-26	291.6	190	102	170	122
CRSB-28	289.3	179	110	151	138
CRSB-30	285.4	184	101	165	120
CRSB-31	284.4	175	109	156	128
CRSB-32	274.1	161	113	130	144
CRSB-35	257.4	164	93	148	109

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
CRSB-36	265.6	164	102	135	131
CRSB-37	270.5	175	95		
CRSB-4	282.8	179	104	148	135
CRSB-40	227.3	186	41	152	75
CRSB-43	258.5	169	90	143	116
CRSB-45	270.6	180	91	143	128
CRSB-47	282.7	163	120	135	148
CRSB-48	259.8	177	83	144	116
CRSB-5	288.3	175	113	135	153
CRSB-50	255.6	185	71	139	117
CRSB-52	233.1	181	52	156	77
CRSB-54	224.7	186	39	166	59
CRSB-55	229.1	182	47	169	60
CRSB-56	232.5	183	50	162	71
CRSB-57	248.2	182	66	170	78
CRSB-58	253.9	186	68	173	81
CRSB-6	289.4	178	111	160	129
CRSB-60	257.0	189	68	159	98
CRSB-61	257.3	185	72	160	97
CRSB-63	240.4	184	56	148	92
CRSB-64	229.9	189	41	147	83
CRSB-65	214.8	182	33	141	74
CRSB-86	206.6	182	25	165	42
CRSB-88	253.2	176	77	153	100
CRSB-89	260.6	182	79	161	100
CRSB-90	268.4	183	85	151	117
CRSB-91	273.1	185	88		
CRSB-92	287.5	181	107	157	131
CRSB-93	286.8	181	106	163	124
CRSB-94	283.3	187	96	154	129
CRSB-95	280.4	191	89	165	115
CRSB-96	282.8	188	95	158	125
CRSB-97	276.8	181	96	156	121
CRSB-98	275.1	181	94	154	121
CRSB-99	274.4	174	100	142	132
CSB-101	281.2	181	100	156	125
CSB-102	283.5	186	98	182	102
CSB-103	257.6	179	79	168	90
CSB-104	224.9	175	50	168	57
CSB-105	212.1	177	35	175	37
CSB-106	183.8	173	11	169	15
CSB-107	220.7				

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
CSB-108	196.7	178	19	165	32
CSB-109	172.9				
CSB-110	184.6			171	14
CSB-111	172.1			160	12
CSB-112	195.3	172	23	153	42
CSB-113	210.4	180	30	161	49
CSB-114	196.0	178	18	168	28
CSB-116	274.7	175	100	151	124
CSB-117	276.5	180	97	150	127
CSB-118	277.8	178	100	171	107
CSB-119	268.3	180	88	156	112
CSB-120	282.8	178	105	159	124
CSB-121	274.2	188	86	163	111
CSB-122	222.9	181	42	165	58
CSB-123	224.2	188	36	182	42
CSB-2C	289.9	181	109	141	149
CSB-3C	280.9	177	104		
CSB-47	282.7	162	121	160	123
CSB-47A	268.9	185	84	161	108
CSB-48	259.8	178	82	160	100
CSB-48A	270.1	178	92	154	116
CSB-56	267.0	184	83	160	107
CSB-58	235.5	187	49	174	62
CSB-59	231.2	181	50	158	73
CSB-60	247.0	181	66	179	68
CSB-61	252.2	175	77	173	79
CSB-62	240.9	179	62	169	72
CSB-63	227.1	180	47	178	49
CSB-64	212.7	178	35	176	37
CSB-65	195.6	165	31	162	34
CSB-66A	191.7				
CSD-4D	306.5	147	160	139	168
E-26	314.3	170	144	135	179
E-4	315.4	140	175	130	185
FAC-1SB	312.2	224	88	217	95
FCH-1	316.8	214	103	202	115
FCH-2	288.7	213	76	197	92
FCH-3	307.2	207	100	196	111
FCH-4	297.5	197	101	187	111
FCH-5	284.2	196	88	191	93
FCH-6	291.5	189	103	182	110
FIW-1MC	293.3	190	103	185	108

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
FIW-2MA	290.5	189	102	180	111
FNB-1A	282.4	208	74	202	80
FNB-3A	282.2	211	71	208	75
FSB-100A	283.8	185	99	183	101
FSB-101A	282.9	191	92	183	100
FSB-112A	227.0	164	63	144	83
FSB-113A	221.3	178	43	171	50
FSB-114A	250.0	178	72	173	77
FSB-115C	205.8	181	25	165	41
FSB-116C	200.5	176	25	171	30
FSB-120A	278.0	181	97	165	113
FSB-121C	254.4	173	81	162	92
FSB-122C	216.0	164	52	148	68
FSB-123C	236.3	183	53	172	64
FSB-1TA	275.4	191	84	187	88
FSB-76A	291.5	abs.	abs.	abs.	abs.
FSB-78A	270.5	163	108	147	124
FSB-79A	216.1	173	43	164	52
FSB-87A	285.6	176	110	173	113
FSB-89C	279.1	186	93	180	99
FSB-91C	277.0	168	109	161	116
FSB-93C	274.0	166	108	151	123
FSB-95C	281.8	174	108	158	124
FSB-96A	277.7	167	111	154	124
FSB-97A	283.8	163	121	152	132
FSB-98A	280.7	172	109	160	121
FSB-99A	285.3	178	107	173	112
FSB-PC	230.8	161	70	157	74
GAPWR-TW-1	219.0				
HAA-1TA	290.2	170	120	160	130
HAA-2AA	291.4	190	102	186	106
HAA-3AA	274.5	191	84	179	96
HAA-4AA	299.2	202	97	194	106
HAA-6AA	279.8	210	70	183	97
HC-03AA	263.8				
HC-12A	287.3	195	92	190	97
HCA-4AA	308.6	234	75	230	79
HCH-1	284.0	202	82	187	97
HCH-2	270.9	196	75	180	91
HCH-3	264.0	197	67	179	85
HCH-4	269.9	193	77	183	87
HCH-5	255.0	192	63	180	75

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
HIW-1BD	275.8	205	71		
HIW-1MC	272.3	187	86	180	93
HIW-2A	276.3	202	75	195	81
HIW-2MC	269.0	199	70	194	76
HIW-4MC	263.4	197	66	190	73
HIW-5MC	266.1	184	82	178	88
HMD-1C	262.7	229	34	226	37
HMD-2C	259.3	222	37	216	43
HMD-3C	257.2	223	34	218	39
HMD-4C	248.5	224	25	220	29
HPC-1	293.5	195	99	188	106
HPT-1A	232.9				
HPT-2A	257.8				
HSB-101C	256.3	195	61	189	67
HSB-103C	245.2	195	50	181	64
HSB-104C	245.5	194	52	185	61
HSB-105C	247.2	190	57	183	64
HSB-106C	250.7	192	59	184	67
HSB-107C	259.3	199	60	191	68
HSB-109C	259.4	203	56	189	70
HSB-110C	253.4	192	61	188	65
HSB-111C	253.7	188	66	172	82
HSB-112C	252.6	191	62	186	67
HSB-113C	258.7	188	71	174	85
HSB-115C	266.8	209	58	197	70
HSB-117A	234.8	216	19	192	43
HSB-118A	245.0	183	62	173	72
HSB-119A	254.8	213	42	195	60
HSB-120A	266.0	203	63	196	70
HSB-121A	272.3	197	75	184	88
HSB-122A	269.4	188	81	177	92
HSB-123A	263.6	196	68	186	78
HSB-124A	263.9	abs.	abs.	abs.	abs.
HSB-132C	238.3	163	75	158	80
HSB-139A	231.5	190	42	179	53
HSB-140A	234.0	194	40	181	53
HSB-141A	252.6	181	72	167	86
HSB-142C	201.6	abs.	abs.		
HSB-143C	220.1	198	22	179	41
HSB-144A	233.6	186	48	179	55
HSB-145C	233.7	184	50	175	59
HSB-146A	249.5	174	76	163	87

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
HSB-148C	248.9	187	62	171	78
HSB-151C	211.6	193	19	183	29
HSB-152C	212.1	198	14	186	26
HSB-65A	270.7	204	67	199	72
HSB-68A	247.4	198	49	193	54
HSB-69A	234.1	187	47	181	53
HSB-83A	234.9	195	40	188	47
HSB-84A	226.7	205	22	181	46
HSB-85A	292.1	204	88	200	92
HSB-86A	260.0	185	75	178	82
HSB-PC	227.8	188	40	178	50
HSB-TB	267.1	207	60	199	68
HSL-6AA	274.6	174	101	169	106
HSL-8AA	286.7	193	94	186	101
IDB-2A	302.4	245	57	228	74
IDP-3A	282.2	191	91	183	99
IDQ-3A	203.2			203	0
KAC-9D	260.2	161	99	149	111
KPT-1	205.2	155	50	145	60
KPT-2	258.2	152	106	132	126
KPT-3	225.5	164	62	134	92
KPT-4	258.9	169	90	154	105
KPT-5	225.1	168	57	139	86
KPT-6	232.8	165	68	145	88
KPT-7	211.8	152	60	136	76
KPT-8	238.6				
KPT-9	204.9	141	64	130	75
L3-CPT-PG-9	270.0	167	103	151	119
LAC-5DL	239.8				
LAC-6DL	239.8				
LAC-7DL	239.4				
LAC-8DL	234.0	207	27	196	38
LCO-5A	230.0	149	81	141	89
LCO-5DL	230.3				
LCO-8DL	243.4				
LFW-10SB	168.4				
LWN-1SB	282.5	162	121	151	132
LWN-2SB	231.0	168	63	151	80
LWN-3SB	245.7	165	81	156	90
LWR-2SB	248.1	177	71	167	81
LWR-3SB	249.1	178	72	162	88
LWR-4SB	293.8	178	116	165	129

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
LWR-8CC	280.3	182	98	132	148
LWR-9SB	238.2	179	59	161	77
M12-17	325.5	169	157	158	168
M121A	303.7	155	149	139	165
M121A	303.7	155	149	139	165
M12A-29	321.0	159	162	135	186
MWD-1A	327.5	171	157	165	163
MWD-C3	322.5	192	131	182	141
MWD-C5	328.7	190	139	180	149
NPN-001	335.9				
NPN-1A	335.9	235	101	224	112
OFS-1SB	261.6	196	66	186	76
OFS-2SB	257.5	198	60	188	70
OFS-3SB	258.1	196	62	185	73
OFS-4SB	258.7	196	63	192	67
OFS-5SB	228.7	189	40	178	51
P-13TA	252.4	108	144	86	167
P-14TA	294.4	213	81	203	92
P-18TA	296.9	186	111	167	130
P-19TA	297.4	186	111	175	122
P-20TA	287.7	166	122	152	136
P-21TA	207.0	104	103	93	114
P-22TA	215.4	128	87	120	95
P-23TA	181.5	145	37	131	51
P-24TA	313.3	196	117	183	130
P-25TA	265.1	157	108	136	129
P-26TA	152.2			152	0
P-27TA	274.1	180	94	169	105
P-28TA	285.6	181	105	174	112
P4-CPT-4	270.0	160	110	141	129
PBF-3	316.7	139	178	136	181
PBF-4	208.1	150	58	138	70
PBF-5	240.6	150	91	140	101
PBF-6	92.5				
PBF-7	285.4	187	98	164	121
PBF-8	292.0	193	99	173	119
PCL-12	265.8	163	103	131	135
PCL-13	274.2	158	116	135	139
PCL-14	250.3	151	99	126	124
PCL-15	242.1	142	100	117	125
PCL-16	282.8	162	121	130	153
PCL-17	291.0	168	123		

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		TCCZ		LAZ	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
PCL-1A	317.7				
PCL-2	304.4	186	118	162	142
PCL-3A	300.0	196	104	174	126
PCL-4	331.7	157	175	148	184
PCL-5	284.3	175	109	142	142
PCL-6	312.6	186	127	166	147
PCL-7B	295.7	153	143	144	152
PCL-8	254.7	158	97	130	125
PCL-9	288.1	150	138	143	145
PPC-1	313.3	188	125	168	145
RCP-1A	294.8	179	116	175	120
RSF-1	300.8	153	148	144	157
RSF-2	300.3	172	128	163	137
RSF-3	304.8	152	153	148	157
SDS-21	251.0	205	47	199	53
SDS-22	283.0	191	93	188	96
SSW-1	311.3	193	118	174	137
SSW-2	167.3			167	0
SSW-3	178.7				
SW-24CP	257.5	195	63	180	78
T18N1A	258.4	135	123	121	138
T18S1A	233.5	140	94	123	111
T18W1A	244.4	163	81	153	91
USGS-MP	245.0	178	67	172	73
VG-1	156.6				
VG-7	250.6				
VG-8	103.7				
YSC-1A	268.9	211	58	199	70
YSC-1C	272.5	215	58	213	60
YSC-2A	281.7	220	62	215	67
YSC-3SB	277.0	211	66	205	72
YSC-4A	287.5	223	65	214	74
YSC-5A	273.0	221	52	209	64

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
131C-100	261.6						
131C-104	276.9						
131C-105	169.8						
131C-49	254.3						
131C-51	265.0						
131C-54	247.1						
131C-55	245.0						
131C-59	227.7						
131C-60	218.2						
131C-63	211.1						
131C-64	211.9						
131C-67	265.8						
131C-68	267.7						
131C-80	205.7						
131C-81	217.9						
131C-82	233.0						
131C-83	240.5						
131C-84	241.9						
131C-85	237.5						
131C-91	233.7						
131C-93	241.9						
131C-95	241.3						
131C-96	243.2						
131C-98	251.0						
131C-R1	271.0						
131C-R2	266.8						
131C-R3	268.8						
131C-R4	285.6						
131C-R5	289.0						
131C-R6	276.0						
BGO-10A	299.1	131	168	124	175		
BGO-10AA	298.8	130	169	126	173		
BGO-12A	311.4	137	174	132	179		
BGO-14A	300.2	133	167	127	173		
BGO-16A	302.8	131	172	126	177		
BGO-18A	292.9	131	162	126	167		
BGO-20AA	280.9	125	156	114	167	43	238
BGO-25A	294.7	138	157	128	167		
BGO-26A	285.1	133	152	129	156		
BGO-27C	273.9						
BGO-29A	262.1	124	138	113	149		
BGO-31C	271.1						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGO-33C	277.4						
BGO-35C	271.4						
BGO-37C	284.3						
BGO-39A	293.7	113	181	102	192	29	265
BGO-3A	288.7	131	158	122	167	41	248
BGO-41A	298.3	138	160	131	167		
BGO-42C	295.9						
BGO-43AA	312.2	135	177	127	185		
BGO-44AA	283.3	131	152	120	163		
BGO-45A	276.9	134	143	130	147		
BGO-46B	263.4	128	135	126	137		
BGO-47A	264.8	131	134	125	140		
BGO-48C	274.7						
BGO-49A	269.1	119	150	115	154		
BGO-50A	253.5	133	121	129	125		
BGO-51AA	287.2	107	180	93	194	32	255
BGO-52AA	281.6	125	157	116	166	18	264
BGO-53AA	288.9	138	151	132	157	29	260
BGO-5C	294.2						
BGO-6A	283.8	121	163	120	164		
BGO-6B	284.5	137	148	123	162		
BGO-8A	281.3	130	151	120	161		
BGO-9AA	282.8	135	148	125	158		
BGT-1	282.9						
BGT-10	215.2	156	59	147	68		
BGT-11	222.5	151	72	146	77	68	155
BGT-12	284.2						
BGT-13	287.8						
BGT-14	280.7						
BGT-15	277.5	150	128				
BGT-16	250.7	151	100				
BGT-17	240.7	150	91				
BGT-18	216.5	162	55	147	70	55	162
BGT-2	276.4						
BGT-20	159.5	151	9	140	20	70	90
BGT-21	294.2						
BGT-22	281.0	126	155	114	167	53	228
BGT-23	270.0						
BGT-24	265.8						
BGT-25	264.8						
BGT-27	256.9	152	105				
BGT-28	258.3	156	102	150	108	48	210

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGT-29	243.0						
BGT-3	275.7	143	133	141	135	65	211
BGT-30	219.0	147	72	141	78		
BGT-31	308.8						
BGT-32	310.1						
BGT-33	290.4						
BGT-34	286.8						
BGT-35	267.7						
BGT-36	261.4	148	113				
BGT-37	251.6	133	119				
BGT-38	240.1						
BGT-39	241.9						
BGT-4	259.2	149	110				
BGT-40	332.3						
BGT-41	328.4	149	179	142	186		
BGT-42	310.9						
BGT-43	277.1						
BGT-44	276.2						
BGT-45	285.3	150	135				
BGT-46	310.0	134	176	125	185		
BGT-47	317.3	137	180	128	189		
BGT-48	314.3						
BGT-49	297.3	135	162	126	171		
BGT-5	225.7	154	72	146	80	72	154
BGT-50	296.3	132	164	124	172		
BGT-51	272.6						
BGT-53	278.3	120	158	109	169	32	246
BGT-54	280.0						
BGT-56	262.9						
BGT-57	259.4						
BGT-58	285.8	112	174	103	183		
BGT-59	281.9						
BGT-6	282.2						
BGT-60	291.4						
BGT-61	284.3	108	176	101	183		
BGT-62	282.0						
BGT-63	293.7						
BGT-63A	290.8						
BGT-64	283.3	123	160				
BGT-66	244.0						
BGT-67	242.0	135	107	128	115	27	215
BGT-7	276.4						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGT-8	249.3	149	100				
BGT-9	226.0	149	77	141	85	64	162
BGX-11D	273.8	126	148	117	157		
BGX-1A	289.1	132	157	127	162		
BGX-2B	289.2	140	149	127	162		
BGX-4A	288.8	130	159	124	165		
BGX-7D	277.1	157	120	144	133		
BGX-9D	277.4	139	138	131	146		
BRR-1D	293.8						
BRR-3D	289.5						
BRR-6B	293.9	123	171	108	186		
BRR-7B	289.6	135	155	122	168		
BRR-8B	276.7	131	146	126	151		
CCP-1A	287.1						
CFD-1	268.8	112	157				
CFD-18	248.3	94	154				
CFD-5	257.8	93	165	89	169	28	230
CMP-1-CP	248.9						
CMP-30B	286.5	95	192				
CMP-32B	251.7	95	157				
CMP-4B-CP	241.8						
CMP-6A-CP	238.4						
CPC-1	285.1	96	189	87	198	-8	293
CRP-5D	274.5						
CRP-9D	268.4	94	175	92	177		
CRSB-1	278.2						
CRSB-101	275.6						
CRSB-11	276.7						
CRSB-14	275.6						
CRSB-16	282.6						
CRSB-17	281.0						
CRSB-18	273.8						
CRSB-20	274.2						
CRSB-21	272.9						
CRSB-24	277.2						
CRSB-26	291.6						
CRSB-28	289.3						
CRSB-30	285.4						
CRSB-31	284.4						
CRSB-32	274.1						
CRSB-35	257.4						
CRSB-36	265.6						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
CRSB-37	270.5						
CRSB-4	282.8						
CRSB-40	227.3						
CRSB-43	258.5						
CRSB-45	270.6						
CRSB-47	282.7						
CRSB-48	259.8						
CRSB-5	288.3						
CRSB-50	255.6						
CRSB-52	233.1						
CRSB-54	224.7						
CRSB-55	229.1	103	126				
CRSB-56	232.5						
CRSB-57	248.2						
CRSB-58	253.9						
CRSB-6	289.4						
CRSB-60	257.0						
CRSB-61	257.3						
CRSB-63	240.4						
CRSB-64	229.9						
CRSB-65	214.8						
CRSB-86	206.6						
CRSB-88	253.2						
CRSB-89	260.6						
CRSB-90	268.4						
CRSB-91	273.1						
CRSB-92	287.5						
CRSB-93	286.8						
CRSB-94	283.3						
CRSB-95	280.4						
CRSB-96	282.8						
CRSB-97	276.8						
CRSB-98	275.1						
CRSB-99	274.4						
CSB-101	281.2						
CSB-102	283.5						
CSB-103	257.6						
CSB-104	224.9	94	131				
CSB-105	212.1	98	114	81	131		
CSB-106	183.8	93	91	69	115		
CSB-107	220.7	102	119	83	138		
CSB-108	196.7	90	107	77	120		

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
CSB-109	172.9	102	71				
CSB-110	184.6						
CSB-111	172.1	101	71	87	85		
CSB-112	195.3	103	92	91	104		
CSB-113	210.4	96	114	81	129		
CSB-114	196.0						
CSB-116	274.7						
CSB-117	276.5						
CSB-118	277.8						
CSB-119	268.3						
CSB-120	282.8						
CSB-121	274.2						
CSB-122	222.9	100	123	88	135		
CSB-123	224.2						
CSB-2C	289.9						
CSB-3C	280.9						
CSB-47	282.7						
CSB-47A	268.9						
CSB-48	259.8						
CSB-48A	270.1						
CSB-56	267.0						
CSB-58	235.5						
CSB-59	231.2						
CSB-60	247.0	109	138				
CSB-61	252.2	108	144				
CSB-62	240.9						
CSB-63	227.1	103	124				
CSB-64	212.7	100	113	96	117		
CSB-65	195.6	90	106	78	118		
CSB-66A	191.7	92	100				
CSD-4D	306.5						
E-26	314.3	75	239				
E-4	315.4	65	250				
FAC-1SB	312.2	149	163				
FCH-1	316.8	142	175	126	191	67	250
FCH-2	288.7	142	147	130	159	58	231
FCH-3	307.2	140	167	131	176	59	248
FCH-4	297.5	128	170	121	177	42	256
FCH-5	284.2	129	155	128	156	36	248
FCH-6	291.5	124	168	121	171	25	267
FIW-1MC	293.3	121	172				
FIW-2MA	290.5	121	170	117	174		

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
FNB-1A	282.4	151	131	138	145		
FNB-3A	282.2	146	136	140	142		
FSB-100A	283.8	118	166	114	170		
FSB-101A	282.9	119	164	116	167		
FSB-112A	227.0	103	124	98	129		
FSB-113A	221.3	109	112	104	117	22	199
FSB-114A	250.0	114	136	110	140		
FSB-115C	205.8	101	105	86	120	6	200
FSB-116C	200.5						
FSB-120A	278.0	112	166	110	168		
FSB-121C	254.4						
FSB-122C	216.0	104	112				
FSB-123C	236.3						
FSB-1TA	275.4	117	158	115	160	24	251
FSB-76A	291.5	121	171	117	175		
FSB-78A	270.5	105	166	100	171		
FSB-79A	216.1	103	113	100	116	18	198
FSB-87A	285.6	115	171	109	177		
FSB-89C	279.1						
FSB-91C	277.0						
FSB-93C	274.0						
FSB-95C	281.8						
FSB-96A	277.7	109	169	101	177		
FSB-97A	283.8	111	173	107	177		
FSB-98A	280.7	109	172	107	174		
FSB-99A	285.3	115	170	112	173		
FSB-PC	230.8						
GAPWR-TW-1	219.0	87	132	55	164	-31	250
HAA-1TA	290.2	117	173	110	181		
HAA-2AA	291.4	125	167	119	173	30	262
HAA-3AA	274.5	128	147	123	152	10	265
HAA-4AA	299.2	125	175	119	181		
HAA-6AA	279.8	125	155	120	160	23	257
HC-03AA	263.8						
HC-12A	287.3						
HCA-4AA	308.6	124	185	117	192		
HCH-1	284.0	135	149	126	158	18	266
HCH-2	270.9	131	140	123	148	0	271
HCH-3	264.0	130	134	123	141		
HCH-4	269.9	123	147	114	156		
HCH-5	255.0	123	132	119	136	-10	265
HIW-1BD	275.8						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
HIW-1MC	272.3						
HIW-2A	276.3	116	160	110	166		
HIW-2MC	269.0						
HIW-4MC	263.4	112	151				
HIW-5MC	266.1						
HMD-1C	262.7	139	124	127	136		
HMD-2C	259.3	143	116	138	121		
HMD-3C	257.2	154	103	149	108		
HMD-4C	248.5	153	96	141	108		
HPC-1	293.5	116	178	110	184	28	266
HPT-1A	232.9	119	114	115	118	53	180
HPT-2A	257.8	121	137	118	140	57	201
HSB-101C	256.3						
HSB-103C	245.2						
HSB-104C	245.5						
HSB-105C	247.2						
HSB-106C	250.7						
HSB-107C	259.3						
HSB-109C	259.4						
HSB-110C	253.4						
HSB-111C	253.7						
HSB-112C	252.6						
HSB-113C	258.7						
HSB-115C	266.8						
HSB-117A	234.8	123	112	117	118		
HSB-118A	245.0	119	126	114	131		
HSB-119A	254.8	115	140	111	144		
HSB-120A	266.0	112	154	110	156		
HSB-121A	272.3	113	159	109	163		
HSB-122A	269.4	110	159	108	161		
HSB-123A	263.6	114	150	108	156		
HSB-124A	263.9	118	146				
HSB-132C	238.3						
HSB-139A	231.5	119	113	115	117		
HSB-140A	234.0	111	123	105	129		
HSB-141A	252.6	119	134	113	140		
HSB-142C	201.6						
HSB-143C	220.1						
HSB-144A	233.6	109	125	104	130		
HSB-145C	233.7						
HSB-146A	249.5	119	131	112	138		
HSB-148C	248.9						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
HSB-151C	211.6						
HSB-152C	212.1						
HSB-65A	270.7	119	152	113	158		
HSB-68A	247.4	116	131	110	137		
HSB-69A	234.1	115	119	112	122		
HSB-83A	234.9	114	121	104	131	12	223
HSB-84A	226.7	119	108	111	116		
HSB-85A	292.1	126	166	119	173		
HSB-86A	260.0	112	148	109	151		
HSB-PC	227.8						
HSB-TB	267.1	110	157	106	161	9	258
HSL-6AA	274.6	126	149	121	154	9	266
HSL-8AA	286.7	137	150	129	158		
IDB-2A	302.4	142	160	138	164	-13	316
IDP-3A	282.2	161	121				
IDQ-3A	203.2	132	71	124	79	55	148
KAC-9D	260.2	95	165	89	171		
KPT-1	205.2						
KPT-2	258.2						
KPT-3	225.5						
KPT-4	258.9						
KPT-5	225.1						
KPT-6	232.8						
KPT-7	211.8						
KPT-8	238.6						
KPT-9	204.9						
L3-CPT-PG-9	270.0						
LAC-5DL	239.8						
LAC-6DL	239.8						
LAC-7DL	239.4						
LAC-8DL	234.0						
LCO-5A	230.0	78	152	66	164		
LCO-5DL	230.3						
LCO-8DL	243.4						
LFW-10SB	168.4	170	-2	168	0	44	124
LWN-1SB	282.5	132	151	119	164		
LWN-2SB	231.0	90	141	82	149	11	220
LWN-3SB	245.7	96	150	89	157	12	234
LWR-2SB	248.1	146	102	131	117	17	231
LWR-3SB	249.1	95	154	86	163	12	238
LWR-4SB	293.8	104	190	96	198	7	287
LWR-8CC	280.3						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
LWR-9SB	238.2	110	128	108	130		
M12-17	325.5						
M121A	303.7	89	215	74	230	-5	309
M121A	303.7	89	215	74	230	-5	309
M12A-29	321.0						
MWD-1A	327.5	133	195	130	198	22	306
MWD-C3	322.5						
MWD-C5	328.7						
NPN-001	335.9						
NPN-1A	335.9	110	226	105	231	2	334
OFS-1SB	261.6	129	133	126	136		
OFS-2SB	257.5	125	133	121	137		
OFS-3SB	258.1	125	133	120	138		
OFS-4SB	258.7	127	132	122	137		
OFS-5SB	228.7	122	107	117	112		
P-13TA	252.4	32	220	10	243	-103	355
P-14TA	294.4	139	155	131	163	26	269
P-18TA	296.9	91	206	86	211	-17	314
P-19TA	297.4	120	178	114	184	-56	353
P-20TA	287.7	84	204	75	213	-10	298
P-21TA	207.0	48	160	-24	231	-115	322
P-22TA	215.4	37	178	-19	234	-91	306
P-23TA	181.5	89	93	58	124	-4	186
P-24TA	313.3	115	198	99	214	-40	354
P-25TA	265.1	100	165	95	171	13	253
P-26TA	152.2	71	81	65	87	14	138
P-27TA	274.1	129	145	127	147	49	225
P-28TA	285.6	141	145	133	153	64	222
P4-CPT-4	270.0						
PBF-3	316.7	79	238	50	267	-23	340
PBF-4	208.1	66	142	41	167	-32	240
PBF-5	240.6	103	138	78	163	6	235
PBF-6	92.5	95	-2	93	0	-2	95
PBF-7	285.4	118	168	114	172	-55	340
PBF-8	292.0	114	178	110	182	-44	336
PCL-12	265.8						
PCL-13	274.2						
PCL-14	250.3						
PCL-15	242.1						
PCL-16	282.8						
PCL-17	291.0						
PCL-1A	317.7						

Appendix B-2: Hydrostratigraphic Boundaries (continued)

		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
PCL-2	304.4						
PCL-3A	300.0						
PCL-4	331.7						
PCL-5	284.3						
PCL-6	312.6						
PCL-7B	295.7						
PCL-8	254.7						
PCL-9	288.1						
PPC-1	313.3	120	193	106	208	-56	370
RCP-1A	294.8	83	212	78	217		
RSF-1	300.8						
RSF-2	300.3						
RSF-3	304.8						
SDS-21	251.0	163	89	148	104		
SDS-22	283.0	149	134	138	145		
SSW-1	311.3	126	185	123	188	12	299
SSW-2	167.3	109	59	96	72	-10	177
SSW-3	178.7	89	90	84	95	-7	186
SW-24CP	257.5	120	138				
T18N1A	258.4	82	177	74	185	-12	270
T18S1A	233.5	96	138	71	163	-4	238
T18W1A	244.4	94	150	84	160	-26	270
USGS-MP	245.0	133	112	113	132	80	165
VG-1	156.6	-1	158	-80	237	-198	355
VG-7	250.6	39	212	-32	283	-123	374
VG-8	103.7	-38	142	-117	221	-239	343
YSC-1A	268.9	159	110	154	115	69	200
YSC-1C	272.5	164	109	157	116		
YSC-2A	281.7	162	120	151	131		
YSC-3SB	277.0	149	128	140	137		
YSC-4A	287.5	160	128	145	143	87	201
YSC-5A	273.0	136	137	128	145		

Notes:
TCCZ - Tan Clay Confining Zone
LAZ - Lower Aquifer Zone
GCU - Gordon Confining Unit
GAU - Gordon Aquifer Unit
MBCS - Meyers Branch Confining System
ft m.s.l. - feet above mean sea level
ft b.g.l. - feet below ground level
Blank field indicates unit not penetrated
ND - Unit boundary not delineated
abs. - Unit absent

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APPENDIX C. PERMEABILITY DATA

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Appendix C-1. Permeability Values Recorded from Pumping Tests

Pumped Well	Observation Well	Test Interval Top (ft b.g.l.)	Test Interval Bottom (ft b.g.l.)	Permeability (ft/day)	Analysis Method	Reference[1]
FSB-PC	FSB-25PC	75.1	125.0	0.80	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-50PC	75.1	125.0	1.40	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-79C	75.1	125.0	3.00	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-100PC	75.1	125.0	2.10	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-103C	75.1	125.0	3.60	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-106C	75.1	125.0	3.40	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-110C	75.1	125.0	1.20	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-150PC	75.1	125.0	1.30	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PD	FSB-25PD	37.3	81.0	46.40	Aqetsolv (Neuman method)	WSRC, 1995b
FSB-PD	FSB-50PD	37.3	81.0	62.50	Aqetsolv (Neuman method)	WSRC, 1995b
FSB-PD	FSB-100PD	37.3	81.0	48.30	Aqetsolv (Neuman method)	WSRC, 1995b
FSB-PD	FSB-150PD	37.3	81.0	49.20	Aqetsolv (Neuman method)	WSRC, 1995b
FSB-76A	FSB-76A	244.1	254.6	1.29	Jacob Semi-Logarithmic	Woodward-Clyde, 1985a
FSB-78A	FSB-78A	233.0	243.4	0.82	Jacob Semi-Logarithmic	Woodward-Clyde, 1985a
FSB-79A	FSB-79A	181.6	192.0	142.90	Jacob Semi-Logarithmic	Woodward-Clyde, 1985a
FSB-87A	FSB-87A	242.0	252.5	51.02	Jacob Semi-Logarithmic	Woodward-Clyde, 1985a
HPT-1A	DRB-6WW	127.0	178.0	1.47E-04	Hantush-Jacob	CH2M Hill, 1989
HPT-1A	HC-10A	127.0	178.0	1.26E-03	Hantush-Jacob	CH2M Hill, 1989
HPT-1A	HPT-2A	127.0	178.0	2.86E-04	Hantush-Jacob	CH2M Hill, 1989
HSB-PC	HSB-25PC	57.0	110.6	0.90	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-50PC	57.0	110.6	1.30	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-100PC	57.0	110.6	1.30	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-136C	57.0	110.6	1.60	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-137C	57.0	110.6	1.10	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-150PC	57.0	110.6	1.20	Hantush-Jacob	WSRC, 1995b
HSB-65A	HSB-65A	197.5	208.2	1.74	Jacob Semi-Logarithmic	Woodward-Clyde, 1985b
HSB-68A	HSB-68A	189.4	199.9	1.13	Jacob Semi-Logarithmic	Woodward-Clyde, 1985b
HSB-83A	HSB-83A	158.9	169.7	10.48	Jacob Semi-Logarithmic	Woodward-Clyde, 1985b
HSB-84A	HSB-68A	150.8	162.0	33.80	Aqtesolv (Non-Leaky Theis)	Albenesius, 1990

Appendix C-1. Permeability Values Recorded from Pumping Tests (Continued)

Pumped Well	Observation Well	Test Interval Top (ft b.g.l.)	Test Interval Bottom (ft b.g.l.)	Permeability (ft/day)	Analysis Method	Reference[1]
HSB-84A	HSB-69A	150.8	162.0	17.29	Aqtesolv (Non-Leaky Theis)	Albenesius, 1990
HSB-84A	HSB-83A	150.8	162.0	39.72	Aqtesolv (Non-Leaky Theis)	Albenesius, 1990
HSB-84A	HSB-86A	150.8	162.0	34.25	Aqtesolv (Non-Leaky Theis)	Albenesius, 1990
HSB-84A	HSB-118A	150.8	162.0	39.12	Aqtesolv (Non-Leaky Theis)	Albenesius, 1990
HSB-84A	HSB-139A	150.8	162.0	27.88	Aqtesolv (Non-Leaky Theis)	Albenesius, 1990
HSB-85A	HSB-85A	221.0	231.0	8.72	Aqtesolv (Non-Leaky Theis)	Woodward-Clyde, 1985b
HSB-86A	HSB-86A	186.1	196.9	5.46	Aqtesolv (Non-Leaky Theis)	Woodward-Clyde, 1985b
HSB-101C	HSB-101C	80.0	90.0	1.68	Hantush and Jacob (1955) Leaky Artesian Solution	Evans, 1991
YSC-1A	YSC-1A	132.0	192.1	62.00	Cooper-Jacob	WEGS, 1990
YSC-1A	YSC-1A	132.0	192.1	37.00	Recovery	WEGS, 1990
YSC-1A	YSC-1A	132.0	192.1	22.00	Theis	WEGS, 1990
YSC-1A	YSC-1A	132.0	192.1	52.00	WHIP(Recovery)	WEGS, 1990
YSC-1A	YSC-1A	132.0	192.1	57.00	WHIP(Theis)	WEGS, 1990
YSC-1A	YSC-4A	132.0	192.1	40.00	Theis Non-Eq.	WEGS, 1990
YSC-1A	YSC-4A	132.0	192.1	43.00	WHIP(Theis)	WEGS, 1990
YSC-1A	YSC-4A	132.0	192.1	47.00	WHIP(Recovery)	WEGS, 1990
YSC-1A	YSC-4A	132.0	192.1	52.00	Recovery	WEGS, 1990

Notes:

ft b.g.l. - feet below ground level

ft/day - feet per day

1 - Detailed description of references in Appendix D

Appendix C-2. Permeability Values Recorded from Slug Tests

Well ID	Screen Top (ft b.g.l.)	Screen Bottom (ft b.g.l.)	Permeability (ft/day)	Solution Method	Test Type	Reference[1]
BGO-1D	48	68	0.31	Bouwer-Rice 1976	Falling Head	S&ME, 1988
BGO-3A	175	185	3.25142	Bouwer-Rice	Rising Head	Amidon, 1995
BGO-3A	175	185	5.191	Bouwer-Rice	Falling Head	Amidon, 1995
BGO-3D	51.7	71.8	0.14	Bouwer-Rice 1976	Falling Head	S&ME, 1988
BGO-5C	101	111	0.13	Hvorslev	Falling Head	S&ME, 1988
BGO-6A	166.3	176.3	0.77	Hvorslev	Falling Head	S&ME, 1988
BGO-8A	166	176	0.21	Hvorslev	Falling Head	S&ME, 1988
BGO-10A	178	188	0.16	Hvorslev	Falling Head	S&ME, 1988
BGO-10AA	208	218	0.43	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-12A	195	205	0.005	Hvorslev	Falling Head	S&ME, 1988
BGO-14A	180.6	190.6	0.04	Hvorslev	Falling Head	S&ME, 1988
BGO-16A	190.3	200.3	0.15	Hvorslev	Falling Head	S&ME, 1988
BGO-18A	183.4	193.4	11.98	Hvorslev	Falling Head	S&ME, 1988
BGO-21D	45.3	65.3	0.79	Bouwer-Rice 1976	Falling Head	S&ME, 1988
BGO-23D	45	65	1.11	Bouwer-Rice 1976	Falling Head	S&ME, 1988
BGO-25A	180.6	190.6	0.5	Hvorslev	Falling Head	S&ME, 1988
BGO-41A	185	195	0.13	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-42C	100	110	0.45	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-43AA	240	250	0.86	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-44AA	212	222.1	4.36	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-45A	150	160	2.45	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-46B	113	123	2.33	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-47A	168	178	3.07	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-48C	88	98	2.15	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-49A	184	194	0.49	Bouwer-Rice 1976	Falling Head	WSRC, 1992a

Appendix C-2. Permeability Values Recorded from Slug Tests (Continued)

Well ID	Screen Top (ft b.g.l.)	Screen Bottom (ft b.g.l.)	Permeability (ft/day)	Solution Method	Test Type	Reference[1]
BGO-50A	153	163	0.4	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-51AA	248	263.6	0.7762	Bouwer-Rice 1976	Rising Head	Amidon, 1995
BGO-51AA	248	263.6	1.188	Bouwer-Rice 1976	Falling Head	Amidon, 1995
BGO-52AA	235	247.8	0.8996	Bouwer-Rice 1976	Rising Head	Amidon, 1995
BGO-52AA	235	247.8	8.15	Bouwer-Rice 1976	Falling Head	Amidon, 1995
BGO-53AA	240	250	1.11744	Bouwer-Rice 1976	Falling Head	Rust, 1996
BGX-1A	165	175.02	0.01	Bouwer-Rice 1976	Falling Head	WSRC, 1991a
BGX-2B	142	151.95	0.21	Bouwer-Rice 1976	Falling Head	WSRC, 1991a
BGX-4A	172	182	1.83	Bouwer-Rice 1976	Falling Head	WSRC, 1991a
BGX-7D	63	83.03	20.38	Bouwer-Rice 1976	Rising Head	WSRC, 1991a
BGX-9D	45	65.01	0.36	Bouwer-Rice 1976	Rising Head	WSRC, 1991a
CMP-30B	172.2	195.5	1.1	Bouwer Rice	Rising Head	WSRC, 1996c
CMP-30B	172.2	195.5	1.4	Bouwer Rice	Falling Head	WSRC, 1996c
FSB-89C	113	123	0.524	Hvorslev	Falling Head	WSRC, 1991d
FSB-91C	117.9	127.9	0.141	Hvorslev	Falling Head	WSRC, 1991d
FSB-93C	122	132	5.27	Hvorslev	Falling Head	WSRC, 1991d
FSB-97A	188	198	0.852	Hvorslev	Falling Head	WSRC, 1991d
FSB-101A	180	190	33.2	Hvorslev	Falling Head	Sirrine, 1987
FSB-112A	136	146	1.7	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-113A	130	140	0.62	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-114A	145	155	0.44	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-115C	32	42	0.36	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-116C	30	40	0.69	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-120A	169	179	0.65	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-121C	96	106	11	Bouwer-Rice 1976	Rising Head	WEGS, 1991

Appendix C-2. Permeability Values Recorded from Slug Tests (Continued)

Well ID	Screen Top (ft b.g.l.)	Screen Bottom (ft b.g.l.)	Permeability (ft/day)	Solution Method	Test Type	Reference[1]
FSB-122C	46	56	2.6	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-123C	71	81	6.7	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HAA-1TA	310	320	0.548	Bouwer-Rice 1976	Rising Head	WSRC, 1995a
HAA-1TA	310	320	0.786	Bouwer-Rice 1976	Falling Head	WSRC, 1995a
HAA-2AA	252	262	19.858	Bouwer-Rice 1976	Rising Head	WSRC, 1995a
HAA-2AA	252	262	30.6552	Bouwer-Rice 1976	Falling Head	WSRC, 1995a
HAA-3AA	258	268	0.3229	Bouwer-Rice 1976	Rising Head	WSRC, 1995a
HAA-3AA	258	268	0.504	Bouwer-Rice 1976	Falling Head	WSRC, 1995a
HAA-6AA	244	254	0.224	Bouwer-Rice 1976	Rising Head	WSRC, 1995a
HAA-6AA	244	254	0.2587	Bouwer-Rice 1976	Falling Head	WSRC, 1995a
HCA-4AA	265	275	13.1717	Bouwer-Rice 1976	Rising Head	WSRC, 1995a
HCA-4AA	265	275	13.78	Bouwer-Rice 1976	Falling Head	WSRC, 1995a
HSB-69A	141	151	8.79	Hvorslev	Rising Head	WSRC, 1991c
HSB-101C	80	90	4	Hvorslev	Falling Head	WSRC, 1991c
HSB-103C	76	86	3.1	Hvorslev	Falling Head	WSRC, 1991c
HSB-105C	85	95	4.3	Hvorslev	Falling Head	WSRC, 1991c
HSB-106C	82	92	24.4	Hvorslev	Falling Head	WSRC, 1991c
HSB-109C	81	91	0.952	Hvorslev	Falling Head	Sirrine, 1988
HSB-110C	72	82	0.709	Hvorslev	Falling Head	Sirrine, 1988
HSB-111C	103	113	1.7	Hvorslev	Falling Head	WSRC, 1991c
HSB-112C	102	112	4.2	Hvorslev	Falling Head	WSRC, 1991c
HSB-113C	97	107	0.992	Hvorslev	Falling Head	Sirrine, 1988
HSB-117A	140	150	0.16	Hvorslev	Falling Head	WSRC, 1991c
HSB-118A	144	154	12	Hvorslev	Falling Head	WSRC, 1991c
HSB-122A	85.8	94.8	6.8	Hvorslev	Falling Head	Sirrine, 1988

Appendix C-2. Permeability Values Recorded from Slug Tests (Continued)

Well ID	Screen Top (ft b.g.l.)	Screen Bottom (ft b.g.l.)	Permeability (ft/day)	Solution Method	Test Type	Reference[1]
HSB-132C	60.2	69.2	0.22	Hvorslev	Rising Head	Sirrine, 1988
HSB-132C	60.2	69.2	0.28	Hvorslev	Falling Head	Sirrine, 1988
HSB-139A	134.4	143.4	3.82	Hvorslev	Falling Head	Sirrine, 1988
HSB-140A	143	153	12	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-141A	162	172	1.9	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-142C	30	40	0.6	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-143C	41	51	2.4	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-144A	145	155	0.22	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-145C	59	69	0.38	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-146A	154	164	9.4	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-148C	80	90	1.8	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-151C	31	41	0.8	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-152C	29	59	0.8	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSL-6AA	246	266	4.2	Bouwer-Rice 1976	Falling Head	WSRC, 1995a
HSL-6AA	246	266	6.7602	Bouwer-Rice 1976	Rising Head	WSRC, 1995a
LAC-5DL	53.6	63.6	0.61	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LAC-6DL	52	62	1.33	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LAC-7DL	52	62	0.27	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LAC-8DL	43.6	53.6	0.74	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LCO-5A	190	200	0.1	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LCO-5DL	45.4	55.4	4.62	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LCO-8DL	55	65	12.17	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
YSC-1C	65	75	2.4	Bouwer-Rice	Rising Head	WEGS, 1990

Notes:

ft b.g.l. - feet below ground level
ft/day - feet per day
1 - Detailed description of references in Appendix D

Appendix C-3. Permeability Values Recorded from Laboratory Tests

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
BGO-3A	162	164	1.14E-05	2.10E-05	Amidon, 1995
BGO-3A	266.1	267	1.40E-04	2.30E-04	Amidon, 1995
BGO-9AA	62	63.5	5.68E-05	2.07E-04	WSRC, 1992
BGO-9AA	137.4	137.7	1.38E-01	1.00E-01	Core Laboratories, 1995
BGO-9AA	142	142.3	2.27E-02	2.69E-02	Core Laboratories, 1995
BGO-9AA	158.7	158.8	3.49E-01	2.08E-02	Core Laboratories, 1995
BGO-9AA	222	223.5	7.67E-05	1.76E-03	WSRC, 1992a
BGO-10A	220	221.5	3.12E-06	5.96E-05	WSRC, 1992a
BGO-20AA	268	270	4.26E-06	1.22E-02	RUST, 1996
BGO-39A	280.5	282.5	1.36E-03	6.53E-03	RUST, 1996
BGO-41A	88	90	9.66E-02	8.52E-04	WSRC, 1992a
BGO-41A	164	166	2.84E-05	3.69E-04	WSRC, 1992a
BGO-43AA	185	187	8.80E-06	2.44E-05	WSRC, 1992a
BGO-44AA	226	227.5	3.41E-02	2.36E-01	WSRC, 1992a
BGO-45A	75	76.8	5.40E-05	7.10E-05	WSRC, 1992a
BGO-45A	144	145	2.04E-04	1.28E-04	WSRC, 1992a
BGO-47A	145.5	147	3.41E-03	5.68E-03	WSRC, 1992a
BGO-49A	75	77	3.70E-08	5.20E-05	WSRC, 1992a
BGO-51AA	298	299.75	2.27E-05	1.11E-05	Amidon, 1995
BGO-53AA	265	267	2.27E-05	2.84E-05	RUST, 1996
BGT-9	72	74	8.24E-04	1.70E-03	RUST, 1996
BGT-9	80	82	8.24E-04	3.12E-03	RUST, 1996
BGT-11	70	71	3.12E-04	9.90E-04	RUST, 1996
BGT-11	179.8	179.8	1.16E-04	1.22E-04	RUST, 1996
BGT-18	175	177	5.96E-05	1.56E-04	RUST, 1996
BGT-18	192	194	1.99E-03	4.54E-03	RUST, 1996
BGT-22	55	57	5.68E-06	3.12E-05	RUST, 1996
BGT-22	165	167	8.52E-04	1.85E-02	RUST, 1996
BGT-22	275	276	3.41E-05		RUST, 1996
BGT-28	207.3	208.7	7.10E-05	7.10E-04	RUST, 1996
BGT-47	108	109	2.84E-03		RUST, 1996
BGT-47	178	179	5.68E-03	1.68E-02	RUST, 1996
BGT-53	88	90	5.11E-05	1.70E-05	RUST, 1996
BGT-53	314	315.6	1.42E-05	1.33E-05	RUST, 1996
BGT-61	102	104	1.42E-05	4.26E-05	RUST, 1996
BGT-61	178	179.1	7.67E-06	8.52E-06	RUST, 1996
BGT-67	57	59	6.82E-02	3.41E-03	RUST, 1996
BGT-67	112	113	7.67E-05	1.16E-05	RUST, 1996
BGX-1A	80	82	3.41E-06	2.53E-05	WSRC, 1991a
BGX-2B	75	77	4.26E-06	1.99E-05	WSRC, 1991a
BGX-2B	156	156.8	1.85E-05	3.98E-05	WSRC, 1991a
BGX-4A	65	67	8.24E-06	1.70E-05	WSRC, 1991a
BGX-7D	123	124.5	6.53E-05		WSRC, 1992a
BGX-9D	70	70.8	9.66E-05	3.41E-04	WSRC, 1991a

Appendix C-3. Permeability Values Recorded from Laboratory Tests (Continued)

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
BGX-9D	102.5	104.5	1.25E-04	4.54E-04	WSRC, 1992a
BGX-11D	94	96	1.14E-03		WSRC, 1992a
BGX-11D	154	156	1.87E-05	9.09E-05	WSRC, 1992a
CPC-1	137.3	137.6	3.42E+00	1.48E+00	Core Laboratories, 1995
CSB002C	83	84	2.13E+00		Law, 1998
CSB002C	130	132	1.85E-02	2.04E-01	Law, 1998
CSB003C	130	132	2.39E-01		Law, 1998
CSB003C	160	162	3.69E-05	3.12E-02	Law, 1998
CSB003C	83	84	7.67E-02		Law, 1998
CSB003C	95	96	3.98E-01		Law, 1998
CSB003C	10	12.5	1.33E-03		Law, 1998
CSB003C	20	22.5	2.10E-01	3.98E-01	Law, 1998
CSB003C	35	37	1.85E-03	2.04E-02	Law, 1998
FAC-1SB	170	172	3.12E-05	2.64E-04	WSRC, 1992b
FCH-1	54.8	56.3	3.69E-02	1.09E-01	WSRC, 1993a
FCH-1	104.8	107.8	2.06E-05		WSRC, 1993a
FCH-1	145.8	146.8	8.78E-04	1.17E-03	WSRC, 1993a
FCH-1	169.8	170.8	1.02E-03		WSRC, 1993a
FCH-1	208.8	211.8	2.07E-05	2.06E-05	WSRC, 1993a
FCH-1	260.3	261.8	7.29E-02		WSRC, 1993a
FCH-2	57.9	59.4	9.46E-05	2.25E-04	WSRC, 1993a
FCH-2	80.1	83.1	2.26E-05		WSRC, 1993a
FCH-2	135.7	138.7	1.94E-05	2.55E-05	WSRC, 1993a
FCH-2	150.1	153.1	2.24E-05		WSRC, 1993a
FCH-2	205.7	208.7	2.38E-05	2.16E-05	WSRC, 1993a
FCH-2	229.4	230.9	1.60E-04		WSRC, 1993a
FCH-3	40.8	41.9	1.46E-04	2.90E-04	WSRC, 1993a
FCH-3	104.8	107.8	6.64E-05		WSRC, 1993a
FCH-3	130.9	132.2	1.52E-03	1.60E-03	WSRC, 1993a
FCH-3	174.8	176	1.55E-03		WSRC, 1993a
FCH-3	199.2	202.2	6.36E-05	6.90E-05	WSRC, 1993a
FCH-3	265.1	266.2	2.05E-04		WSRC, 1993a
FCH-4	33.1	34.7	9.20E-05	2.24E-04	WSRC, 1993a
FCH-4	103.9	106.9	2.98E-05		WSRC, 1993a
FCH-4	120	122.5	1.62E-05	2.11E-05	WSRC, 1993a
FCH-4	174.9	177.4	1.86E-05		WSRC, 1993a
FCH-4	190.5	193.5	2.67E-05	3.27E-05	WSRC, 1993a
FCH-4	262.7	264.3	1.58E-04		WSRC, 1993a
FCH-5	90	93	3.01E-05		WSRC, 1993a
FCH-5	122.2	124.2	1.10E+00	1.52E+00	WSRC, 1993a
FCH-5	160	162	1.31E+00		WSRC, 1993a
FCH-5	191.2	194.2	2.76E-05	3.24E-05	WSRC, 1993a
FCH-5	259	259.5	1.15E-04		WSRC, 1993a
FCH-6	105.7	108.2	1.86E-04		WSRC, 1993a

Appendix C-3. Permeability Values Recorded from Laboratory Tests (Continued)

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
FCH-6	170.7	171.7	1.11E-03		WSRC, 1993a
FCH-6	268.2	269.7	9.40E-04		WSRC, 1993a
FIW-1MC	104	106	4.30E-05	1.50E-03	AT&E, 1992
FIW-2MA	103.5	105.5	3.70E-05	2.30E-02	AT&E, 1992
FIW-2MA	171.2	172	2.10E-05	4.30E-05	AT&E, 1992
FSB-89C	97	97.7	8.83E-05		AT&E, 1987
FSB-91C	110	110.7	5.40E-05		AT&E, 1987
FSB-96A	117	119.5		8.43E-04	RUST, 1994
FSB-96A	172	173		1.05E-05	RUST, 1994
FSB-97A	126.33	127.08	1.15E-04		AT&E, 1987
FSB-97A	127.5	128.25	1.87E-05		AT&E, 1987
FSB-101A	166.5	167	3.81E-06		AT&E, 1987
FSB-114A	138.5	140		5.96E-05	WEGS, 1991
FSB-120A	168	168.4		8.50E-03	WEGS, 1991
FSB-122C	70	72	9.00E-04		WEGS, 1991
HCH-1	55	58	2.28E-01	2.58E-01	WSRC, 1993a
HCH-1	155	156.5	4.32E-02	1.01E-01	WSRC, 1993a
HCH-1	270	273	4.54E-05	5.42E-05	WSRC, 1993a
HCH-2	65	68	1.37E-01	1.79E-01	WSRC, 1993a
HCH-2	145	148	1.47E-04	1.76E-04	WSRC, 1993a
HCH-2	276.3	278	3.12E-04	4.63E-04	WSRC, 1993a
HCH-3	85	88	1.54E-03	2.09E-03	WSRC, 1993a
HCH-3	140	141.5	1.10E-03	1.16E-03	WSRC, 1993a
HCH-3	255	258	4.80E-03	1.10E-02	WSRC, 1993a
HCH-4	80	83	7.10E-05	8.80E-05	WSRC, 1993a
HCH-4	230	231.6	2.52E-04	3.46E-04	WSRC, 1993a
HCH-5	140	142.5	1.23E-01	1.58E-01	WSRC, 1993a
HCH-5	271.6	273.4	2.75E-04	3.24E-04	WSRC, 1993a
HIW-1MC	79	81	5.40E-04	1.40E-02	AT&E, 1992
HIW-2A	78	80	1.02E-05	1.14E-03	RUST, 1994
HIW-2A	165	165.4	2.84E-04	3.41E-04	RUST, 1994
HMD-1C	132	134	1.33E-06	5.96E-06	WSRC, 1991b
HMD-2C	117	118.6	1.14E-06	5.40E-06	WSRC, 1991b
HMD-3C	107.3	108.6	1.90E-03	3.41E-03	WSRC, 1991b
HMD-4C	29	31	9.09E-03	7.67E-02	WSRC, 1991b
HSB-TB	112	112.6	5.30E-01	1.97E-01	Core Laboratories, 1995
HSB-TB	127	127.3	1.40E-01	5.29E-01	Core Laboratories, 1995
HSB-TB	151	151.3	4.00E-02	1.00E-01	Core Laboratories, 1995
HSB-TB	154.4	154.6		1.73E+00	Core Laboratories, 1995
HSB-69A	120	120.8	1.52E-04		AT&E, 1988
HSB-107C	60.9	62	1.75E-04		WSRC, 1990a
HSB-117A	111.67	112.34	1.81E-03		AT&E, 1988
HSB-118A	128	129	1.57E-05		WSRC, 1991c
HSB-119A	141.1	141.5	9.34E-04		WSRC, 1991c

Appendix C-3. Permeability Values Recorded from Laboratory Tests (Continued)

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
HSB-120A	155	155.5	2.72E-03		WSRC, 1991c
HSB-121A	164	165	7.51E-05		WSRC, 1991c
HSB-122A	65	65.5	7.40E-04		WSRC, 1991c
HSB-122A	161	161.5	1.79E-05		WSRC, 1991c
HSB-123A	150.5	151.5	6.69E-04		WSRC, 1991c
HSB-139A	115	115.6	2.20E-04		AT&E, 1988
HSB-140A	124	126	1.64E-04		WEGS, 1991
HSB-146A	131	132	3.40E-04		WEGS, 1991
HSB-148C	66	68	1.09E-03		WEGS, 1991
IDP-3A	261.25	262.75	3.41E-02		Law Engineering, 1988
IDQ-3A	49	51	2.04E-04		Law Engineering, 1988
IDQ-3A	75	77	7.83E-03		Law Engineering, 1988
IDQ-3A	172	174	4.83E-05		Law Engineering, 1988
LCO-5A	18.1	19.9	9.94E-04	3.41E-03	WSRC, 1996a
MWD-1A	115.5	116	7.04E-05	2.69E-04	AT&E, 1988
OFS-1SB	67	68.65	3.41E-05		Amidon, 1995
OFS-2SB	108	108.3		3.60E-02	Core Laboratories, 1995
OFS-2SB	114	114.2	7.60E-02	1.32E-03	Core Laboratories, 1995
OFS-3SB	63	65	6.82E-05	1.70E-01	Amidon, 1995
OFS-3SB	135	137	4.80E-06	8.00E-06	Amidon, 1995
OFS-4SB	25.2	25.5		6.04E+00	Core Laboratories, 1995
OFS-4SB	45	47	6.25E-04	5.40E-03	Amidon, 1995
OFS-4SB	47.5	47.8		7.50E-01	Core Laboratories, 1995
OFS-4SB	56	56.3	2.77E+01	5.80E+00	Core Laboratories, 1995
OFS-4SB	78	78.4		2.17E-01	Core Laboratories, 1995
OFS-4SB	85.6	86	1.60E-03		Core Laboratories, 1995
OFS-4SB	98.4	98.75	5.37E-03	1.80E-01	Core Laboratories, 1995
OFS-4SB	109	109.35	1.89E-01		Core Laboratories, 1995
OFS-4SB	114.5	115	1.93E-03		Core Laboratories, 1995
OFS-4SB	126.4	126.7		2.49E+00	Core Laboratories, 1995
OFS-4SB	135	136.5	1.14E-05	6.53E-05	Amidon, 1995
OFS-4SB	143	143.3		7.72E+00	Core Laboratories, 1995
OFS-4SB	167	167.3		2.41E+01	Core Laboratories, 1995
OFS-4SB	175.7	176		3.18E+01	Core Laboratories, 1995
OFS-5SB	27	28.9	1.42E+00	1.42E+00	Amidon, 1995
OFS-5SB	56.5	56.8		1.11E+01	Core Laboratories, 1995
OFS-5SB	108	108.3	4.27E-01	1.22E-01	Core Laboratories, 1995
OFS-5SB	108.6	109.6	4.50E-06	1.79E-05	Amidon, 1995
OFS-5SB	129.5	129.8	3.62E+01	2.92E+01	Core Laboratories, 1995
OFS-5SB	158.2	159.2		3.26E+01	Core Laboratories, 1995
P-18TA	180	182	7.60E-05	5.60E-05	Bledsoe, 1987
P-18TA	261	263	3.90E-02	8.80E-02	Bledsoe, 1987
P-18TA	410	412	9.00E-05	1.00E-04	Bledsoe, 1987
P-18TA	643	645	6.80E-05		Bledsoe, 1987

Appendix C-3. Permeability Values Recorded from Laboratory Tests (Continued)

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
P-19TA	190	192.9	3.40E-05	7.90E-03	Bledsoe, 1987
P-19TA	282	283	9.60E-03	9.90E-02	Bledsoe, 1987
P-19TA	355	358	3.90E-05	5.90E-05	Bledsoe, 1987
P-19TA	495	497	8.50E-05	6.50E-03	Bledsoe, 1987
P-19TA	548	550	1.90E-02	7.90E-03	Bledsoe, 1987
P-21TA	160	162	1.90E-03	1.70E-02	PSI, 1986
P-21TA	325	327	3.40E-01	1.50E+00	PSI, 1986
P-21TA	380	382	5.40E-02	6.80E-01	PSI, 1986
P-21TA	495	497	6.30E-04	7.70E-04	PSI, 1986
P-21TA	522	524	1.80E-05	2.80E-05	PSI, 1986
P-21TA	560	562	9.40E-05	8.50E-05	PSI, 1986
P-22TA	61	63	4.80E-04	9.70E-04	PSI, 1986
P-22TA	140	142	3.70E-04	1.90E-04	PSI, 1986
P-22TA	331	333	1.40E-04	1.20E-04	Bledsoe, 1987
P-22TA	390	392	1.02E-03		PSI, 1986
P-22TA	612	614	1.20E-04	2.80E-04	PSI, 1986
P-23TA	97	99	3.60E-04		Bledsoe, 1987
P-23TA	185	187	9.60E-05	1.10E-04	Bledsoe, 1987
P-23TA	224	226	4.20E-05	3.60E-05	Bledsoe, 1987
P-23TA	301	303	3.40E-05	1.10E-01	Bledsoe, 1987
P-23TA	361	363	9.60E-04		Bledsoe, 1987
P-23TA	401	403	1.10E-04	2.40E-04	Bledsoe, 1987
YSC-1A	65	67	7.38E-05	8.24E-05	WEGS, 1990
YSC-1A	113.1	113.7	1.48E-04	4.54E-05	WEGS, 1990
YSC-1C	59	60.9	1.25E-05	5.96E-04	WEGS, 1990
YSC-1C	113	114.5	2.58E-04	3.98E-05	WEGS, 1990
YSC-2A	121.8	122.6	2.61E-06		WEGS, 1990
YSC-3SB	69	71	1.28E-05	1.45E-05	WEGS, 1990
YSC-3SB	127	128	4.54E-06	5.11E-05	WEGS, 1990
YSC-4A	71.3	72	1.73E-03	8.80E-05	WEGS, 1990
YSC-4A	130.3	130.8	1.82E-03		WEGS, 1990
YSC-4A	140	141.1	2.67E-06		WEGS, 1990
YSC-5A	54	55	1.62E-05	4.26E-05	WEGS, 1990
YSC-5A	108.3	108.6	1.16E-04	5.34E-02	Core Laboratories, 1995
YSC-5A	110.3	110.6	1.43E-01	1.88E-01	Core Laboratories, 1995
YSC-5A	136	137	1.39E-03	1.59E-05	WEGS, 1990

Notes:
ft b.g.l. - feet below ground level
ft/day - feet per day
1 - Detailed description of references in Appendix D

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APPENDIX D. DATA SOURCES

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APPENDIX D-1. DATA SOURCES

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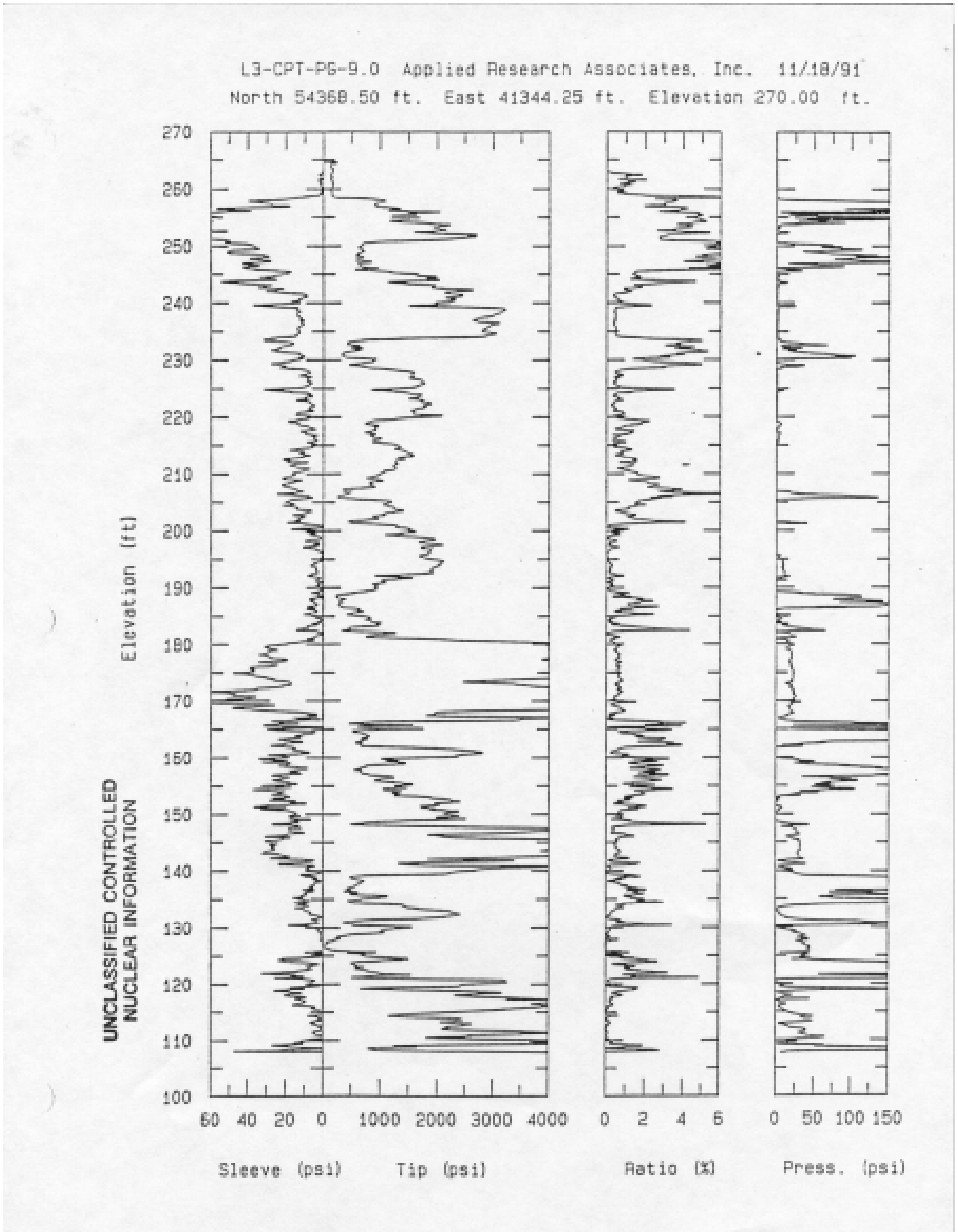
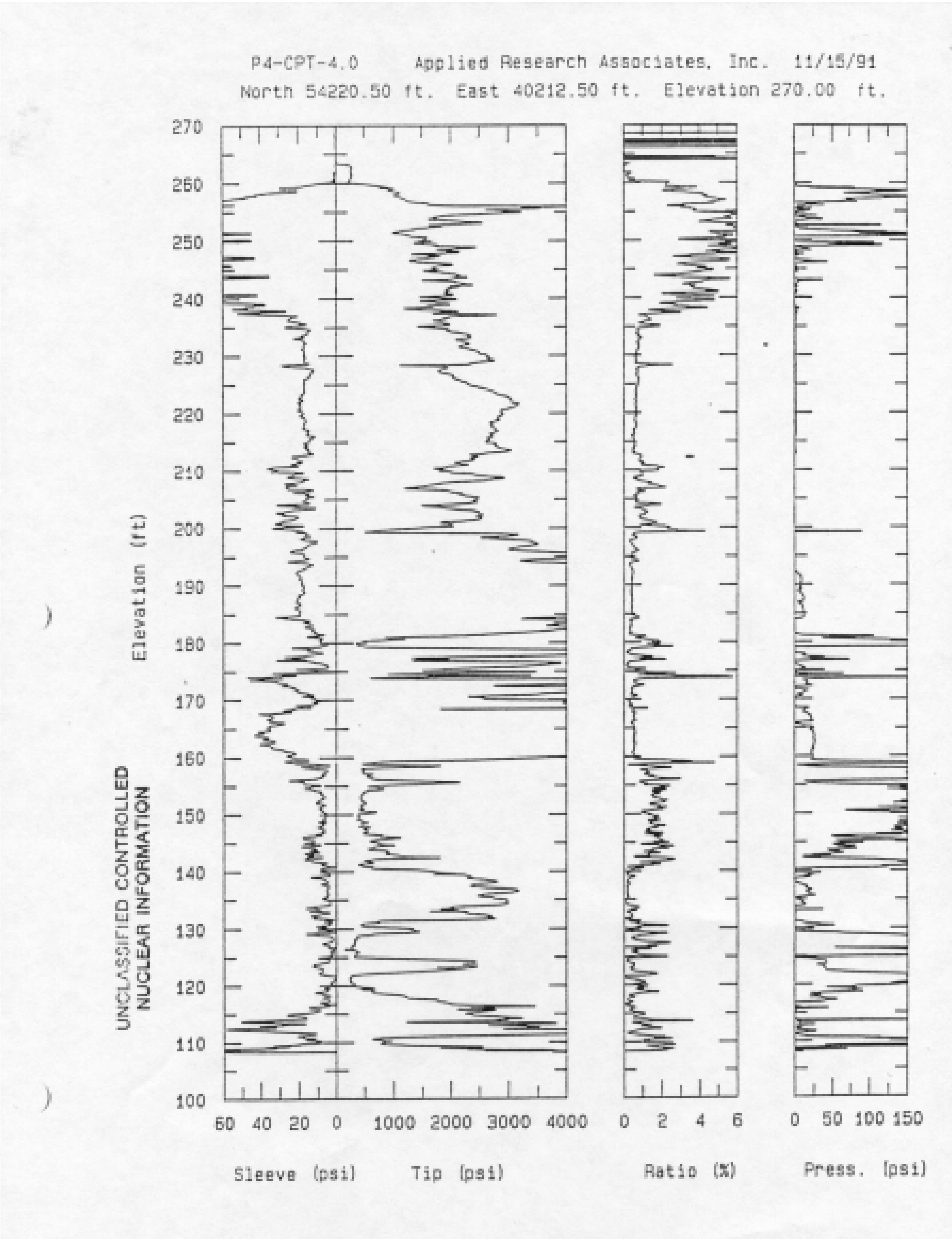


APPENDIX D-2. ARA, 1992, *Paper Copies of CPT Data*



APPENDIX D-3. ARA, 1996, *MWD-C3 and MWD-C5 Raw CPT Data*

Applied Research Associates, Inc.
Electric Cone Penetrometer Data
Cone_TAP v 2.23

Test Id: MWD-C3 Date: 02/29/96
Site: SRS "F" AREA S.C. Cone Id: 108.013
Location: EAST OF F AREA IN THE WOODS GWT (ft): 60.0
Project: 5302 Soil Density(pcf): 120.0
Surface Elev.: 322.5 Northing: 69734.70 Easting: 75249.03

Depth (ft)	Elevation (ft)	Sleeve Stress (tsf)	Tip Stress UNC (tsf)	Tip Stress COR (tsf)	Ratio COR (%)	Pore Pressure (tsf)	Excitation (Vdc)	Over-burden (tsf)	Eff. Overburden (tsf)	Wet Density (pcf)	Class. FR	Class. PP	Blow Count (blows/ft)
0	322.5	0	0	0	0	0	4	0	0	120	-99	-99	-99
0.19	322.31	0	18.9	18.9	0	0.02	4.002	0.01	0.01	120	-99	-99	-99
0.27	322.23	0	23.58	23.59	0	0.02	4.002	0.02	0.02	120	-99	-99	-99
0.35	322.15	0	28.27	28.27	0.01	0.01	4.002	0.02	0.02	120	-99	-99	-99
0.43	322.07	0.01	32.6	32.61	0.02	0.01	4.002	0.03	0.03	120	-99	-99	-99
0.51	321.99	0.02	35.73	35.73	0.05	0.01	4.002	0.03	0.03	120	-99	-99	-99
0.59	321.91	0.04	37.81	37.81	0.1	0.02	4.002	0.04	0.04	120	-99	-99	-99
0.67	321.83	0.06	36.85	36.85	0.17	0.01	4.003	0.04	0.04	120	7	7	8
0.75	321.75	0.09	37.37	37.38	0.23	0.01	4.002	0.05	0.05	120	7	7	8
0.83	321.67	0.09	38.15	38.16	0.24	0.01	4.002	0.05	0.05	120	7	7	8
0.91	321.59	0.1	37.72	37.72	0.27	0.01	4.003	0.05	0.05	120	7	7	8
0.99	321.51	0.09	36.42	36.42	0.26	0.01	4.002	0.06	0.06	120	7	7	8
1.07	321.43	0.08	34.94	34.95	0.24	0.01	4.003	0.06	0.06	120	7	7	7
1.15	321.35	0.07	33.12	33.12	0.21	0.01	4.003	0.07	0.07	120	7	7	7
1.23	321.27	0.06	31.47	31.48	0.19	0.01	4.003	0.07	0.07	120	7	7	7
1.31	321.19	0.04	30.18	30.18	0.14	0.02	4.002	0.08	0.08	120	7	7	6
1.39	321.11	0.03	29.95	29.96	0.1	0.01	3.999	0.08	0.08	120	7	7	6
1.47	321.03	0.02	29.35	29.35	0.07	0.01	3.999	0.09	0.09	120	-99	7	-99
1.55	320.95	0.02	28	28.01	0.06	0.02	4.003	0.09	0.09	120	-99	7	-99
1.63	320.87	0.01	27.83	27.83	0.04	0.02	4.003	0.1	0.1	120	-99	7	-99
1.71	320.79	0	27.74	27.75	0.02	0.02	4.003	0.1	0.1	120	-99	7	-99
1.79	320.71	0	27.83	27.83	0.01	0.02	4.003	0.11	0.11	120	-99	7	-99
1.87	320.63	0	27.66	27.66	0.01	0.03	4.003	0.11	0.11	120	-99	7	-99
1.95	320.55	0	27.57	27.57	0.01	0.02	4.003	0.12	0.12	120	-99	7	-99
2.03	320.47	0.01	27.39	27.4	0.02	0.01	4.003	0.12	0.12	120	-99	7	-99
2.11	320.39	0.01	27.48	27.48	0.04	0.01	4.003	0.13	0.13	120	-99	7	-99
2.19	320.31	0.02	27.65	27.66	0.06	0.01	4.003	0.13	0.13	120	-99	7	-99
2.27	320.23	0.02	28	28	0.08	0.01	4.003	0.14	0.14	120	-99	7	-99
2.35	320.15	0.03	28.35	28.35	0.1	0.01	4.003	0.14	0.14	120	7	7	6
2.42	320.08	0.03	29.04	29.04	0.12	0.01	4.003	0.15	0.15	120	7	7	6
2.5	320	0.04	30.17	30.17	0.14	0.01	4.003	0.15	0.15	120	7	7	6
2.57	319.93	0.05	31.64	31.64	0.15	0.01	4.003	0.15	0.15	120	7	7	7
2.65	319.85	0.06	33.12	33.12	0.17	0.01	4.003	0.16	0.16	120	7	7	7
2.72	319.78	0.06	34.85	34.85	0.18	0.01	4.003	0.16	0.16	120	7	7	7
2.8	319.7	0.07	36.67	36.67	0.19	0.01	4.003	0.17	0.17	120	7	7	8
2.87	319.63	0.08	38.23	38.23	0.2	0.01	4.003	0.17	0.17	120	7	7	8
2.95	319.55	0.08	39.44	39.45	0.21	0.02	4.003	0.18	0.18	120	7	7	8
3.02	319.48	0.1	40.23	40.23	0.25	0.01	4.003	0.18	0.18	120	7	7	9
3.1	319.4	0.15	40.4	40.4	0.38	0.01	4.003	0.19	0.19	120	6	7	10
3.34	319.16	0.51	36.42	36.42	1.4	0.02	4.003	0.2	0.2	120	6	7	9
3.42	319.08	0.62	31.65	31.66	1.97	0.04	4.003	0.2	0.2	120	6	6	8
3.49	319.01	0.75	28.78	28.8	2.61	0.06	4.003	0.21	0.21	120	5	6	9
3.57	318.93	0.89	26.96	26.98	3.29	0.06	4.003	0.21	0.21	120	5	6	8
3.64	318.86	1	26.44	26.47	3.79	0.12	4.003	0.22	0.22	120	8	6	18
3.72	318.78	1.08	23.67	23.68	4.56	0.06	4.003	0.22	0.22	120	9	6	16
3.8	318.7	1.11	21.76	21.78	5.1	0.11	4.003	0.23	0.23	120	9	6	15
3.87	318.63	1.12	20.54	20.58	5.42	0.17	4.003	0.23	0.23	120	9	6	14
3.94	318.56	1.09	18.55	18.63	5.85	0.39	4.003	0.24	0.24	120	9	6	12
4.02	318.48	1.05	18.29	18.39	5.7	0.48	4.003	0.24	0.24	120	9	6	12
4.09	318.41	1.04	18.67	18.83	5.52	0.79	3.999	0.25	0.25	120	9	6	12
4.16	318.34	1.01	18.32	18.55	5.46	1.14	3.999	0.25	0.25	120	9	6	12
4.24	318.26	0.98	17.42	17.71	5.55	1.42	4.003	0.25	0.25	120	9	6	12

APPENDIX D-3. ARA, 1996, *MWD-C3 and MWD-C5 Raw CPT Data*

Applied Research Associates, Inc.
Electric Cone Penetrometer Data
Cone_TAP v 2.23

Test Id: MWD-C5 Date: 03/04/96
Site: SRS "F" AREA S.C. Cone Id: 108.013
Location: EAST OF F AREA IN THE WOODS GWT (ft): 65.0
Project: 5302 Soil Density(pcf): 120.0
Surface Elev.: 328.7 Northing: 69835.55 Easting: 74766.97

Depth (ft)	Elevation (ft)	Sleeve Stress (tsf)	Tip Stress UNC (tsf)	Tip Stress COR (tsf)	Ratio COR (%)	Pore Pressure (tsf)	Excitation (Vdc)	Overburden (tsf)	Eff. Overburden (tsf)	Wet Density (pcf)	Class. FR	Class. PP	Blow Count (blows/ft)
0	328.7	0	0	0	0	0	4.002	0	0	120	-99	-99	-99
0.15	328.55	0	9.91	9.91	0	0	4.002	0.01	0.01	120	-99	-99	-99
0.17	328.53	0	10.17	10.17	0	0	4.002	0.01	0.01	120	-99	-99	-99
0.21	328.49	0	10.61	10.6	0	0	4.001	0.01	0.01	120	-99	7	-99
0.25	328.45	0	13.21	13.21	0	0	4.002	0.01	0.01	120	-99	7	-99
0.29	328.41	0	16.51	16.51	0	0	4.002	0.02	0.02	120	-99	7	-99
0.33	328.37	0	20.77	20.77	0	0	4.002	0.02	0.02	120	-99	-99	-99
0.38	328.32	0	25.81	25.81	0	0	4.002	0.02	0.02	120	-99	-99	-99
0.42	328.28	0	30.16	30.16	0.01	0	4.002	0.03	0.03	120	-99	-99	-99
0.46	328.24	0	33.2	33.2	0.01	0	4.002	0.03	0.03	120	-99	-99	-99
0.51	328.19	0	35.81	35.81	0	0	4.002	0.03	0.03	120	-99	-99	-99
0.56	328.14	0	38.33	38.33	0	0	4.002	0.03	0.03	120	-99	-99	-99
0.61	328.09	0	41.02	41.02	0	0	4.002	0.04	0.04	120	-99	-99	-99
0.65	328.05	0.01	44.31	44.31	0.01	0	3.997	0.04	0.04	120	-99	-99	-99
0.7	328	0.01	45.78	45.78	0.03	0	3.997	0.04	0.04	120	-99	-99	-99
0.75	327.95	0.02	46.5	46.5	0.04	0	4.002	0.05	0.05	120	-99	-99	-99
0.8	327.9	0.02	48.06	48.06	0.05	0	4.002	0.05	0.05	120	-99	7	-99
0.85	327.85	0.03	49.19	49.19	0.06	0	4.002	0.05	0.05	120	-99	7	-99
0.9	327.8	0.03	49.98	49.98	0.07	0	4.002	0.05	0.05	120	-99	7	-99
0.95	327.75	0.04	50.32	50.32	0.07	0	4.002	0.06	0.06	120	-99	7	-99
1.01	327.69	0.04	50.24	50.24	0.09	0	4.002	0.06	0.06	120	-99	7	-99
1.06	327.64	0.05	50.15	50.15	0.1	0	4.002	0.06	0.06	120	-99	7	-99
1.12	327.58	0.05	49.8	49.8	0.11	0	4.002	0.07	0.07	120	7	7	11
1.17	327.53	0.05	49.28	49.28	0.11	0	4.002	0.07	0.07	120	7	7	11
1.23	327.47	0.06	48.58	48.58	0.11	0	4.002	0.07	0.07	120	7	7	10
1.28	327.42	0.06	47.8	47.8	0.12	0	4.002	0.08	0.08	120	7	7	10
1.33	327.37	0.06	46.93	46.93	0.12	0	4.002	0.08	0.08	120	7	7	10
1.39	327.31	0.06	45.8	45.8	0.12	0	4.002	0.08	0.08	120	7	7	10
1.44	327.26	0.06	44.85	44.85	0.13	0	4.002	0.09	0.09	120	7	7	10
1.5	327.2	0.06	43.89	43.89	0.13	0	4.002	0.09	0.09	120	7	7	9
1.55	327.15	0.06	43.11	43.11	0.13	0	4.002	0.09	0.09	120	7	7	9
1.61	327.09	0.05	42.15	42.15	0.13	0	4.002	0.1	0.1	120	7	7	9
1.66	327.04	0.05	41.11	41.11	0.13	0	4.002	0.1	0.1	120	7	7	9
1.72	326.98	0.05	40.15	40.15	0.12	0	4.002	0.1	0.1	120	7	7	9
1.78	326.92	0.04	39.11	39.11	0.11	0	4.002	0.11	0.11	120	7	7	8
1.84	326.86	0.04	38.33	38.33	0.11	0	4.002	0.11	0.11	120	7	7	8
1.89	326.81	0.04	37.89	37.89	0.1	0	4.002	0.11	0.11	120	-99	7	-99
1.95	326.75	0.04	37.28	37.28	0.09	0	4.002	0.12	0.12	120	-99	7	-99
2.01	326.69	0.03	37.02	37.02	0.09	0	4.002	0.12	0.12	120	-99	7	-99
2.07	326.63	0.03	36.93	36.94	0.09	0.01	4.002	0.12	0.12	120	-99	7	-99
2.13	326.57	0.03	37.11	37.11	0.09	0	4.002	0.13	0.13	120	-99	7	-99
2.19	326.51	0.03	37.37	37.37	0.09	0	4.002	0.13	0.13	120	-99	7	-99
2.25	326.45	0.04	37.8	37.8	0.1	0.01	4.002	0.14	0.14	120	-99	7	-99
2.32	326.38	0.04	38.32	38.33	0.1	0	4.002	0.14	0.14	120	7	7	8
2.38	326.32	0.04	40.94	40.94	0.1	0	3.995	0.14	0.14	120	7	7	9
2.45	326.25	0.05	41.08	41.08	0.11	0	3.998	0.15	0.15	120	7	7	9
2.51	326.19	0.05	40.85	40.85	0.12	0.01	4.002	0.15	0.15	120	7	7	9
2.57	326.13	0.06	42.06	42.06	0.13	0.01	4.002	0.15	0.15	120	7	7	9
2.64	326.06	0.06	43.19	43.19	0.15	0.01	4.002	0.16	0.16	120	7	7	9
2.71	325.99	0.05	44.41	44.41	0.12	0.01	4.002	0.16	0.16	120	7	7	10
2.77	325.93	0.04	45.28	45.28	0.08	0.01	4.002	0.17	0.17	120	-99	7	-99
2.84	325.86	0.03	45.71	45.71	0.07	0.01	4.002	0.17	0.17	120	-99	7	-99

APPENDIX D-4. ARA, 1999, *CSB-47A and CSB-48A Raw CPT Data*

Applied Research Associates
Electric Cone Penetrometer Data
Cone_TAP v 2.51

Test Id: CSB-47 Date: 10/30/98

Site: SRS, AIKEN, SC Cone Id: 108.074
Location: C SEEPAGE BASIN GWT (ft): 58.0

Project: 4569 Soil Density(pcf): 120
Client: SRS

Surface Elev.: 268.9 Northing: 68006.20 Easting: 44200.20

Depth (ft)	Elevation (ft)	Sleeve Stress (tsf)	Tip Stress UNC (tsf)	Tip Stress COR (tsf)	Ratio COR (%)	Pore Pressure (tsf)	Resistivity (ohm-m)	Excitation (Vdc)	Over-burden (tsf)	Eff. Overburden (tsf)	Wet Density (pcf)	Class. FR	Class. PP	Blow Count (blows/ft)
0	268.9	0	0	0	0	0	0	3.995	0.00E+00	0.00E+00	120	-99	-99	-99
0.18	268.72	0	7.8	7.8	0	0.02	1926.89	3.996	1.10E-02	1.10E-02	120	-99	7	-99
0.26	268.64	0	9.6	9.6	0	0.03	1597.27	3.996	1.54E-02	1.54E-02	120	-99	7	-99
0.33	268.57	0.07	11.6	11.6	0.65	0.01	767.37	3.996	1.96E-02	1.96E-02	120	7	7	2
0.4	268.5	0.08	15	15	0.53	0.02	985.13	3.996	2.43E-02	2.43E-02	120	7	7	3
0.48	268.42	0.08	16.8	16.9	0.48	0.03	1350.07	3.996	2.86E-02	2.86E-02	120	7	7	4
0.55	268.35	0.1	19	19	0.53	0.01	2249.41	3.996	3.30E-02	3.30E-02	120	7	7	4
0.62	268.28	0.12	22.5	22.5	0.54	0.01	2963.44	3.996	3.74E-02	3.74E-02	120	7	7	5
0.7	268.2	0.14	28	28	0.5	0.01	2654.71	3.996	4.18E-02	4.18E-02	120	7	7	6
0.77	268.13	0.16	35.9	36	0.44	0.02	1292.35	3.996	4.61E-02	4.61E-02	120	7	7	8
0.83	268.07	0.17	45.1	45.1	0.38	0.03	1623.66	3.996	5.00E-02	5.00E-02	120	7	7	10
0.9	267.99	0.19	55.1	55.1	0.34	0.04	3155.65	3.996	5.43E-02	5.43E-02	120	-99	-99	-99
1.08	267.82	0.2	80.2	80.2	0.26	0.02	1160.49	3.996	6.49E-02	6.49E-02	120	-99	-99	-99
1.15	267.75	0.21	85.9	85.9	0.25	0.01	1117.36	3.996	6.92E-02	6.92E-02	120	-99	-99	-99
1.22	267.68	0.23	92.2	92.2	0.25	0.01	1448.62	3.996	7.34E-02	7.34E-02	120	-99	-99	-99
1.29	267.61	0.24	98.7	98.7	0.25	0.01	2216.22	3.996	7.76E-02	7.76E-02	120	-99	-99	-99
1.37	267.53	0.26	104.2	104.2	0.25	0.01	2654.48	3.996	8.21E-02	8.21E-02	120	-99	-99	-99
1.44	267.46	0.29	106.8	106.8	0.27	0	3423.55	3.996	8.65E-02	8.65E-02	120	-99	-99	-99
1.51	267.39	0.35	107.6	107.6	0.32	0	4634.32	3.996	9.06E-02	9.06E-02	120	-99	-99	-99
1.75	267.15	0.32	90.1	90.2	0.35	0.17	5413.18	3.996	1.05E-01	1.05E-01	120	7	7	19
1.83	267.07	0.28	79.9	79.9	0.35	0.15	5962	3.995	1.10E-01	1.10E-01	120	7	7	17
1.9	267	0.25	70.1	70.1	0.36	0.13	4851.89	3.995	1.14E-01	1.14E-01	120	7	7	15
1.97	266.93	0.23	61.5	61.5	0.38	0.12	4294.53	3.996	1.18E-01	1.18E-01	120	7	7	13
2.05	266.85	0.22	54	54	0.4	0.11	3826.32	3.996	1.23E-01	1.23E-01	120	7	7	12
2.12	266.78	0.22	48.2	48.2	0.45	0.1	3159.88	3.996	1.28E-01	1.28E-01	120	7	7	10
2.2	266.7	0.21	43.3	43.3	0.48	0.1	2626.36	3.996	1.32E-01	1.32E-01	120	7	7	9
2.27	266.63	0.23	38.6	38.6	0.6	0.11	2160.48	3.996	1.36E-01	1.36E-01	120	6	7	10
2.34	266.56	0.38	33.6	33.6	1.14	0.13	1803.93	3.996	1.41E-01	1.41E-01	120	6	7	8
2.41	266.49	0.44	30.7	30.7	1.42	0.14	1125.41	3.996	1.45E-01	1.45E-01	120	6	7	8
2.49	266.41	0.45	29.5	29.5	1.52	0.15	446.84	3.996	1.49E-01	1.49E-01	120	6	7	7
2.56	266.34	0.51	25.9	25.9	1.98	0.14	428.48	3.996	1.54E-01	1.54E-01	120	6	6	6
2.63	266.27	0.58	25.1	25.1	2.33	0.13	451.6	3.996	1.58E-01	1.58E-01	120	5	6	8
2.71	266.19	0.66	19.6	19.7	3.37	0.44	466.87	3.996	1.62E-01	1.62E-01	120	5	6	6
2.78	266.12	0.73	17.6	17.7	4.14	0.42	480.4	3.996	1.67E-01	1.67E-01	120	9	6	12
2.86	266.04	0.79	17.4	17.5	4.5	0.42	498.01	3.996	1.71E-01	1.71E-01	120	9	6	12
2.93	265.97	0.8	17	17.1	4.69	0.43	524.97	3.996	1.76E-01	1.76E-01	120	9	6	11
3	265.9	0.82	16.7	16.8	4.87	0.31	524.01	3.996	1.80E-01	1.80E-01	120	9	6	11
3.07	265.83	0.82	17.1	17.2	4.79	0.26	540.36	3.996	1.84E-01	1.84E-01	120	9	6	11
3.15	265.75	0.81	17	17.1	4.71	0.2	551.54	3.996	1.89E-01	1.89E-01	120	9	6	11
3.22	265.68	0.8	17.9	17.9	4.48	0.13	561.84	3.996	1.93E-01	1.93E-01	120	9	6	12
3.29	265.61	0.8	19.5	19.5	4.08	0.09	583.64	3.996	1.98E-01	1.98E-01	120	9	6	13
3.37	265.53	0.8	20.8	20.8	3.87	0.04	627.68	3.996	2.02E-01	2.02E-01	120	8	6	14
3.44	265.46	0.91	23.7	23.7	3.84	0.04	686.16	3.996	2.07E-01	2.07E-01	120	8	6	16
3.51	265.39	1.1	27.6	27.7	3.97	0.16	769.73	3.996	2.11E-01	2.11E-01	120	8	6	18
3.59	265.31	1.34	32	32.1	4.18	0.25	897.62	3.996	2.15E-01	2.15E-01	120	8	6	21
3.66	265.24	1.6	37.5	37.6	4.26	0.31	1074.14	3.996	2.20E-01	2.20E-01	120	8	6	25
3.74	265.16	1.88	42.5	42.6	4.41	0.29	1229.98	3.996	2.24E-01	2.24E-01	120	8	7	28
3.81	265.09	2.14	46.5	46.6	4.59	0.33	1348.57	3.995	2.28E-01	2.28E-01	120	9	7	31
3.88	265.02	2.37	49.1	49.2	4.83	0.31	1415.3	3.995	2.33E-01	2.33E-01	120	9	7	33
3.95	264.95	2.6	51.9	51.9	5	0.16	1451.1	3.996	2.37E-01	2.37E-01	120	9	7	35

APPENDIX D-4. ARA, 1999, *CSB-47A and CSB-48A Raw CPT Data*

Applied Research Associates
Electric Cone Penetrometer Data
Cone_TAP v 2.51

Test Id: CSB-48 Date: 10/30/98

Site: SRS, AIKEN, SC Cone Id: 108.074
Location: C SEEPAGE BASIN GWT (ft): 55.8

Project: 4569 Soil Density(pcf): 120
Client: SRS

Surface Elev.: 270.1 Northing: 68205.20 Easting: 44199.80

Depth (ft)	Elevation (ft)	Sleeve Stress (tsf)	Tip Stress UNC (tsf)	Tip Stress COR (tsf)	Ratio COR (%)	Pore Pressure (tsf)	Resistivity (ohm-m)	Excitation (Vdc)	Over-burden (tsf)	Eff. Overburden (tsf)	Wet Density (pcf)	Class. FR	Class. PP	Blow Count (blows/ft)
0	270.1	0	0	0	0	0	0	4.004	0.00E+00	0.00E+00	120	-99	-99	-99
0.17	269.93	0	14.2	14.2	0	0	0	4.004	1.01E-02	1.01E-02	120	-99	-99	-99
0.24	269.86	0	22.1	22.1	0	0.01	1109.09	4.004	1.46E-02	1.46E-02	120	-99	-99	-99
0.31	269.79	0.09	28.2	28.2	0.33	0.02	1616.47	4.004	1.89E-02	1.89E-02	120	-99	-99	-99
0.39	269.71	0.11	33.3	33.3	0.33	0.01	3422.7	4.003	2.35E-02	2.35E-02	120	-99	-99	-99
0.47	269.63	0.12	35.9	35.9	0.34	0.02	4918.34	4.003	2.80E-02	2.80E-02	120	-99	-99	-99
0.54	269.56	0.13	37.3	37.3	0.36	0.01	4854.76	4.004	3.24E-02	3.24E-02	120	-99	-99	-99
0.62	269.48	0.14	38.3	38.3	0.36	0.01	3728.25	4.004	3.71E-02	3.71E-02	120	-99	-99	-99
0.69	269.41	0.14	38.1	38.1	0.36	0	3975.84	4.004	4.15E-02	4.15E-02	120	7	7	8
0.76	269.34	0.13	37	37	0.36	0	4723.97	4.004	4.59E-02	4.59E-02	120	7	7	8
0.84	269.26	0.13	34.9	34.9	0.37	0.01	5951.98	4.004	5.04E-02	5.04E-02	120	7	7	7
0.92	269.18	0.12	32.5	32.5	0.37	0	6285.92	4.004	5.49E-02	5.49E-02	120	7	7	7
0.99	269.11	0.11	30.2	30.2	0.36	0.01	6114.31	4.004	5.95E-02	5.95E-02	120	7	7	6
1.07	269.03	0.1	28.1	28.1	0.35	0	6022.94	4.004	6.40E-02	6.40E-02	120	7	7	6
1.14	268.96	0.09	26.9	26.9	0.35	0	5827.38	4.004	6.83E-02	6.83E-02	120	7	7	6
1.21	268.89	0.1	26.3	26.3	0.39	0	5956.58	4.004	7.28E-02	7.28E-02	120	7	7	6
1.29	268.81	0.12	26.4	26.4	0.46	0	6658.11	4.004	7.72E-02	7.72E-02	120	7	7	6
1.36	268.74	0.14	26.6	26.6	0.52	0.01	2446.25	4.004	8.16E-02	8.16E-02	120	6	7	7
1.43	268.67	0.17	26.3	26.3	0.64	0.01	1368.89	4.004	8.59E-02	8.59E-02	120	6	7	7
1.51	268.59	0.23	24	24	0.98	0.02	1008.66	4.004	9.04E-02	9.04E-02	120	6	7	6
1.75	268.35	0.53	21.3	21.3	2.5	0.01	531.4	4.004	1.05E-01	1.05E-01	120	5	7	6
1.82	268.28	0.61	21.1	21.1	2.88	0.02	541.5	4.004	1.09E-01	1.09E-01	120	8	7	14
1.9	268.2	0.68	20.8	20.8	3.29	0.02	533.82	4.004	1.14E-01	1.14E-01	120	8	7	14
1.97	268.13	0.73	20.6	20.6	3.55	0	571.7	4.004	1.18E-01	1.18E-01	120	8	7	14
2.05	268.05	0.75	20.8	20.8	3.59	-0.01	622.57	4.003	1.23E-01	1.23E-01	120	8	7	14
2.12	267.98	0.76	21.5	21.5	3.53	-0.02	617.5	4.003	1.27E-01	1.27E-01	120	8	7	14
2.2	267.9	0.78	22.8	22.8	3.42	-0.01	621.29	4.004	1.32E-01	1.32E-01	120	8	7	15
2.27	267.83	0.8	25.7	25.7	3.12	-0.07	640.19	4.004	1.36E-01	1.36E-01	120	8	7	17
2.34	267.76	0.84	28.8	28.7	2.92	-0.24	639.32	4.004	1.41E-01	1.41E-01	120	8	7	19
2.42	267.68	0.9	31.7	31.7	2.84	-0.25	664.71	4.004	1.45E-01	1.45E-01	120	8	7	21
2.49	267.61	0.97	35.8	35.7	2.71	-0.12	667.42	4.004	1.50E-01	1.50E-01	120	8	7	24
2.57	267.53	1.07	40.1	40	2.66	-0.1	709.21	4.004	1.54E-01	1.54E-01	120	8	7	27
2.64	267.46	1.18	44.1	44	2.68	-0.34	761.87	4.004	1.59E-01	1.59E-01	120	8	7	29
2.71	267.39	1.31	49.5	49.4	2.66	-0.32	862.69	4.004	1.63E-01	1.63E-01	120	8	7	33
2.79	267.31	1.49	54.9	54.8	2.71	-0.4	1002.33	4.004	1.67E-01	1.67E-01	120	8	7	37
2.87	267.23	1.69	58.1	58	2.92	-0.43	1183.75	4.004	1.72E-01	1.72E-01	120	8	7	39
2.94	267.16	1.95	62.1	62	3.14	-0.35	1398.46	4.004	1.77E-01	1.77E-01	120	8	7	41
3.02	267.08	2.22	64.8	64.8	3.43	-0.42	1564.13	4.004	1.81E-01	1.81E-01	120	8	7	43
3.09	267.01	2.45	65.8	65.7	3.72	-0.47	1647.39	4.004	1.86E-01	1.86E-01	120	8	7	44
3.16	266.94	2.61	68.1	68	3.84	-0.5	1646.15	4.004	1.90E-01	1.90E-01	120	8	7	45
3.24	266.86	2.74	70.3	70.2	3.9	-0.52	1592.7	4.004	1.94E-01	1.94E-01	120	8	7	47
3.32	266.78	2.85	72.6	72.5	3.93	-0.53	1559.18	4.004	1.99E-01	1.99E-01	120	8	7	48
3.39	266.71	3	74	73.9	4.06	-0.49	1540.74	4.004	2.03E-01	2.03E-01	120	8	7	49
3.47	266.63	3.16	74.3	74.2	4.26	-0.48	1556.21	4.004	2.08E-01	2.08E-01	120	8	7	50
3.54	266.56	3.26	74.9	74.8	4.36	-0.51	1572.11	4.004	2.12E-01	2.12E-01	120	8	7	50
3.61	266.49	3.31	77.1	77	4.3	-0.45	1572.66	4.004	2.17E-01	2.17E-01	120	8	7	51
3.69	266.41	3.31	81.3	81.4	4.07	0.29	1637.16	4.004	2.21E-01	2.21E-01	120	8	7	54
3.76	266.34	3.36	85.2	85.4	3.94	0.88	1734.25	4.004	2.26E-01	2.26E-01	120	8	7	57
3.84	266.26	3.43	88.4	88.8	3.87	2.05	1834.09	4.004	2.30E-01	2.30E-01	120	8	7	59
3.91	266.19	3.49	90.3	90.7	3.85	1.9	1953.44	4.004	2.35E-01	2.35E-01	120	8	7	60

APPENDIX D-5. Bechtel, 1998, *As-built of CPT Locations 100-C Area*

12/16/98 00:37 FAX 8039526628 001

BSRI-1998-001

Post-it® Fax Note 7671

*OCTOBER 26, 1998
*
*ASBUILT OF CPT LOCATIONS 100-C AREA
*
*PREPARED BY BSRI LAYOUT
*

* PT.NO.	NORTHING	EASTING	ELEV.	DESCRIPTION
21	67134.2301	45211.9250	284.494	*CSBCP-31
22	67280.4410	45223.2661	285.415	*CSBCP-30
23	67420.6409	45225.3347	286.407	*CSBCP-29
24	67576.4596	45225.7611	289.264	*CSBCP-28
25	67729.9224	45220.2972	291.413	*CSBCP-27
26	67876.4273	45223.2671	291.521	*CSBCP-26
27	68389.7755	44400.5673	273.104	*CRSB-91
28	68401.7580	44995.9584	282.760	*CRSB-96
29	68252.9587	44995.6681	280.365	*CRSB-95
30	68103.9354	44994.4549	283.370	*CRSB-94
31	67950.2706	44983.5740	286.836	*CRSB-93
32	67806.0587	45003.3581	287.395	*CRSB-92
33	68193.2914	44394.3070	274.188	*CSBCP-18
34	68002.5492	44400.0535	276.217	*CSBCP-19
35	67810.1128	44401.2500	274.364	*CSBCP-20
36	67600.7617	44391.8232	272.344	*CSBCP-21
37	67396.7758	44401.2493	274.811	*CSBCP-22
38	67200.7724	44409.8967	272.241	*CSBCP-23
39	67008.5187	44392.0117	274.131	*CSBCP-32
40	68718.6477	44544.4457	276.752	*CRSB-97
41	68851.7141	44548.8027	275.106	*CRSB-98
42	68994.3248	44547.0711	274.438	*CRSB-99
43	69205.2661	44553.5562	275.841	*CRSB-100
44	68404.9372	44200.1871	268.391	*CRSB-90
45	68404.1450	43986.5262	260.605	*CRSB-89
46	68423.7658	43795.5934	253.197	*CRSB-88
47	67825.6650	43793.8145	257.399	*CSBCP-35
48	68202.0010	43406.0174	238.212	*CSBCP-42
49	68401.4103	43399.3213	226.761	*CSBCP-41
50	68601.0706	43409.9940	227.330	*CRSB-40
51	68799.0243	43405.0651	233.137	*CRSB-52
52	68981.2324	43401.8242	242.892	*CRSB-51
53	69193.9594	43418.2119	255.607	*CRSB-50
54	69393.5281	43410.4341	260.097	*CRSB-49
55	69597.6751	43418.6101	259.827	*CRSB-48
56	67621.8151	43785.5227	265.622	*CSBCP-36
57	67423.5631	43790.4938	270.470	*CSBCP-37
58	67224.5854	43796.3938	274.862	*CSBCP-38
59	67185.4853	43419.5077	282.661	*CSBCP-47
60	66996.3208	43801.3898	277.306	*CSBCP-39
61	68652.4961	43191.7701	224.691	*CRSB-54
62	68684.9715	43004.8441	229.142	*CRSB-55
63	68719.9810	42804.1955	232.539	*CRSB-56
64	68810.6255	42405.2755	248.173	*CRSB-57
65	68845.9278	42209.6879	253.859	*CRSB-58
66	68881.6087	42017.6341	257.874	*CRSB-59
67	68927.5130	41797.9866	257.035	*CRSB-60
69	68789.0772	42627.2019	243.216	*131C-96
70	68714.8804	42560.4269	246.770	*131C-97
71	68661.7151	42487.5767	250.975	*131C-98
72	68535.4245	42328.1151	261.621	*131C-100
73	68404.2912	42152.5328	271.914	*131C-102

APPENDIX D-5. Bechtel, 1998, *As-built of CPT Locations 100-C Area*

74	68301.8338	41995.8445	276.909	*131C-104
76	68964.9657	42868.9501	211.805	*CRSB-82
77	69159.8170	42917.4268	211.292	*CRSB-87
79	69352.7306	42845.6011	206.554	*CRSB-86
80	69527.6468	42748.5641	208.431	*CRSB-85
82	69694.1083	42642.7173	218.046	*CRSB-84
83	69875.1739	42578.3406	227.206	*CRSB-83
86	70125.5319	42073.8166	205.720	*131C-80
87	70172.5373	42140.6284	217.846	*131C-81
88	70261.4411	42225.0317	232.955	*131C-82
89	70325.1656	42299.1710	240.507	*131C-83
90	70387.2988	42379.5052	241.872	*131C-84
91	70529.0042	42515.0933	232.774	*131C-86
95	68964.1082	41602.1805	257.276	*CRSB-61
96	69001.0420	41398.8823	251.876	*CRSB-62
98	69199.1208	41402.2369	241.273	*131C-95
100	69026.4221	41190.0613	240.382	*CRSB-63
101	69107.7828	40798.6681	229.915	*CRSB-64
102	69183.4549	40519.9175	214.813	*CRSB-65
104	69269.9900	40003.5948	167.165	*CRSB-66
106	69448.9103	41571.5499	239.449	*131C-92
107	69542.4931	41626.7048	233.651	*131C-91
108	69637.4270	41641.9086	227.259	*131C-90

APPENDIX D-5. Bechtel, 1998, *As-built of CPT Locations 100-C Area*

DEC-17-1998 12:08 FROM ENVIRONMENTAL RESTORATION TO 57673 P.01

CPT AS-BUILTS AROUND CRSB PERIMETER

BSRI-1998-001

PT.NO.	NORTHING	EASTING	ELEV.	DESCRIPTION
11	66908.2163	45003.7777	278.200	*crsb-1
12	67055.8858	44987.7817	284.511	*crsb-2
13	67201.5039	44995.8471	285.765	*crsb-3
14	67312.0592	44995.7068	282.760	*crsb-4
15	67302.4142	44613.0100	277.623	*crsb-15
16	67405.8843	44524.4464	276.405	*crsb-13
17	67510.6277	44511.4962	276.745	*crsb-12
18	67613.7111	44513.7972	276.714	*crsb-11
19	67711.8169	44518.7153	276.733	*crsb-10
20	67807.1663	44725.1708	281.478	*crsb-17
21	67805.5497	44809.9707	284.069	*crsb-9
22	67802.9168	44903.9927	286.256	*crsb-8
23	67802.1708	44957.7505	286.715	*crsb-7
24	67653.7501	44996.2176	289.386	*crsb-6
25	67505.5472	44990.6544	288.297	*crsb-5
27	67305.0579	44515.8228	275.545	*crsb-14
28	67308.3902	44827.8971	282.561	*crsb-16

Post-it® Fax Note 7671	Date 12/17 # of pages ▶ 1
To Marry Harris	From Pat Nichols
Co./Dept.	Co.
Phone #	Phone # 2-6465
Fax # 5-7673	Fax #

MARRY – ADDITIONAL INFO FOR C-AREA CPTs.

entered
KH

TOTAL P.01

APPENDIX D-6. Bechtel, 1999, *As-built of CPT Locations at the 100-C Area Seepage Basins*

02/11/99 15:39 ☎803 725 7673 WSRC/ESS 001

BSRI-1999-001

*FEBRUARY 11, 1999
*
*ASBUILT OF CPT LOCATIONS AT THE 100-C AREA SEEPAGE BASINS
*
*PREPARED BY BSRI LAYOUT
*BLDG. 704-N PHONE: 7-4661
*
*FILENAME: C-CPT.TXT
*

*PT.NO.	NORTHING	EASTING	ELEV.	DESCRIPTION
120	67198.4415	44990.2159	285.693	*CRSB-3
121	67055.7979	44987.8728	284.513	*CRSB-2
122	66908.7234	45003.8431	278.234	*CRSB-1
123	67123.9034	45211,0013	284.425	*CRSB-31
124	67280.3946	45223.1925	285.401	*CRSB-30
125	67722.9179	45225.1951	291.176	*CRSB-27
126	67873.3124	45225.5210	291.625	*CRSB-26
127	67801.8422	44904.2854	286.238	*CRSB-8
128	67809.7353	44718.1568	281.006	*CRSB-17
129	68103.9620	44994.6532	283.343	*CRSB-9 — MAY BE CRSB-94
130	68652.5985	43191.6909	224.722	*CRSB-54
131	68684.9897	43004.5969	229.143	*CRSB-55
132	68789.2121	42627.0705	243.203	*CSB-86A
133	68956.1748	42861.8146	212.133	*CSB-82
134	70037.4592	42748.3899	241.966	*131C-53
137	70348.8206	41250.7075	169.883	*131C-105
138	70264.6959	41242.6020	165.944	*131C-106
139	70469.1324	41360.7944	177.764	*131C-107
140	70658.6147	41452.7071	171.876	*131C-108
142	70673.4582	41551.3386	178.257	*131C-109
144	69079.0471	43375.8182	245.739	*131C-48
145	69018.2198	43459.8185	249.638	*131C-44
146	68964.5498	43538.4581	250.957	*131C-40
147	69041.3274	43585.8621	259.755	*131C-41
148	69090.6416	43506.2583	259.031	*131C-45
149	69151.4357	43419.4026	254.289	*131C-49
150	69243.5703	43496.2194	263.388	*131C-50
151	69313.8691	43526.8912	264.968	*131C-51
154	69269.4722	40001.4623	167.065	*CRSB-66
155	69183.3078	40519.9054	214.796	*CRSB-65
156	69448.4889	41571.9683	239.792	*131C-92
159	67149.4642	40545.1302	251.681	*CSB-61A
161	67398.3563	43403.2988	279.995	*CSB-47A
163	69213.2778	44554.1214	274.901	*CRSB-100
165	69156.9637	44243.5832	000.000	*CRP-9D
			268.390	*TOP OF CONCRETE
			270.710	*TOP OF TEE
166	69196.9556	44082.1093	000.000	*CRP-7D
			262.960	*TOP OF CONCRETE
			265.190	*TOP OF TEE
168	68003.8449	44792.4574	277.198	*CRSB-24

AREA C RESURVEY

Post-it® Fax Note 7671

Date 2/ /99	# of pages ▸
To Kelley Hawkins	From
Co./Dept.	Co.
Phone #	Phone # 5-4184
Fax # 724-5926	Fax # 5-7673

APPENDIX D-7. Harris, 1997**,** *borings.xls***,** electronic file received from M. K. Harris

WELL	SRS NORTHING	SRS EASTING	ELEV. CASING	GROUND ELEV.
PBF 002	50,667.38	91,082.89		268.35
PBF 002	50,667.38	91,082.89		268.35
PBF 003	58,766.62	60,380.36		316.65
PBF 004	58,148.66	29,985.13		208.10
PBF 005	53,591.29	30,319.43		240.60
PBF 006	55,621.75	12,814.48		92.50
PBF 006	55,621.75	12,814.48		92.50
PBF 007	55,420.69	59,568.97		285.42
PBF 007	55,420.69	59,568.97		285.42
PBF 008	55,744.48	59,812.89		292.01

APPENDIX D-8. Kirr, 1998**,** *Well-Boring Locations.doc***,** electronic file received from J. Kirr

Designation	Northing	Easting	Elevation	Description
CRP-3C	68697.04	44016.51	266.04	Well
CRP-3D	68694.01	44012.93	265.31	Well
CRP-5C	68535.99	44527.84	275.05	Well
CRP-5D	68549.46	44515.25	274.50	Well
CRP-6DR	68309.80	44007.90	261.50	Well
CRP-7D	69197.00	44082.00	262.98	Well
CRP-8D	68650.37	43681.94	246.08	Well
CRP-9D	69156.95	44243.47	268.40	Well
CRP-10D	68998.72	43741.10	264.84	well
CRP-11D	68711.23	44168.20	268.93	well-remedial action
131C-05	68686.55	44092.00	286.40	Soil Boring
131C-06	68671.91	44181.38	270.30	Soil Boring
131C-07	68659.91	44233.05	270.90	Soil Boring
131C-08	68649.28	44309.43	272.30	Soil Boring
131C-09	68806.94	44545.51	275.81	Soil Boring
131C-10	68876.37	43991.49	286.80	Soil Boring
131C-11	68813.26	44479.47	289.70	Soil Boring
131C-12	68946.35	44462.48	284.10	Soil Boring
131C-13	68739.33	44193.46	270.10	Soil Boring
131C-14	68959.22	44302.84	283.10	Soil Boring
131C-15	68558.37	43893.00	256.58	Surface Sample
131C-16	68481.21	44209.67	270.00	Surface Sample
131C-19	68825.41	44385.92	289.79	Soil Boring
131C-20	68848.61	44261.09	286.38	Soil Boring
131C-21	68871.79	44154.21	285.58	Soil Boring
131C-16-CPT	68489.63	44589.14		CPT
131C-17-CPT	68323.35	44053.31		CPT
131C-18-CPT	68719.30	44158.79		CPT
131C-19-CPT	68250.65	43902.38		CPT
131C-20-CPT	68387.70	43890.75		CPT
131C-21-CPT	69047.72	44066.46		CPT
131C-22-CPT	69178.44	43996.57		CPT
131C-23-CPT	68469.44	43981.91		CPT
131C-24-CPT	68420.34	44249.81		CPT
131C-25-CPT	68272.82	44358.99		CPT
131C-26-CPT	68099.70	44236.10		CPT
131C-27-CPT	68868.40	43833.60	263.67	CPT
131C-28-CPT	68786.40	43776.30	256.28	CPT
131C-29-CPT	68968.30	43829.00	265.82	CPT

APPENDIX D-8. Kirr, 1998**,** *Well-Boring Locations.doc***,** electronic file received from J. Kirr

Designation	Northing	Easting	Elevation	Description
131C-30-CPT	68703.90	43720.20	248.98	CPT (not used)
131C-31-CPT	69068.10	43824.30	267.66	CPT
131C-32-CPT	69168.00	43819.50	267.32	CPT
131C-33-CPT	68760.10	43637.40	245.55	CPT (not used)
131C-34-CPT	68842.70	43693.80	252.60	CPT
131C-35-CPT	68923.20	43750.00	260.77	CPT
131C-36-CPT	68816.50	43554.90	242.54	CPT (not used)
131C-37-CPT	68899.10	43611.00	251.43	CPT (not used)
131C-38-CPT	68978.00	43666.40	259.84	CPT (not used)
131C-39-CPT	69024.70	43746.40	265.26	CPT (not used)
131C-40-CPT	68987.60	43564.20	249.50	CPT (not used)
131C-41-CPT	69034.30	43652.70	259.40	CPT (not used)
131C-42-CPT	69080.80	43741.30	266.30	CPT (not used)
131C-43-CPT	69127.70	43829.50	266.30	CPT (not used)
131C-44-CPT	69075.80	43517.40	248.50	CPT (not used)
131C-45-CPT	69122.60	43606.00	258.50	CPT (not used)
131C-46-CPT	69169.30	43694.50	265.30	CPT (not used)
131C-47-CPT	69216.00	43782.80	265.40	CPT (not used)
131C-48-CPT	69164.30	43470.70	244.00	
131C-49-CPT	69211.00	43559.00	254.20	
131C-50-CPT	69257.90	43648.00	261.90	
131C-51-CPT	69304.40	43736.00	265.30	
131C-52-CPT	70071.8	42566.50	230.34	
131C-53-CPT	70022.4	42759.40	243.34	
131C-54-CPT	69970.8	42952.30	247.06	
131C-55-CPT	69923.3	43145.90	245.01	
131C-56-CPT	69875.7	43339.80	248.84	
131C-57-CPT	69831.3	43533.90	249.36	
131C-58-CPT	69790.8	43728.20	243.11	
131C-59-CPT	69874.5	42563.40	227.70	
131C-60-CPT	69691.0	42639.30	218.20	
131C-61-CPT	69523.0	42745.40	208.54	
131C-62-CPT	69346.2	42836.60	207.16	
131C-63-CPT	69158.7	42902.80	211.14	
131C-64-CPT	68969.9	42859.40	211.86	
131C-65-CPT	68868.40	43833.60	263.67	CPT-28 (dual location)
131C-66-CPT	68868.40	43833.60	263.67	CPT-27 (dual location)
131C-67-CPT	68968.30	43829.00	265.82	CPT-29 (dual location)
131C-68-CPT	69068.10	43824.30	267.66	CPT-31 (dual location)
131C-69-CPT	69168.00	43819.50	267.32	CPT-32 (dual location)

APPENDIX D-8. Kirr, 1998**,** *Well-Boring Locations.doc***,** electronic file received from J. Kirr

Designation	Northing	Easting	Elevation	Description
CPT 70 thru 76	Contingent Locations	Not Used –only designated		
131C-80-CPT	70122.76	42076.62	206.0	
131C-81-CPT	70172.7	42140.8	218.0	
131C-82-CPT	70264.36	42218.22	232.97	
131C-83-CPT	70328.34	42295.50	240.08	
131C-84-CPT	70405.96	42359.58	239.80	
131C-85-CPT	70466.62	42439.04	237.49	
131C-86-CPT	70547.24	42500.84	231.84	
131C-87-CPT	70616.97	42572.93	226.81	
131C-88-CPT	70688.59	42642.17	218.62	
131C-89-CPT	69733.61	41646.48	219.21	
131C-90-CPT	69635.71	41644.49	227.38	
131C-91-CPT	69534.62	41626.52	233.76	
131C-92-CPT	69449.63	41574.46	239.59	
131C-93-CPT	69366.69	41518.62	241.89	
131C-94-CPT	69282.99	41463.87	241.43	
131C-95-CPT	69203.51	41402.77	241.31	
131C-96-CPT	68800.66	42630.16	242.58	
131C-97-CPT	68720.26	42554.06	246.72	
131C-98-CPT	68655.72	42481.42	251.58	
131C-99-CPT	68597.42	42400.45	256.73	
131C-100-CPT	68535.41	42322.07	261.78	
131C-101-CPT	68474.57	42242.58	266.72	
131C-102-CPT	68415.79	42161.62	271.46	
131C-103-CPT	68363.00	42075.15	275.46	
131C-104-CPT	68303.94	41995.22	277.06	
131C-105-CPT	70356.80	41240.70	169.30	
131C-106-CPT	70265.80	41241.70	165.80	
131C-107-CPT	70472.20	41366.00	178.40	
131C-108-CPT	70658.70	41452.20	171.10	
131C-109-CPT	70703.60	41537.20	172.00	
131C-R1-CPT	68682.80	44316.00	271.00	IAPP SAMPLES
131C-R2-CPT	68734.70	44066.10	266.80	IAPP SAMPLES
131C-R3-CPT	68882.90	43994.50	268.80	IAPP SAMPLES
131C-R4-CPT	68863.30	44197.30	285.60	IAPP SAMPLES
131C-R5-CPT	68830.80	44359.60	289.00	IAPP SAMPLES
131C-R6-CPT	69031.60	44274.00	276.00	IAPP SAMPLES

APPENDIX D-8. Kirr, 1998**,** *Well-Boring Locations.doc***,** electronic file received from J. Kirr

Designation	Northing	Easting	Elevation	Description
131C-R7-CPT	68696.7	44230.0	269.58	IAPP SAMPLES
131C-R8-CPT	68724.1	44113.4	267.75	IAPP SAMPLES
131C-R9-CPT	68725.9	44025.0	266.20	IAPP SAMPLES
131C-R10-CPT	68693.3	44100.7	268.20	IAPP SAMPLES
Orange Ball	68713.98	44059.54		Pit Area
Orange Ball	68667.05	44054.39		Pit Area
Orange Ball	68611.40	44335.05		Pit Area
Orange Ball	68661.19	44349.12		Pit Area
Corner Marker	68776.82	43994.46		Mounded Area
Corner Marker	68985.12	44022.36		Mounded Area
Corner Marker	68678.88	44528.36		Mounded Area
Corner Marker	69014.24	44532.13		Mounded Area

APPENDIX D-9. Rucker, 1999a, *grucker.990113.csbvoc.xls*, CRSB Analytical Data received from G. Rucker

SAMPLE ID	ANALYTE	EASTING	NORTHING	DEPTH	DL	RQ	RESULT	UNITS
CRSB-56-01	1,1,1-Trichloroethan	43,999.43	68,602.13	67.0	1	U	1	UGL
CRSB-58-08	Tritium	41,577.12	68,028.13	118.0	1301		17,300.0	pCi/L
CRSB-59-01	1,1,1-Trichloroethan	41,295.09	67,751.28	40.0	1.00	U	1	UGL
CRSB-60-08	Tritium	40,980.25	67,502.28	158.0	1301		25,300.0	pCi/L
CRSB-61-01	1,1,1-Trichloroethan	40,668.70	67,245.08	69.0	1	U	1	UGL
CRSB-62-08	Tritium	40,344.02	67,014.10	159.0	1301		187.0	pCi/L
CRSB-63-01	1,1,1-Trichloroethan	40,014.43	66,792.95	53.0	1	U	1	UGL
CRSB-64-08	1,2-Dichloroethylene	39,707.79	66,530.84	140.0	1	U	1	UGL
CRSB-65-08	Tritium	39,517.58	66,173.72	148.0	1301		219.0	pCi/L
CRSB-66A-01	1,1,1-Trichloroethan	39,622.52	65,783.83	28.0	1	U	1	UGL

APPENDIX D-10. Rucker, 1999b, *CRSBTA.xls*, CRSB locations received from G. Rucker r

Borehole	Northing	Easting	Eleve
CSB-101	66002.48	44868.43	281.20
CSB-102	65984.05	43109.96	283.50
CSB-103	64510.41	44149.64	257.60
CSB-104	63455.35	43787.85	224.90
CSB-105	63628.93	42549.54	212.10
CSB-106	64261.04	41634.09	183.80
CSB-107	64785.48	42446.08	220.70
CSB-108	65154.15	40531.22	196.70
CSB-109	65351.75	39098.64	172.93
CSB-110	66382.03	38102.37	184.60
CSB-111	66888.08	38022.32	172.10
CSB-112	67195.7	38892.52	195.30
CSB-113	67729.39	39311.45	210.40
CSB-114	68278.36	40206.45	196.00
CSB-115	69107.78	40798.67	229.92
CSB-116	67598.91	42794.74	274.74
CSB-117	67218.22	42698.32	276.50
CSB-118	66802.15	42707.65	277.80
CSB-119	67398.77	42193.79	268.30
CSB-120	66998.48	42197.24	282.80
CSB-121	66601.65	42197.24	274.24
CSB-122	65679.58	41120.9	222.9
CSB-123	65585.04	41352.9	224.2

APPENDIX D-11. WSRC, 1998, *CMP Pits Sample Locations*

GWStatus

WSRC-1998-008

Location	Northing	Easting	Elevation
CMP-1CP	52470.6	53252.6	240.9
			240.9
CMP-2CP	52540	53280	247.2
CMP-3CP	52614	53286.3	245.2
CMP-4CP	52688.5	53280.3	241.8
			241.8
CMP-5CP	52760.6	53262.2	238.9
CMP-6CP	52653.3	53105.7	238.4
			238.4
CMP-7CP	52685.9	54290.8	228
CMP-8CP	51947.4	53885.5	280.2
			280.2
			280.2
CMP-9CP	51988.8	53723.5	279.5
			279.5
CMP-10CP	51978.1	53570.8	281.2
			281.2
CMP-11CP	51918.3	53438.4	280.6
			280.6
CMP-12CP	51781	53367.8	287.7
			287.7
CMP-13CP	51471.4	53658.6	308.8
CMP-14CP	51541.1	53777.6	315.6
CMP-15CP	51594.1	53734.7	316.8
			316.8
CMP-16CP	51694.7	53897.2	316.3
CMP-17CP	51405.2	53861.4	309.2
CMP-18CP	51479.6	53938.3	313.6
			313.6
CMP-19CP	51755.4	53753.9	310.2
			310.2
			310.2
			310.2
CMP-20CP	51769.8	53672	304.1
CMP-21CP	51632.6	53948	313.6
CMP-22CP	53840.6	53919.3	288.2
CMP-23CP	52128.7	53707.7	273.5
			273.5
CMP-24CP	52208	53844.8	273.8
CMP-25CP	52338.1	53417.1	257.1
			257.1
CMP-26CP	52369.5	53216.7	252
			252
			252
CMP-27CP	52353.4	53323.8	254.5
			254.5
			254.5
CMP-28CP	52313.5	53524.1	263.3
			263.3
			263.3
CMP-29CP	52413.1	53818	254.7
			254.7
CMP-30CP	52512.6	53606.8	248.8
			248.8
CMP-31CP	52630.8	53486.5	242.7
			242.7
CMP-32CP	51696.4	54011.5	276.6
			276.6
			276.6
CMP-33CP	52011.5	54127.2	287.1
CMP-34CP	51824.2	54249.4	287.8
CMP-35CP	51772.6	54264.1	276.8
			276.8
CMP-36CP	51623.6	54174.9	285.5

APPENDIX D-11. WSRC, 1998, *CMP Pits Sample Locations*

GWStatus

	N	E	
			206.5
CMP-37CP	51491.4	54211.7	206.5
			206.5
CMP-38CP	51411.7	53880.4	309.5
CMP-39CP	51390.6	54311.6	284
			284
			284
CMP-40CP	52141.1	54150.2	250.6
CMP-41CP	52049.6	54072.7	250.3
CMP-42CP	51802.9	53687.5	303
			303
CMP-43CP	51705.4	54330.8	269.9
			269.9
			269.9
			269.9
CMP-44CP	51684.6	54070.5	287.6
			287.6
			287.6
CMP-45CP	52347.4	53821.3	202.1
			202.1
CMP-46CP	52044	53806.9	220.1
			220.1
			220.1

APPENDIX D-12. WSRC, unknown, *Location of BGT Cores*, Data received from M. Amidon

Site ID	Northing	Easting	Grnd Elevation (ft.)
BGT001	76700.6	59178.4	282.9
BGT002	76957.6	59607.2	276.4
BGT003	77197.6	60045.9	275.7
BGT004	77437.6	60484.5	259.2
BGT005	77677.6	60924.1	225.7
BGT006	77254.8	58746.7	282.2
BGT007	77717.8	58935.7	276.4
BGT008	78161.5	59118.6	249.3
BGT009	78642.3	59316.7	226.0
BGT010	79104.6	59507.2	215.2
BGT011	79566.9	59697.7	222.5
BGT012	77291.2	58045.9	284.2
BGT013	77488.9	58074.0	287.8
BGT014	77984.0	58143.4	280.7
BGT015	78479.2	58212.8	277.5
BGT016	78974.1	58283.5	250.7
BGT017	79469.7	58350.0	240.7
BGT018	79965.3	58416.5	216.5
BGT019	80460.8	58483.0	236.3
BGT020	80956.4	58549.6	159.3
BGT021	77280.7	56952.5	294.2
BGT022	77680.3	56970.3	281.0
BGT023	78279.7	56997.0	270.0
BGT024	78779.2	57019.2	265.8
BGT025	79278.7	57041.4	264.8
BGT026	79778.2	57063.7	250.2
BGT027	80277.7	57085.9	256.9
BGT028	80777.2	57108.1	258.3
BGT029	81276.7	57130.4	243.0
BGT030	81726.3	57150.4	219.0
BGT031	77229.0	56189.8	308.76
BGT032	77791.4	56121.1	310.12
BGT033	78404.5	56037.2	290.42
BGT034	78803.9	56027.5	286.76
BGT035	79305.8	55929.9	267.73
BGT036	79801.9	55867.5	261.36
BGT037	80298.0	55805.0	251.60
BGT038	80870.5	55733.0	240.14
BGT039	81290.2	55680.3	241.88
BGT040	77297.2	55644.4	332.32
BGT041	77734.8	55490.1	328.37
BGT042	78240.7	55313.1	310.92
BGT043	79655.9	54816.0	277.08
BGT044	80127.7	54650.4	276.20
BGT045	80461.7	54533.1	285.28

APPENDIX D-12. WSRC, unknown, *Location of BGT Cores*, Data received from M. Amidon

BGT046	76714.3	55355.0	310.00
BGT047	77051.9	54986.6	317.32
BGT048	77135.7	54895.1	314.33
BGT049	76203.9	54946.3	297.26
BGT050	76359.3	54756.2	296.27
BGT051	75519.8	54505.7	272.64
BGT052	75640.6	54093.8	264.26
BGT053	75837.7	53422.0	278.25
BGT054	75941.7	52889.1	279.96
BGT055	76009.4	52382.3	270.68
BGT056	73521.2	56265.8	262.94
BGT057	73268.5	56104.2	259.35
BGT058	73406.9	57399.6	285.76
BGT059	72802.6	57123.2	281.88
BGT060	73120.6	58057.2	291.42
BGT061	72911.8	58490.1	284.30
BGT062	72854.4	58609.0	282.03
BGT063A	73646.4	58768.1	290.79
BGT063	73319.4	59146.3	293.67
BGT064	73013.7	59500.0	283.25
BGT065	72734.8	59822.7	276.29
BGT066	74476.6	60033.7	244.04
BGT067	74443.1	60426.7	242.03

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APPENDIX E-1. STREAM BASE FLOW ESTIMATES BASED ON USGS GAUGING STATION DATA

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Appendix E-1. Stream Base Flow Estimates Based on USGS Gauging Station Data

Groundwater flow in upper aquifers at the Savannah River Site is recharge driven, with streams intercepting flow from higher elevations. Nearly all recharge within the CKLP reactor region discharges to streams within or bounding the same area, usually the nearest stream. For this type of groundwater flow system, recharge and discharge estimates, coupled with head measurements and confining unit leakance estimates, define the overall horizontal conductivities of upper aquifers required to calibrate a numerical flow model. Because conductivity data at the model scale are typically non-existent, stream base flow estimates are important model calibration targets. In this appendix, simple hydrograph separation techniques are used to estimate the long-term average rate of groundwater discharge to certain stream reaches within the CKLP reactor area.

The U. S. Geological Survey has monitored stream flows at numerous locations across the Savannah River Site for decades. The data are published annually for the preceding water year (Cooney and others, 1998, for example), and made available electronically from the United States NWIS-W data retrieval web site (http://h2o-nwisw.er.usgs.gov/nwis-w/US/). Figure E-1 illustrates the location and identification number of each USGS gauging station. Industrial discharges from SRS operations are monitored near outfalls by the USGS, separate from NPDES outfall monitoring conducted by SRS. Figures E-2, E-3 and E-4 show the relationship between USGS and NPDES gauging stations for the General Separations Area/C-Area, K-Area , and L- and P-Areas, respectively.

Given the locations of the USGS gauging stations, regional scale base flows are most easily estimated for the stream reaches and wetland areas enclosed by the polygons depicted in Figure E-5. For example, base flow between the headwaters of Meyers Branch and Road 9 is more conveniently estimated than base flow over the entire reach, because there is not a gauging station on Meyers Branch just above its confluence with Steel Creek. Similarly, base flow will be estimated for portions of Upper Three Runs and Steel Creek. On the other hand, gauging stations are located where Pen Branch and Fourmile Branch enter the Savannah River Swamp, so base flow for the entire drainage can be conveniently estimated.

Figure E-6 is an example hydrograph produced from USGS data for the two gauging stations located on Meyers Branch for water years 1993 through 1996. Station 021973561 is located at Road 9 and station 02197354 monitors the P007 outfall. Discharges to P007 are small relative to the total flow at Road 9. Not surprisingly, the downstream data exhibits a seasonal variation with elevated average flows occurring from late fall through early spring. Over

shorter periods, individual rainfall events are readily observed as a step increase in daily flow followed by an exponential decline. Presumably these peaks are due to direct precipitation, surface runoff and subsurface stormflow, and not reflective of base flow.

Because downstream USGS gauging stations measure total stream flow, the base flow component must be separated from other contributors to a hydrograph of total flow. These include the direct precipitation, surface runoff and subsurface stormflow components mentioned above, as well as process water discharges to outfalls. Shirmohammadi and others (1984) observed that “daily values of precipitation and streamflow are not sufficient for detailed hydrograph analysis using traditional hydrograph separation techniques” and developed an approximate method for partitioning daily total streamflow data, such as that available from the USGS for SRS streams. Hydrograph separation for this project is accomplished with a simplified version of the approach of Shirmohammadi and others (1984). The following steps are applied to the time series of daily total stream flow:

1) Compute the average, F_{avg}, of the downstream flow, F

2) Subtract outfall flows from the downstream flow leaving “natural” flow components, $F_{natural}$. For Steel Creek and Upper Three Runs, flow entering the polygonal area of interest from upstream is also subtracted.

3) Remove the remaining direct precipitation, surface runoff and subsurface stormflow components by creating a “clipped” time series, $F_{base\ flow}$, according to

   $$F_{base\ flow} = \min[F_{natural}, 1.05 \times \max(F_{natural,\ previous}, F_{avg})]$$

4) Smooth the base flow component, $F_{base\ flow}$, over 4 water years, 1993 to 1996, for easier visualization using a running digital filter:

   $$F_{smooth} = (F_{base\ flow,i-1} + F_{base\ flow,i} + F_{base\ flow,i+1})/3$$

5) Average the smoothed base flow component, F_{smooth}, over the 4 water years from 1993 to 1996, producing $F_{smthavg}$.

The third step is based on the assumption that the base flow component responds slowly to rainfall events, and therefore cannot increase very rapidly from one day to the next (5% or less). No restriction on the rate of decrease is imposed. The fourth step does not affect the average computed in the fifth step.

The maximum rate of base flow increase, specified in step 3, was selected according to the recommendations of Linsley and others (1982, chapter 7). As a rule of thumb, the duration of direct runoff following the end of a rainfall is approximately $A^{0.2}$ days, where A is the drainage area in square miles (Linsley and others, 1982, equation 7-4). Pen Branch has a drainage area of 21 square miles resulting in runoff terminating after about 2 days. The drainage area of Fourmile Branch is 22 square miles yielding essentially the same duration. Taking these streams as representative, base flow should typically depart from total flow at the start of a rainfall event and rejoin the total flow after 2 days plus the duration of the rain. The total time of departure would be roughly 2 to 3 days. However, inspection of several individual rainfall events in comparison to the qualitative guidelines of Linsley and others (1982, Figure 7-5) suggests that runoff often lasts longer, sometimes up to roughly 6 days following a heavy rain. The maximum rate of base flow increase was set to 1.05 to yield a 2 to 6 day duration. Figure E-6 shows a sample segment of total and estimated base flow for Meyers Branch.

Applying the above procedure to the appropriate data for each drainage basin yields the results illustrated in Figures E-7 through E-12. In these figures, the upper plots (a) show the reference downstream flow and any outfall or upstream flows. Additional detail on the more significant outfall flow rates is provided by Figures E-13 through E-20. Note that generally outfall and upstream flows form a large component of the downstream flow. The curves (b) at the bottom of Figures E-6 through E-11 show the “base flow”, “smooth” and “smthavg” components as defined in steps 3) to 5) above.

Table E-1 summarizes the bottom line results. The appropriate base flow target for CKLP model calibration is gotten by multiplying the base flow estimate for the stream reach by the fraction of the reach contained within the model domain. For Upper Three Runs between Road C and Road A, which lies on the CKLP model boundary, a reasonable assumption is that each side contributes equally. The main branch of Meyers Branch forms a boundary of the model, but a major tributary just south of Dunbarton Road is totally outside the model domain. Overall, perhaps 1/3 of this reach lies within the model. Far more uncertain is the fraction of base flow to the larger Upper Three Runs reach that should be attributed to groundwater from within the model; 1/4 is suggested in Table E-1. The Steel Creek estimate is negative and indicates a losing reach, presumably reflecting artificial flows to L-Lake to maintain the current lake level.

The stated accuracy of the various raw USGS gauging station data is typically “good” (<10% error 95% of the time), “fair” (<15% error 95% of the time) or “poor” (less than “fair”

accuracy) (Cooney and others, 1998, p. 16). Uncertainty in the long-term average flows ultimately used in this analysis are much smaller than uncertainty in a daily flow. Larger contributors to overall uncertainty are biases in the hydrograph separation procedure, and the estimated fraction of the analyzed reach that lies within the model domain. The uncertainty of the results summarized in Table E-1 can be estimated by considering different values for the assumed maximum rate of base flow increase. As shown by Table E-2, the base flow estimates appear to have an uncertainty around plus or minus 10% due to uncertainty in the chosen rate. Biases in hydrograph separation technique might add another 5 to 10%. For example, base flow continues to decrease during flood conditions before ascending. The hydrograph separation technique used here allows baseflow to increase immediately, and might produce slightly high estimates. Some of the model calibration targets contain added uncertainty in the amount that should be partitioned to the model domain. Overall, the baseflow targets may have an uncertainty of 15 to 25%.

Exceptions include the base flow estimates for Steel Creek and Upper Three Runs. These base flow estimates are derived by taking the difference of large, nearly equal, flows. Uncertainty in daily measurements can not be neglected for these reaches. The additional uncertainty can be estimated as follows. Assume the 2□ confidence interval on a daily flow measurement is 15% of the mean, □:

$$2\sigma = 0.15\mu$$

For independent errors in daily flow, the uncertainty in the long-term average is

$$2\sigma_{\mu} = \frac{2\sigma}{\sqrt{n}} = \frac{0.15\mu}{\sqrt{n}}$$

where n is the number of individual measurements, approximately 4×365 = 1460 for 4 Water Years of data. For a base flow estimate that is a linear combination of long-term flow station estimates, the uncertainty is

$$2\sigma_{\sum\mu} = \sqrt{\sum\left(2\sigma_{\mu}\right)^2} = \sqrt{\sum\left(\frac{0.15\mu}{\sqrt{n}}\right)^2}$$

where the errors are again assumed to be independent. For Steel Creek, the result is

Station	Mean (cfs)
Steel Creek at Road A	78
L007 outfall	69
Steel Creek above Road B	7.5
Meyers Branch at Road 9	10.5
Base flow estimate	2.2
Absolute uncertainty	0.41
Relative uncertainty	19%

For Upper Three Runs between Roads C and A, the result is

Station	Mean (cfs)
Upper Three Runs at Road A	244
Upper Three Runs at Road A	228
Base flow estimate	8.9
Absolute uncertainty	1.3
Relative uncertainty	15%

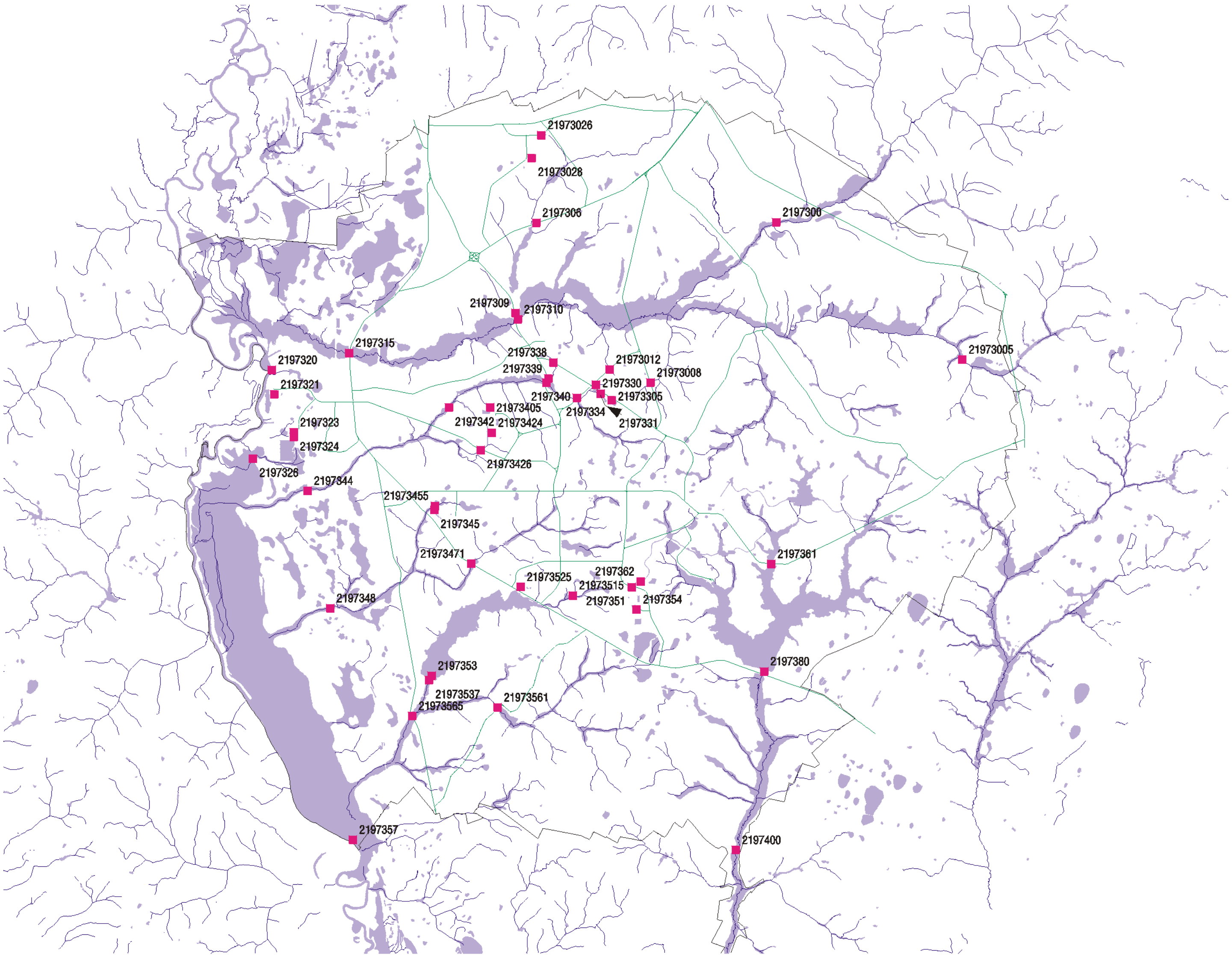
These additional uncertainties are reflected in Table E-1. For biased measurements, the uncertainty would be higher. The above analysis is based on the independent, unbiased errors and therefore underestimates the actual uncertainty.

References

Cooney, T. W., P. A. Drewes, K. H. Jones, J. W. Gissendanner and B. W. Church, 1998, Water resources data – South Carolina, Water year 1997, Volume 1, U. S. Geological Survey Water-Data Report SC-97-1.

Linsley, R. K. Jr., M. A. Kohler and J. L. H. Paulhus, 1982, Hydrology for engineers, 3rd edition, McGraw-Hill, New York.

Shirmohammadi, A., W. G. Knisel and J. M. Sheridan, 1984, An approximate method for partitioning daily streamflow data, Journal of Hydrology, v74, p. 335-354.



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21973028
2197306
2197300
2197309
2197310
2197315
21973005
2197320
2197338
21973012
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21973008
2197321
2197330
2197340
21973305
21973405
2197334
2197331
2197323
2197342
21973424
2197324
21973426
2197326
2197344
21973455
2197345
2197361
21973471
2197362
21973525
21973515
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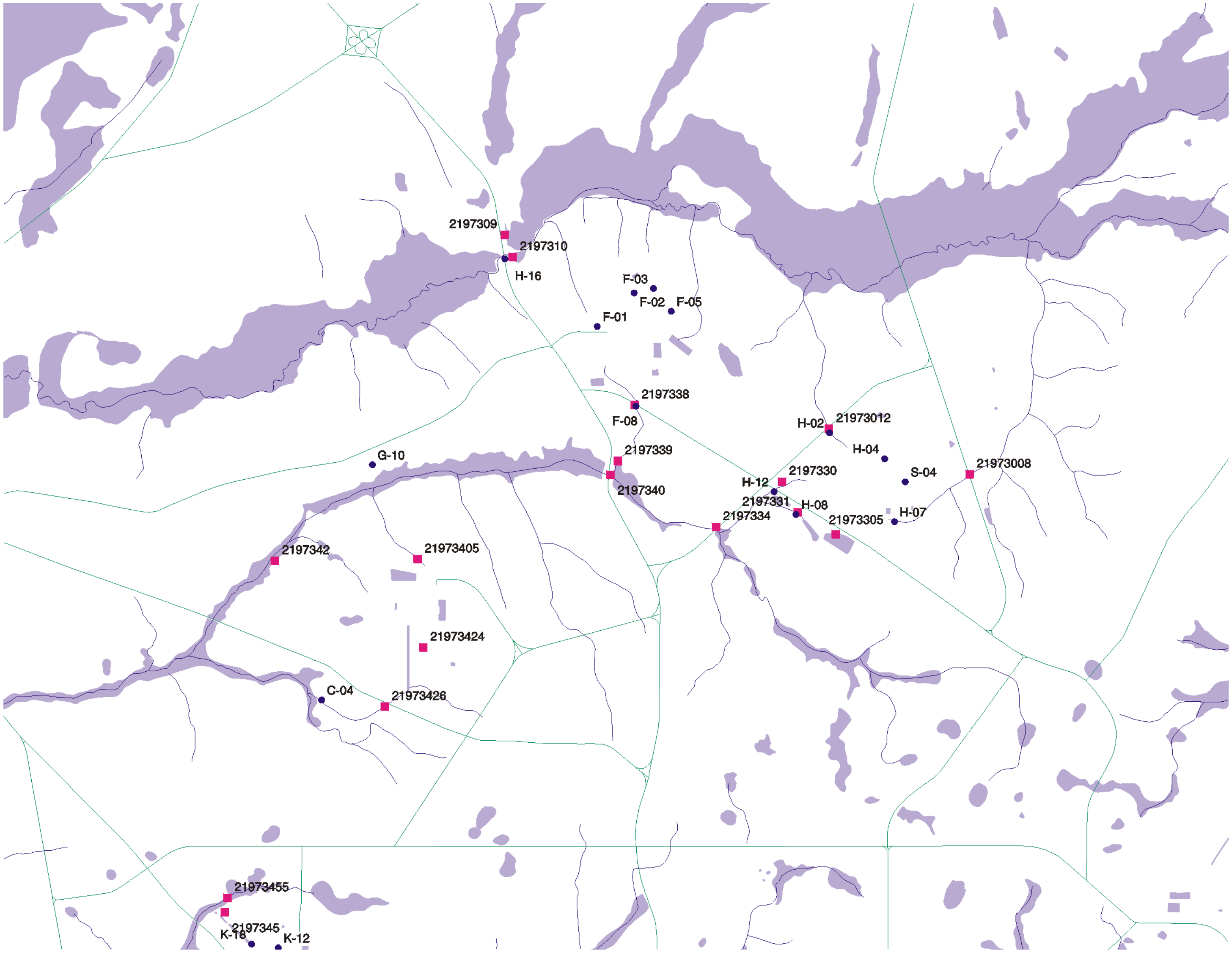
21973565
2197357
2197400

Figure E-1.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F-03
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F-01
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F-08
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S-04
21973008
2197340
H-12
2197330
2197331
H-08
2197334
21973305
H-07
G-10
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21973405
21973424
C-04
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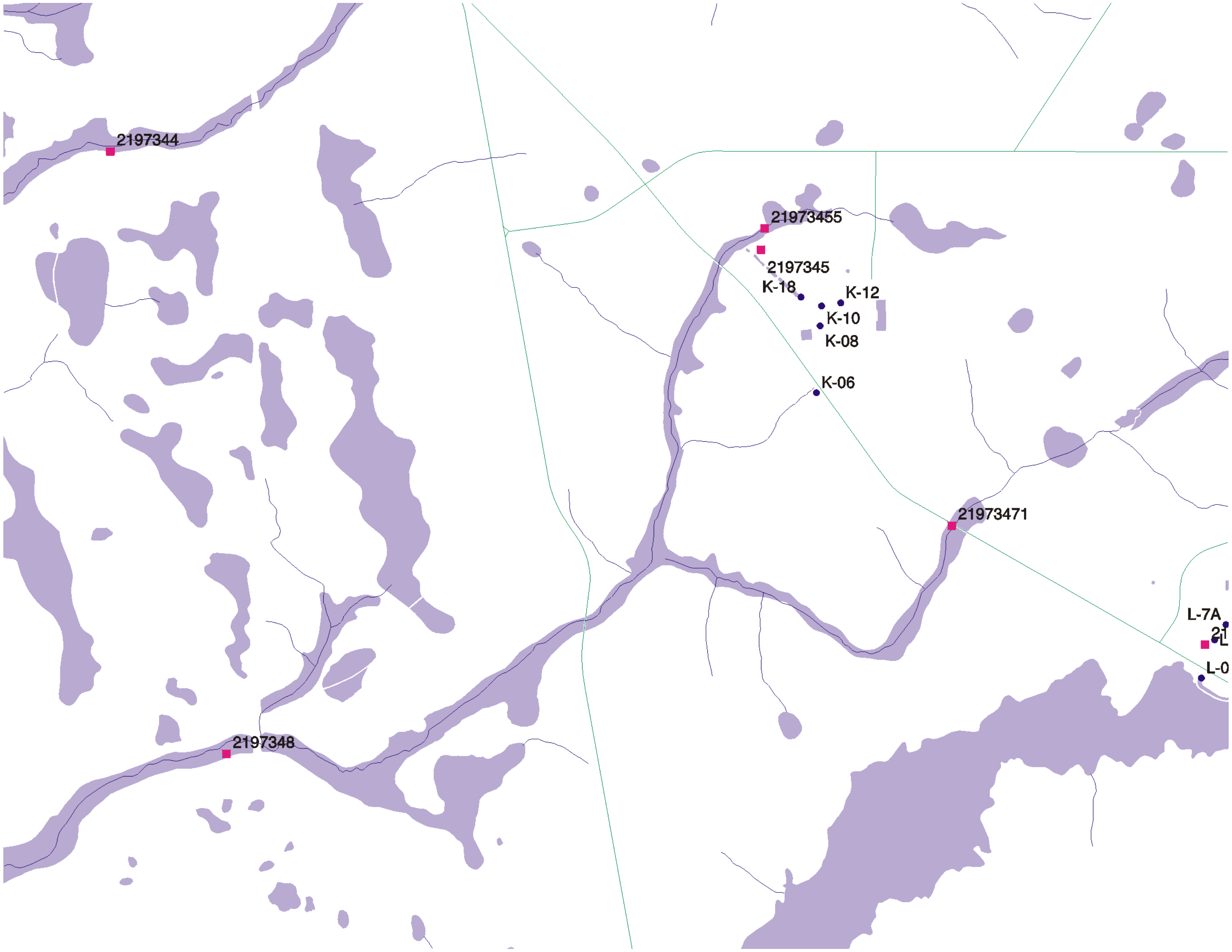
21973455
2197345
K-18
K-12

Figure E-2.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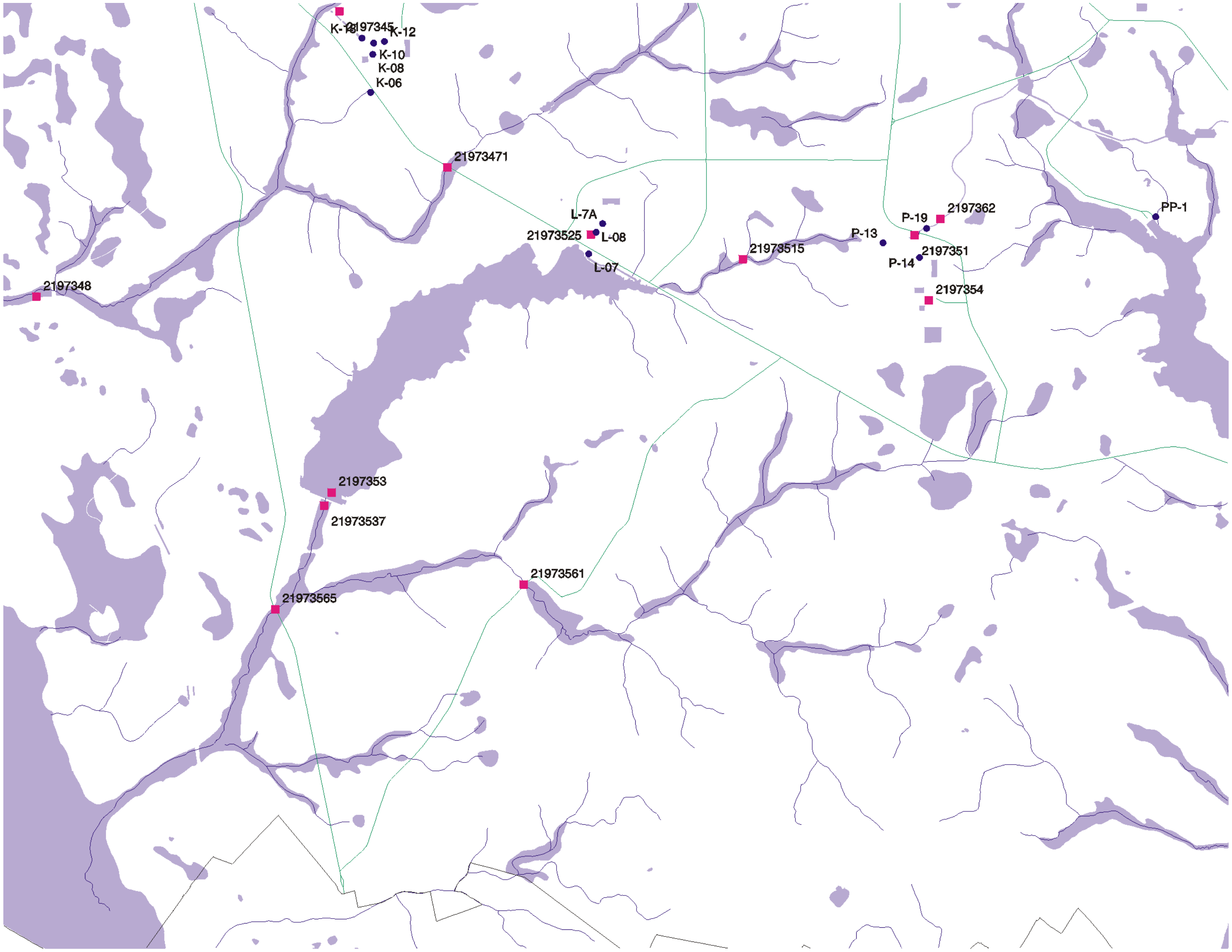
21973455
2197345
K-18
K-12
K-10
K-08
K-06
21973471
L-7A
2197348

Figure E-3.



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K-12
K-10
K-08
K-06
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L-7A
21973525
L-08
L-07
21973515
P-13
P-19
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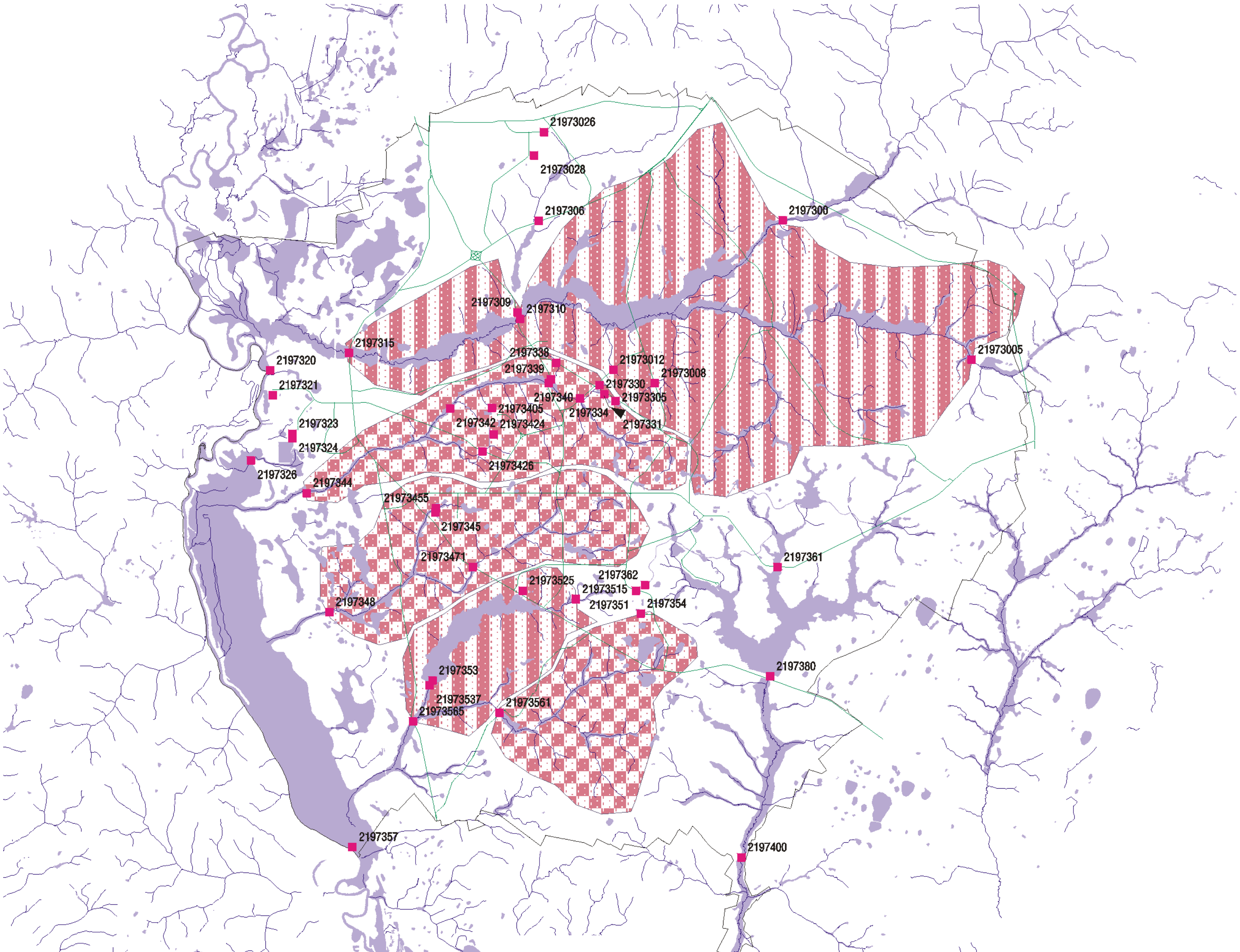
P-14
2197354
PP-1
2197353
21973537
21973561
21973565

Figure E-4.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21973515
2197351
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2197400

Figure E-5.

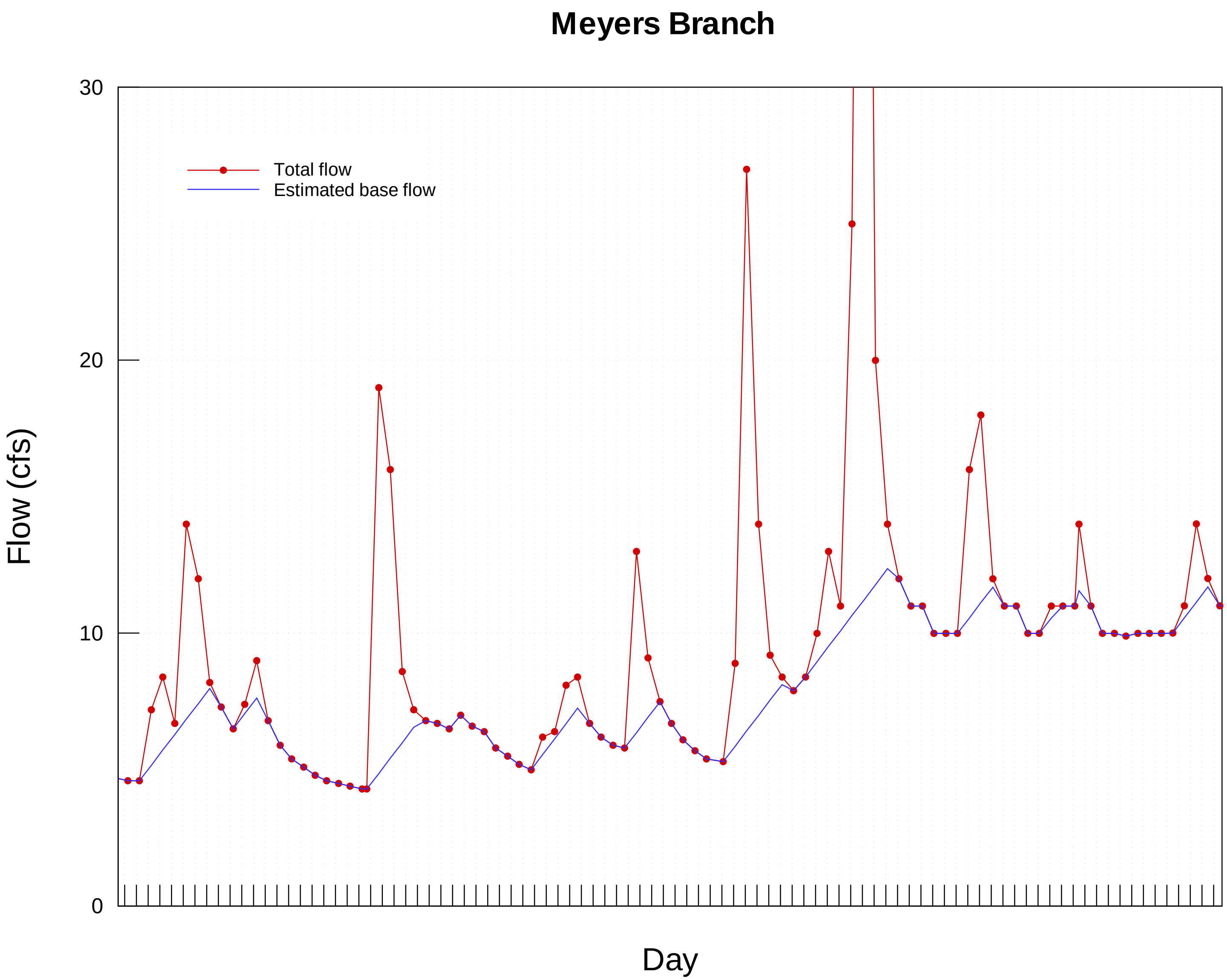
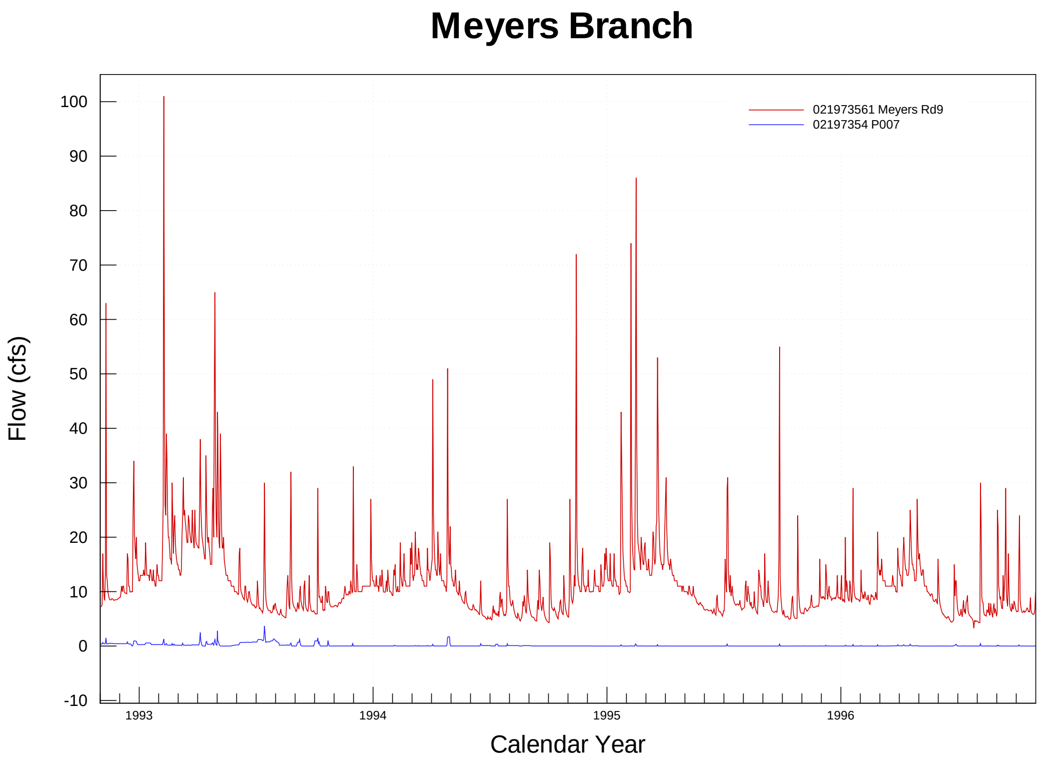

Meyers Branch
Total flow
Estimated base flow
Flow (cfs)
30
20
10
0
Day

Figure E-6.


Meyers Branch
021973561 Meyers Rd9
02197354 P007
Flow (cfs)
100
90
80
70
60
50
40
30
20
10
0
-10
1993
1994
1995
1996
Calendar Year

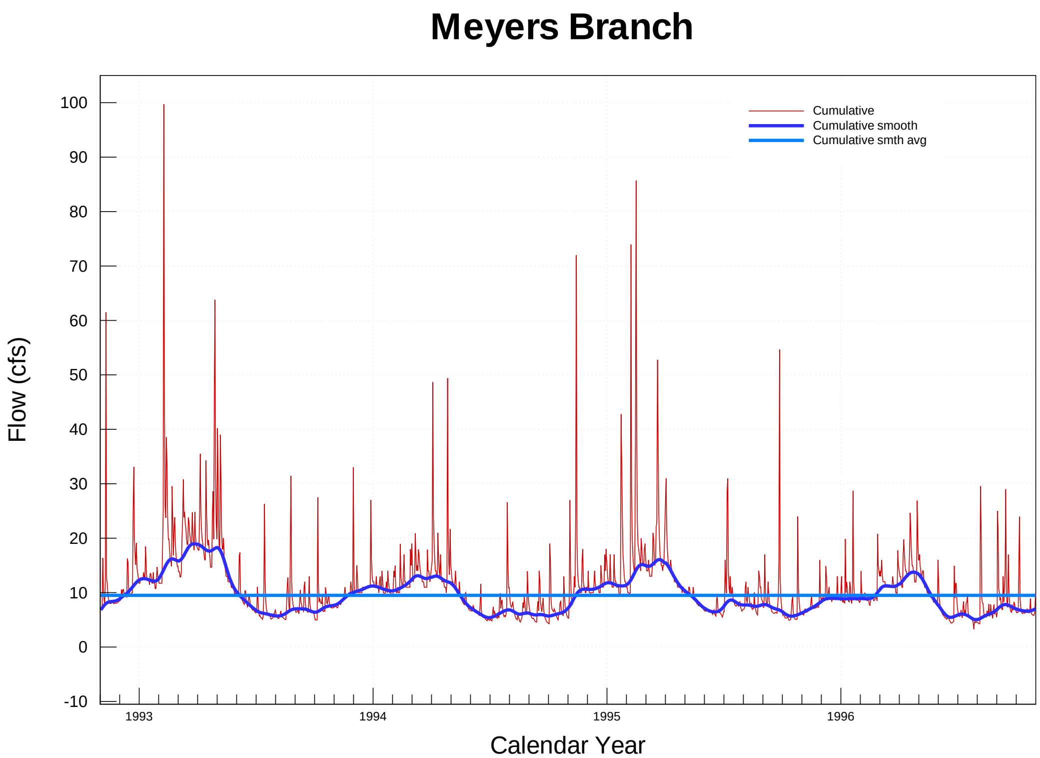
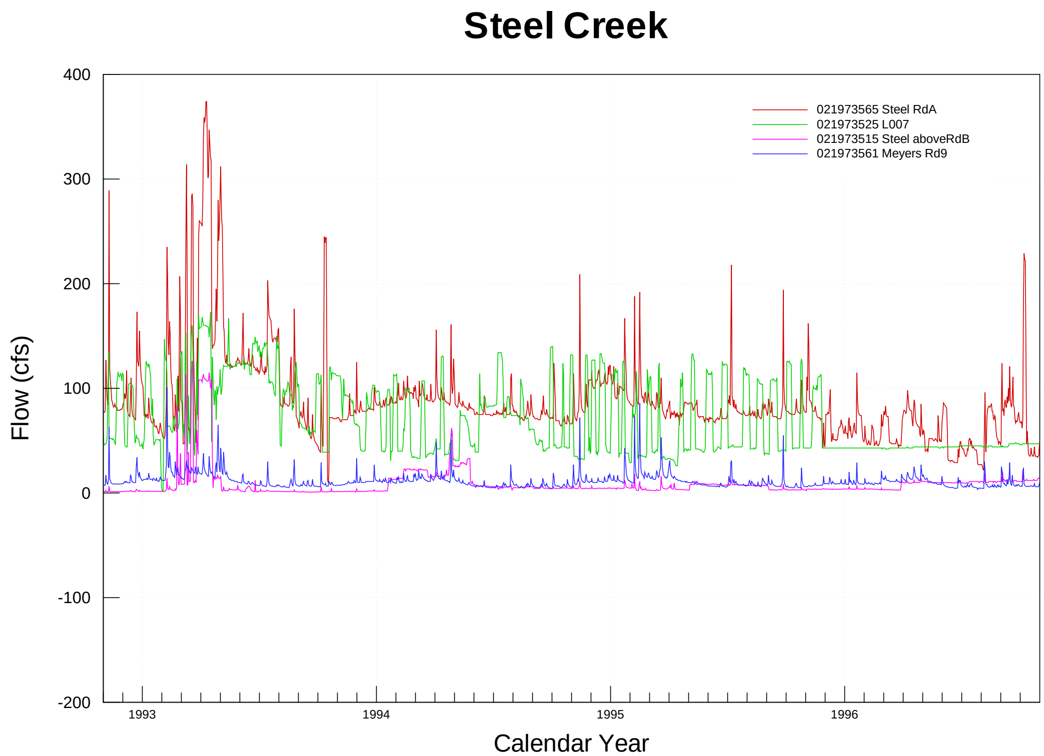

Meyers Branch
Cumulative
Cumulative smooth
Cumulative smth avg
Flow (cfs)
100
90
80
70
60
50
40
30
20
10
0
-10
1993
1994
1995
1996
Calendar Year

Figure E-7.


Steel Creek
021973565 Steel RdA
021973525 L007
021973515 Steel aboveRdB
021973561 Meyers Rd9
Flow (cfs)
400
300
200
100
0
-100
-200
1993
1994
1995
1996
Calendar Year

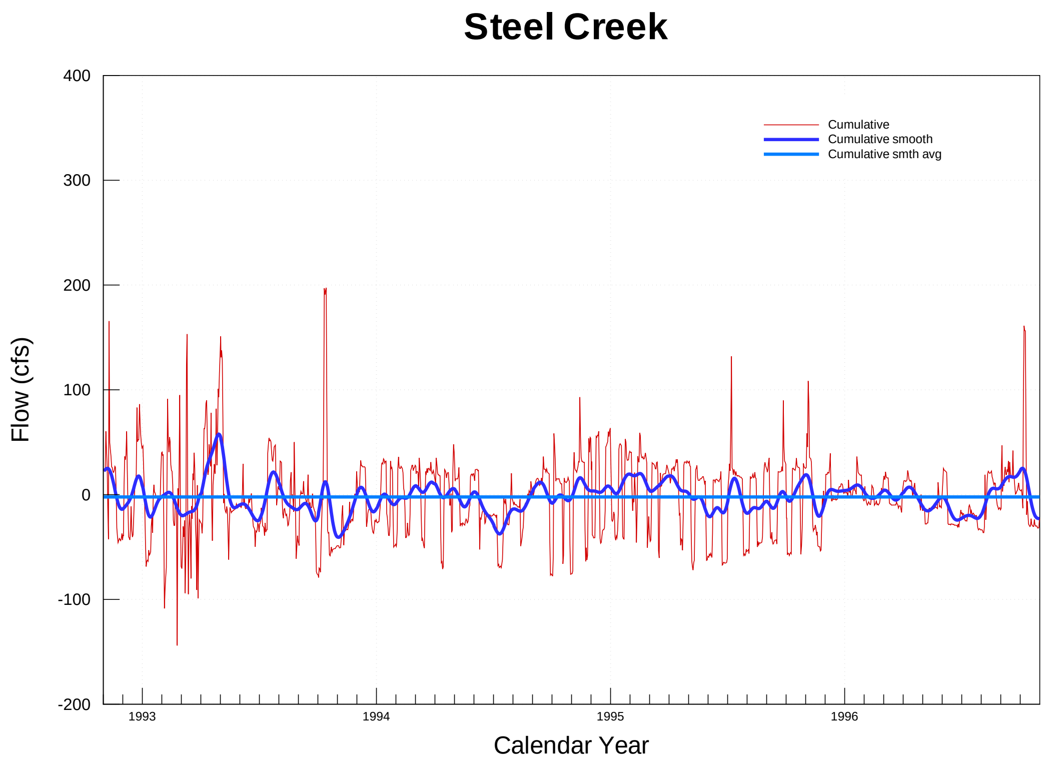
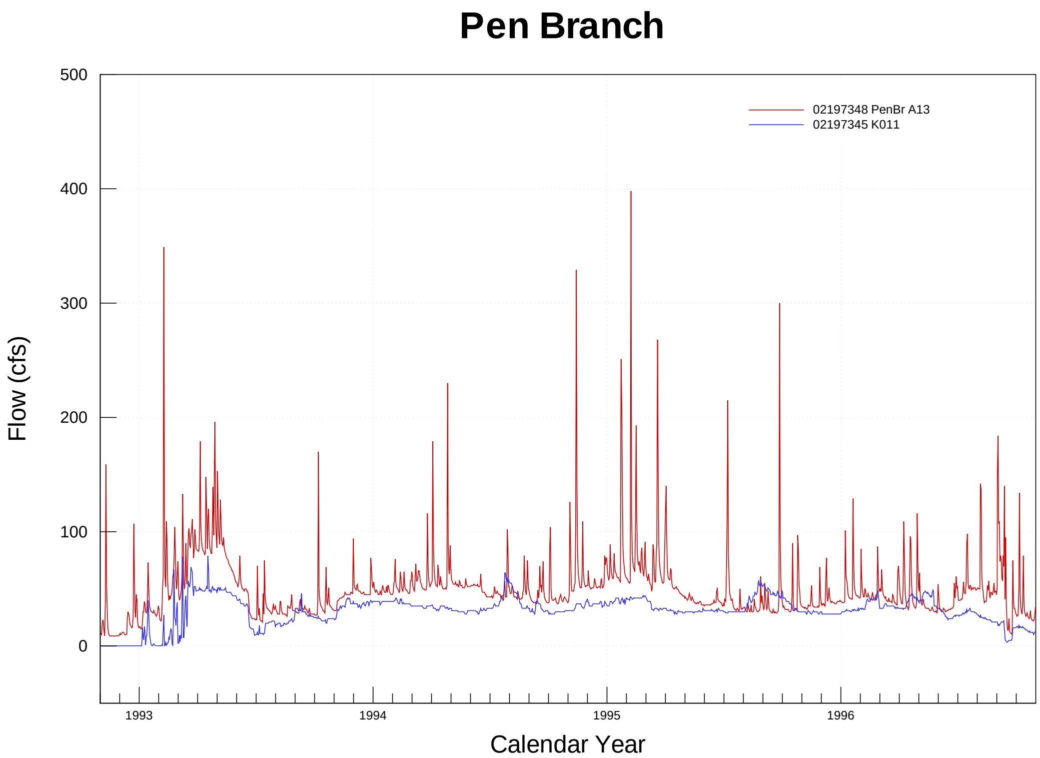

Steel Creek
Cumulative
Cumulative smooth
Cumulative smth avg
Flow (cfs)
400
300
200
100
0
-100
-200
1993
1994
1995
1996
Calendar Year

Figure E-8.


Pen Branch
Flow (cfs)
500
400
300
200
100
0
02197348 PenBr A13
02197345 K011
1993
1994
1995
1996
Calendar Year

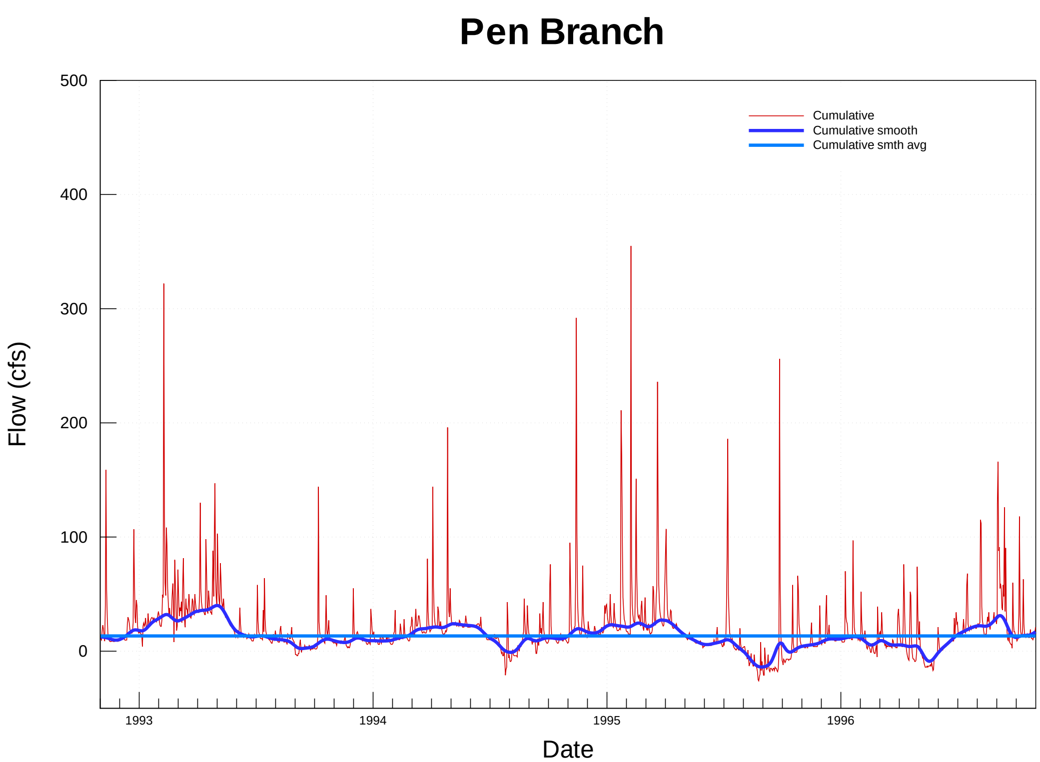
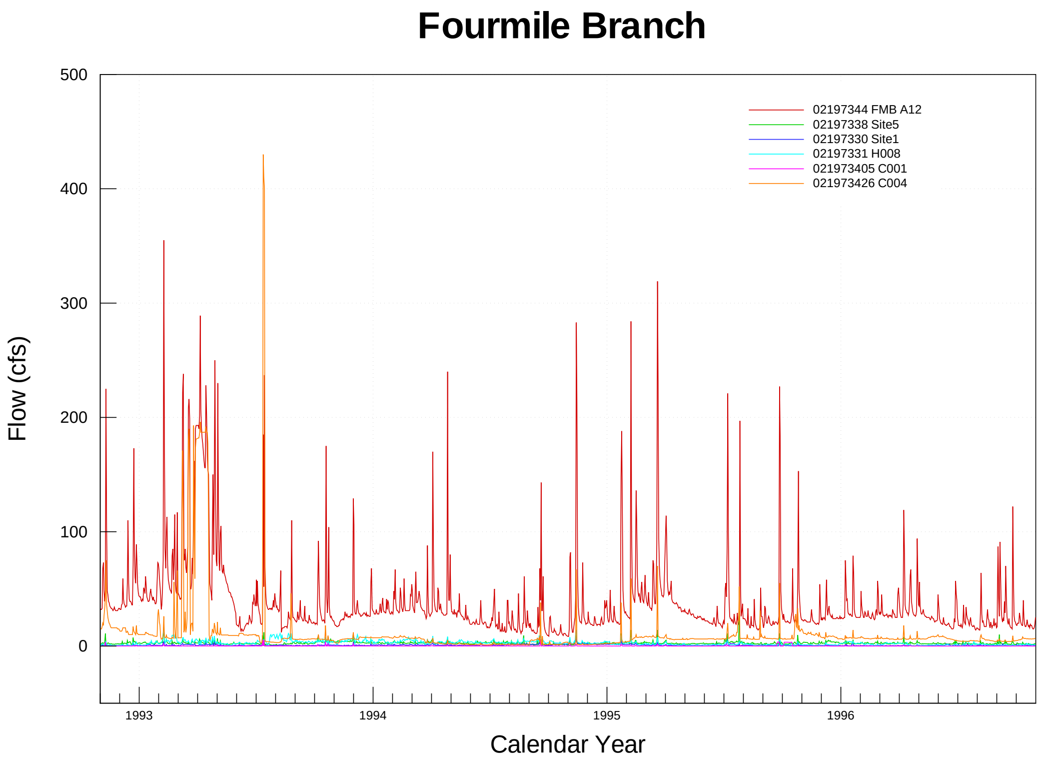

Pen Branch
Flow (cfs)
500
400
300
200
100
0
Cumulative
Cumulative smooth
Cumulative smth avg
1993
1994
1995
1996
Date

Figure E-9.


Fourmile Branch
02197344 FMB A12
02197338 Site5
02197330 Site1
02197331 H008
021973405 C001
021973426 C004
Flow (cfs)
500
400
300
200
100
0
1993
1994
1995
1996
Calendar Year

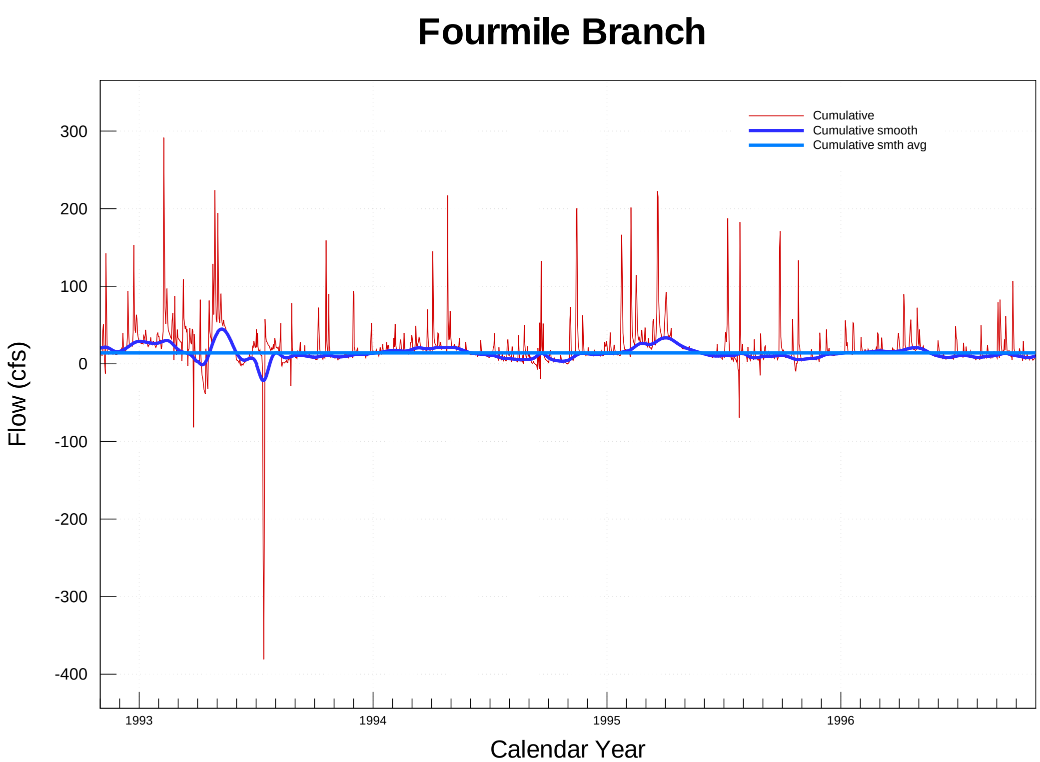
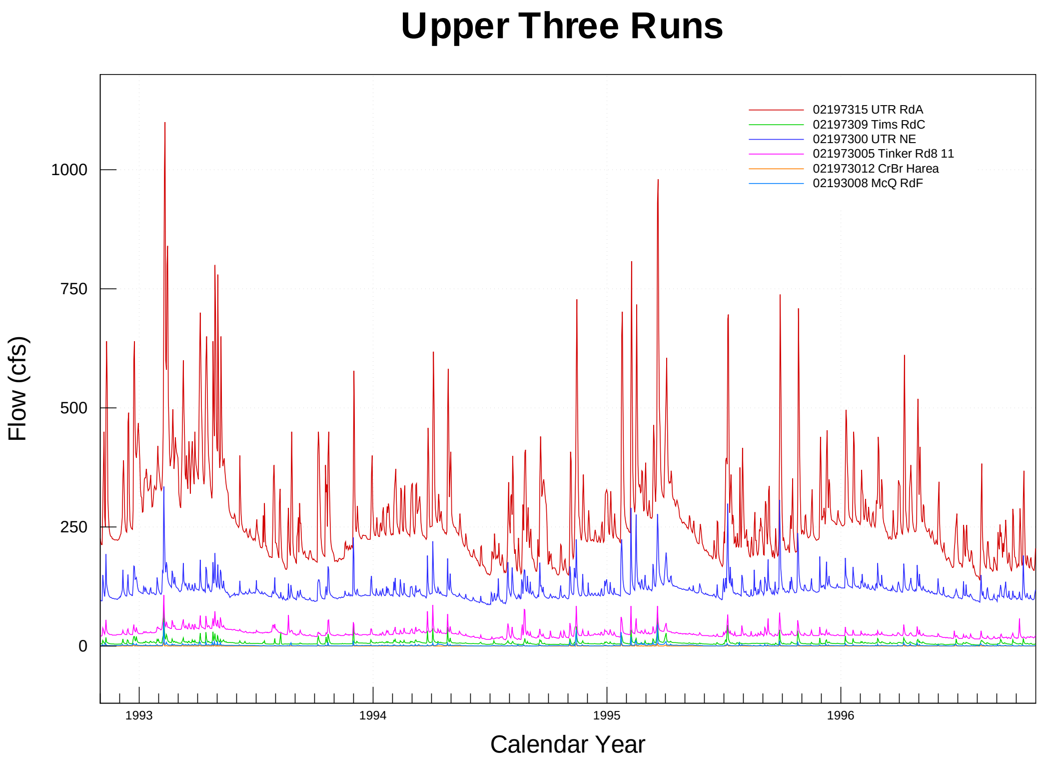

Fourmile Branch
Cumulative
Cumulative smooth
Cumulative smth avg
Flow (cfs)
300
200
100
0
-100
-200
-300
-400
1993
1994
1995
1996
Calendar Year

Figure E-10.


Upper Three Runs
02197315 UTR RdA
02197309 Tims RdC
02197300 UTR NE
021973005 Tinker Rd8 11
021973012 CrBr Harea
02193008 McQ RdF
Flow (cfs)
1000
750
500
250
0
1993
1994
1995
1996
Calendar Year

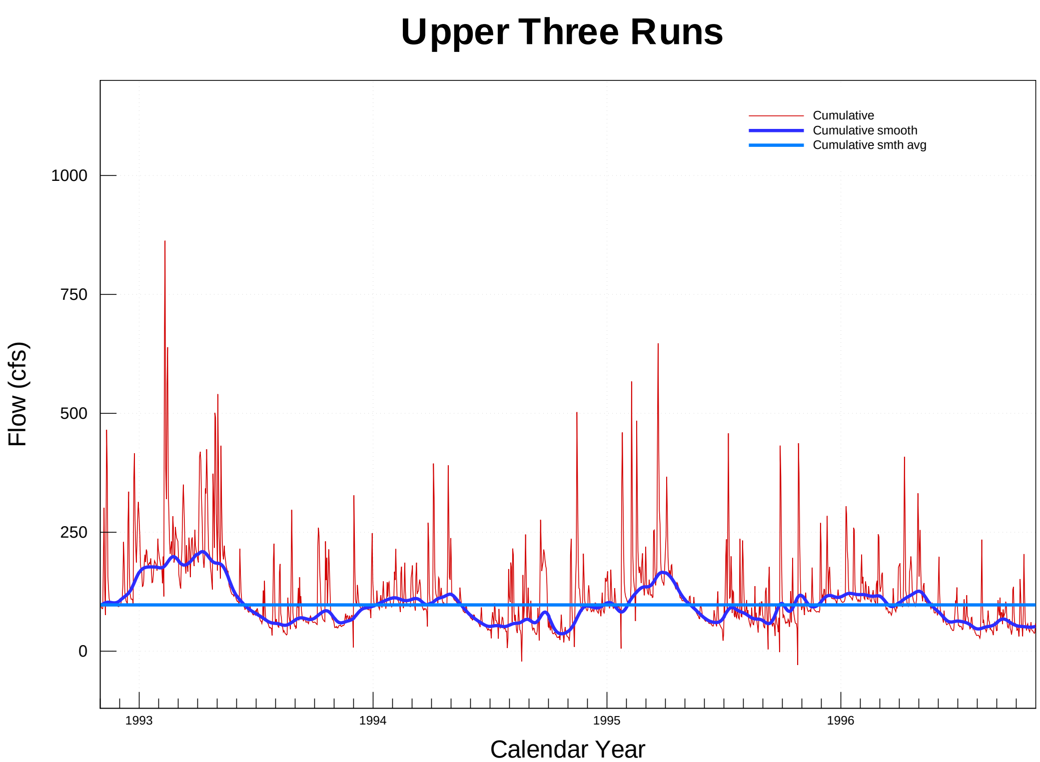
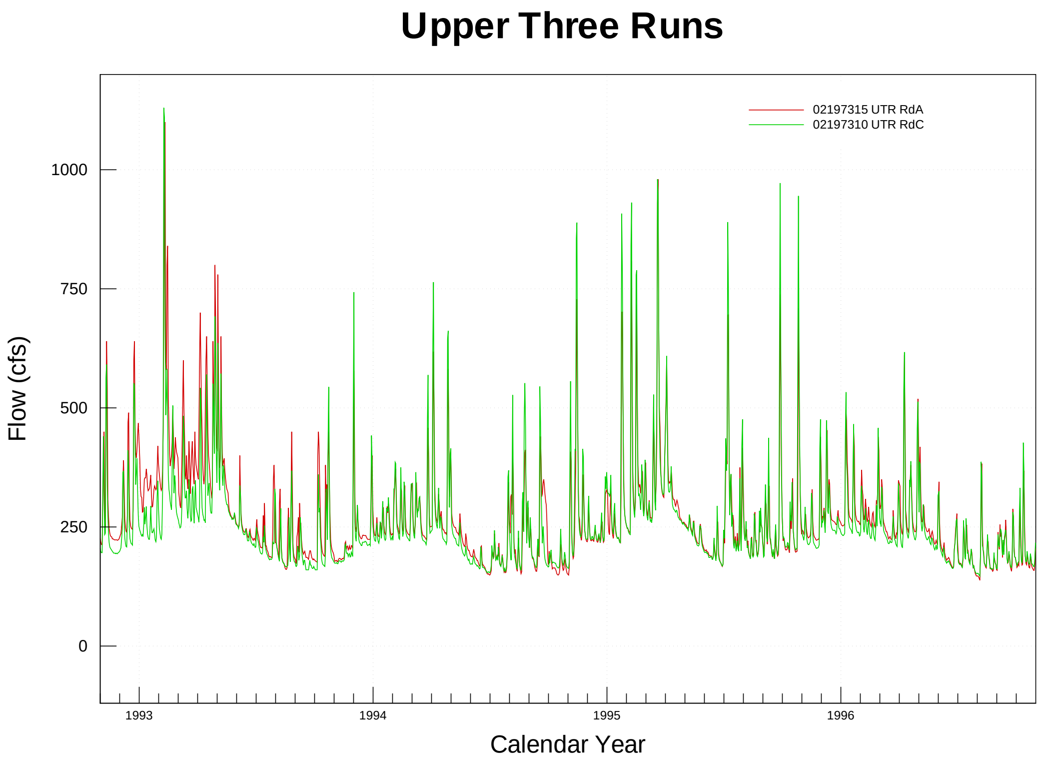

Upper Three Runs
Cumulative
Cumulative smooth
Cumulative smth avg
Flow (cfs)
1000
750
500
250
0
1993
1994
1995
1996
Calendar Year

Figure E-11.


Upper Three Runs
02197315 UTR RdA
02197310 UTR RdC
Flow (cfs)
1000
750
500
250
0
1993
1994
1995
1996
Calendar Year

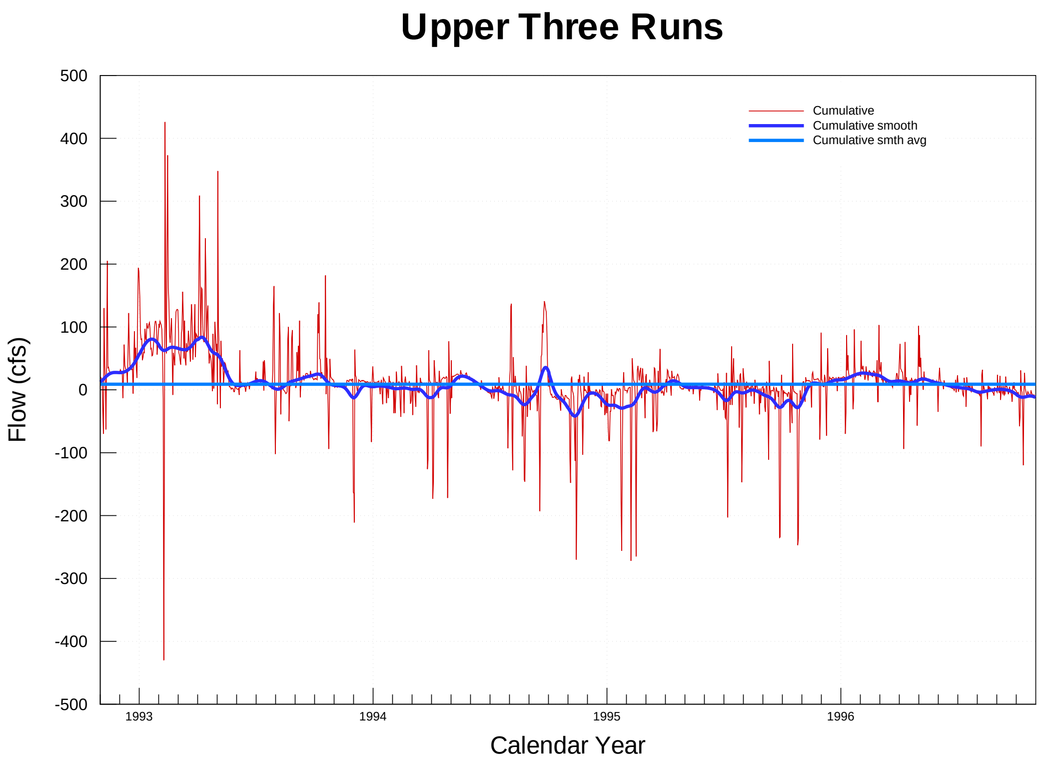

Upper Three Runs
Cumulative
Cumulative smooth
Cumulative smth avg
Flow (cfs)
500
400
300
200
100
0
-100
-200
-300
-400
-500
1993
1994
1995
1996
Calendar Year

Figure E-12.

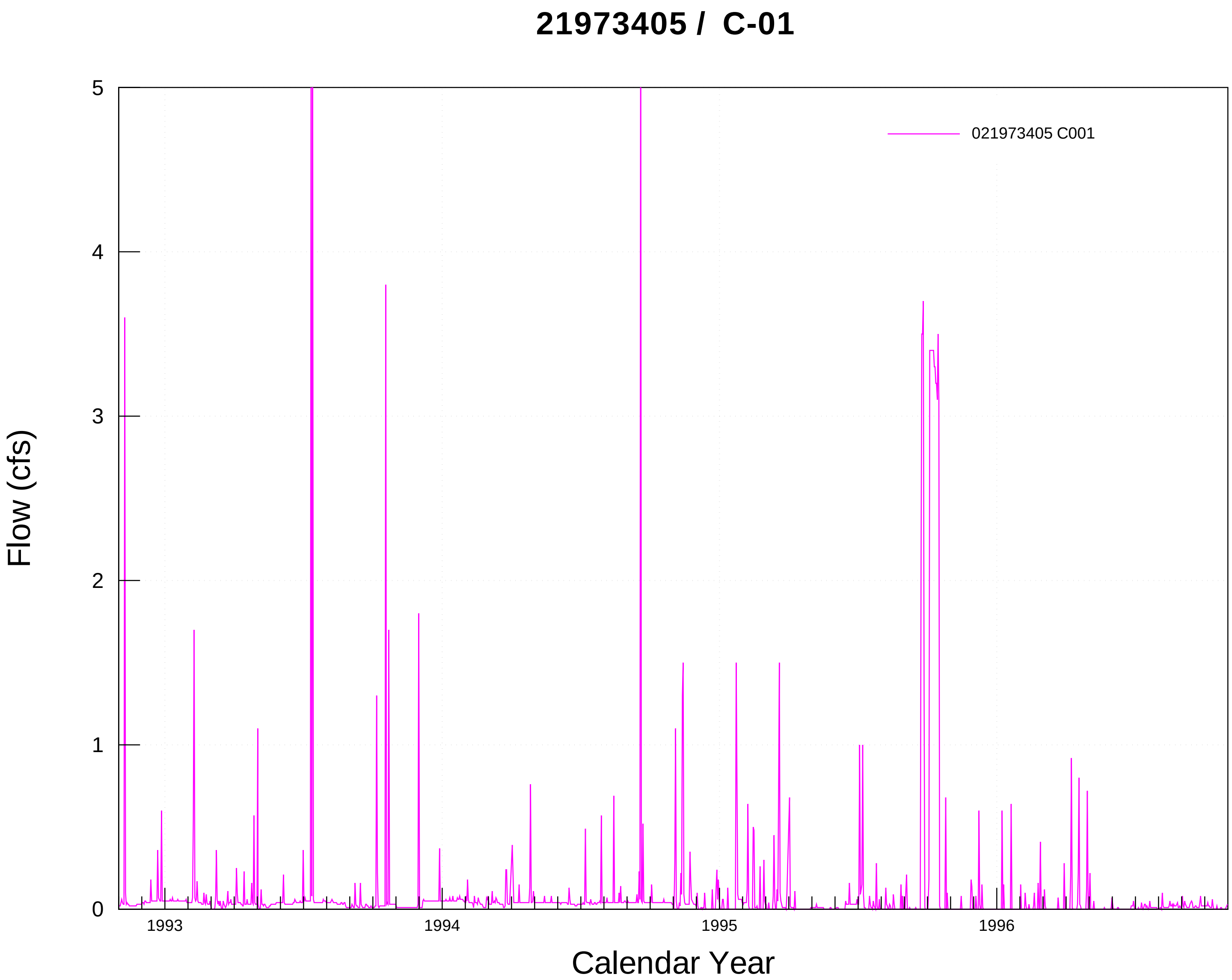

21973405 / C-01
021973405 C001
Flow (cfs)
0
1
2
3
4
5
1993
1994
1995
1996
Calendar Year

Figure E-13.

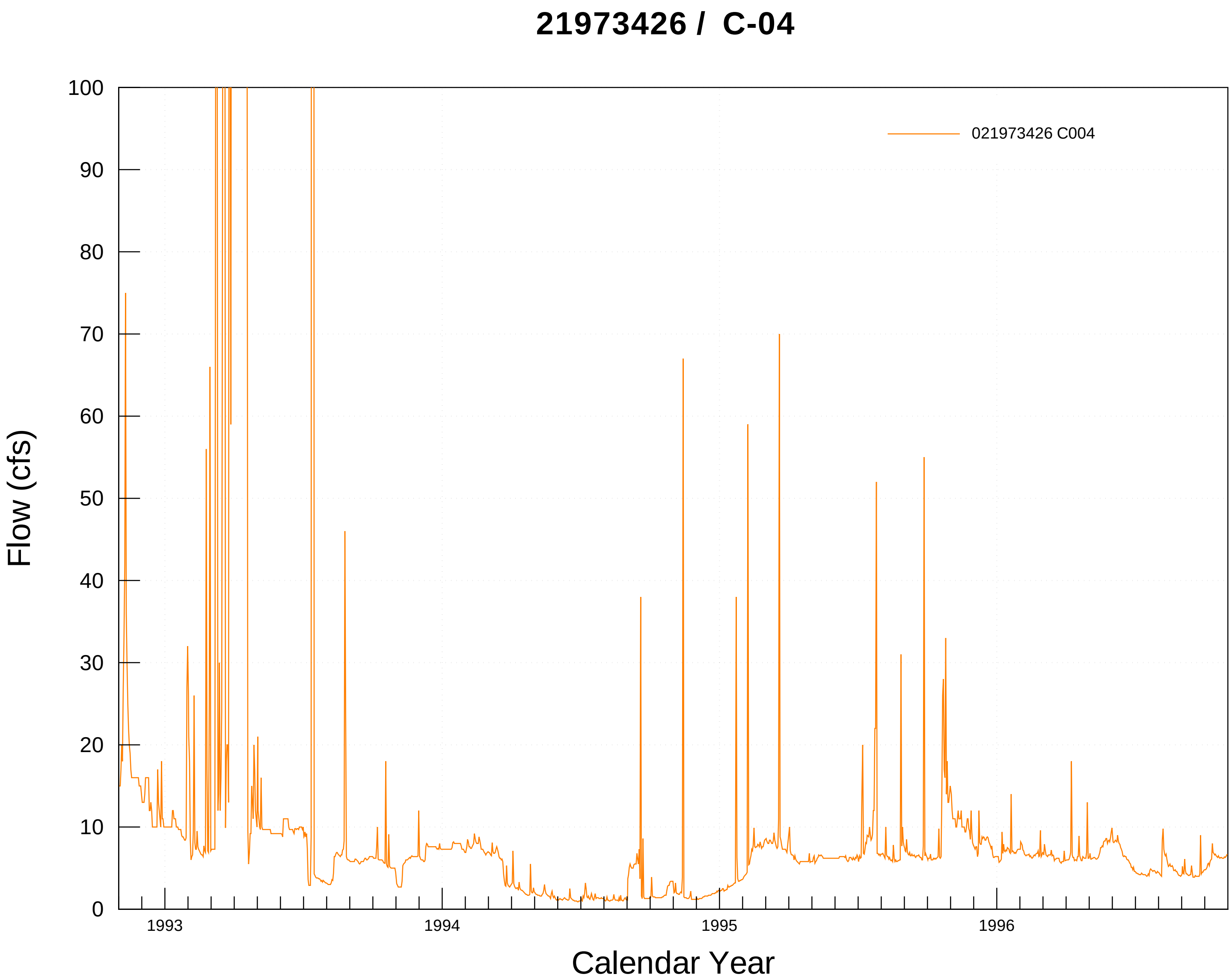

21973426 / C-04
Flow (cfs)
Calendar Year
021973426 C004
0
10
20
30
40
50
60
70
80
90
100
1993
1994
1995
1996

Figure E-14.

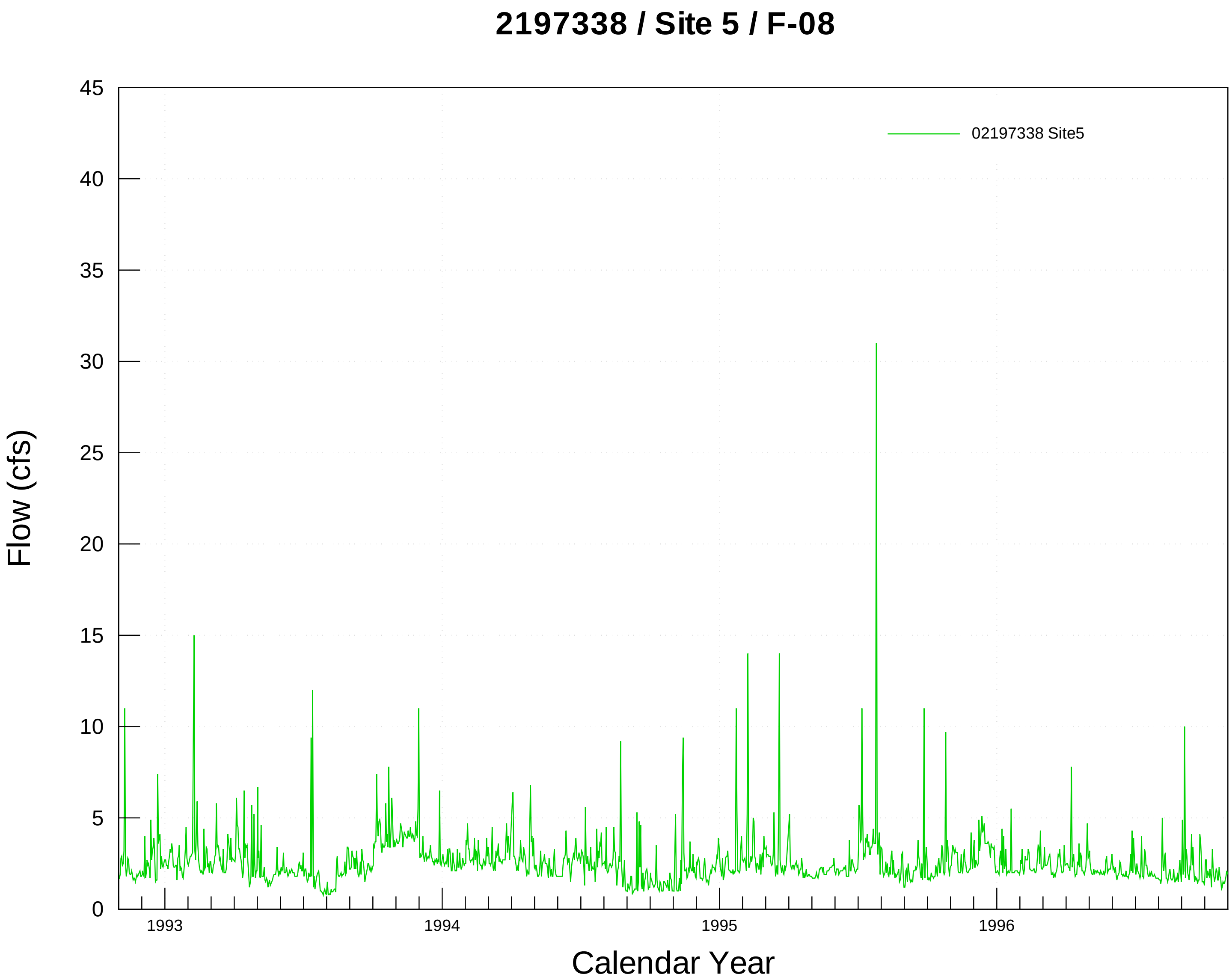

2197338 / Site 5 / F-08
02197338 Site5
Flow (cfs)
Calendar Year
0
5
10
15
20
25
30
35
40
45
1993
1994
1995
1996

Figure E-15.

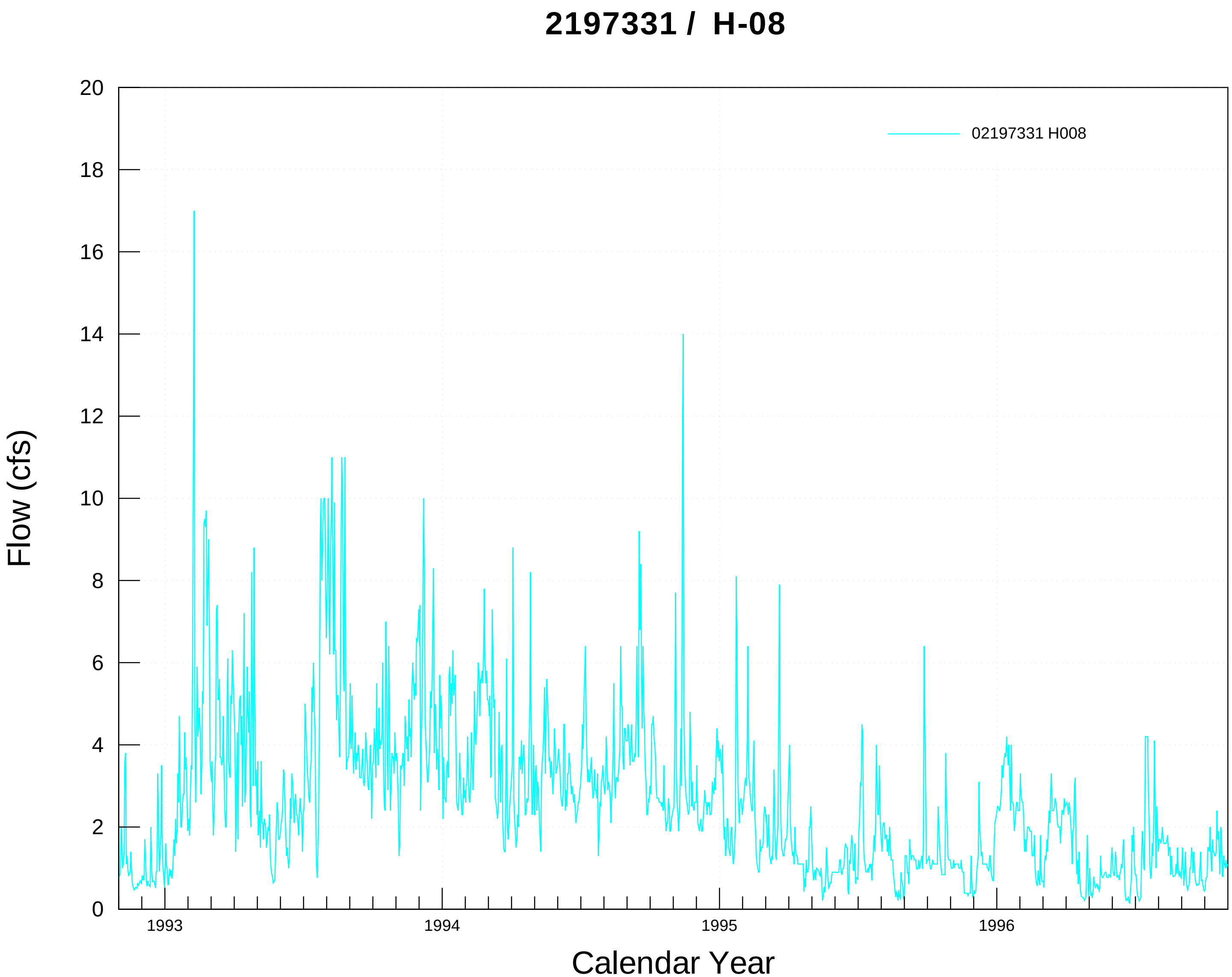

2197331 / H-08
02197331 H008
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
1993
1994
1995
1996
Calendar Year

Figure E-16.

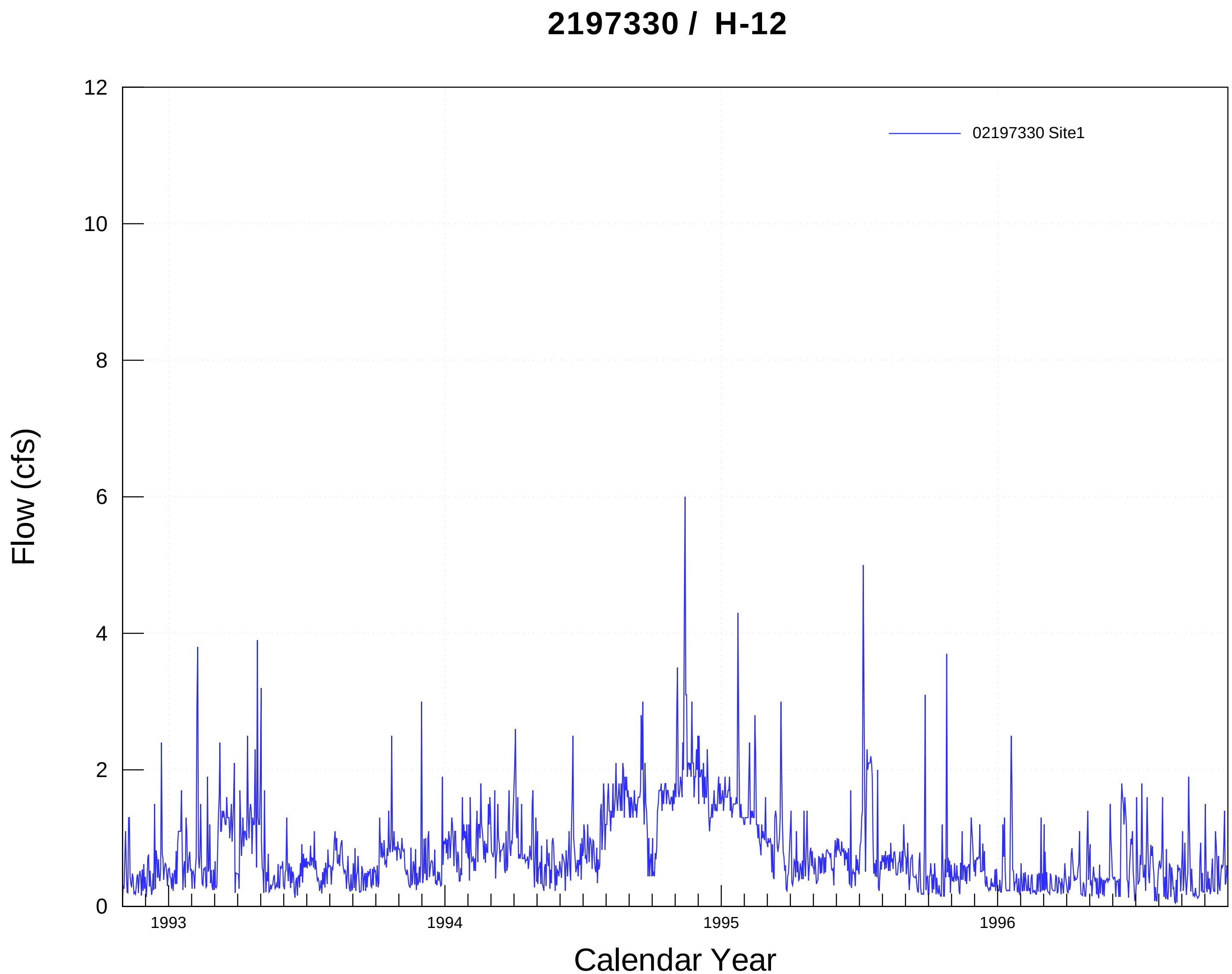

2197330 / H-12
02197330 Site1
Flow (cfs)
Calendar Year
0
2
4
6
8
10
12
1993
1994
1995
1996

Figure E-17.

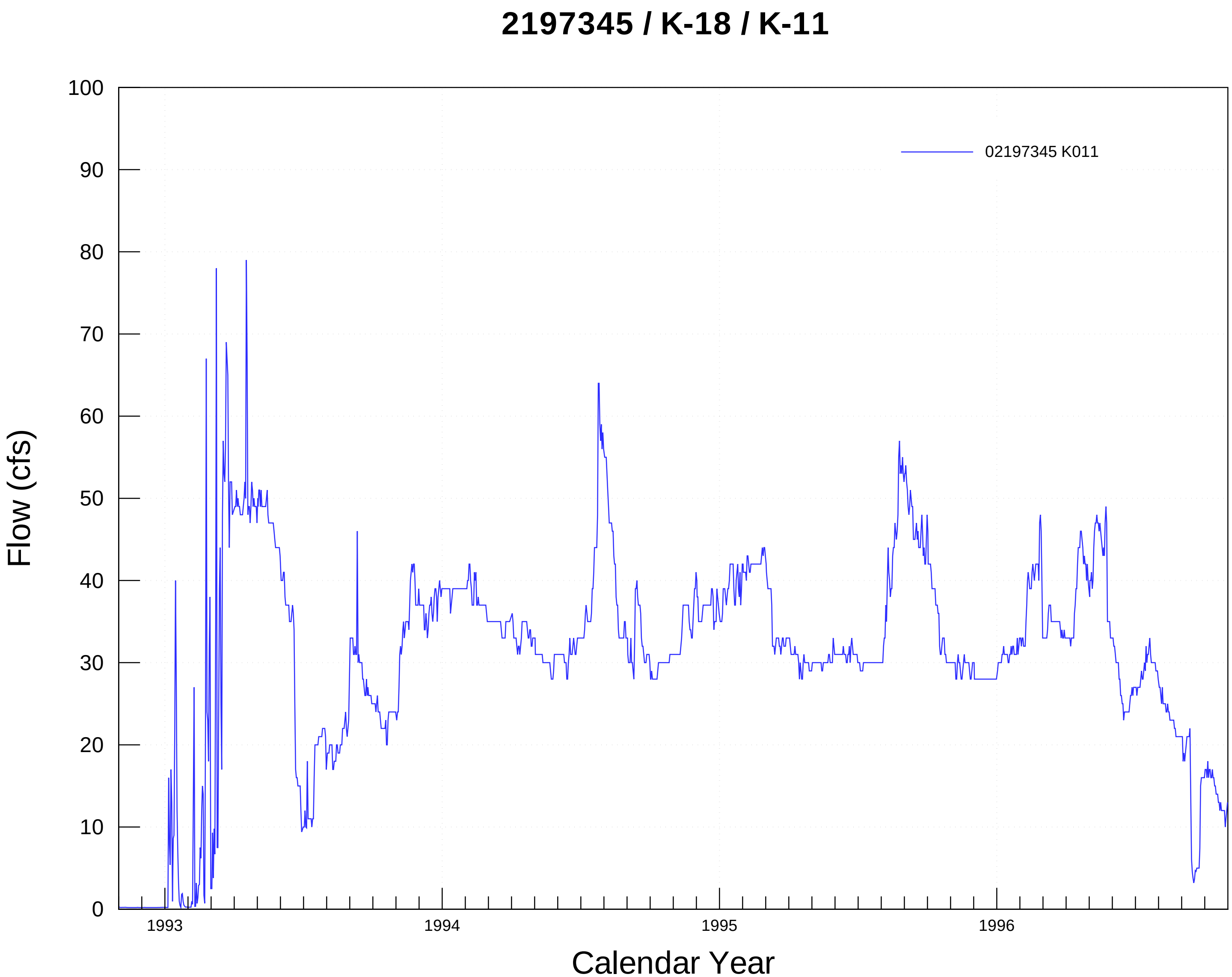

2197345 / K-18 / K-11
02197345 K011
Flow (cfs)
100
90
80
70
60
50
40
30
20
10
0
1993
1994
1995
1996
Calendar Year

Figure E-18.

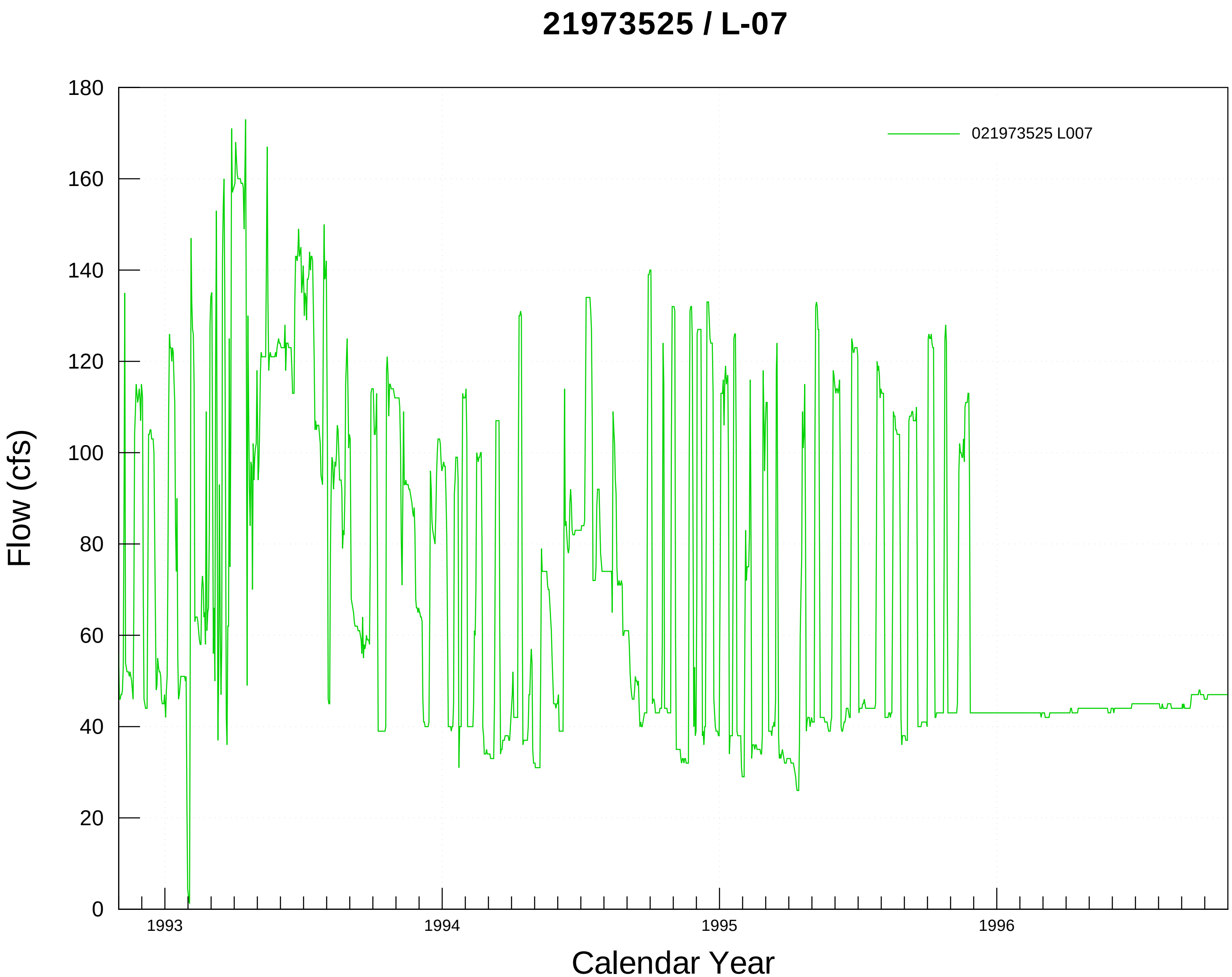

21973525 / L-07
021973525 L007
Flow (cfs)
0
20
40
60
80
100
120
140
160
180
1993
1994
1995
1996
Calendar Year

Figure E-19.

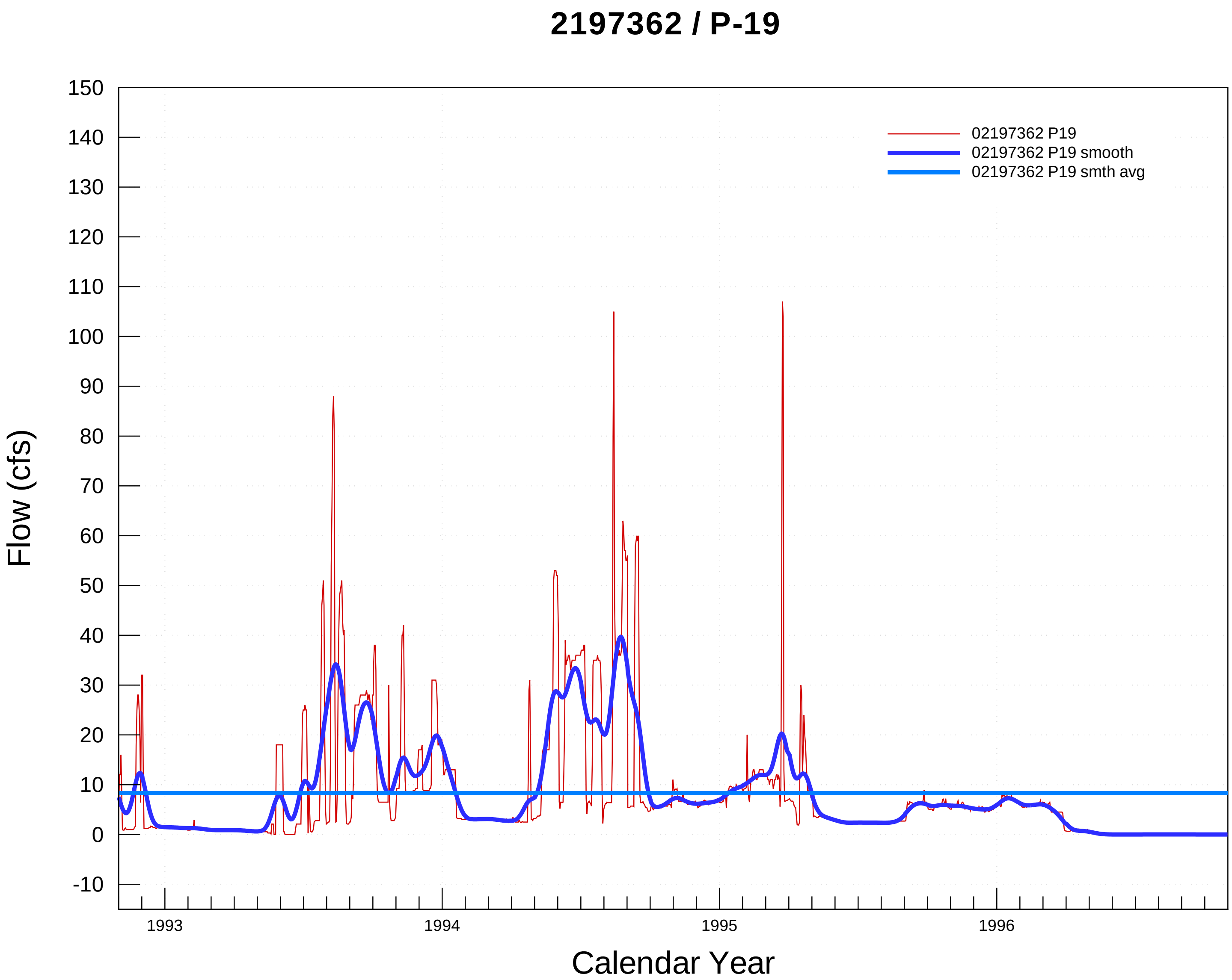

2197362 / P-19
02197362 P19
02197362 P19 smooth
02197362 P19 smth avg
Flow (cfs)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
1993
1994
1995
1996
Calendar Year

Figure E-20.

Table E-1. Base flow estimates based on hydrograph separation of USGS gauging station data

Stream reach	Estimated base flow (cfs)	Fraction of reach within CKLP model	Base flow target (cfs)	Estimated uncertainty
Meyers Branch (headwaters to Road 9)	9.5	1/3 ?	3.2 ?	±20-25%
Steel Creek (above Road B to Road A; includes L-Lake)	-2.2	1	-2.2	±40-45% or more
Pen Branch (headwaters to Road A13; includes Indian Grave Branch)	13.3	1	13.3	±15-20%
Fourmile Branch (headwaters to Road A12)	14.1	1	14.1	±15-20%
Upper Three Runs (Tims Branch at Road C/UTR near site boundary/Tinker Creek at Road 8-11 to UTR at Road A)	97	1/4 ??	24 ??	-
Upper Three Runs (Road C to Road A)	8.9	1/2	4.5	±35-40% or more

Table E-2. Sensitivity of base flow estimates to the assumed maximum rate of daily base flow increase.

Stream reach	**Estimated base flow for r = 1.025 (cfs)**	**Estimated base flow for r = 1.05 (cfs)**	**Estimated base flow for r = 1.10 (cfs)**
Meyers Branch (headwaters to Road 9)	9.2 (-3%)	9.5	9.8 (+3%)
Steel Creek (above Road B to Road A; includes L-Lake)	-2.2 (0%)	-2.2	-2.2 (0%)
Pen Branch (headwaters to Road A13; includes Indian Grave Branch)	12.3 (-8%)	13.3	14.3 (+8%)
Fourmile Branch (headwaters to Road A12)	13.0 (-8%)	14.1	15.1 (+7%)
Upper Three Runs (Tims Branch at Road C/UTR near site boundary/Tinker Creek at Road 8-11 to UTR at Road A)	91 (-6%)	97	104 (+7%)
Upper Three Runs (Road C to Road A)	7.7 (-13%)	8.9	10.1 (+13%)

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APPENDIX E-2. STREAM BASEFLOW MEASUREMENTS AT THE SAVANNAH RIVER SITE

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APPENDIX E-2. STREAM BASEFLOW MEASUREMENTS AT THE SAVANNAH RIVER SITE

A program was initiated in the mid 1990's to acquire information on the extent of perennial streams on the SRS and in a band approximately 5 miles wide surrounding the SRS on the South Carolina side of the Savannah River. The purpose of the program was to determine the full extent of flowing stream reaches in their headwater areas and obtain numerous measurements of flow rates along individual SRS streams at times that reflected baseflow conditions.

Acquisition of baseflow measurements in SRS streams began in the fall of 1997 and has continued as necessary for calibration of regional groundwater flow models. Baseflow measurement acquisition is listed below, by stream reach.

STREAM REACH	MEASUREMENT PERIOD
Upper Pen Branch	September 1997
Mill Creek	December 1997
Indian Grave Branch	December 1997
R-Canal Turnout Drainageway	February 1998
Meyers Branch	February 1998 and April 1998
Four Mile Branch and tributaries near C-Reactor	December 1998

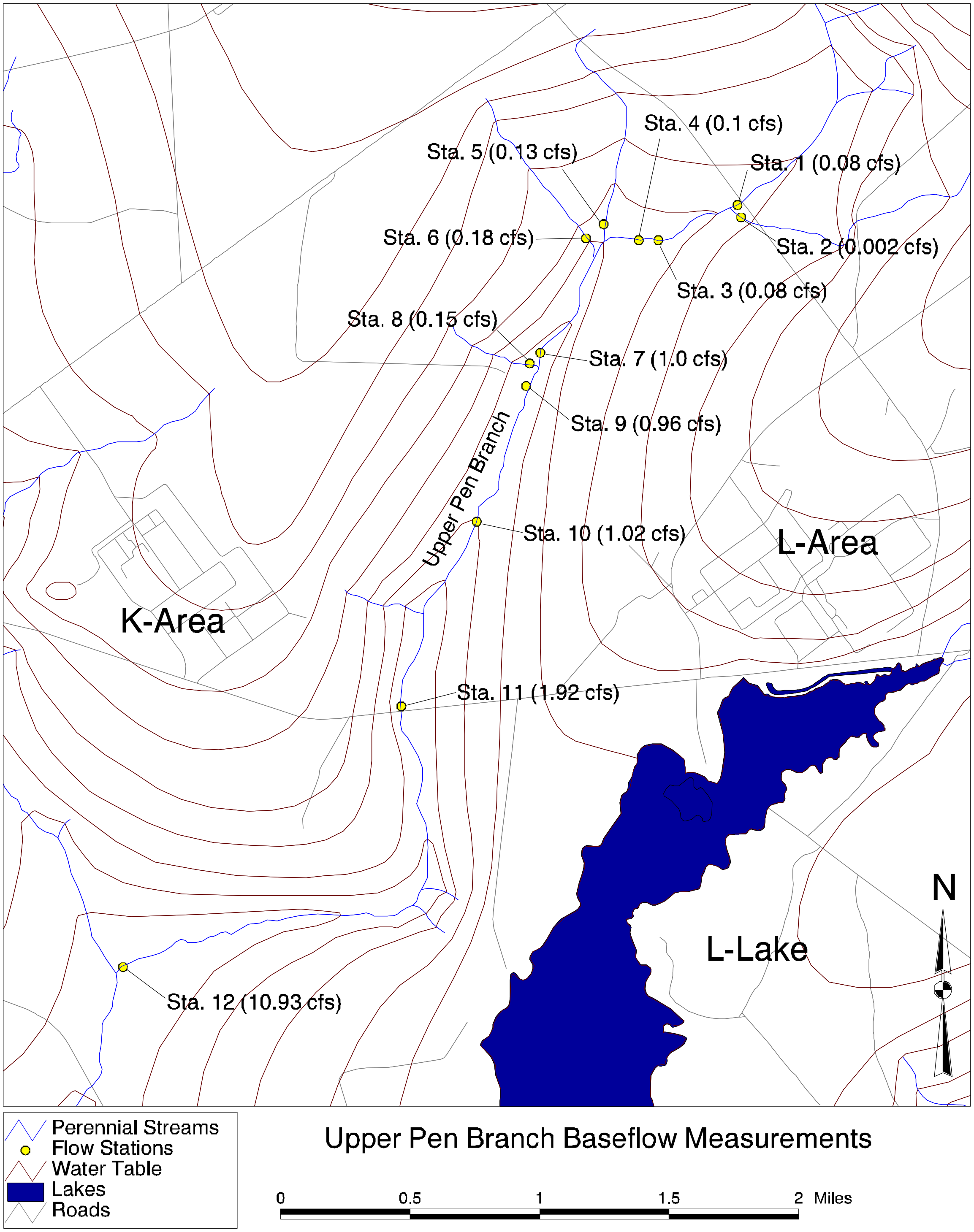
It was assumed that baseflow conditions are reached relatively quickly following rainfall events, after approximately 8-10 days without rainfall following a significant rainfall event. Examination of SRS stream hydrographs tends to support this assumption. Most of the measurements, however, were obtained after much longer periods without rainfall.

Two types of instruments were used depending on the magnitude of flow at a selected station. A cutthroat flume for stream reaches with flow rates less than 0.02 to 0.15 cubic feet/second (cfs). An instream flow velocity indicator (Marsh-McBirney Portable Water Flow Meter Model 201) was utilized to acquire stream flow rates greater than approximately 0.15 cfs. The following procedures contained in WSRC-L-14.1 Rev. 43 were utilized to operate the Marsh McBirney Flow Meter and to perform the stream flow rate measurements: EESOP-2-102, Stream Velocity and Discharge Measurements and EESOP-2-103, Marsh-McBirney Portable Current Meter Operation and Maintenance. There is no formal SRS procedure for the use of the cutthroat flume, however the manufacturer's guidelines were utilized to obtain these measurements.

The strategy was to start at the headwaters of a stream and obtain measurements at different stations while working in the downstream direction. If possible, measurements were obtained just upstream of the point of entry of significant tributary branches. Measurements were also obtained on the tributaries themselves so that their relative contribution could be quantified.

All measurements along a single stream reach were obtained within a short a period of time, generally over a period of 1 to 2 days, to minimize the possibility that baseflow conditions might be impacted by rainfall events. In the case of Meyers Branch, where measurements were obtained on different days separated by a two-month period, one measurement station was re-measured on the second measurement date to provide a means to compare measurements obtained on the two days.

For each of the streams a map is presented illustrating its perennial reaches and the perennial reaches of its primary tributaries. Also shown are the ground water basin boundaries associated with each stream reach, the position of measurement stations along the stream reaches and a posting of the baseflow measurement at each station. Data used to calculate baseflow of each station is provided on the pages following each illustration.


Sta. 4 (0.1 cfs)
Sta. 5 (0.13 cfs)
Sta. 1 (0.08 cfs)
Sta. 6 (0.18 cfs)
Sta. 2 (0.002 cfs)
Sta. 3 (0.08 cfs)
Sta. 8 (0.15 cfs)
Sta. 7 (1.0 cfs)
Sta. 9 (0.96 cfs)
Upper Pen Branch
Sta. 10 (1.02 cfs)
L-Area
K-Area
Sta. 11 (1.92 cfs)
N
L-Lake
Sta. 12 (10.93 cfs)
Perennial Streams
Flow Stations
Water Table
Lakes
Roads
Upper Pen Branch Baseflow Measurements
0
0.5
1
1.5
2 Miles

UPPER PEN BRANCH BASEFLOW

Station 1 Just downstream from Road C, Near confluence of easternmost two headwater tributaries

Approx UTM Coord. 441732E, 3676976N

(10/14/97)

Flume Measurement 4" throat width, fluid height=0.2', Q=0.082cfs or 37.3gpm

Station 2 Just downstream from Road C, Near confluence of easternmost two headwater tributaries

Approx UTM Coord. 441740E, 3676937N

(10/14/97)

Flume Measurement, 4" throat width, fluid height=0.03', Q=0.0019cfs or 0.84gpm

Station 3 Just downstream from powerline road, approximately 150 ft.

Approx UTM coordinates 441114E, 3676771N

(10/14/97)

Flume Measurement; 4" throat width, height=0.192, Q=0.078cfs or 35gpm

Station 4 Just downstream from powerline road, approximately 200 ft.

Approx UTM coordinates 441044E, 36767791N

(10/14/97)

Flume Measurement; 4" throat width, height=0.22, Q=0.101cfs or 45.1gpm

Station 5 On central headwater tributary of Pen Branch, just upstream of confluence with the headwater branch containing the eastern two headwater tributaries.

Approx UTM coordinates 440930E, 36768281N

(10/14/97)

Flume Measurement; 4" throat width, height=0.25, Q=0.13cfs or 58.3gpm

Station 6 On westernmost headwater tributary of Pen Branch, just upstream from confluence with the main branch (containing the three easternmost headwater tributaries.)
Approx UTM coordinates 440850E, 36767511N

(10/14/97)

Flume Measurement; 4" throat width, height=0.29, Q=0.175cfs or 78.4gpm

Station 7 On main segment Pen Branch, approx 780 ft downstream from Sta. 6
Approx UTM coordinates 440523E, 36760281N

(10/15/97)

Flume Measurement; 4" throat width, height=0.3
8, Q=0.3cfs or 135gpm

Flowmeter Measurement

Segment	depth(cm)	depth(ft)	Width(ft)	velocity(ft/sec)	Q (cfs)
1	8	0.26	1	0.96	0.25
2	10	0.33	1	0.96	0.31
3	9	0.30	1	0.69	0.20
4	9	0.30	1	0.79	0.23
				Tot Flow =	1.00

Station 8 On lateral tributary to main branch of Pen Branch, close to sta. 7.
Approx UTM coordinates 440487E, 36759941N

(10/15/97)

Flume Measurement; 4" throat width, height=0.29, Q=0.175cfs or 78.4gpm

Station 9 On main fork of Pen Branch, close to stations 7 and 8, downstream of their confluence

Approx UTM coordinates 440479E, 36758991N

(10/15/97)

Flowmeter Measurement

Segment	depth(cm)	depth(ft)	width(ft)	velocity(ft/sec)	Q (cfs)
1	9	0.30	1	0.08	0.02
2	10	0.33	1	0.31	0.10
3	13	0.43	1	0.52	0.22
4	12	0.39	1	0.39	0.15
5	12	0.39	1	0.5	0.20
6	13	0.43	1	0.52	0.22
7	12	0.39	1	0.21	0.08
8	9	0.30	1	-0.13	-0.04
				Tot Flow =	0.96

Station 10 On Pen Branch at Road 6.2, approximately 100 ft downstream from bridge.

Approx UTM coordinates 440122E, 3674981N

(10/15/97)

Flowmeter Measurement

Tape msmt	Segment	depth(cm)	depth(ft)	width(ft)	Velocity (ft/sec)	Q (cfs)
1.5	1	8	0.26	1	0.22	0.06
2.5	2	10	0.33	1	0.2	0.07
3.5	3	9	0.30	1	0.49	0.14
4.5	4	10	0.33	1	0.55	0.18
5.5	5	8	0.26	1	0.63	0.17
6.5	6	10	0.33	1	0.52	0.17
7.5	7	7	0.23	1	0.41	0.09
8.5	8	7	0.23	1	0.32	0.07
9.5	9	8	0.26	1	0.21	0.06
10.5	10	6	0.20	1	0.06	0.01
					Tot Flow =	1.02

Station 11 On Pen Branch at B Road, approximately 75 ft upstream from bridge.

Approx UTM coordinates 439666E, 3673894N

(10/15/97)

Flowmeter Measurement

Tape msmt	Segment	depth(cm)	depth(ft)	width(ft)	velocity(ft/sec)	Q (cfs)
1.5	1	9	0.30	1	0.11	0.03
2.5	2	15	0.49	1	0.26	0.13
3.5	3	14	0.46	1	0.28	0.13
4.5	4	14	0.46	1	0.84	0.39
5.5	5	10	0.33	1	0.87	0.29
6.5	6	10	0.33	1	0.9	0.30
7.5	7	10	0.33	1	0.99	0.32
8.5	8	10	0.33	1	0.82	0.27
9.5	9	9	0.30	1	0.18	0.05
10.5	10	6	0.20	1	0.07	0.01
					Tot Flow =	1.92

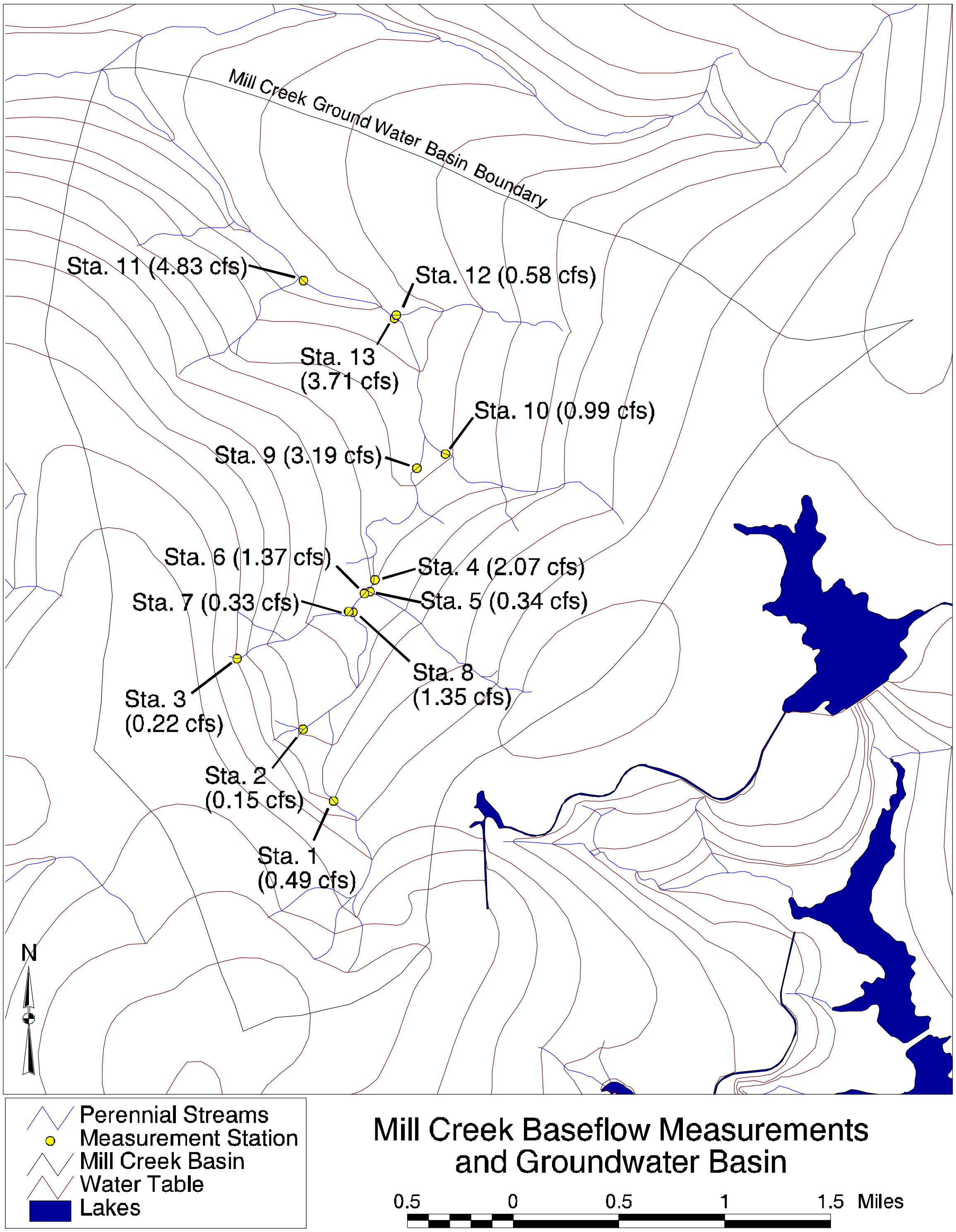
Station 12 On Pen Branch just upstream from confluence with Indian Grave Branch

Approx UTM coordinates 437922E, 3672243N

12/18/97

Flowmeter Measurements

Segment	Tape	depth(cm)	depth(ft)	width(ft)	velocity (ft/sec)	corr. velocity (ft/sec)	Q (cfs)
1	0.5	24	0.79	1	-0.05	0	0.00
2	1.5	26	0.85	1	0.22	0.27	0.23
3	2.5	39	1.28	1	0.9	0.95	1.22
4	3.5	35	1.15	1	0.8	0.85	0.98
5	4.5	33	1.08	1	0.91	0.96	1.04
6	5.5	29	0.95	1	0.88	0.93	0.88
7	6.5	27	0.89	1	0.94	0.99	0.88
8	7.5	26	0.85	1	0.98	1.03	0.88
9	8.5	27	0.89	1	0.87	0.92	0.82
10	9.5	26	0.85	1	0.97	1.02	0.87
11	10.5	26	0.85	1	0.79	0.84	0.72
12	11.5	24	0.79	1	0.59	0.64	0.50
13	12.5	25	0.82	1	0.48	0.53	0.43
14	13.5	30	0.98	1	0.62	0.67	0.66
15	14.5	26	0.85	1	0.66	0.71	0.61
16	15.5	16	0.52	1	0.38	0.43	0.23
						Tot Flow =	10.93



Mill Creek Baseflow Measurements and Groundwater Basin

MILL CREEK BASEFLOW

Station 1 Mill Creek where Woodward Rd. crosses, upstream side of road.

Approximate UTM Coordinates:
445115E, 3682835N

(12/4/97)

Flume Measurement: 8" throat, fluid height=0.5 ft., Q=1.06cfs or 475gmp

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	9	0.30	0.01	0.06	0.018
2	1.5	1	12	0.39	0.03	0.08	0.031
3	2.5	1	16	0.52	0.18	0.23	0.121
4	3.5	1	18	0.59	0.40	0.45	0.266
5	4.5	1	11	0.36	0.11	0.16	0.058

Station 2 Along Monroe-Owens Rd. First tributary north of main channel of Mill Creek.

Approximate UTM Coordinates: 444846E, 3683390N

(12/4/97)

Flume Measurement: 8" throat, fluid height=0.19 ft., Q=0.152cfs or 69gmp

Station 3 Along Monroe-Owens Rd. Second tributary north of main channel of Mill Creek.

Approximate UTM Coordinates: 444344E, 3683928N

(12/4/97)

Flume Measurement: 8" throat, fluid height=0.23 ft., Q=0.22cfs or 101gmp

Station 4 Main branch of Mill Creek, downstream of first major tributary entering from south.

Approximate UTM Coordinates: 445355E, 3684472N

(12/4/97)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	14	0.46	0.16	0.21	0.096
2	1.5	1	15	0.49	0.35	0.40	0.197
3	2.5	1	14	0.46	0.26	0.31	0.142
4	3.5	1	24	0.79	0.34	0.39	0.307
5	4.5	1	22	0.72	0.24	0.29	0.209
6	5.5	1	25	0.82	0.36	0.41	0.336
7	6.5	1	30	0.98	0.40	0.45	0.443
8	7.5	1	26	0.85	0.22	0.27	0.230
9	8.5	1	25	0.82	0.07	0.12	0.098
10	9.25	0.5	20	0.66	-0.02	0.03	0.010
						Tot. flow=	2.07

Station 5 Tributary to Mill Creek, entering from south, just upstream of confluence with Mill Ck.

Approximate UTM Coordinates:
445348E, 3684437N

(12/4/97)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	4	0.13	0.06	0.11	0.014
2	1.5	1	10	0.33	0.15	0.20	0.066
3	2.5	1	17	0.56	0.37	0.42	0.234
4	3.5	1	8	0.26	0.04	0.09	0.024
						Tot. flow=	0.34

Station 6 Main branch of Mill Creek, upstream of first major tributary entering from south.

Approximate UTM Coordinates:
445318E, 3684317N

(12/4/97)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	9	0.30	0.38	0.43	0.127
2	1.5	1	20	0.66	0.10	0.15	0.098
3	2.5	1	20	0.66	0.51	0.56	0.367
4	3.5	1	20	0.66	0.79	0.84	0.551
5	4.5	1	15	0.49	0.05	0.10	0.049
6	5.5	1	17	0.56	0.04	0.09	0.050
7	6.5	1	10	0.33	0.35	0.40	0.131
						Tot. flow=	1.37

Station 7 Northernmost trib. to Mill Ck that crosses powerline road, just above entry into Mill Ck.

Approximate UTM Coordinates:
445200E, 3684304N

(12/4/97)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	24	0.79	0.37	0.42	0.331
						Tot. flow=	0.33

Station 8 Main branch of Mill Creek, upstream of confluence with northernmost powerline tirbutary

Approximate UTM Coordinates:
445216E, 3684298N

(12/4/97)

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	12	0.39	0.04	0.09	0.035
2	1.5	1	13	0.43	0.26	0.31	0.132
3	2.5	1	13	0.43	0.38	0.43	0.183
4	3.5	1	14	0.46	0.44	0.49	0.225
5	4.5	1	18	0.59	0.48	0.53	0.313
6	5.5	1	20	0.66	0.35	0.40	0.262
7	6.5	1	20	0.66	0.25	0.30	0.197
						Tot. flow=	1.35

Station 9 Main branch of Mill Creek, upstream of confluence with 2'nd major trib. from south

Approximate UTM Coordinates:
445744E, 3685452N

(12/4/97)

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	22	0.72	0.02	0.07	0.051
2	1.5	1	30	0.98	0.06	0.11	0.108
3	2.5	1	40	1.31	0.04	0.09	0.118
4	3.5	1	50	1.64	0.12	0.17	0.279
5	4.5	1	48	1.57	0.16	0.21	0.331
6	5.5	1	48	1.57	0.20	0.25	0.394
7	6.5	1	45	1.48	0.22	0.27	0.399
8	7.5	1	43	1.41	0.20	0.25	0.353
9	8.5	1	48	1.57	0.13	0.18	0.283
10	9.5	1	48	1.57	0.11	0.16	0.252
11	10.5	1	56	1.84	0.07	0.12	0.220
12	11.5	1	54	1.77	0.10	0.15	0.266
13	12.5	1	46	1.51	0.04	0.09	0.136
						Tot. flow=	3.19

Station 10 2'nd major tributary to Mill Ck. from south, just upstream from confluence.

Approximate UTM Coordinates:
445899E, 3685493N

(12/4/97)

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	6	0.20	0.24	0.29	0.057
2	1.5	1	6	0.20	0.58	0.63	0.124
3	2.5	1	5	0.16	0.61	0.66	0.108
4	3.5	1	6	0.20	0.78	0.83	0.163
5	4.5	1	7	0.23	0.64	0.69	0.158
6	5.5	1	7	0.23	0.65	0.70	0.161
7	6.5	1	8	0.26	0.55	0.60	0.157
8	7.5	1	8	0.26	0.17	0.22	0.058
						Tot. flow=	0.99

Station 11 Main branch of Mill Creek, at USGS station site where "buried cable road" crosses.

Approximate UTM Coordinates:
444821E, 3686806N

(12/8/97)

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	19	0.62	0.04	0.09	0.056
2	1.5	1	22	0.72	0.43	0.48	0.346
3	2.5	1	22	0.72	0.54	0.59	0.426
4	3.5	1	22	0.72	0.58	0.63	0.455
5	4.5	1	22	0.72	0.63	0.68	0.491
6	5.5	1	22	0.72	0.70	0.75	0.541
7	6.5	1	22	0.72	0.67	0.72	0.520
8	7.5	1	24	0.79	0.65	0.70	0.551
9	8.5	1	24	0.79	0.58	0.63	0.496
10	9.5	1	25	0.82	0.41	0.46	0.377
11	10.5	1	22	0.72	0.34	0.39	0.282
12	11.5	1	19	0.62	0.41	0.46	0.287
						Tot. flow=	4.83

Station 12 1'st major tributary from east as you proceed upstream from Tinker Ck. Measured very close to confluence with Mill Creek.

Approximate UTM Coordinates:
445559E, 3686545N

(12/8/97)
Flowmeter Measurement

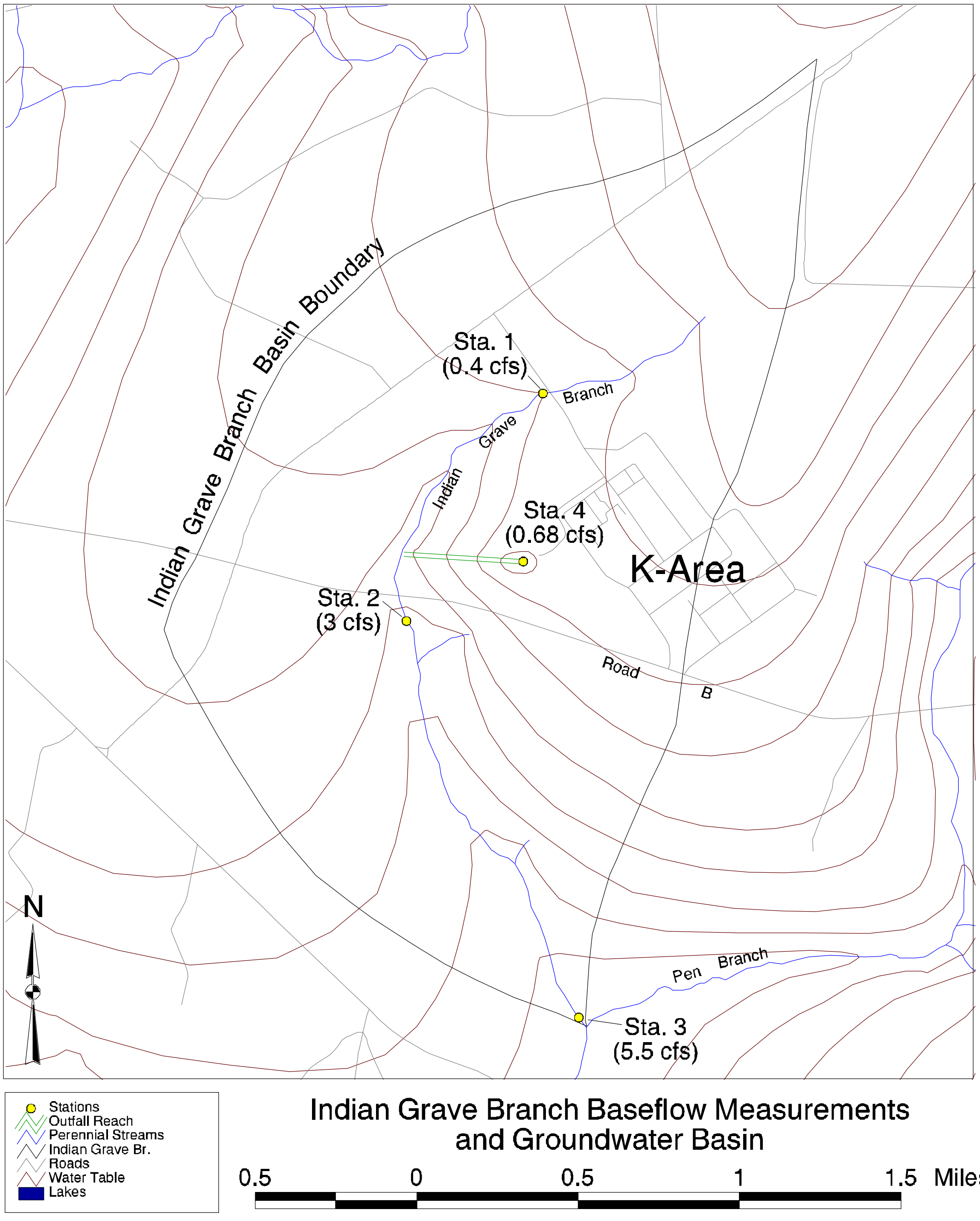
Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	9	0.30	0.23	0.28	0.083
2	1.5	1	12	0.39	0.50	0.55	0.217
3	2.5	1	12	0.39	0.53	0.58	0.228
4	3.5	1	8	0.26	0.16	0.21	0.055
						Tot. flow=	0.58

Station 13 Main branch of Mill Creek, just upstream of confluence with 1'st major tributary to enter Mill Creek from east, as you proceed upstream from Tinker Creek.

Approximate UTM Coordinates:
445534E, 3686510N

(12/8/97)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	8	0.26	0.25	0.30	0.079
2	1.5	1	16	0.52	0.34	0.39	0.205
3	2.5	1	19	0.62	0.67	0.72	0.449
4	3.5	1	22	0.72	0.79	0.84	0.606
5	4.5	1	21	0.69	0.85	0.90	0.620
6	5.5	1	19	0.62	0.71	0.76	0.474
7	6.5	1	20	0.66	0.71	0.76	0.499
8	7.5	1	20	0.66	0.65	0.70	0.459
9	8.5	1	12	0.39	0.56	0.61	0.240
10	9.5	1	8	0.26	0.27	0.32	0.084
						Tot. flow=	3.71



Indian Grave Branch Baseflow Measurements and Groundwater Basin

INDIAN GRAVE BRANCH BASEFLOW

Station 1 Indian Grave Branch, approximately 100 ft. downstream from road 6.4

Approximate UTM Coordinates: 437677E, 3675456N

(12/18/97)

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	6	0.20	-0.03	0.02	0.004
2	1.5	1	12	0.39	-0.04	0.01	0.004
3	2.5	1	12	0.39	0.45	0.50	0.197
4	3.5	1	12	0.39	0.40	0.45	0.177
						Tot. flow=	0.38

Station 2 Indian Grave Branch about 150 yards downstream from Road B

Approximate UTM Coordinates: 436979E, 3674290N

(12/18/97)

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	flow vel. (ft/sec)	Q (cfs)
1	0.5	1	7	0.23	0.02	0.07	0.016
2	1.5	1	14	0.46	0.27	0.32	0.147
3	2.5	1	17	0.56	0.56	0.61	0.340
4	3.5	1	20	0.66	0.48	0.53	0.348
5	4.5	1	22	0.72	0.47	0.52	0.375
6	5.5	1	26	0.85	0.36	0.41	0.350
7	6.5	1	30	0.98	0.56	0.61	0.600
8	7.5	1	24	0.79	0.38	0.43	0.339
9	8.5	1	24	0.79	0.23	0.28	0.220
10	9.5	1	21	0.69	0.18	0.23	0.158
11	10.5	1	16	0.52	0.07	0.12	0.063
12	11.5	1	10	0.33	0.02	0.07	0.023
						Tot. flow=	2.98

Station 3 Indian Grave Branch just above confluence with Pen Branch

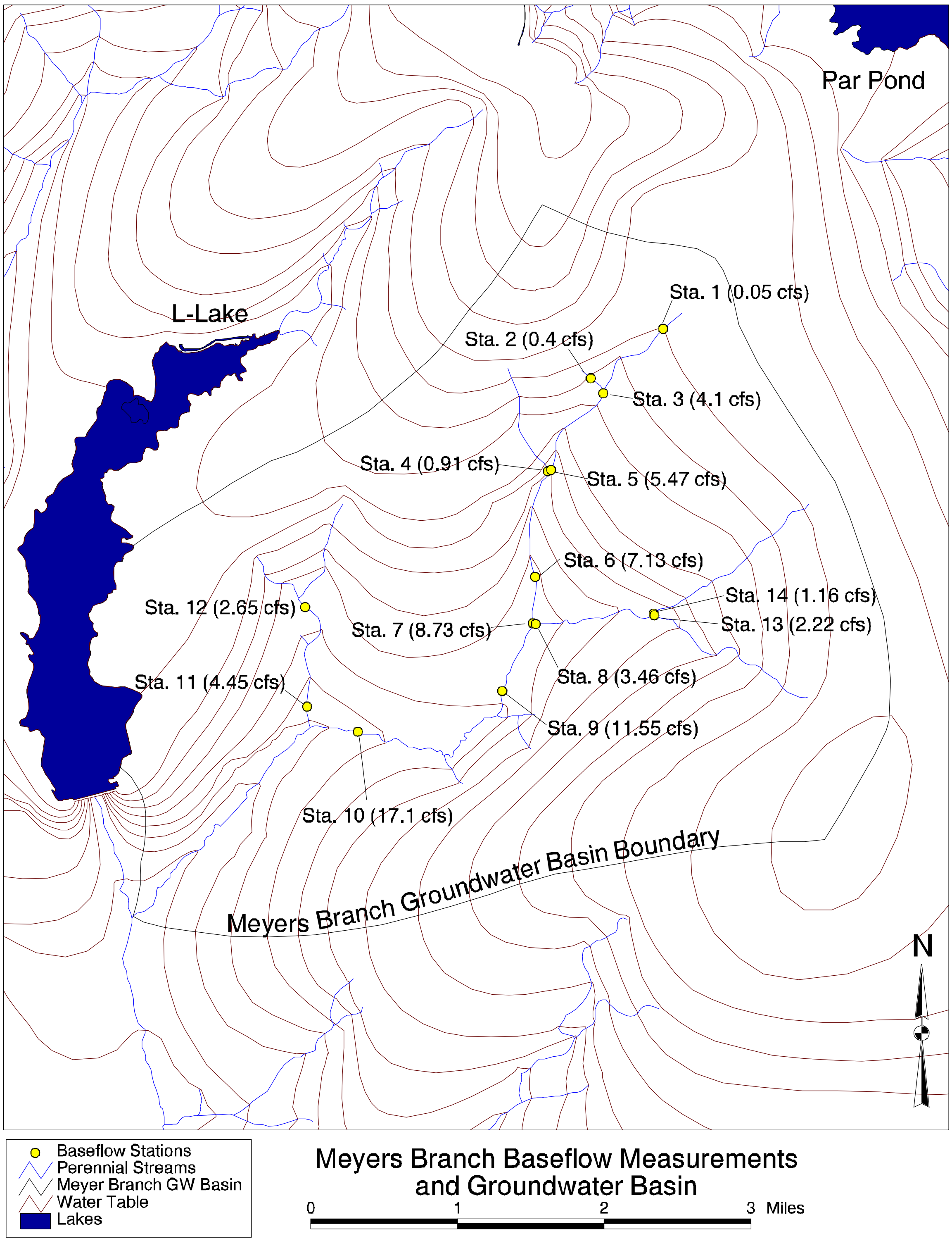
Approximate UTM Coordinates: 437845E, 3672268N

(12/18/97)

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	flow vel. (ft/sec)	Q (cfs)
1	0.5	1	6	0.20	0.20	0.25	0.049
2	1.5	1	9	0.30	0.64	0.69	0.204
3	2.5	1	12	0.39	1.13	1.18	0.465
4	3.5	1	16	0.52	1.33	1.38	0.724
5	4.5	1	16	0.52	1.39	1.44	0.756
6	5.5	1	20	0.66	1.51	1.56	1.024
7	6.5	1	20	0.66	1.63	1.68	1.102
8	7.5	1	17	0.56	1.02	1.07	0.597
9	8.5	1	14	0.46	0.87	0.92	0.423
10	9.5	1	12	0.39	0.37	0.42	0.165
						Tot. flow=	5.51

Station 4 Discharge at K-18 Outfall Tot. flow= 0.68 cfs



Meyers Branch Baseflow Measurements and Groundwater Basin

MEYERS BRANCH BASEFLOW

Station 1 Meyers Branch headwaters of main branch, 0.3 mi S. of Rd. B on an abandoned road.

Approximate UTM Coordinates:
447,249E, 3,674,190N

(2/2/98) Flume Measurement: 8" throat, fluid height=0.11 ft., Q=0.05cfs or 23gmp

Station 2 Tributary to Meyers Branch, entering from northwest.

Approximate UTM Coordinates:
446,457E, 3673647N

(2/2/98)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	5	0.16	0.12	0.12	0.020
2	1.5	1	8	0.26	0.37	0.37	0.097
3	2.5	1	6	0.20	0.71	0.71	0.140
4	3.5	1	8	0.26	0.75	0.75	0.197
						Tot. flow=	0.45

Station 3 Main channel of Meyers Branch, downstream of confluence with tributary entering from northwest.

Approximate UTM Coordinates:
446591E, 36734822N

(2/2/98)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	7	0.23	0.30	0.30	0.069
2	1.5	1	14	0.46	1.12	1.12	0.514
3	2.5	1	18	0.59	0.95	0.95	0.561
4	3.5	1	16	0.52	1.14	1.14	0.598
5	4.5	1	14	0.46	1.51	1.51	0.694
6	5.5	1	16	0.52	1.32	1.32	0.693
7	6.5	1	14	0.46	0.94	0.94	0.432
8	7.5	1	18	0.59	0.56	0.56	0.331
9	8.5	1	16	0.52	0.30	0.30	0.157
10	9.25	0.5	10	0.33	0.31	0.31	0.051
						Tot. flow=	4.10

Station 4 Tributary to Meyers Branch, entering from northwest, about 150 ft from confluence with Meyers Br.

Approximate UTM Coordinates:
445985E, 3672628N

(2/2/98)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	7	0.23	0.12	0.12	0.028
2	1.5	1	12	0.39	0.22	0.22	0.087
3	2.5	1	11	0.36	0.74	0.74	0.267
4	3.5	1	12	0.39	0.67	0.67	0.264
5	4.5	1	14	0.46	0.37	0.37	0.170
6	6.5	1	9	0.30	0.33	0.33	0.097
7	6.25	0.5	2	0.07	0.04	0.04	0.001
						Tot. flow=	0.91

Station 5 Main channel of Meyers Branch, upstream of confluence with tributary entering from northwest.

Approximate UTM Coordinates:
446020E, 3672643N

(2/2/98) Flowmeter Measurement Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	4	0.13	0.02	0.02	0.003
2	1.5	1	13	0.43	0.78	0.78	0.333
3	2.5	1	17	0.56	1.62	1.62	0.904
4	3.5	1	17	0.56	2.52	2.52	1.406
5	4.5	1	15	0.49	2.35	2.35	1.157
6	5.5	1	15	0.49	1.67	1.67	0.822
7	6.5	1	15	0.49	1.31	1.31	0.645
8	7.5	1	11	0.36	0.28	0.28	0.101
9	8.5	1	10	0.33	0.31	0.31	0.102
10	9.25	0.5	6	0.20	0.02	0.02	0.002
						Tot. flow=	5.47

Station 6 Meyers Branch, approx. 150 yds downstream from Old Dunbarton Rd.

Approximate UTM Coordinates:
445846E, 3671467N

(2/2/98) Flowmeter Measurement Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	20	0.66	0.03	0.03	0.020
2	1.5	1	38	1.25	0.42	0.42	0.524
3	2.5	1	37	1.21	1.05	1.05	1.275
4	3.5	1	35	1.15	1.45	1.45	1.665
5	4.5	1	36	1.18	1.35	1.35	1.595
6	5.5	1	38	1.25	1.05	1.05	1.309
7	6.5	1	42	1.38	0.60	0.60	0.827
8	7.5	1	43	1.41	0.20	0.20	0.282
9	8.5	1	43	1.41	0.05	0.05	0.071
10	9.5	1	42	1.38	-0.09	-0.09	-0.124
11	10.5	1	32	1.05	-0.12	-0.12	-0.126
12	11.5	1	20	0.66	-0.23	-0.23	-0.151
13	12.5	1	4	0.13	-0.19	-0.19	-0.025
14	13.5	1	3	0.10	-0.11	-0.11	-0.011
						Tot. flow=	7.13

Station 7 Main channel of Meyers Branch, upstream of confluence with trib. entering from east.

Approximate UTM Coordinates:
445821E, 3670958N

(2/2/98)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	17	0.56	0.83	0.83	0.463
2	1.5	1	18	0.59	0.65	0.65	0.384
3	2.5	1	18	0.59	1.02	1.02	0.602
4	3.5	1	12	0.39	1.51	1.51	0.595
5	4.5	1	14	0.46	1.48	1.48	0.680
6	5.5	1	15	0.49	1.42	1.42	0.699
7	6.5	1	16	0.52	1.52	1.52	0.798
8	7.5	1	16	0.52	1.85	1.85	0.971
9	8.5	1	18	0.59	1.70	1.70	1.004
10	9.5	1	18	0.59	1.88	1.88	1.110
11	10.5	1	14	0.46	1.78	1.78	0.818
12	11.5	1	14	0.46	1.39	1.39	0.638
13	12.5	1	9	0.30	-0.10	-0.10	-0.030
						Tot. flow=	8.73

Station 8 Tributary to Meyers Branch. entering main channel from east, just upstream from confluence.

Approximate UTM Coordinates:
445899E, 3685493N

(2/2/98)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	16	0.52	0.35	0.35	0.184
2	1.5	1	24	0.79	1.46	1.46	1.150
3	2.5	1	27	0.89	1.70	1.70	1.506
4	3.5	1	28	0.92	0.59	0.59	0.542
5	4.5	1	16	0.52	0.18	0.18	0.094
6	5.5	1	4	0.13	-0.11	-0.11	-0.014
						Tot. flow=	3.46

Station 9 Meyers Branch, just upstream from first point it passes under Seaboard Coast RR Line.

Approximate UTM Coordinates:
445482E, 3670216N

(2/2/98)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	14	0.46	0.33	0.33	0.152
2	1.5	1	24	0.79	0.48	0.48	0.378
3	2.5	1	36	1.18	1.10	1.10	1.299
4	3.5	1	36	1.18	1.28	1.28	1.512
5	4.5	1	34	1.12	1.32	1.32	1.473
6	5.5	1	29	0.95	1.18	1.18	1.123
7	6.5	1	26	0.85	1.27	1.27	1.083
8	7.5	1	22	0.72	1.40	1.40	1.011
9	8.5	1	24	0.79	1.03	1.03	0.811
10	9.5	1	24	0.79	1.38	1.38	1.087
11	10.5	1	28	0.92	1.12	1.12	1.029
12	11.5	1	20	0.66	0.91	0.91	0.597
13	12.5	1	18	0.59	1.00	1.00	0.591
14	13.5	1	14	0.46	0.76	0.76	0.349
15	14.25	0.5	4	0.13	0.46	0.46	0.030
						Tot. flow=	12.52

Station 10 Meyers Branch, downstream approx. 150 yards from bridge on Rd 9.

Approximate UTM Coordinates:
443897E, 3669769N

(2/2/98)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	20	0.66	0.37	0.37	0.243
2	1.5	1	22	0.72	0.55	0.55	0.397
3	2.5	1	27	0.89	0.85	0.85	0.753
4	3.5	1	28	0.92	0.90	0.90	0.827
5	4.5	1	28	0.92	1.20	1.20	1.102
6	5.5	1	32	1.05	2.10	2.10	2.205
7	6.5	1	30	0.98	2.35	2.35	2.313
8	7.5	1	30	0.98	2.15	2.15	2.116
9	8.5	1	26	0.85	1.85	1.85	1.578
10	9.5	1	26	0.85	2.00	2.00	1.706
11	10.5	1	24	0.79	2.10	2.10	1.654
12	11.5	1	22	0.72	1.65	1.65	1.191
13	12.5	1	20	0.66	1.35	1.35	0.886
14	13.5	1	10	0.33	0.42	0.42	0.138
15	14.5	1	6	0.20	-0.05	-0.05	-0.010
						Tot. flow=	17.10

Station 11 First major trib. to Meyer Branch east of L-Lake, enters from north, just N. of steep road grade.

Approximate UTM Coordinates:
443342E, 3670046N

(2/2/98)

Flowmeter Measurement						corrected	
Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	flow vel. (ft/sec)	Q (cfs)
1	0.5	1	12	0.39	-0.05	-0.05	-0.020
2	1.5	1	28	0.92	0.22	0.22	0.202
3	2.5	1	32	1.05	0.43	0.43	0.451
4	3.5	1	32	1.05	0.70	0.70	0.735
5	4.5	1	42	1.38	0.90	0.90	1.240
6	5.5	1	43	1.41	1.08	1.08	1.524
7	6.5	1	36	1.18	0.43	0.43	0.508
8	7.5	1	30	0.98	-0.13	-0.13	-0.128
9	8.5	1	15	0.49	-0.12	-0.12	-0.059
						Tot. flow=	4.45

Station 12 Tributary to Meyers Br. Located east of L-Lake, enters Meyers Br. from the north.

Approximate UTM Coordinates:
443320E, 3671135N

(4/2/98)

Flowmeter Measurement						corrected	
Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	flow vel. (ft/sec)	Q (cfs)
1	0.5	1	30	0.98	0.10	0.10	0.098
2	1.5	1	36	1.18	0.55	0.55	0.650
3	2.5	1	37	1.21	0.50	0.50	0.607
4	3.5	1	37	1.21	0.50	0.50	0.607
5	4.5	1	34	1.12	0.40	0.40	0.446
6	5.5	1	29	0.95	0.25	0.25	0.238
						Tot. flow=	2.65

Station 13 Confluence of 2 tribs to MeyersBr. Just S. of RR line. Southernmost of the 2 tributaries.

Approx UTM coordinates:
447153E; 3671048N

(4/2/98)
Flowmeter Measurement

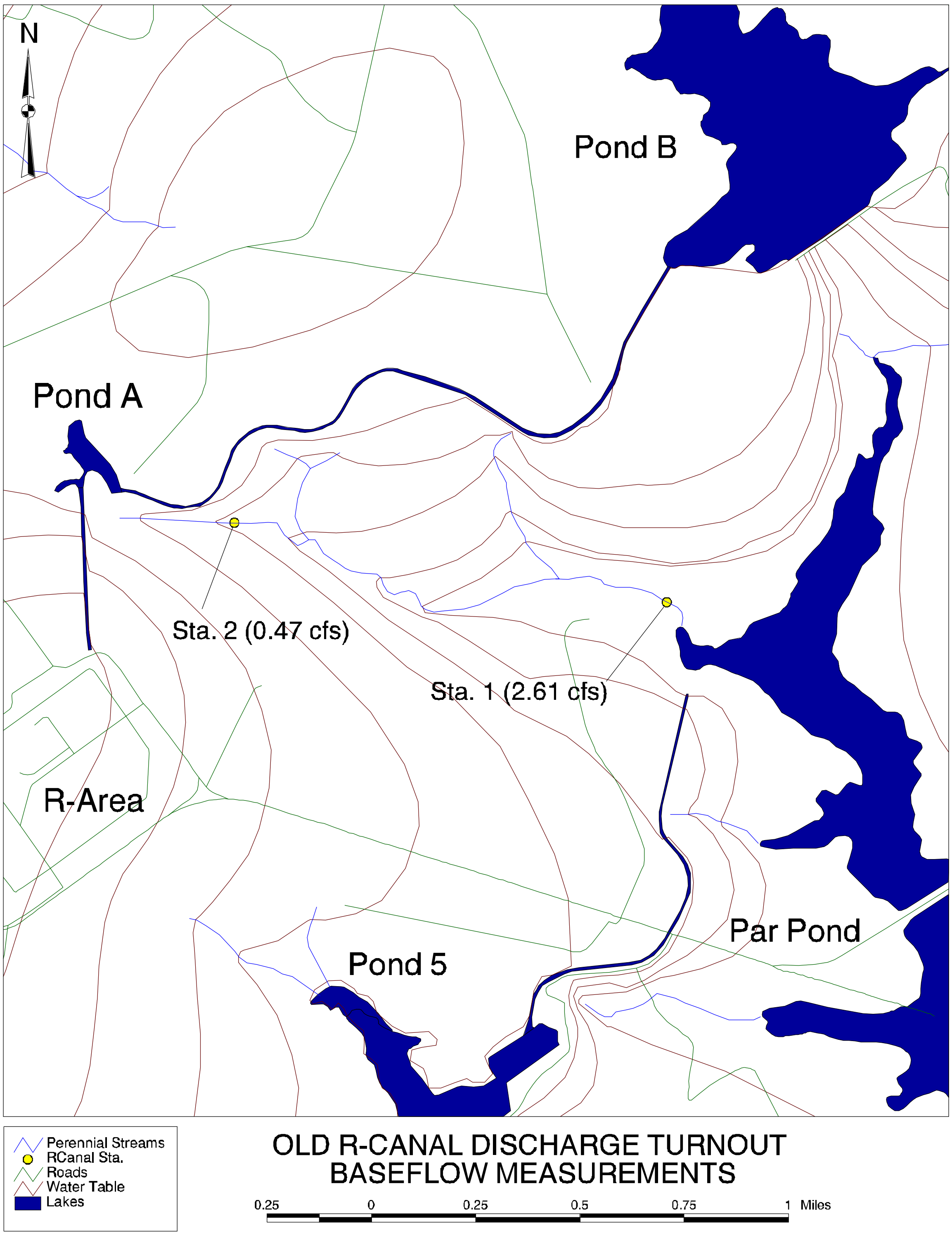
Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	10	0.33	0.20	0.20	0.066
2	1.5	1	12	0.39	0.90	0.90	0.354
3	2.5	1	10	0.33	0.85	0.85	0.279
4	3.5	1	10	0.33	1.05	1.05	0.345
5	4.5	1	12	0.39	0.90	0.90	0.354
6	5.5	1	16	0.52	1.15	1.15	0.604
7	6.5	1	12	0.39	0.50	0.50	0.197
8	7.5	1	12	0.39	0.05	0.05	0.020
						Tot. flow=	2.22

Station 14 Confluence of 2 tribs to MeyersBr. Just S. of RR line. Northernmost of the 2 tributaries.

Approx UTM coordinates: 447149E; 3671064N

(4/2/98)
Flowmeter measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	12	0.39	0.05	0.05	0.020
2	1.5	1	14	0.46	0.80	0.80	0.367
3	2.5	1	14	0.46	1.30	1.30	0.597
4	3.5	1	9	0.30	0.60	0.60	0.177
						Tot. flow=	1.16


N
Pond B
Pond A
Sta. 2 (0.47 cfs)
Sta. 1 (2.61 cfs)
R-Area
Par Pond
Pond 5
Perennial Streams
RCanal Sta.
Roads
Water Table
Lakes
OLD R-CANAL DISCHARGE TURNOUT
BASEFLOW MEASUREMENTS
0.25
0
0.25
0.5
0.75
1
Miles

OLD R-CANAL DISCHARGE TURNOUT BASEFLOW

Station 1 R-Canal discharge turnout drainage, near entrance to Par Pond

Approximate UTM Coordinates:
447931E, 3682189N

(2/2/98)
Flowmeter Measurement

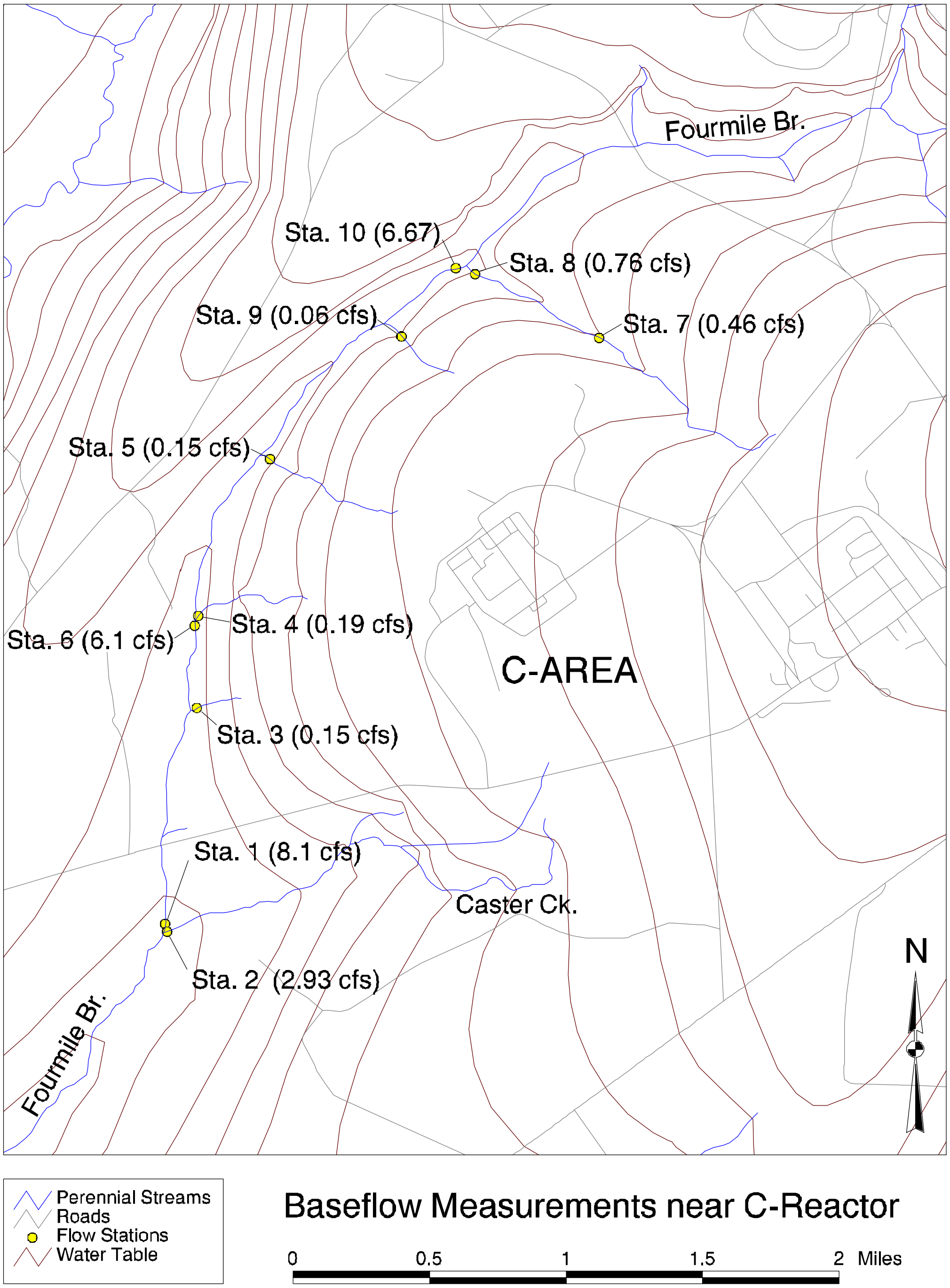
Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	10	0.33	0.14	0.14	0.046
2	1.5	1	28	0.92	0.38	0.38	0.349
3	2.5	1	30	0.98	0.41	0.41	0.404
4	3.5	1	27	0.89	0.53	0.53	0.470
5	4.5	1	26	0.85	0.52	0.52	0.444
6	5.5	1	34	1.12	0.42	0.42	0.469
7	6.5	1	34	1.12	0.30	0.30	0.335
8	7.5	1	24	0.79	0.13	0.13	0.102
9	8.5	1	8	0.26	-0.02	-0.02	-0.005
						Tot. flow=	2.61

Station 2 R-Canal discharge turnout drainage, 0.3 mi downstream from diversion box.

Approximate UTM Coordinates:
446804E, 3682517N

(2/2/98)
Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	5	0.16	0.12	0.12	0.020
2	1.5	1	8	0.26	0.37	0.37	0.097
3	2.5	1	6	0.20	0.71	0.71	0.140
4	3.5	1	8	0.26	0.75	0.80	0.210
						Tot. flow=	0.47



Baseflow Measurements near C-Reactor

C-AREA STREAM BASEFLOW MEASUREMENTS IN FOURMILE BRANCH AND ITS MAIN TRIBUTARIES FROM THE C-REACTOR SIDE

Station 1 Main branch of Fourmile Br., 100' upstream of confluence with Caster Ck.

Approximate UTM Coordinates: 3676961 N, 434965 E

12/7/98-1

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.50	0.39	0.38	0.190
2	1.5	1	0.80	0.48	0.47	0.376
3	2.5	1	0.85	0.73	0.72	0.612
4	3.5	1	0.90	0.46	0.45	0.405
5	4.5	1	0.85	0.05	0.04	0.034
6	5.5	1	1.10	0.23	0.22	0.242
7	6.5	1	1.10	0.22	0.21	0.231
8	7.5	1	1.20	0.52	0.51	0.612
9	8.5	1	1.10	0.80	0.79	0.869
10	9.5	1	1.20	0.70	0.69	0.828
11	10.5	1	1.10	0.65	0.64	0.704
12	11.5	1	1.20	0.32	0.31	0.372
13	12.5	1	1.20	0.02	0.01	0.012
14	13.5	1	1.20	0.08	0.07	0.084
15	14.5	1	1.10	0.32	0.31	0.341
16	15.5	1	1.30	0.30	0.29	0.377
17	16.5	1	1.30	0.15	0.14	0.182
18	17.5	1	1.10	1.00	0.99	1.089
19	18.5	1	1.20	0.38	0.37	0.444
20	19.5	1	1.10	0.04	0.03	0.033
21	20.5	1	1.00	0.08	0.07	0.070
22	21.5	1	0.80	0.01	0.00	0.000
23	22.25	0.5	0.80	-0.01	-0.02	-0.008
					Tot. flow=	8.10

Station 2 Caster Ck. About 20 feet upstream of confluence with Fourmile Br.

Approximate UTM Coordinates: 3676914 N, 435026 E

12/7/98_2

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.70	0.03	0.02	0.014
2	1.5	1	0.70	0.07	0.06	0.042
3	2.5	1	0.70	0.31	0.30	0.210
4	3.5	1	0.70	0.45	0.44	0.308
5	4.5	1	0.70	0.50	0.49	0.343
6	5.5	1	0.80	0.35	0.34	0.272
7	6.5	1	0.90	0.15	0.14	0.126
8	7.5	1	0.80	0.10	0.09	0.072
9	8.5	1	0.90	0.22	0.21	0.189
10	9.5	1	1.10	0.32	0.31	0.341
11	10.5	1	1.10	0.42	0.41	0.451
12	11.5	1	1.10	0.26	0.25	0.275
13	12.5	1	1.10	0.08	0.07	0.077
14	13.5	1	1.00	0.09	0.08	0.080
15	14.5	1	0.90	0.07	0.06	0.054
16	15.5	1	0.70	0.09	0.08	0.056
17	16.5	1	0.30	0.08	0.07	0.021
					Tot. flow=	2.93

Station 3 First tributary to 4MB south of the "Twin Lakes" tributary, just above mouth

Approx. UTM Coordinates: 3678228 N, 435196 E

12/8/98_1

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.75	1.5	1.00	0.11	0.10	0.150
					Tot. flow=	0.15

Station 4 "Twin Lakes" tributary to 4MB, just above the mouth.

Approx. UTM Coordinates: 3678776 N, 435211 E

12/8/98_2

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.20	0.50	0.49	0.098
2	1.5	1	0.30	0.31	0.30	0.090
3	2.25	0.5	0.20	-0.01	-0.02	-0.002

Station 5 First drainage north of "Twin Lakes" drainage, near confluence with 4MB

Approx. UTM Coordinates: 3679757 N, 435631 E

12/8/98_3

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.20	0.21	0.20	0.040
2	1.5	1	0.35	0.32	0.31	0.109
3	2.5	1	0.10	0.01	0.00	0.000
					Tot. flow=	0.15

Station 6 Fourmile Branch, just below confluence with Twin Lakes drainage and about 200 ft upstream from Sewage Plant discharge line.

Approx. UTM Coordinates: 3678674 N, 435160 E

12/8/98_4 Flowmeter Measurement Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.10	0.26	0.25	0.025
2	1.5	1	0.30	0.63	0.62	0.186
3	2.5	1	0.40	0.89	0.88	0.352
4	3.5	1	0.50	0.93	0.92	0.460
5	4.5	1	0.60	0.91	0.90	0.540
6	5.5	1	0.55	1.04	1.03	0.567
7	6.5	1	0.70	0.96	0.95	0.665
8	7.5	1	0.70	0.93	0.92	0.644
9	8.5	1	0.80	0.78	0.77	0.616
10	9.5	1	0.85	0.84	0.83	0.706
11	10.5	1	0.75	0.53	0.52	0.390
12	11.5	1	0.65	0.22	0.21	0.137
13	12.5	1	0.60	0.66	0.65	0.390
14	13.5	1	0.50	0.42	0.41	0.205
15	14.5	1	0.30	0.56	0.55	0.165
16	15.5	1	0.25	0.23	0.22	0.055
					Tot. flow=	6.10

Station 7 "Construction Outfall" tributary to 4MB, near asbestos pits, near fork in drainage.

Approx. UTM Coordinates: 3680419 N, 437588 E

12/9/98_1

Flowmeter Measurement Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.20	0.24	0.23	0.046
2	1.5	1	0.30	0.71	0.70	0.210
3	2.5	1	0.25	0.75	0.74	0.185
4	3.5	1	0.10	0.22	0.21	0.021
5	4.25	0.5	0.05	0.05	0.04	0.001
					Tot. flow=	0.46

Station 8 "Construction Outfall" tributary to 4MB, near asbestos pits, 250' above mouth.

Approx. UTM Coordinates: 3680843 N, 436833 E

12/9/98_2 Flowmeter Measurement

Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.50	0.07	0.06	0.030
2	1.5	1	0.50	0.70	0.69	0.345
3	2.5	1	0.30	0.65	0.64	0.192
4	3.5	1	0.30	0.36	0.35	0.105
5	4.5	1	0.20	0.29	0.28	0.056
6	5.5	1	0.15	0.22	0.21	0.032
7	6.25	0.5	0.15	-0.01	-0.02	-0.002
					Tot. flow=	0.76

Station 9 First trib. to 4MB south of "construction outfall" tributary. About 200 yds upstream from mouth.

Approx. UTM Coordinates: 3680423 N, 436400 E

12/9/98_3 Flowmeter Measurement

Segment	Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.20	0.01	0.00	0.000
2	1.5	1	0.70	0.10	0.09	0.063
3	2.5	1	0.50	0.00	-0.01	-0.005
					Tot. flow=	0.06

Station 10 Fourmile Branch about 150 feet downstream of steamline road, north of C-Area.

Approx. UTM Coordinates: 3680839 N, 436684 E

(12/8/97) FlowmeterSegment	Measurement Tape	width (ft.)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	0.70	0.38	0.37	0.259
2	1.5	1	0.70	0.70	0.69	0.483
3	2.5	1	0.70	0.72	0.71	0.497
4	3.5	1	0.60	0.65	0.64	0.384
5	4.5	1	0.60	0.50	0.49	0.294
6	5.5	1	0.50	0.40	0.39	0.195
7	6.5	1	0.40	0.46	0.45	0.180
8	7.5	1	0.40	0.60	0.59	0.236
9	8.5	1	0.45	0.70	0.69	0.311
10	9.5	1	0.60	0.76	0.75	0.450
11	10.5	1	0.50	0.88	0.87	0.435
12	11.5	1	0.60	0.98	0.97	0.582
13	12.5	1	0.70	0.88	0.87	0.609
14	13.5	1	0.60	0.75	0.74	0.444
15	14.5	1	0.50	0.75	0.74	0.370
16	15.5	1	0.40	0.58	0.57	0.228
17	16.5	1	0.45	0.40	0.39	0.176
18	17.5	1	0.65	0.52	0.51	0.332
19	18.5	1	0.65	0.31	0.30	0.195
20	19.25	1	0.40	0.05	0.04	0.016
					Tot. flow=	6.67

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APPENDIX F. HYDRAULIC HEAD TARGET AND RESIDUAL DATA

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APPENDIX F. HYDRAULIC HEAD TARGET AND RESIDUAL DATA

Hydraulic Head Targets

Table F-1 summarizes the hydraulic head data available for model calibration. When multiple measurements are available for a given well, the mean water level is shown. Otherwise, the single reading is given. The sample standard deviation of the mean, sample standard deviation of the population, and number of readings follow the target head, where applicable. The "category" column refers to the aquifer zone: 1=Gordon, 2="lower" UTRA, 3=transmissive zone, 4=AA horizon, 5=A/uu horizon and 6=mixed or other. The average head target has a "2 sigma" uncertainty of ±0.8 ft, not counting one-time readings which inflate the overall average uncertainty.

Table F-1. Hydraulic Head Targets for Model Calibration

′BG 26 ′	58809.70	73958.40	210.7	230.7	239.35	0.85	1.20	2	4
′BG 27 ′	58810.00	74356.70	234.4	254.4	240.95	0.85	1.20	2	5
′BG 28 ′	58810.20	74752.00	239.7	259.7	247.10	0.60	0.85	2	5
′BG 29 ′	58809.90	75151.60	231.6	251.6	245.00	0.60	0.85	2	5
′BG 30 ′	58809.10	75550.10	231.7	251.7	237.55	0.05	0.07	2	5
′BG 31 ′	58803.70	75949.90	223.3	243.3	233.70	0.50	0.71	2	4
′BG 32 ′	58803.50	76349.90	226.9	246.9	233.40	0.30	0.42	2	4
′BG 33 ′	58526.00	76479.90	221.2	241.2	232.90	0.30	0.42	2	4
′BG 34 ′	58107.40	76493.60	217.4	237.4	232.85	0.45	0.64	2	4
′BG 35 ′	57726.40	76495.30	228.0	248.0	232.90	0.20	0.28	2	5
′BG 36 ′	57620.30	76747.60	223.3	243.3	232.50	0.60	0.85	2	4
′BG 37 ′	57251.00	76804.90	227.8	247.8	232.85	0.55	0.78	2	5
′BG 38 ′	56851.10	76805.00	225.9	245.9	232.30	0.40	0.57	2	5
′BG 39 ′	56451.30	76804.90	226.0	246.0	231.70	0.50	0.71	2	5
′BG 40 ′	56051.00	76805.10	221.9	241.9	231.40	0.50	0.71	2	5
′BG 41 ′	55868.80	76576.30	221.0	241.0	230.75	0.25	0.35	2	4
′BG 42 ′	55869.50	76178.80	217.1	237.1	230.70	0.60	0.85	2	4
′BG 43 ′	56039.40	75852.50	222.9	242.9	230.50	0.40	0.57	2	4
′BG 51 ′	58599.30	73864.30	221.2	241.2	240.70	-1.00	-1.00	1	4
′BG 52 ′	55524.30	75910.40	223.8	243.8	229.32	0.28	1.48	27	4
′BG 53 ′	55073.90	76157.30	214.7	234.7	228.04	0.31	0.94	9	4
′BG 54 ′	54830.30	75837.90	215.2	235.2	228.61	0.32	1.71	29	4
′BG 55 ′	54590.50	75525.30	214.9	234.9	226.56	0.61	3.28	29	4
′BG 56 ′	54481.90	75206.50	210.9	230.9	225.05	0.27	0.76	8	4
′BG 57 ′	54820.00	75000.40	214.6	234.6	225.27	0.15	0.45	9	4
′BG 58 ′	55162.30	74790.90	218.2	238.2	226.78	0.27	0.81	9	4
′BG 59 ′	55508.30	74593.40	217.7	237.7	229.85	0.40	2.04	26	4
′BG 60 ′	55850.30	74386.30	215.5	235.5	230.80	0.39	2.01	26	4
′BG 61 ′	56360.80	74075.40	225.0	245.0	232.83	0.48	2.42	26	4
′BG 62 ′	56530.90	73971.60	222.5	242.5	233.41	0.44	1.47	11	4
′BG 63 ′	56870.50	73754.50	224.2	244.2	235.24	0.43	1.35	10	4
′BG 64 ′	57212.40	73547.20	227.3	247.3	238.13	0.38	1.21	10	4
′BG 65 ′	57552.70	73340.60	230.9	250.9	235.74	0.42	1.31	10	4
′BG 66 ′	57805.00	73585.00	231.0	251.0	235.20	0.60	1.81	9	4
′BG 67 ′	57902.60	73954.10	224.7	244.7	236.49	0.55	2.90	28	4
′BG 68 ′	58251.50	76553.60	216.5	242.9	232.22	-1.00	-1.00	1	4
′BG 69 ′	58226.20	76553.80	222.2	242.2	232.48	-1.00	-1.00	1	4
′BG 80 ′	57962.60	76596.50	226.2	248.6	232.73	-1.00	-1.00	1	4
′BG 81 ′	57983.00	76621.90	222.9	246.9	227.35	-1.00	-1.00	1	4
′BG 84 ′	57955.40	76695.90	227.2	247.2	232.58	-1.00	-1.00	1	4
′BG 85 ′	57928.90	76719.00	228.0	248.0	232.55	-1.00	-1.00	1	4
′BG 86 ′	57979.40	76721.40	228.0	248.0	232.48	-1.00	-1.00	1	4

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'BG 87 '	57951.90	76748.90	226.2	245.8	232.30	-1.00	-1.00	1	4	
'BG 91 '	56649.40	78031.30	205.4	235.4	218.82	0.51	2.24	19	4	
'BG 92 '	56828.00	79019.60	197.2	227.2	208.97	0.69	3.01	19	3	
'BG 93 '	57160.80	79930.80	180.5	210.5	199.16	1.00	4.36	19	6	?
'BG 94 '	57494.00	80867.20	152.8	182.8	191.19	0.27	1.20	20	2	
'BG 95 '	58407.00	80059.90	152.5	182.5	192.86	0.26	1.17	20	2	
'BG 96 '	58297.80	79396.30	177.2	207.2	197.82	0.64	2.77	19	2	
'BG 98 '	57398.70	77597.90	212.5	242.5	224.46	-1.00	-1.00	1	4	
'BG 99 '	58404.10	76904.60	215.9	245.9	232.53	-1.00	-1.00	1	4	
'BG 100 '	58899.10	77815.60	203.3	233.3	224.80	-1.00	-1.00	1	4	
'BG 103 '	59752.10	77883.60	169.5	199.5	199.95	0.34	1.42	17	2	
'BG 107 '	60120.10	74803.60	208.3	228.3	234.59	0.91	4.15	21	4	
'BG 108 '	59827.90	74383.00	217.3	247.3	238.99	0.35	1.56	20	4	
'BG 109 '	59626.10	73926.20	228.4	258.4	240.79	0.54	2.40	20	5	
'BG 110 '	59277.20	73354.70	224.3	254.3	241.51	0.50	2.18	19	4	
'BG 113 '	59386.00	77410.20	196.4	216.4	217.10	-1.00	-1.00	1	6	?
'BG 115 '	57884.50	77207.20	198.9	218.9	215.80	-1.00	-1.00	1	3	
'BG 119 '	57004.90	77743.70	209.2	229.2	215.37	-1.00	-1.00	1	4	
'BG 122 '	56789.70	78581.10	189.9	209.9	211.34	0.35	1.52	19	3	
'BG 124 '	57095.00	77254.00	214.8	234.8	231.82	-1.00	-1.00	1	4	
'BGO 1D '	58779.30	73737.90	225.0	245.0	238.52	0.34	2.84	69	4	
'BGO 2D '	58809.70	74552.90	218.9	238.9	238.19	0.19	1.43	59	4	
'BGO 3A '	58806.80	75561.70	103.7	113.7	163.04	0.09	0.46	24	1	
'BGO 3C '	58806.40	75550.40	178.7	188.7	225.92	0.19	1.00	27	2	
'BGO 3D '	58809.20	75351.30	227.6	247.6	235.57	0.18	1.12	38	4	
'BGO 3DR'	58820.00	75512.30	217.5	237.6	231.91	0.13	0.59	21	4	
'BGO 4D '	58803.70	76150.10	220.6	240.6	232.59	0.61	3.47	32	4	
'BGO 5C '	58794.50	76476.90	183.2	193.2	216.25	0.33	2.50	57	2	
'BGO 5D '	58784.80	76477.50	219.3	239.3	230.66	0.35	2.72	60	4	
'BGO 6A '	58316.80	76487.20	107.5	117.5	159.33	0.07	0.58	61	1	
'BGO 6B '	58346.50	76553.20	139.7	149.7	219.05	0.15	1.01	45	2	
'BGO 6C '	58307.00	76487.10	158.0	168.0	220.32	0.23	1.85	64	2	
'BGO 6D '	58297.10	76487.30	217.2	237.2	231.38	0.09	0.74	65	4	
'BGO 7D '	57917.20	76494.50	220.2	240.2	232.64	0.29	2.24	61	4	
'BGO 8A '	57618.30	76569.00	105.3	115.3	160.96	0.77	2.43	10	1	
'BGO 8AR'	57617.50	76598.80	94.6	104.6	160.90	0.21	1.47	51	1	
'BGO 8C '	57618.70	76579.20	174.3	184.3	224.31	0.50	3.90	61	2	
'BGO 8D '	57617.80	76588.80	220.6	240.6	232.73	0.40	3.14	62	4	
'BGO 9AA'	57371.90	76975.70	73.8	83.8	158.01	0.08	0.50	43	1	
'BGO 9D '	57478.90	76811.60	209.2	229.2	230.13	0.43	3.42	64	4	
'BGO 10A '	57050.90	76805.20	111.1	121.1	170.74	1.35	5.87	19	1	
'BGO 10AA'	56990.50	76997.90	80.8	90.8	157.61	0.49	3.06	39	1	
'BGO 10AR'	57063.80	76806.00	96.5	106.5	158.49	0.08	0.55	45	1	
'BGO 10B '	56978.80	76982.10	139.0	149.0	219.85	0.21	1.30	39	2	
'BGO 10C '	57041.10	76805.20	157.3	167.3	220.45	0.14	1.17	65	2	
'BGO 10DR'	57073.70	76804.80	218.3	238.3	231.68	0.23	1.55	46	4	
'BGO 11D '	56651.30	76805.10	216.3	236.3	230.91	0.36	2.36	43	4	
'BGO 11DR'	56650.40	76849.30	213.1	233.0	230.54	0.25	1.11	20	4	
'BGO 12AR'	56259.90	76803.80	99.3	109.3	157.82	0.09	0.46	27	1	
'BGO 12AX'	56258.00	76834.80	99.5	109.5	157.35	0.14	0.65	21	1	
'BGO 12C '	56241.10	76805.20	153.6	163.6	220.05	0.24	0.77	10	2	
'BGO 12CR'	56215.20	76806.00	144.0	154.0	221.95	0.19	1.02	28	2	
'BGO 12CX'	56230.40	76834.50	141.2	151.2	230.39	0.25	1.14	21	2	
'BGO 12D '	56231.10	76805.20	217.8	237.8	231.43	0.20	1.30	43	4	
'BGO 12DR'	56214.70	76834.60	212.7	232.8	220.13	0.28	1.26	21	4	
'BGO 13DR'	55840.40	76824.70	210.3	220.3	230.99	0.19	1.36	51	4	
'BGO 14A '	55838.30	76377.50	109.6	119.6	157.25	0.72	2.77	15	1	
'BGO 14AR'	55788.90	76351.80	96.8	106.8	159.14	0.23	1.60	47	1	
'BGO 14C '	55839.00	76367.70	192.1	202.1	221.36	0.95	3.55	14	2	
'BGO 14CR'	55789.00	76337.80	190.1	200.1	223.75	0.19	1.34	50	2	
'BGO 14DR'	55789.40	76322.10	218.1	238.1	230.64	0.22	1.52	48	4	
'BGO 15D '	55859.10	75973.50	218.7	238.7	230.02	0.20	1.60	62	4	
'BGO 16A '	56194.20	75757.00	102.5	112.5	160.99	0.22	1.04	23	1	
'BGO 16AR'	56217.10	75743.20	103.7	113.7	161.03	0.08	0.48	41	1	
'BGO 16B '	56183.80	75767.50	136.0	146.0	218.39	0.19	1.24	44	2	
'BGO 16D '	56202.10	75751.40	217.3	237.3	230.98	0.15	1.16	63	4	
'BGO 17D '	56399.40	75599.60	204.0	224.0	232.40	1.06	3.67	12	4	
'BGO 17DR'	56407.20	75604.00	216.9	236.9	231.62	0.55	3.59	43	4	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'BGO 18A '	56699.70	75599.90	99.5	109.5	161.16	0.09	0.75	63	1	
'BGO 18D '	56711.20	75600.00	219.6	239.6	232.04	0.15	1.16	59	4	
'BGO 19D '	56997.30	75350.00	196.8	216.8	234.13	0.23	1.23	29	6	?
'BGO 19DR'	56800.70	75520.00	196.7	216.7	231.49	0.19	0.87	20	6	?
'BGO 20A '	57100.40	74966.40	86.3	96.3	163.48	0.39	1.79	21	1	
'BGO 20AA'	57089.50	74949.80	18.3	28.3	161.56	0.10	0.46	22	6	?
'BGO 20B '	57119.80	74951.50	131.0	141.0	227.59	0.21	1.20	32	2	
'BGO 20C '	57106.00	74937.60	174.0	184.0	228.80	0.21	1.15	29	2	
'BGO 20D '	57113.80	74962.20	216.3	236.3	233.83	0.19	1.60	69	4	
'BGO 21D '	57470.70	74688.50	217.7	237.7	234.95	0.21	1.69	66	4	
'BGO 22D '	57817.30	74482.20	194.2	214.2	232.63	0.20	0.92	22	6	?
'BGO 22DR'	57831.50	74471.50	219.2	239.2	236.43	0.76	3.80	25	4	
'BGO 22DX'	57770.74	74560.48	217.9	237.9	234.35	0.24	0.93	15	4	
'BGO 23D '	58133.00	74238.10	222.0	242.0	236.03	0.14	1.10	63	4	
'BGO 24D '	58438.80	74012.40	221.0	241.0	237.09	0.15	1.22	64	4	
'BGO 25A '	55668.10	76158.50	104.1	114.1	160.78	0.14	1.11	59	1	
'BGO 26A '	55014.20	76144.60	81.0	91.0	160.71	0.59	4.03	47	1	
'BGO 26D '	55015.20	76128.00	213.4	233.5	227.68	0.29	2.21	57	4	
'BGO 27C '	54671.40	75666.30	154.9	163.9	220.88	0.20	1.47	52	2	
'BGO 27D '	54680.20	75677.30	209.3	229.3	227.64	0.19	1.47	59	4	
'BGO 28D '	54457.90	75348.30	210.1	230.1	226.34	0.20	1.50	57	4	
'BGO 29A '	54103.50	75560.00	102.5	112.5	159.70	0.13	0.92	53	1	
'BGO 29C '	54099.10	75577.80	176.8	186.8	223.08	0.20	1.35	44	2	
'BGO 29D '	54099.40	75592.50	208.5	228.5	226.38	0.21	1.45	46	4	
'BGO 30C '	54512.30	75181.00	178.4	188.4	219.09	0.25	1.85	55	2	
'BGO 30D '	54499.20	75187.70	207.8	227.8	225.74	0.20	1.53	57	4	
'BGO 31C '	54816.20	74978.00	176.4	186.4	225.57	0.20	1.51	57	2	
'BGO 31D '	54841.70	74985.30	211.1	231.1	226.69	0.21	1.59	57	4	
'BGO 32D '	55250.20	74727.00	214.5	234.5	227.73	0.20	1.55	59	4	
'BGO 33C '	55681.40	74479.70	177.8	187.8	225.18	0.18	1.39	59	2	
'BGO 33D '	55695.40	74468.70	213.1	233.1	230.25	0.25	2.11	70	4	
'BGO 34D '	56082.60	74228.80	212.7	232.7	232.82	0.21	1.70	69	4	
'BGO 35C '	56545.70	73953.90	161.9	171.9	228.87	0.19	1.46	61	2	
'BGO 35D '	56556.50	73946.00	219.4	239.4	234.68	0.25	2.13	70	4	
'BGO 36D '	56888.10	73743.80	223.3	243.3	237.08	0.26	2.21	71	4	
'BGO 37C '	57279.20	73498.20	168.8	178.8	230.95	0.29	2.04	50	2	
'BGO 37D '	57292.90	73490.80	226.1	246.1	238.64	0.29	2.45	72	4	
'BGO 38D '	57557.50	73329.30	222.3	242.3	236.46	0.25	2.15	74	4	
'BGO 39A '	57821.90	73573.20	84.8	94.8	167.67	0.09	0.44	22	1	
'BGO 39C '	57816.10	73563.30	174.9	184.9	231.08	0.61	3.44	32	2	
'BGO 39D '	57831.00	73583.50	224.7	244.7	235.64	0.18	1.45	67	4	
'BGO 40D '	54638.60	76125.80	216.6	226.5	222.46	0.21	1.45	48	4	
'BGO 41A '	55403.70	76469.50	103.3	113.3	158.55	0.11	0.71	39	1	
'BGO 42C '	55522.30	76404.70	185.9	195.9	223.40	0.21	1.38	42	2	
'BGO 43A '	56253.40	77061.40	105.9	115.9	158.98	0.33	2.01	37	1	
'BGO 43AA'	56268.60	77066.00	62.2	72.2	156.69	0.13	0.84	42	1	
'BGO 43CR'	56237.20	77035.20	178.4	188.4	225.40	0.23	1.45	40	2	
'BGO 43D '	56238.80	77056.70	198.2	208.2	231.49	0.20	1.32	43	6	?
'BGO 44A '	57851.20	76755.20	98.0	108.0	158.06	0.46	2.99	43	1	
'BGO 44AA'	57880.50	76757.00	61.2	71.3	158.70	0.06	0.41	41	1	
'BGO 44B '	57865.80	76756.00	148.1	158.1	221.00	0.50	3.34	45	2	
'BGO 44C '	57894.90	76757.80	190.6	200.6	220.63	0.44	2.95	45	6	?
'BGO 44D '	57910.00	76759.50	223.4	233.4	232.54	0.17	1.13	42	4	
'BGO 45A '	54550.10	75830.00	116.9	126.9	160.81	0.07	0.48	45	6	?
'BGO 45B '	54563.60	75840.30	137.0	147.0	219.06	0.35	2.31	45	2	
'BGO 45C '	54577.40	75835.00	190.5	200.5	222.90	0.32	2.12	44	2	
'BGO 45D '	54585.60	75854.30	209.6	229.6	227.50	0.43	2.88	44	4	
'BGO 46B '	54444.70	75012.10	140.4	150.4	218.15	0.17	1.13	42	2	
'BGO 46C '	54433.90	75022.20	178.0	188.0	219.60	0.24	1.61	45	2	
'BGO 46D '	54420.00	75033.80	202.1	212.1	225.26	0.27	1.78	44	3	
'BGO 47A '	54914.00	74728.80	86.8	96.8	162.44	0.07	0.46	43	1	
'BGO 47C '	54933.40	74752.00	178.6	188.6	222.92	0.19	1.26	44	2	
'BGO 47D '	54922.90	74739.70	203.4	213.4	226.24	0.30	1.95	43	3	
'BGO 48C '	55124.40	74599.60	176.7	186.7	223.56	0.20	1.29	44	2	
'BGO 48D '	55121.00	74586.40	202.0	212.0	226.75	0.22	1.43	44	3	
'BGO 49A '	56205.10	73902.80	75.1	85.1	166.76	1.02	4.09	16	1	
'BGO 49C '	56202.20	73917.20	166.0	176.0	228.15	0.21	1.53	53	2	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'BGO 49D '	56198.80	73931.50	218.5	238.5	234.38	0.24	1.68	51	4	
'BGO 50A '	54179.80	75201.20	90.5	100.5	160.25	0.08	0.57	48	1	
'BGO 50C '	54197.00	75190.40	162.5	172.5	218.12	0.42	2.79	44	2	
'BGO 50D '	54209.10	75181.30	208.0	228.0	225.26	0.22	1.44	44	4	
'BGO 51A '	57841.80	74133.00	75.1	85.1	165.95	0.16	0.80	24	1	
'BGO 51AA'	57867.00	74113.10	29.2	39.2	168.34	0.09	0.44	23	6	?
'BGO 51B '	57848.30	74127.70	116.9	126.9	230.39	0.25	1.42	32	2	
'BGO 51C '	57854.40	74123.10	175.1	185.1	231.21	0.23	1.31	32	2	
'BGO 51D '	57860.60	74118.00	220.1	240.1	235.90	0.20	1.12	33	4	
'BGO 52A '	57184.00	74632.60	81.7	91.7	163.83	0.10	0.44	21	1	
'BGO 52AA'	57178.10	74638.00	36.6	46.6	163.08	0.10	0.44	21	1	
'BGO 52B '	57189.80	74627.30	126.7	136.7	228.13	0.20	1.09	30	2	
'BGO 52B '	57189.80	74627.30	126.7	136.7	228.13	0.20	1.09	30	2	
'BGO 52C '	57195.50	74622.00	178.7	188.7	229.40	0.21	1.14	30	2	
'BGO 52D '	57201.40	74617.30	219.4	239.4	233.96	0.16	0.92	31	4	
'BGO 53A '	55423.90	76070.80	78.7	88.7	159.09	0.09	0.42	23	1	
'BGO 53AA'	55431.50	76065.00	38.9	48.9	155.69	0.08	0.38	23	1	
'BGO 53B '	55416.20	76076.60	143.5	153.5	221.68	0.38	1.83	23	2	
'BGO 53C '	55408.30	76082.50	183.2	193.2	222.63	0.26	1.20	22	2	
'BGO 53D '	55425.50	76056.00	225.3	245.3	229.68	0.24	1.12	22	5	
'BGX 1A '	58590.40	76831.90	114.1	124.1	158.67	0.48	3.14	43	1	
'BGX 1C '	58599.80	76820.00	176.0	186.0	216.02	0.16	1.10	45	2	
'BGX 1D '	58608.60	76809.50	214.7	234.7	229.56	0.10	0.68	48	4	
'BGX 2B '	58256.50	77203.40	137.2	147.2	212.93	0.17	1.14	45	2	
'BGX 2D '	58265.60	77192.40	181.1	191.1	215.42	0.22	1.49	47	2	
'BGX 3D '	57780.10	77577.00	201.6	221.6	214.91	0.31	2.13	46	3	
'BGX 4A '	57215.60	77879.20	106.8	116.8	155.18	0.06	0.41	46	1	
'BGX 4C '	57202.20	77886.20	170.7	180.7	214.35	0.45	3.06	46	2	
'BGX 4D '	57186.20	77893.90	203.8	223.8	215.87	0.23	1.56	46	4	
'BGX 5D '	57308.60	78402.00	195.0	215.0	209.19	0.24	1.66	47	3	
'BGX 6D '	57524.90	78740.10	191.0	211.0	206.05	0.25	1.68	46	6	?
'BGX 7D '	58312.80	78349.30	194.1	214.1	205.88	0.23	1.47	40	6	?
'BGX 8DR'	58942.50	77589.60	183.1	203.1	205.67	0.19	1.24	42	2	
'BGX 9D '	59522.10	76936.00	212.4	232.4	226.65	0.30	2.04	47	4	
'BGX 10D '	59765.50	76183.30	216.2	236.2	225.62	0.25	1.68	47	4	
'BGX 11D '	59581.40	75300.70	216.7	236.7	235.60	0.19	1.24	43	4	
'BGX 12C '	59675.30	74427.90	174.1	184.1	234.57	0.42	2.73	43	2	
'BGX 12D '	59674.30	74410.90	223.7	243.7	239.04	0.26	1.78	48	4	
'BRD 1 '	29277.70	55860.50	148.9	178.9	167.27	0.33	1.92	33	3	
'BRD 2 '	29357.10	56093.30	148.5	178.5	168.87	0.70	4.02	33	3	
'BRD 3 '	29538.90	55918.70	158.5	188.5	170.84	1.21	4.69	15	3	
'BRD 4 '	29219.20	56060.40	129.1	159.1	166.01	0.36	2.00	31	6	?
'BRD 5D '	29252.60	55955.70	148.4	168.4	166.90	0.38	1.95	26	3	
'BRR 1D '	50588.20	77365.20	200.4	220.4	217.15	0.46	2.11	21	3	
'BRR 2D '	50306.30	77431.40	196.1	216.1	215.49	0.47	2.20	22	3	
'BRR 3D '	50203.50	77398.30	197.1	217.1	215.29	0.43	2.09	24	3	
'BRR 4D '	50104.50	77360.50	198.7	218.7	215.10	0.45	2.06	21	3	
'BRR 5D '	50009.00	77266.70	202.1	222.1	214.91	0.39	1.88	23	3	
'BRR 6C '	51094.70	77062.90	156.0	166.0	211.63	0.26	0.57	5	2	
'BRR 7BR'	50707.50	77575.40	141.6	151.6	204.87	0.03	0.05	2	2	
'BRR 7C '	50698.10	77572.90	175.9	185.9	209.81	0.34	0.75	5	2	
'BRR 7D '	50688.30	77570.70	201.9	221.9	217.88	0.30	0.67	5	3	
'BRR 8B '	50116.50	77634.70	138.7	148.7	204.34	0.38	0.85	5	2	
'BRR 8C '	50125.60	77632.00	182.7	192.7	208.50	0.38	0.84	5	6	?
'BRR 8DR'	50142.30	77627.30	204.0	219.0	214.89	0.57	1.14	4	3	
'CBR 1D '	52822.10	60419.50	230.9	250.9	253.63	0.54	2.60	23	5	
'CBR 2D '	52694.00	60368.90	233.8	253.8	253.09	0.52	2.56	24	5	
'CBR 3D '	52627.20	60388.50	234.1	254.1	253.21	0.55	2.62	23	5	
'CCB 1 '	46990.10	65438.50	198.4	228.4	225.56	0.61	3.25	28	4	
'CCB 2 '	46893.60	65306.10	198.6	228.6	222.70	0.71	4.17	35	4	
'CCB 3 '	47006.60	65187.50	205.6	235.6	225.24	0.64	3.57	31	4	
'CCB 4 '	47181.60	65310.20	211.2	241.2	226.21	0.66	3.87	34	4	
'CDB 1 '	45685.50	67514.60	195.7	216.6	213.91	0.53	3.19	36	3	
'CDB 2 '	45617.70	67415.30	195.1	216.1	214.69	0.57	3.49	38	3	
'CMP 8A '	54270.20	52671.20	13.7	23.5	182.94	0.30	1.62	29	1	
'CMP 8B '	54280.20	52674.60	156.6	166.6	198.46	0.14	0.76	32	2	
'CMP 9B '	53842.30	51691.60	149.0	159.0	194.72	0.13	0.68	28	2	
'CMP 10 '	54006.50	51390.40	188.8	218.8	220.05	0.41	2.03	25	6	?

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'CMP 10B '	54005.90	51380.70	137.4	147.4	195.01	0.13	0.74	31	2	
'CMP 10C '	53994.30	51402.70	179.6	189.6	198.92	0.26	0.51	4	2	
'CMP 11 '	53640.60	51481.30	185.2	215.2	212.03	0.45	2.36	27	6	?
'CMP 11B '	53661.90	51456.60	139.7	149.7	195.05	0.15	0.84	31	2	
'CMP 11D '	53647.00	51467.90	209.5	229.9	222.19	0.71	2.14	9	3	
'CMP 12A '	53524.60	51949.20	22.1	32.1	181.59	0.36	1.92	29	1	
'CMP 12B '	53517.70	51943.30	148.0	158.0	194.64	0.14	0.76	31	2	
'CMP 13B '	53937.80	51855.50	134.2	144.2	194.67	0.14	0.75	31	2	
'CMP 14B '	52587.30	52376.40	130.0	140.0	194.55	0.12	0.68	31	2	
'CMP 14C '	52579.60	52371.70	185.1	215.1	212.44	0.63	3.29	27	6	?
'CMP 14D '	52589.50	52363.50	204.1	224.5	216.16	0.91	2.04	5	3	
'CMP 15A '	52896.80	51357.20	14.2	24.2	180.60	0.31	1.67	29	1	
'CMP 15B '	52904.70	51349.50	145.1	155.1	202.85	0.38	2.20	33	2	
'CMP 16B '	53849.90	51576.70	141.7	151.7	194.77	0.14	0.75	31	2	
'CMP 30B '	53166.90	51729.80	97.4	107.5	194.72	0.17	0.30	3	2	
'CMP 30C '	53208.20	51718.40	179.5	189.5	210.85	0.20	0.40	4	2	
'CMP 30D '	53202.90	51709.70	211.6	231.6	221.12	1.07	2.62	6	3	
'CMP 31B '	53259.80	52319.10	110.0	120.0	194.41	0.13	0.26	4	2	
'CMP 32B '	54052.80	52220.00	97.7	107.7	195.54	0.15	0.37	6	2	
'CMP 32C '	54061.10	52214.60	185.2	195.2	195.93	0.17	0.34	4	2	
'CMP 32D '	54069.20	52209.20	218.6	228.6	220.97	0.02	0.04	5	6	?
'CRP 1 '	44372.20	68617.70	187.8	217.8	208.30	0.39	2.32	35	3	
'CRP 2 '	44336.40	69043.00	171.8	201.8	207.16	0.34	2.00	34	3	
'CRP 3 '	44001.00	68665.50	184.0	214.0	206.91	1.48	6.80	21	3	
'CRP 3C '	44023.80	68701.60	121.1	131.1	196.71	0.22	0.57	7	2	
'CRP 3D '	44012.90	68693.60	194.3	214.3	207.50	0.28	1.02	13	3	
'CRP 4 '	44101.20	68447.40	180.7	210.7	207.31	0.74	4.20	32	3	
'CRP 5C '	44527.70	68535.60	110.1	120.1	198.27	0.25	0.74	9	2	
'CRP 5D '	44515.00	68549.10	194.6	214.6	210.80	1.00	3.99	16	4	
'CRP 6DR'	44017.50	68311.50	194.2	214.2	210.50	-1.00	-1.00	1	4	
'CRP 7D '	44081.80	69196.70	188.0	208.0	206.56	0.41	1.55	14	3	
'CRP 8D '	43681.70	68650.40	191.0	211.0	207.58	0.67	1.76	7	4	
'CRP 9D '	44243.20	69156.70	191.4	211.4	207.20	0.40	1.14	8	3	
'CRP 10D '	43742.70	68999.80	189.5	209.5	204.96	0.89	1.98	5	3	
'CRP 11D '	44164.40	68713.50	193.7	203.6	207.85	0.87	2.30	7	3	
'CSA 1 '	50197.00	61808.40	232.0	262.0	243.36	0.63	3.44	30	5	
'CSA 2 '	50218.60	61761.80	218.2	248.2	243.37	0.87	4.85	31	5	
'CSA 3 '	50173.20	61720.20	218.6	248.6	242.61	0.83	4.61	31	5	
'CSA 4 '	50132.70	61781.90	218.4	248.4	243.00	0.62	3.45	31	5	
'CSB 1A '	44974.00	67593.00	194.9	224.9	213.34	0.49	2.82	33	4	
'CSB 1C '	45207.33	67083.64	141.4	161.4	204.96	0.48	1.08	5	2	
'CSB 2A '	44802.60	67310.20	192.6	222.6	210.97	0.55	3.08	31	3	
'CSB 2C '	44973.31	67608.88	146.9	166.9	204.43	0.61	1.23	4	6	?
'CSB 3A '	44648.30	67385.60	193.0	223.0	210.56	0.51	3.03	35	4	
'CSB 3C '	44617.79	67762.90	137.9	157.9	206.06	0.53	1.18	5	2	
'CSB 4A '	44618.50	67561.80	188.0	218.0	210.63	0.50	3.03	37	3	
'CSB 5A '	44618.90	67751.60	185.9	215.9	210.68	0.48	2.94	37	3	
'CSB 6A '	44863.80	67812.40	189.8	219.8	211.31	0.51	2.95	34	3	
'CSB 7D '	45206.93	67097.80	191.7	211.7	212.84	0.60	1.47	6	3	
'CSD 1D '	50170.50	63255.80	238.4	273.4	244.96	0.54	2.63	24	5	
'CSD 2D '	50144.00	63126.20	233.8	258.8	247.63	1.27	4.74	14	5	
'CSD 4D '	50058.90	63143.80	213.5	263.5	243.99	0.64	2.94	21	5	
'CSD 8D '	49903.10	63195.00	226.8	256.8	243.22	0.55	2.66	23	5	
'CSD 9D '	49838.80	63080.90	226.2	256.2	243.22	0.62	2.82	21	5	
'CSD 10D '	49806.50	63094.10	224.5	254.5	243.12	0.62	2.82	21	5	
'CSD 11D '	49763.90	63956.30	220.9	250.9	242.95	0.65	3.00	21	5	
'CSD 12D '	49937.30	63004.70	224.5	254.5	243.59	0.63	2.87	21	5	
'CSD 13D '	49665.50	62897.80	202.4	252.4	242.42	0.63	2.96	22	4	
'CSF 1D '	49431.30	62368.60	228.2	248.2	243.36	0.17	0.29	3	5	
'CSF 2D '	50880.70	61053.30	235.2	255.2	250.98	0.34	0.48	2	5	
'CSO 1 '	52484.20	61071.10	232.0	262.0	251.37	0.67	3.86	33	5	
'CSO 2 '	52559.00	61114.30	209.7	239.7	252.56	0.62	3.20	27	5	
'CSR 1 '	52804.30	64413.10	237.2	267.2	256.53	0.69	3.75	30	5	
'CSR 3 '	53229.90	65234.80	238.1	268.1	254.54	0.75	4.13	30	5	
'CSR 4 '	53214.40	64412.80	237.6	267.6	256.72	0.75	4.03	29	5	
'DBP 1 '	18661.80	66691.40	93.2	123.2	119.99	0.44	2.54	34	2	
'DBP 2 '	18407.30	66478.20	84.3	114.3	117.41	0.27	1.61	36	2	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'DBP 3 '	18427.50	66775.50	86.4	116.4	121.06	0.36	2.21	37	2
'DBP 4 '	18342.10	66679.60	84.2	114.2	118.97	0.33	1.91	33	2
'DBP 5 '	18605.20	66485.60	96.1	116.1	117.52	0.49	1.89	15	2
'DCB 1A '	19856.30	64028.50	90.1	120.1	115.37	0.17	0.87	28	2
'DCB 2A '	20895.20	63436.10	97.4	127.4	124.85	0.24	1.32	30	2
'DCB 3A '	20899.90	62674.90	96.2	126.2	120.65	0.21	1.13	29	2
'DCB 4A '	20493.80	62678.80	92.5	122.5	119.15	0.15	0.88	33	2
'DCB 5A '	20139.80	63126.10	85.9	115.9	118.85	0.15	0.82	32	2
'DCB 6 '	19979.30	64167.90	109.5	129.5	116.77	0.16	0.89	32	2
'DCB 7 '	20036.30	64001.40	108.9	128.9	118.01	0.15	0.86	32	2
'DCB 8 '	21014.10	63473.90	110.3	130.3	126.45	0.26	1.50	33	2
'DCB 9 '	19807.40	64190.60	97.3	117.3	114.90	0.17	0.94	30	2
'DCB 10 '	19852.30	63803.10	99.8	119.8	116.64	0.36	2.04	32	2
'DCB 11 '	19248.60	64638.30	106.8	126.8	122.09	0.29	1.60	31	2
'DCB 12 '	18529.80	65150.00	92.0	112.0	109.75	0.13	0.74	32	2
'DCB 13 '	19235.40	63842.50	102.0	122.1	117.17	0.76	4.35	33	2
'DCB 14 '	19392.40	64909.80	94.6	114.6	111.57	1.41	4.22	9	2
'DCB 15 '	17635.90	64607.40	99.8	119.9	111.61	0.46	2.25	24	2
'DCB 16 '	17611.20	63956.00	100.1	120.1	111.99	0.24	1.31	29	2
'DCB 17A '	19841.80	64583.20	109.4	119.4	116.52	0.15	0.30	4	2
'DCB 17B '	19844.70	64588.80	99.2	101.7	116.85	0.14	0.27	4	2
'DCB 17C '	19846.50	64593.70	87.4	89.9	116.03	0.13	0.25	4	2
'DCB 18A '	19881.30	64051.80	110.1	120.1	116.16	0.34	0.76	5	2
'DCB 18B '	19874.50	64046.10	100.5	103.0	113.23	0.32	0.65	4	2
'DCB 18C '	19869.40	64041.40	87.7	90.2	112.63	0.29	0.57	4	2
'DCB 19A '	19890.30	64022.10	111.9	121.9	120.05	0.64	1.28	4	2
'DCB 19B '	19885.30	64016.50	101.9	104.4	117.27	0.31	0.62	4	2
'DCB 19C '	19879.70	64010.90	89.1	91.6	116.33	0.33	0.66	4	2
'DCB 20A '	20106.50	63931.00	110.9	120.9	117.07	0.15	0.30	4	2
'DCB 20B '	20102.60	63935.30	100.3	102.8	116.36	0.16	0.32	4	2
'DCB 20C '	20098.10	63940.40	89.4	91.9	116.29	0.17	0.35	4	2
'DCB 20D '	20087.90	63953.30	46.2	48.7	114.29	0.30	0.59	4	1
'DCB 21A '	19854.70	63914.80	110.1	120.1	116.75	0.34	0.68	4	2
'DCB 21B '	19851.50	63920.00	102.2	104.7	113.26	0.23	0.46	4	2
'DCB 21C '	19849.20	63925.30	88.3	90.8	112.85	0.22	0.44	4	2
'DCB 22A '	19794.20	63907.60	109.8	119.8	112.73	0.12	0.26	5	2
'DCB 22B '	19790.70	63913.10	100.9	103.4	112.66	0.19	0.37	4	2
'DCB 22C '	19788.70	63919.10	88.1	90.6	112.74	0.39	0.78	4	2
'DCB 23A '	19608.30	63870.40	105.7	115.7	111.77	0.12	0.28	6	2
'DCB 23B '	19607.00	63876.30	94.1	96.6	108.72	0.08	0.16	4	2
'DCB 23C '	19605.70	63882.50	86.6	89.1	108.95	0.15	0.29	4	2
'DCB 23D '	19602.20	63900.00	49.1	51.6	111.44	0.27	0.54	4	1
'DCB 24A '	19983.10	63321.60	109.2	119.2	115.39	0.13	0.25	4	2
'DCB 24B '	19972.40	63318.20	100.6	103.1	115.15	0.06	0.10	3	2
'DCB 24C '	19966.40	63315.70	87.6	90.1	116.21	0.12	0.23	4	2
'DOB 1 '	23567.80	68438.10	114.7	144.7	143.23	0.40	2.73	47	2
'DOB 2 '	23340.80	68568.00	115.3	145.3	143.31	0.43	2.96	47	2
'DOB 3 '	23633.30	68693.50	115.9	145.9	143.13	0.53	3.14	35	2
'DOB 4 '	23815.60	68514.40	109.2	139.2	142.39	0.51	3.02	35	2
'DOB 7 '	23485.70	68315.80	125.7	145.7	143.18	0.46	1.83	16	2
'DOB 8 '	23710.40	68429.20	128.3	148.3	143.78	0.48	1.91	16	2
'DOB 9 '	23690.70	68811.60	128.5	148.5	144.10	0.42	0.73	3	2
'DOB 10 '	23291.40	68490.90	128.3	148.3	143.30	0.42	1.67	16	2
'DOB 11 '	23400.80	68445.20	126.7	131.7	140.92	0.32	0.56	3	2
'DOB 12 '	23398.78	68450.08	133.1	138.1	140.56	0.36	1.54	18	2
'DOB 14 '	23527.50	68335.00	132.6	137.6	139.68	0.33	0.58	3	2
'DOB 15 '	23189.90	68139.60	110.9	116.0	141.92	0.20	0.34	3	2
'DOB 16 '	23190.80	68133.90	103.5	108.6	141.39	0.19	0.32	3	2
'DOL 1 '	23586.10	68794.40	109.2	119.2	144.27	0.40	0.69	3	2
'F 2 '	51484.30	75677.40	207.0	217.0	218.37	1.40	2.42	3	3
'F 18A '	50108.00	74170.20	194.4	204.4	203.79	1.24	3.71	9	3
'FAB 1 '	54915.50	77798.80	215.4	235.4	228.36	0.22	0.78	13	4
'FAB 2 '	55137.50	77470.10	216.5	236.5	229.12	0.21	0.77	14	4
'FAB 3 '	55030.80	77151.20	211.8	231.8	228.85	0.21	0.72	12	4
'FAB 4 '	54759.70	77584.60	214.2	234.2	228.54	0.20	0.68	11	4
'FAC 3 '	55322.70	78018.30	224.8	254.8	229.11	0.28	1.58	31	5
'FAC 4 '	55472.90	78223.80	207.8	237.8	228.52	0.26	1.45	31	4
'FAC 5 '	55241.30	77960.30	214.0	234.0	224.91	0.60	3.18	28	4

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

’FAC 5P ’	55314.80	78175.70	225.7	235.7	229.73	0.38	0.86	5	5	
’FAC 6 ’	55335.50	78129.00	216.2	236.2	220.78	0.80	4.10	26	5	
’FAC 7 ’	55356.20	78123.40	215.7	235.7	223.18	1.03	5.57	29	5	
’FAC 8 ’	55366.00	78090.90	216.0	236.0	227.17	0.73	3.91	29	5	
’FAC 9C ’	55339.30	78030.50	197.4	207.4	217.42	0.28	0.57	4	3	
’FAC 10C ’	55298.40	78119.70	200.2	210.2	217.42	0.28	0.63	5	3	
’FAC 11C ’	55231.90	78100.30	201.4	211.4	217.49	0.28	0.63	5	3	
’FAC 12C ’	55226.40	78047.20	198.0	208.0	217.55	0.28	0.63	5	3	
’FAL 1 ’	53756.40	78115.90	207.0	238.5	218.73	0.29	1.74	35	5	
’FAL 2 ’	53757.40	78231.90	206.6	238.0	217.15	0.29	1.71	34	6	?
’FBP 1A ’	51080.70	78893.00	161.8	191.8	206.72	0.37	2.13	33	2	
’FBP 2A ’	50534.10	79711.40	137.1	167.1	191.51	0.47	2.70	33	2	
’FBP 3A ’	50913.40	79838.90	141.0	171.0	194.31	0.46	2.78	37	2	
’FBP 4 ’	51368.20	79320.00	165.2	195.2	212.39	0.33	1.92	33	2	
’FBP 5D ’	51073.90	79193.80	192.6	212.6	205.23	0.41	1.53	14	6	?
’FBP 6D ’	50547.10	79672.90	178.3	198.3	194.77	0.55	2.20	16	2	
’FBP 7D ’	50878.90	79805.70	183.2	203.2	194.09	0.28	0.68	6	2	
’FBP 8D ’	51386.40	79291.80	172.8	192.8	207.08	0.49	1.82	14	2	
’FBP 9D ’	51074.00	79565.10	177.9	197.9	200.29	0.71	2.54	13	2	
’FBP 11D ’	50767.90	79099.30	192.0	212.1	203.03	0.15	0.41	7	6	?
’FBP 12D ’	51165.70	78932.30	182.1	202.1	208.42	0.45	1.58	12	2	
’FBP 13D ’	50694.10	79748.90	172.7	192.7	194.94	0.91	3.51	15	2	
’FC 1A ’	53115.10	79664.50	96.7	101.7	143.51	-1.00	-1.00	1	1	
’FC 1B ’	53115.00	79672.40	151.8	156.8	210.78	-1.00	-1.00	1	2	
’FC 1C ’	53115.10	79680.10	183.9	188.9	214.00	-1.00	-1.00	1	2	
’FC 1D ’	53114.50	79688.30	217.2	222.2	223.63	-1.00	-1.00	1	5	
’FC 3A ’	57620.00	78726.60	21.5	26.5	175.47	-1.00	-1.00	1	6	?
’FC 3B ’	57629.90	78727.70	61.2	66.2	150.63	-1.00	-1.00	1	1	
’FC 3C ’	57639.00	78728.00	121.0	126.0	151.80	-1.00	-1.00	1	1	
’FC 3D ’	57647.90	78728.40	165.9	170.9	206.43	-1.00	-1.00	1	2	
’FC 3E ’	57655.50	78728.80	185.7	190.7	205.33	-1.00	-1.00	1	2	
’FC 3F ’	57663.20	78729.10	205.1	210.1	206.25	-1.00	-1.00	1	3	
’FC 4A ’	53896.50	82242.50	-28.0	-23.0	173.31	-1.00	-1.00	1	6	?
’FC 4B ’	53901.30	82249.00	76.1	81.1	140.96	-1.00	-1.00	1	1	
’FC 4C ’	53905.90	82255.40	116.3	121.3	137.64	-1.00	-1.00	1	1	
’FC 4D ’	53910.70	82262.20	146.4	151.4	151.03	-1.00	-1.00	1	6	?
’FC 4E ’	53915.30	82268.90	176.4	181.4	185.19	-1.00	-1.00	1	2	
’FCA 2C ’	53712.20	78296.00	295.3	299.3	297.45	0.56	2.63	22	5	
’FCA 2D ’	53715.20	78295.80	219.0	239.0	225.03	0.35	2.28	42	5	
’FCA 9D ’	53733.10	78600.50	221.9	241.9	225.20	0.23	1.31	32	5	
’FCA 9DR’	53734.50	78608.80	207.7	227.7	224.00	0.41	1.52	14	4	
’FCA 10A ’	53571.90	78640.40	221.0	241.0	225.27	0.22	1.40	42	5	
’FCA 10D ’	53732.00	78640.00	219.5	239.5	225.76	0.38	2.03	28	5	
’FCA 16A ’	53568.80	78899.50	215.1	235.1	225.18	0.20	1.28	42	5	
’FCA 16B ’	53571.00	78898.00	295.3	299.3	298.00	0.41	1.73	18	5	
’FCA 16D ’	53719.50	78898.50	221.1	241.1	224.96	0.26	1.37	28	5	
’FCA 19D ’	53719.10	78271.90	209.7	229.7	217.22	0.34	1.85	29	4	
’FCB 1 ’	54871.80	76835.40	205.6	235.6	230.23	0.24	0.34	2	4	
’FCB 2 ’	55046.70	76679.70	205.2	235.2	228.60	0.79	4.44	32	4	
’FCB 3 ’	54874.40	76427.80	195.3	225.3	223.94	0.31	1.72	30	6	?
’FCB 4 ’	54605.90	76780.40	204.5	234.5	228.18	0.60	3.42	32	4	
’FCB 5 ’	54773.00	76492.60	217.1	237.1	228.84	0.32	1.73	30	4	
’FCB 6 ’	54733.40	76582.10	215.1	235.1	229.08	0.27	1.40	26	4	
’FET 1D ’	53299.90	76165.60	206.9	226.9	223.75	0.27	1.50	30	4	
’FET 2D ’	52981.20	76045.80	209.5	229.5	222.40	0.29	1.57	30	4	
’FET 3D ’	53025.70	75961.00	203.0	223.0	222.60	0.29	1.57	30	3	
’FET 4D ’	53149.00	75959.30	205.1	225.1	222.95	0.28	1.59	32	3	
’FIW 1D ’	51420.00	76114.90	198.9	218.9	214.73	-1.00	-1.00	1	3	
’FIW 1ID’	51362.50	76171.60	194.0	214.0	219.04	0.86	2.10	6	3	
’FIW 2IC’	51202.60	75924.50	125.3	175.2	212.61	0.78	2.20	8	2	
’FIW 2MA’	51184.50	75930.80	100.5	110.5	151.83	0.23	0.64	8	1	
’FIW 2MC’	51263.50	75757.90	127.9	167.9	210.05	1.30	3.89	9	2	
’FIW 2MD’	51202.40	75934.90	190.9	220.8	217.09	0.81	2.28	8	3	
’FNB 1 ’	54271.60	80151.50	177.2	207.2	210.94	0.40	2.22	30	6	?
’FNB 1A ’	54288.80	80154.50	107.9	117.9	144.29	0.10	0.25	7	1	
’FNB 2 ’	54362.10	80442.30	180.8	210.8	207.10	0.42	2.33	31	6	?
’FNB 2A ’	54355.80	80454.70	111.1	121.1	143.59	0.15	0.40	7	1	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'FNB 3 '	54105.80	80553.10	182.1	212.1	209.27	0.43	2.37	31	6	?
'FNB 3A '	54116.60	80557.20	109.2	119.2	143.14	0.22	0.59	7	1	
'FNB 4 '	53843.50	80409.80	179.6	209.6	213.61	0.48	2.70	31	6	?
'FNB 5 '	54295.20	80556.10	193.5	203.5	206.66	0.40	1.12	8	6	?
'FNB 6 '	54096.28	80822.49	200.6	210.6	208.73	0.21	0.43	4	3	
'FNB 7 '	54398.46	80649.18	192.4	202.4	203.95	0.22	0.44	4	6	?
'FNB 8 '	54550.33	80521.45	195.4	205.4	202.85	0.15	0.33	5	3	
'FOB 1D '	50026.60	73812.76	175.4	195.4	204.05	0.81	1.97	6	3	
'FOB 4D '	49338.12	74430.27	174.0	194.1	206.94	0.93	2.28	6	3	
'FOB 5C '	49730.31	74607.04	129.3	149.3	202.57	0.97	2.74	8	2	
'FOB 7C '	50235.60	76074.12	148.9	168.9	209.84	0.73	2.08	8	2	
'FOB 7D '	50244.28	76085.38	193.9	213.9	212.71	1.10	2.46	5	3	
'FOB 8D '	49940.18	75772.14	191.4	211.4	212.33	1.17	2.86	6	3	
'FOB 9C '	50797.38	75773.51	155.5	175.5	211.99	0.73	2.06	8	2	
'FOB 9D '	50782.52	75774.99	192.6	212.6	214.82	1.16	2.84	6	3	
'FOB 11C '	51920.55	75613.91	156.2	176.2	214.27	0.80	2.26	8	2	
'FOB 11D '	51909.29	75602.78	199.0	219.0	217.69	0.91	2.40	7	3	
'FOB 12D '	49785.91	75596.56	179.3	199.3	211.49	1.13	2.76	6	3	
'FRB 1 '	53914.94	76229.52	212.2	232.2	227.65	0.90	2.02	5	4	
'FRB 3 '	53588.10	76117.53	216.2	231.2	224.91	0.87	1.94	5	4	
'FRB 4 '	53653.31	76076.19	214.6	229.6	224.30	0.67	1.78	7	4	
'FSB 0PD'	49849.80	74549.20	171.6	215.3	207.62	0.38	0.92	6	3	
'FSB 50PD'	49874.60	74600.90	174.7	219.8	207.23	1.04	2.94	8	3	
'FSB 76 '	51388.80	76141.60	197.0	227.0	218.17	0.26	2.18	69	3	
'FSB 76A '	51391.60	76131.90	36.9	47.4	155.27	0.11	0.92	72	1	
'FSB 76B '	51394.00	76122.40	99.2	109.7	151.77	0.08	0.66	72	1	
'FSB 76C '	51396.40	76112.40	154.8	165.3	213.00	0.17	1.51	82	2	
'FSB 77 '	50713.10	75129.40	186.4	216.4	212.49	0.20	1.74	78	3	
'FSB 78 '	50164.70	74764.00	187.7	217.7	208.84	0.24	2.17	83	3	
'FSB 78A '	50172.80	74757.70	27.0	37.5	156.26	0.09	0.78	74	1	
'FSB 78B '	50178.80	74765.90	82.4	92.8	154.65	0.09	0.76	71	1	
'FSB 78C '	50170.20	74772.50	141.6	151.4	208.00	0.16	1.41	81	2	
'FSB 79 '	50139.70	73663.10	174.1	204.1	201.63	0.32	2.84	81	3	
'FSB 79A '	50149.60	73664.50	24.0	34.4	158.19	0.17	1.43	73	1	
'FSB 79B '	50159.20	73666.10	80.7	91.2	158.28	0.10	0.88	72	1	
'FSB 79C '	50171.30	73668.00	149.8	159.6	196.88	0.12	1.07	80	2	
'FSB 87A '	50115.80	75601.70	33.1	43.6	153.99	0.09	0.74	72	1	
'FSB 87B '	50104.90	75597.00	90.0	100.5	150.76	0.08	0.65	73	1	
'FSB 87C '	50093.40	75591.90	148.8	159.3	208.78	0.22	1.93	75	2	
'FSB 87D '	50081.10	75586.30	187.4	216.8	213.95	0.48	2.54	28	3	
'FSB 88C '	51518.00	75619.40	158.4	168.4	212.72	0.21	1.77	71	2	
'FSB 88D '	51527.00	75621.80	202.1	222.1	216.26	0.20	1.79	77	3	
'FSB 89C '	51345.20	75553.20	156.1	166.1	212.07	0.19	1.60	70	2	
'FSB 89D '	51335.80	75548.30	201.9	221.9	215.66	0.21	1.75	72	3	
'FSB 90C '	51148.60	75382.90	158.1	168.1	211.09	0.20	1.70	73	2	
'FSB 90D '	51140.70	75376.90	205.1	225.1	215.39	0.53	3.65	48	3	
'FSB 91C '	50953.50	75213.30	149.1	159.1	210.87	0.16	1.43	78	2	
'FSB 91D '	50946.60	75207.60	200.9	220.9	213.86	0.21	1.80	73	3	
'FSB 92C '	50564.00	75053.20	147.6	157.6	209.42	0.47	3.24	48	2	
'FSB 92D '	50557.60	75045.80	201.7	221.7	212.07	0.19	1.61	71	3	
'FSB 93C '	50458.30	74897.30	142.0	152.0	208.90	0.16	1.39	78	2	
'FSB 93D '	50452.40	74888.50	197.9	217.9	210.85	0.20	1.73	77	3	
'FSB 94C '	50180.00	74869.00	139.8	149.8	207.96	0.25	2.24	78	2	
'FSB 94DR'	50162.90	74869.10	183.3	203.4	210.21	0.19	1.48	58	3	
'FSB 95C '	50016.70	74971.70	145.8	155.8	205.64	0.30	1.05	12	2	
'FSB 95CR'	49987.80	75001.90	151.9	161.9	208.00	0.16	1.29	63	2	
'FSB 95D '	50008.90	74977.50	207.8	227.8	210.45	1.18	3.72	10	4	
'FSB 95DR'	49996.00	74991.70	187.0	207.0	210.47	0.19	1.46	60	3	
'FSB 96A '	49778.70	74882.20	85.7	95.7	152.05	0.11	0.37	12	1	
'FSB 96AR'	49746.60	74914.90	79.0	89.0	153.47	0.07	0.52	58	1	
'FSB 97A '	49965.70	75171.20	85.8	95.8	152.31	0.08	0.66	71	1	
'FSB 97C '	49970.60	75179.60	143.8	153.8	208.32	0.17	1.50	76	2	
'FSB 97D '	49975.50	75188.90	196.9	216.9	210.84	0.18	1.62	79	3	
'FSB 98A '	50121.60	75389.80	84.7	94.7	150.61	0.14	0.51	14	1	
'FSB 98AR'	50105.80	75362.00	82.1	92.1	151.90	0.05	0.38	53	1	
'FSB 98C '	50116.50	75381.20	148.4	158.4	209.30	0.20	1.74	73	2	
'FSB 98D '	50111.60	75371.90	200.3	220.3	212.31	0.19	1.67	76	3	
'FSB 99A '	50314.80	75675.60	92.9	102.9	150.78	0.08	0.63	71	1	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'FSB 99C '	50320.60	75683.70	157.2	167.2	209.91	0.21	1.73	71	2	
'FSB 99D '	50326.90	75691.70	198.1	218.1	212.38	0.24	2.11	77	3	
'FSB100A '	50958.40	75534.40	95.8	105.8	151.62	0.08	0.68	70	1	
'FSB101A '	51191.30	75719.00	92.9	102.9	151.84	0.09	0.77	70	1	
'FSB102C '	50834.80	73582.90	145.9	155.9	195.37	0.06	0.47	71	2	
'FSB103C '	49651.30	74210.00	147.1	157.1	202.62	0.14	1.27	80	2	
'FSB104C '	49248.60	73872.60	150.7	160.7	201.08	0.15	1.26	70	2	
'FSB104D '	49255.40	73865.20	190.4	210.4	204.58	0.17	1.48	73	3	
'FSB105C '	49828.00	75234.20	141.5	151.5	207.89	0.31	2.74	80	2	
'FSB105D '	49833.30	75244.30	203.7	223.7	208.26	0.31	1.02	11	3	
'FSB105DR'	49841.00	75258.10	188.5	208.6	210.97	0.21	1.61	58	3	
'FSB106C '	50651.30	74190.10	156.0	166.0	201.45	0.13	1.10	75	2	
'FSB106D '	50636.80	74193.00	202.9	222.9	207.12	0.28	1.83	42	3	
'FSB107C '	51158.10	75184.00	150.8	160.8	210.33	0.34	2.86	71	2	
'FSB107D '	51149.80	75177.20	200.9	220.9	213.85	0.24	2.08	78	3	
'FSB108D '	51142.30	76260.70	203.8	223.8	217.70	0.25	2.48	97	3	
'FSB109D '	50488.60	75855.90	205.8	225.8	213.69	0.25	2.15	74	3	
'FSB110C '	50150.60	74190.70	137.2	147.2	201.26	0.20	1.72	76	2	
'FSB110D '	50141.60	74193.30	191.1	211.1	205.64	0.15	1.32	78	3	
'FSB111C '	51526.30	75383.30	159.0	169.0	212.18	0.20	1.65	72	2	
'FSB111D '	51515.90	75382.90	201.7	221.7	215.55	0.25	2.13	74	3	
'FSB112A '	48809.10	74231.40	81.0	91.0	153.58	0.06	0.45	59	1	
'FSB112C '	48794.80	74227.50	129.1	139.1	201.90	0.21	1.62	61	2	
'FSB112D '	48780.00	74223.70	188.9	208.9	206.15	0.18	1.36	58	3	
'FSB113A '	51068.10	74167.50	81.0	91.3	159.00	0.36	2.78	59	1	
'FSB113C '	51084.20	74160.70	154.0	164.0	202.64	0.18	1.38	60	2	
'FSB113D '	51098.40	74154.80	189.6	209.6	207.42	0.17	1.33	59	3	
'FSB114A '	52046.60	75297.40	95.2	105.0	155.76	0.06	0.48	59	1	
'FSB114C '	52033.80	75288.50	158.0	168.0	213.68	0.17	1.30	61	2	
'FSB114D '	52018.60	75278.60	197.7	217.8	217.17	0.19	1.47	59	3	
'FSB115C '	49736.00	72515.50	163.8	173.8	184.41	0.11	0.88	64	6	?
'FSB115D '	49728.30	72504.30	182.5	192.5	191.38	0.16	1.26	63	3	
'FSB116C '	50645.90	72725.50	160.5	170.5	189.59	0.23	1.72	58	2	
'FSB116D '	50629.70	72727.40	186.4	196.4	191.96	0.16	1.28	66	3	
'FSB117D '	50486.80	74070.40	189.7	209.7	205.18	0.14	1.06	58	3	
'FSB118D '	51276.30	74697.90	191.3	211.3	211.68	0.21	1.59	57	3	
'FSB119D '	50600.60	74599.70	193.1	213.1	208.38	0.16	1.37	69	3	
'FSB120A '	49175.70	75538.90	99.0	109.0	152.77	1.14	8.39	54	1	
'FSB120C '	49171.10	75549.80	150.7	160.7	206.31	0.17	1.33	58	2	
'FSB120D '	49163.70	75568.70	196.5	216.5	209.68	0.24	1.90	65	3	
'FSB121C '	48413.10	75155.70	148.4	158.4	204.39	0.18	1.37	58	2	
'FSB121DR'	48429.70	75151.90	191.3	211.3	207.24	0.20	1.50	54	3	
'FSB122C '	48195.00	73881.80	160.0	170.0	200.11	0.25	1.89	59	2	
'FSB122D '	48201.70	73865.50	186.6	206.6	203.45	0.27	2.07	58	3	
'FSB123C '	51750.50	74566.70	155.3	165.3	210.45	0.19	1.47	57	2	
'FSB123D '	51734.80	74562.70	194.1	214.1	212.29	0.17	1.30	58	3	
'FSB150PC'	49990.10	74090.00	107.6	160.1	198.57	0.46	1.30	8	2	
'FSB150PD'	49717.90	74615.80	176.2	221.3	207.99	0.70	1.99	8	3	
'FSL 1D '	52992.50	79063.10	208.5	228.6	224.68	0.16	1.12	50	5	
'FSL 2D '	52790.60	78636.50	208.7	228.8	225.10	0.17	1.30	57	6	?
'FSL 3D '	52465.20	77765.20	205.9	226.0	222.76	0.25	1.85	55	4	
'FSL 4D '	52230.40	77452.40	204.0	224.1	217.51	0.19	1.38	50	4	
'FSL 5D '	51903.30	77047.70	203.5	223.7	220.79	0.21	1.48	48	4	
'FSL 6D '	51727.90	76733.10	202.1	222.1	220.15	0.20	1.41	48	3	
'FSL 7D '	51485.60	76327.80	199.5	219.6	218.24	0.28	1.96	50	3	
'FSL 8D '	51513.50	76054.70	202.7	222.8	217.62	0.22	1.49	46	3	
'FSL 9D '	51543.90	75768.40	201.4	221.5	216.80	0.48	3.32	47	3	
'FSS 1D '	53897.60	75257.60	209.9	229.9	223.69	0.21	1.55	55	4	
'FSS 2D '	53918.90	75103.50	204.4	224.4	222.88	0.23	1.70	53	3	
'FSS 3D '	53548.00	74960.50	205.8	225.8	220.71	0.23	1.70	54	3	
'FSS 4D '	52876.10	75537.80	202.6	222.6	218.96	0.26	1.87	53	3	
'FST 1D '	49102.00	81242.60	119.5	129.5	125.73	0.36	1.03	8	1	
'FTF 1 '	53179.80	77413.30	221.2	241.2	227.43	1.45	5.44	14	5	
'FTF 2 '	53275.10	77336.00	219.4	239.4	225.16	0.71	3.55	25	5	
'FTF 3 '	53244.80	77235.30	218.2	221.2	223.85	0.66	3.62	30	4	
'FTF 4 '	53268.20	77132.90	216.6	236.6	223.81	0.37	2.07	31	5	
'FTF 5 '	53168.30	77035.60	215.3	235.3	223.45	0.50	2.84	32	4	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'FTF 6 '	53062.00	77151.40	216.9	236.9	223.41	0.42	2.26	29	5	
'FTF 7 '	53089.70	77235.90	222.1	226.1	223.74	0.36	2.05	33	4	
'FTF 8 '	53059.90	77336.20	219.6	239.6	225.07	0.74	3.13	18	5	
'FTF 9 '	52769.50	77482.80	216.4	236.4	221.13	0.90	4.78	28	5	
'FTF 10 '	52905.00	77336.00	215.1	235.1	220.09	1.23	5.64	21	4	
'FTF 11 '	52748.80	77180.70	215.8	235.8	220.49	1.31	5.99	21	5	
'FTF 12 '	52648.50	77321.40	215.0	235.0	226.76	0.28	1.54	31	4	
'FTF 13 '	53098.40	76637.80	216.1	236.1	228.19	1.20	6.80	32	4	
'FTF 15 '	53230.00	76732.00	197.5	227.5	225.11	0.58	3.34	33	6	?
'FTF 16 '	52879.80	76758.60	203.8	233.8	223.33	0.47	2.72	33	6	?
'FTF 17 '	52884.00	76872.00	200.6	230.6	222.94	0.35	2.04	34	6	?
'FTF 18 '	52879.20	76955.80	202.3	232.3	223.26	0.51	2.90	32	6	?
'FTF 19 '	52670.40	77139.10	198.3	228.3	222.37	0.36	2.05	33	6	?
'FTF 20 '	52500.00	77015.00	198.3	228.3	221.81	0.31	1.82	34	6	?
'FTF 21 '	52498.60	76866.70	198.7	228.7	223.06	0.27	1.59	34	3	
'FTF 22 '	52494.70	76751.30	212.6	242.6	221.71	0.35	2.02	34	6	?
'FTF 23 '	52660.30	76611.80	201.2	231.2	222.18	0.36	2.08	33	6	?
'FTF 24A '	52780.80	77256.60	212.7	232.7	222.00	0.69	3.90	32	4	
'FTF 25A '	52868.70	77308.40	212.8	232.8	223.18	0.33	1.92	33	4	
'FTF 26 '	52875.40	77250.00	206.3	226.3	223.26	0.33	1.88	32	4	
'FTF 27 '	52823.50	77227.20	213.5	243.5	223.33	0.39	2.23	32	5	
'H 6 '	58335.40	72009.10	225.2	235.2	231.04	0.86	1.91	5	4	
'H 7 '	58336.10	71949.20	224.9	234.9	228.96	0.48	1.07	5	4	
'H 8 '	58233.90	71615.40	218.4	228.4	227.01	0.18	0.48	7	4	
'H 9 '	58275.30	71572.60	207.4	217.4	226.76	0.33	0.74	5	4	
'H 10 '	57822.80	71607.20	222.5	232.5	227.27	0.39	1.04	7	4	
'H 11 '	57779.40	71565.90	212.0	222.0	227.70	0.41	0.92	5	4	
'H 18A '	57337.70	71339.60	217.5	227.5	224.08	0.25	1.09	19	4	
'H 19 '	57041.70	71434.20	219.6	221.1	227.63	1.02	3.52	12	4	
'HAA 1A '	62967.90	69879.10	94.9	104.9	181.25	0.22	0.66	9	1	
'HAA 1AA'	62960.40	69885.70	13.6	23.6	181.15	0.30	0.90	9	6	?
'HAA 1B '	62976.00	69872.20	119.3	129.3	251.76	0.61	1.83	9	2	
'HAA 1C '	62983.00	69866.20	147.4	157.4	252.36	0.63	1.88	9	2	
'HAA 1D '	62991.00	69859.10	261.8	281.8	276.83	0.63	1.89	9	5	
'HAA 1TA'	62953.30	69892.20	-29.8	-19.8	180.96	0.48	1.44	9	6	?
'HAA 2A '	61276.00	70930.40	107.3	117.3	177.19	0.19	0.57	9	1	
'HAA 2AA'	61285.10	70925.40	29.4	39.4	177.77	0.23	0.70	9	6	?
'HAA 2B '	61267.50	70935.40	127.2	137.2	253.24	0.42	1.26	9	2	
'HAA 2C '	61258.90	70940.40	171.9	181.9	254.82	0.35	1.04	9	2	
'HAA 2D '	61250.60	70945.40	260.3	280.4	276.61	0.39	1.34	12	5	
'HAA 3A '	60190.40	71470.90	96.8	106.8	175.78	0.19	0.57	9	1	
'HAA 3AA'	60201.90	71488.00	6.5	16.5	175.03	0.19	0.58	9	6	?
'HAA 3B '	60178.40	71453.20	125.9	135.9	240.59	0.39	1.30	11	2	
'HAA 3C '	60167.40	71436.90	163.3	173.3	243.95	0.49	1.48	9	2	
'HAA 3D '	60154.30	71418.40	246.7	266.7	264.58	0.82	3.91	23	5	
'HAA 4A '	61920.00	72223.00	105.4	115.3	174.85	0.21	0.63	9	1	
'HAA 4AA'	61929.60	72223.20	32.2	42.2	175.13	0.17	0.59	12	1	
'HAA 4B '	61909.90	72222.90	124.5	135.0	250.41	0.38	1.14	9	6	?
'HAA 4C '	61899.90	72223.10	158.3	168.3	251.83	0.39	1.11	8	2	
'HAA 4D '	61890.00	72223.30	255.7	275.7	270.14	0.43	1.28	9	5	
'HAA 5A '	62657.40	70601.10	100.7	110.7	179.23	1.29	2.24	3	1	
'HAA 6A '	63870.00	71440.90	95.6	105.6	178.92	0.19	0.57	9	1	
'HAA 6AA'	63860.20	71441.00	25.8	35.8	178.60	0.18	0.54	9	1	
'HAA 6B '	63879.80	71440.40	131.3	141.4	235.67	0.27	0.82	9	2	
'HAA 6C '	63889.90	71440.60	161.1	171.1	235.86	0.28	0.84	9	2	
'HAA 6D '	63900.20	71440.30	247.1	267.2	264.83	0.37	1.30	12	5	
'HAC 1 '	61415.20	72171.00	258.8	278.8	269.40	0.31	1.64	28	5	
'HAC 2 '	61366.90	72220.20	258.8	278.8	268.99	0.34	1.79	28	5	
'HAC 3 '	61313.60	72183.40	255.0	275.0	269.11	0.29	1.56	29	5	
'HAC 4 '	61372.00	72120.30	254.1	274.1	269.63	0.31	1.66	28	5	
'HAP 1 '	63398.80	71209.80	256.3	276.3	270.90	0.30	1.48	24	5	
'HAP 2 '	63519.80	71122.90	243.8	263.8	270.35	0.24	1.27	29	5	
'HC 1A '	61867.00	71755.00	89.5	94.5	175.80	0.00	0.00	2	1	
'HC 1D '	61867.00	71746.00	206.5	211.5	268.95	0.75	1.06	2	3	
'HC 1E '	61864.00	71746.00	251.5	256.5	275.00	0.50	0.71	2	5	
'HC 2A '	61866.00	71794.00	72.2	77.2	175.80	0.50	0.71	2	1	
'HC 2B '	61876.00	71785.00	85.7	90.7	175.00	1.00	1.41	2	1	
'HC 2C '	61872.00	71784.00	135.7	140.7	253.70	0.50	0.71	2	2	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'HC 2D '	61866.00	71784.00	178.2	183.2	255.80	0.50	0.71	2	2	
'HC 2E '	61861.00	71784.00	205.7	210.7	269.50	1.00	1.41	2	3	
'HC 2F '	61861.00	71780.00	250.7	255.7	274.30	0.00	0.00	2	5	
'HC 4A '	63409.00	71606.00	150.0	155.0	244.70	0.00	0.00	2	2	
'HC 6A '	62060.00	72150.00	156.2	161.2	252.20	0.50	0.71	2	2	
'HC 6B '	62070.00	72150.00	210.2	215.2	268.90	1.00	1.41	2	3	
'HC 8A '	60058.50	77481.80	13.3	16.3	175.63	-1.00	-1.00	1	6	?
'HC 8B '	60058.40	77487.50	132.5	137.5	155.47	-1.00	-1.00	1	1	
'HC 8C '	60065.10	77484.40	187.3	192.3	197.49	-1.00	-1.00	1	2	
'HC 10A '	61593.40	75806.70	114.0	117.0	163.34	-1.00	-1.00	1	1	
'HC 10B '	61600.10	75801.30	164.8	169.8	208.91	1.11	1.92	3	2	
'HC 11C '	62131.40	74496.40	190.8	195.8	236.60	1.00	1.41	2	6	?
'HC 12B '	59488.40	73186.90	177.3	182.3	240.75	1.43	2.48	3	2	
'HCA 1 '	63109.00	72521.70	253.7	273.7	269.37	0.26	1.52	34	5	
'HCA 2 '	62943.30	72265.90	242.0	273.4	270.26	0.27	1.56	33	5	
'HCA 3 '	63108.70	72651.70	253.8	273.8	269.16	0.24	1.42	34	5	
'HCA 4 '	62942.90	72523.70	241.9	273.3	269.34	0.25	1.57	41	5	
'HCA 4A '	62929.90	72515.50	103.7	113.7	175.66	0.18	0.59	11	1	
'HCA 4AA'	62942.50	72513.70	33.6	43.6	175.31	0.18	0.59	11	6	?
'HCA 4B '	62942.30	72532.90	126.6	136.6	246.11	0.29	0.96	11	2	
'HCA 4C '	62931.80	72532.80	153.8	163.8	246.82	0.30	0.98	11	2	
'HCB 1 '	63921.50	71426.80	222.6	252.6	263.62	0.26	1.44	32	4	
'HCB 2 '	63797.90	71289.70	239.9	269.9	268.15	0.21	1.24	34	5	
'HCB 3 '	63919.90	71098.80	233.6	263.6	266.56	0.17	0.95	32	4	
'HCB 4 '	64054.50	71244.20	235.9	265.9	264.36	0.37	2.17	34	4	
'HET 1D '	60546.00	71948.30	240.3	260.3	267.81	0.36	2.00	31	5	
'HET 2D '	60094.40	72006.00	239.7	259.7	258.59	0.34	1.96	33	5	
'HET 3D '	60110.50	72093.90	239.9	259.9	259.41	0.57	3.36	35	5	
'HET 4D '	60166.50	72178.10	239.5	259.6	259.40	0.30	1.78	34	5	
'HHP 1D '	60533.88	71026.79	260.4	270.4	271.42	0.16	0.36	5	5	
'HHP 2D '	60803.08	70886.58	263.2	273.2	274.78	0.41	0.92	5	5	
'HIW 1ID'	58480.00	72506.90	213.0	228.0	231.87	0.58	0.81	2	4	
'HIW 1MD'	58486.00	72546.30	214.9	239.7	235.47	1.20	3.17	7	4	
'HIW 1PD'	58395.30	72543.30	215.5	240.5	234.93	1.19	3.16	7	4	
'HIW 2A '	56753.00	73249.70	78.3	88.3	167.52	0.19	0.60	10	1	
'HIW 2D '	56750.20	73269.20	210.9	230.8	231.11	0.83	2.99	13	4	
'HIW 2MC'	56698.40	73226.40	154.0	184.0	228.29	0.76	2.14	8	2	
'HIW 2MC'	56698.40	73226.40	124.1	139.0	228.29	0.76	2.14	8	2	
'HIW 3MC'	56649.70	73360.40	156.1	186.1	230.18	1.41	4.22	9	2	
'HIW 3MC'	56649.70	73360.40	126.4	141.3	230.18	1.41	4.22	9	2	
'HIW 4MC'	56570.10	73160.10	150.4	180.4	219.68	-1.00	-1.00	1	2	
'HIW 4MC'	56570.10	73160.10	120.8	135.7	219.68	-1.00	-1.00	1	2	
'HIW 5MC'	56498.90	73557.90	154.2	184.1	228.60	0.70	2.10	9	2	
'HIW 5MC'	56498.90	73557.90	124.4	139.2	228.60	0.70	2.10	9	2	
'HMD 1D '	56973.30	78731.70	199.7	219.7	209.68	0.24	1.65	46	3	
'HMD 2D '	57269.70	79665.80	190.8	210.8	200.99	0.26	1.74	46	6	?
'HMD 3D '	57745.20	79578.70	187.7	207.7	200.32	0.26	1.71	45	6	?
'HMD 4D '	58188.50	79160.40	188.9	208.9	200.02	0.39	2.61	45	2	
'HOB 2D '	57273.89	72811.95	200.4	220.4	230.41	1.21	2.98	6	3	
'HOB 3D '	58034.78	72326.22	207.7	227.7	230.33	1.22	2.98	6	4	
'HOB 4D '	58370.03	72223.65	210.4	230.4	232.19	1.41	3.15	5	4	
'HOB 6D '	57421.25	70577.88	186.9	196.9	206.90	0.55	1.34	6	3	
'HOB 7D '	56289.34	71879.82	197.4	217.4	220.85	0.68	1.68	6	3	
'HR3 11 '	60146.50	71402.80	200.4	230.0	259.68	0.33	1.95	34	4	
'HR3 13 '	60065.50	71649.40	205.1	234.8	258.90	0.47	2.75	34	4	
'HR3 18P '	60218.26	71550.99	244.3	264.3	267.68	1.33	2.66	4	5	
'HR8 11 '	59559.80	71945.70	207.9	237.6	245.78	0.52	3.26	39	4	
'HR8 12 '	59330.10	71780.10	206.3	235.9	239.40	0.43	2.57	36	4	
'HR8 13 '	59300.20	71559.60	201.7	231.4	237.22	0.49	2.91	35	4	
'HR8 14 '	59612.10	71431.40	202.3	231.9	242.30	1.40	5.61	16	4	
'HSB 50PC'	55690.30	72161.10	119.5	169.6	216.93	0.89	2.52	8	2	
'HSB 65 '	58432.00	72425.60	212.4	242.4	232.70	0.32	2.69	70	4	
'HSB 65A '	58436.00	72436.20	62.5	73.2	171.54	0.15	1.27	70	1	
'HSB 65B '	58439.40	72445.60	123.3	133.3	224.55	0.13	1.09	69	2	
'HSB 65C '	58447.10	72439.60	207.8	218.6	233.06	0.26	2.21	70	4	
'HSB 66 '	56928.30	72429.20	198.1	228.1	224.68	0.36	3.26	82	4	
'HSB 67 '	58424.30	71505.00	200.7	230.7	222.88	0.38	3.33	77	4	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'HSB 68 '	56901.00	71528.00	213.3	243.3	221.72	0.23	1.78	59	4	
'HSB 68A '	56892.10	71526.90	47.5	58.0	171.95	0.12	1.00	70	1	
'HSB 68B '	56882.10	71525.50	123.5	134.5	216.75	0.25	2.09	72	2	
'HSB 68C '	56872.70	71524.10	168.4	179.5	217.68	0.18	1.54	72	2	
'HSB 69 '	56475.10	71546.90	199.0	229.0	219.38	0.11	0.94	77	4	
'HSB 69A '	56465.10	71549.40	83.1	93.1	171.67	0.42	3.44	68	1	
'HSB 70 '	55758.90	72606.90	205.7	235.7	223.94	0.39	3.22	68	4	
'HSB 70C '	55757.10	72597.30	164.9	174.9	223.06	0.23	1.90	71	2	
'HSB 71 '	55279.20	72875.90	204.8	234.8	223.96	0.41	3.35	68	4	
'HSB 71C '	55281.50	72866.60	171.9	181.9	222.56	0.25	2.13	70	2	
'HSB 83A '	58606.10	71648.60	65.2	76.0	173.05	0.26	2.37	82	1	
'HSB 83B '	58594.90	71639.60	121.2	132.1	223.00	0.15	1.24	72	2	
'HSB 83C '	58614.80	71636.90	160.2	171.2	224.85	0.14	1.12	69	2	
'HSB 83D '	58601.70	71628.10	198.7	228.7	224.88	0.14	1.15	72	4	
'HSB 84A '	56359.10	71586.20	64.7	75.9	171.98	0.11	0.95	70	1	
'HSB 84B '	56352.40	71603.30	121.8	132.9	210.78	0.10	0.81	71	2	
'HSB 84C '	56360.10	71597.10	170.9	181.8	213.51	0.22	1.87	73	2	
'HSB 84D '	56349.90	71583.90	199.5	219.5	218.86	0.11	0.91	70	3	
'HSB 85A '	58943.40	73791.90	61.1	71.1	168.87	0.09	0.79	83	1	
'HSB 85B '	58953.30	73789.30	133.2	143.2	233.85	0.18	1.72	87	2	
'HSB 85C '	58947.40	73802.30	214.2	224.2	239.19	0.23	2.01	74	4	
'HSB 86A '	55985.90	72520.20	63.1	73.9	168.77	0.11	0.89	71	1	
'HSB 86B '	55976.90	72519.00	113.8	124.0	221.56	0.17	1.41	72	2	
'HSB 86C '	55984.60	72529.70	189.4	199.4	223.45	0.21	1.79	73	6	?
'HSB 86D '	55996.50	72522.10	206.6	236.6	223.42	0.21	1.81	71	4	
'HSB100C '	58806.50	72077.20	153.0	163.0	226.95	0.22	1.82	71	2	
'HSB100D '	58796.90	72073.80	216.9	236.9	233.86	0.21	1.86	76	4	
'HSB100PC'	55720.00	72058.30	117.6	167.7	215.72	1.04	2.95	8	2	
'HSB100PD'	56379.50	71445.30	195.0	214.9	217.05	0.38	1.08	8	3	
'HSB101C '	58604.40	72001.90	166.3	176.3	226.25	0.25	2.16	72	2	
'HSB101D '	58594.80	71997.50	216.1	236.1	230.69	0.22	1.92	76	4	
'HSB102C '	58399.70	71960.10	166.7	176.7	224.74	0.17	1.42	70	2	
'HSB102D '	58393.40	71952.40	216.3	236.3	228.71	0.20	1.71	73	4	
'HSB103C '	58323.60	71593.90	159.2	169.2	223.51	0.15	1.28	71	2	
'HSB103D '	58315.60	71588.10	213.7	233.7	225.70	0.15	1.29	74	4	
'HSB104C '	58082.60	71376.80	163.5	173.5	220.71	0.13	1.06	71	2	
'HSB104D '	58075.80	71370.20	210.6	230.6	224.80	0.23	1.95	73	4	
'HSB105C '	57883.80	71447.30	152.2	162.2	219.69	0.12	0.97	69	2	
'HSB105D '	57877.40	71454.80	211.8	231.8	225.31	0.16	1.43	77	4	
'HSB106C '	57651.50	71720.90	158.7	168.7	221.87	0.13	1.05	70	2	
'HSB106D '	57644.80	71727.80	210.7	230.7	226.04	0.16	1.37	72	4	
'HSB107C '	57432.00	71698.50	159.3	169.3	219.49	0.14	1.21	71	2	
'HSB107D '	57412.20	71696.60	215.1	235.1	224.74	0.15	1.28	74	4	
'HSB108C '	57155.50	71688.70	186.0	196.0	218.61	0.16	1.31	71	6	?
'HSB108D '	57145.60	71688.00	212.0	232.0	223.53	0.15	1.23	66	4	
'HSB109C '	56895.60	71684.80	168.4	178.4	218.83	0.12	0.99	72	2	
'HSB109D '	56885.50	71685.60	213.0	233.0	222.67	0.18	1.46	63	4	
'HSB110C '	56680.70	71779.30	171.4	181.4	219.14	0.12	0.99	71	2	
'HSB110D '	56672.10	71785.20	211.4	231.4	222.06	0.16	1.31	70	4	
'HSB111C '	56501.90	71919.40	140.7	150.7	220.30	0.13	1.08	71	2	
'HSB111D '	56494.50	71926.20	185.7	195.7	221.90	0.16	1.31	71	6	?
'HSB111E '	56487.20	71932.80	211.7	231.7	221.89	0.17	1.46	73	4	
'HSB112C '	56417.40	72156.40	140.6	150.6	221.61	0.15	1.29	71	2	
'HSB112D '	56408.10	72161.60	188.3	198.3	222.81	0.23	1.98	72	6	?
'HSB112E '	56399.50	72166.60	211.7	231.7	222.52	0.16	1.45	79	4	
'HSB113C '	56160.40	72312.30	154.7	164.7	221.86	0.16	1.35	69	2	
'HSB113C '	56160.40	72312.30	151.7	161.7	221.86	0.16	1.35	69	2	
'HSB113D '	56164.30	72302.70	216.2	236.2	222.48	0.19	1.67	76	4	
'HSB114C '	56107.00	72464.60	185.6	195.6	223.33	0.20	1.64	70	6	?
'HSB114D '	56104.60	72474.20	212.8	232.8	223.19	0.21	1.80	74	4	
'HSB115C '	56043.20	72653.20	182.8	192.8	224.16	0.30	2.54	72	2	
'HSB115D '	56039.80	72662.30	213.9	233.9	223.85	0.21	1.96	85	4	
'HSB116C '	55989.10	72888.10	180.5	190.5	225.02	0.21	1.74	69	2	
'HSB116D '	55988.20	72898.10	214.5	234.5	225.88	0.42	3.59	75	4	
'HSB117A '	55170.10	72733.60	84.8	94.8	166.76	0.09	0.72	69	1	
'HSB117C '	55162.90	72740.70	165.1	175.1	221.68	0.34	2.85	71	2	
'HSB117D '	55155.60	72747.60	200.3	220.3	223.72	0.32	2.77	75	3	
'HSB118A '	55775.60	72696.40	91.0	101.0	167.78	0.11	0.92	70	6	?

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'HSB119A '	56100.20	73082.50	93.3	103.3	167.08	0.10	0.85	70	6	?
'HSB120A '	56431.90	73395.10	91.0	101.0	166.41	0.10	0.83	69	1	
'HSB121A '	57389.60	72024.80	88.3	98.3	171.74	0.11	0.91	68	1	
'HSB122A '	57747.40	72195.90	85.4	95.4	171.59	0.13	1.06	69	1	
'HSB123A '	58124.80	72189.80	93.6	103.6	171.98	0.29	2.53	75	6	?
'HSB124AR'	58531.70	72202.70	94.6	104.6	172.19	0.11	0.82	53	1	
'HSB125C '	58592.80	71503.60	145.6	155.6	223.51	0.14	1.19	69	2	
'HSB125D '	58584.10	71498.20	199.4	219.4	221.27	0.13	1.08	70	3	
'HSB126C '	57178.20	70627.70	176.3	181.3	203.99	0.06	0.50	66	2	
'HSB126D '	57169.60	70633.40	190.5	200.5	205.17	0.06	0.54	71	3	
'HSB127C '	56792.10	71210.10	148.4	158.4	210.39	0.07	0.60	70	2	
'HSB127D '	56788.00	71218.90	197.8	217.8	218.03	0.11	0.92	69	3	
'HSB129C '	55110.00	71830.40	147.8	157.8	205.74	0.15	1.27	71	2	
'HSB129D '	55103.40	71837.10	185.2	205.2	208.44	0.11	0.95	69	3	
'HSB130C '	54643.60	70762.40	159.9	169.9	199.98	0.06	0.52	71	2	
'HSB130D '	54651.70	70757.20	182.1	202.1	200.24	0.09	0.72	71	3	
'HSB131C '	56894.90	70374.70	148.5	158.5	203.93	0.07	0.54	69	2	
'HSB131D '	56891.10	70365.00	195.7	205.7	205.10	0.14	1.24	75	3	
'HSB132C '	58787.70	71472.40	168.6	178.6	221.57	0.10	0.87	69	2	
'HSB132D '	58799.30	71469.50	206.5	226.5	221.18	0.16	1.30	68	4	
'HSB133C '	59110.30	71949.50	173.3	183.3	230.77	0.17	1.43	70	2	
'HSB133D '	59102.30	71943.50	208.5	228.5	235.37	0.21	1.72	70	4	
'HSB134C '	58289.90	71210.30	149.1	159.1	220.97	0.12	1.02	72	2	
'HSB134D '	58296.50	71217.30	205.8	225.8	222.09	0.21	1.74	72	4	
'HSB135C '	56560.80	71390.20	147.3	157.3	206.79	0.07	0.55	67	2	
'HSB135D '	56552.80	71396.70	199.9	219.9	218.26	0.11	0.87	67	3	
'HSB136C '	55949.60	71900.30	160.5	170.5	217.28	0.16	1.31	71	2	
'HSB136D '	55941.70	71906.00	200.2	220.2	220.72	0.16	1.31	70	3	
'HSB137C '	55700.20	72269.90	163.8	173.8	220.04	0.19	1.65	73	2	
'HSB137D '	55696.10	72278.90	205.3	225.3	221.96	0.21	1.72	70	4	
'HSB138D '	55260.70	73160.20	208.1	228.1	223.78	0.29	2.46	70	4	
'HSB139A '	57365.40	71127.40	87.6	97.6	173.74	0.12	0.98	67	1	
'HSB139C '	57374.50	71129.80	148.5	158.5	214.48	0.09	0.80	73	2	
'HSB139D '	57384.40	71133.20	206.7	226.7	222.54	0.22	1.84	70	4	
'HSB140A '	56535.40	70050.30	81.0	91.0	175.50	0.37	2.71	55	6	?
'HSB140C '	56551.80	70049.20	161.6	171.6	205.64	0.28	2.12	56	2	
'HSB140D '	56560.60	70036.00	194.1	214.1	213.86	0.37	2.76	56	3	
'HSB141A '	59168.70	71213.60	80.6	90.6	175.12	0.16	1.22	60	1	
'HSB141C '	59170.20	71196.70	154.7	164.7	229.07	0.32	1.58	25	2	
'HSB141CR'	59167.20	71226.70	152.1	162.1	229.33	0.55	3.06	31	2	
'HSB141D '	59170.90	71184.40	217.8	237.8	240.83	0.60	4.71	62	4	
'HSB142C '	53505.30	73119.00	161.6	171.6	198.28	0.27	2.04	58	2	
'HSB142D '	53493.10	73113.00	189.7	199.7	197.94	0.29	2.21	59	3	
'HSB143C '	52773.20	73738.20	169.1	179.1	209.34	0.14	1.08	57	2	
'HSB143D '	52774.50	73754.00	196.9	216.9	213.22	0.18	1.35	57	3	
'HSB144A '	56200.50	71892.10	78.6	88.6	171.37	0.32	2.49	59	1	
'HSB145C '	57769.00	71098.90	164.7	174.7	213.53	0.21	1.64	59	2	
'HSB145D '	57753.90	71088.00	184.2	194.2	220.43	0.22	1.67	60	6	?
'HSB146A '	58454.00	70478.90	85.5	95.5	176.09	0.08	0.57	56	1	
'HSB146C '	58473.10	70471.60	152.3	162.3	210.01	0.15	1.15	57	2	
'HSB146D '	58493.00	70469.70	204.0	224.1	222.57	0.43	3.27	58	4	
'HSB147D '	55804.40	73827.90	215.2	235.2	231.53	0.32	2.43	59	4	
'HSB148C '	55344.20	70151.50	158.9	168.9	201.78	0.08	0.62	63	2	
'HSB148D '	55355.70	70160.90	198.1	218.1	213.46	0.20	1.63	65	3	
'HSB149D '	57286.30	71338.80	207.0	227.0	222.61	0.41	3.10	57	4	
'HSB150D '	58692.80	71692.60	206.9	226.9	226.80	0.35	2.72	60	4	
'HSB150PC'	55543.90	72236.40	119.5	169.6	217.37	0.85	2.42	8	2	
'HSB151C '	54014.90	72997.90	170.6	180.6	207.82	0.16	1.21	59	2	
'HSB151D '	54026.40	72997.80	197.6	207.6	207.16	0.18	1.37	57	3	
'HSB152C '	54346.70	72012.00	173.1	183.1	199.04	0.06	0.45	58	2	
'HSB152D '	54362.10	72011.70	197.0	207.0	205.56	0.35	1.35	15	3	
'HSL 1D '	58925.00	72179.60	219.8	239.8	235.58	0.33	2.26	47	4	
'HSL 2D '	59423.50	72190.80	225.2	245.3	242.11	0.26	1.80	48	4	
'HSL 3D '	59770.60	72251.50	233.7	253.8	250.38	0.32	2.32	52	5	
'HSL 4D '	60171.90	72453.70	245.0	265.1	261.98	0.28	1.98	50	5	
'HSL 5D '	60339.40	72562.20	247.8	267.7	265.94	0.46	3.17	47	5	
'HSL 5D '	60339.40	72562.20	242.6	247.7	265.94	0.46	3.17	47	5	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'HSL 6A '	60549.50	72684.50	104.7	114.7	168.42	0.14	0.56	16	1	
'HSL 6AA'	60555.70	72692.60	18.6	28.6	169.13	0.14	0.56	17	1	
'HSL 6B '	60543.60	72676.30	127.9	137.9	244.59	0.30	1.19	16	2	
'HSL 6C '	60537.60	72667.50	157.6	167.6	245.42	0.28	1.16	17	2	
'HSL 6D '	60531.10	72659.70	243.9	264.0	260.12	0.32	2.34	52	5	
'HSL 6D '	60531.10	72659.70	239.4	243.9	260.12	0.32	2.34	52	4	
'HSL 7D '	60723.00	72674.40	242.3	262.4	259.98	0.29	2.07	50	5	
'HSL 8A '	61113.90	72721.00	108.8	118.8	172.78	0.14	0.57	17	1	
'HSL 8AA'	61113.80	72729.40	28.7	38.7	175.72	0.47	2.14	21	1	
'HSL 8B '	61115.00	72710.20	138.7	148.7	249.22	0.28	1.15	17	2	
'HSL 8C '	61115.90	72700.50	171.7	181.7	250.39	0.24	1.05	19	2	
'HSL 8D '	61117.10	72688.10	248.4	268.4	260.94	0.23	1.74	56	5	
'HSS 1D '	64675.60	67610.30	236.5	256.5	268.77	0.66	3.42	27	4	
'HSS 2D '	64785.90	67355.90	234.5	254.5	267.87	0.66	3.42	27	4	
'HSS 3D '	64709.50	68257.50	262.6	282.6	281.85	0.72	3.73	27	5	
'HTF 1 '	62067.00	71745.00	236.9	256.9	272.90	0.30	1.73	33	5	
'HTF 2 '	62175.00	71610.00	237.0	257.0	274.33	0.28	1.60	32	5	
'HTF 4 '	61942.00	71630.00	235.2	255.2	274.34	0.27	1.52	31	5	
'HTF 5 '	62110.00	71390.00	264.3	284.3	279.58	1.35	6.89	26	5	
'HTF 7 '	62112.00	71130.00	263.5	283.5	275.95	0.35	1.80	26	5	
'HTF 8 '	61965.00	71270.00	263.6	283.6	273.92	0.55	2.62	23	5	
'HTF 9 '	61698.00	71652.00	245.8	265.8	273.81	0.35	2.07	34	5	
'HTF 10 '	61838.00	71520.00	245.2	265.2	273.32	0.28	1.56	31	5	
'HTF 11 '	61722.00	71398.00	238.9	258.9	274.03	0.33	1.87	32	5	
'HTF 12 '	61593.00	71520.00	242.9	262.9	273.47	0.35	2.08	36	5	
'HTF 13 '	61586.00	71856.00	262.6	282.6	274.19	0.30	1.65	30	5	
'HTF 14 '	61462.00	71858.00	261.9	281.9	273.23	0.41	2.15	27	5	
'HTF 15 '	61353.00	71700.00	260.7	280.7	273.55	0.23	1.37	37	5	
'HTF 16 '	61950.00	72150.00	248.3	268.3	269.67	0.41	2.00	24	5	
'HTF 17 '	61188.00	72600.00	238.4	258.4	262.53	0.53	3.18	36	5	
'HTF 18 '	61223.30	71771.80	251.7	271.7	271.64	0.28	1.72	37	5	
'HTF 19 '	61079.20	71902.50	245.7	265.7	269.17	0.26	1.60	37	5	
'HTF 20 '	61086.40	72073.30	251.9	271.9	267.89	0.35	2.08	36	5	
'HTF 21 '	61261.00	71998.20	242.6	262.6	269.60	0.28	1.66	35	5	
'HTF 22 '	62553.60	71363.40	251.4	271.4	275.47	0.32	1.83	32	5	
'HTF 23 '	62670.30	71363.10	256.8	276.8	274.55	0.38	2.21	33	5	
'HTF 24 '	62775.60	71362.60	257.8	277.8	274.11	0.31	1.75	31	5	
'HTF 25 '	62902.00	71224.30	252.5	272.5	274.67	0.51	2.93	33	5	
'HTF 26 '	62815.70	71090.70	255.5	275.5	275.44	0.47	2.71	33	5	
'HTF 27 '	62660.30	71057.90	259.1	279.1	276.90	0.68	3.99	34	5	
'HTF 28 '	62515.70	71080.10	251.9	271.9	275.99	0.26	1.46	31	5	
'HTF 29 '	62414.90	71229.90	259.9	289.9	275.79	0.32	1.79	32	5	
'HTF 31 '	62662.50	70747.00	246.7	266.7	275.61	0.31	1.68	29	5	
'HTF 32 '	62807.90	70880.60	251.1	271.1	274.74	0.28	1.61	33	5	
'HTF 34 '	61978.50	71144.10	251.7	271.7	274.33	1.27	6.35	25	5	
'HWP 1D '	59852.50	72158.08	239.9	249.9	245.25	0.20	0.29	2	5	
'HWP 2D '	59918.86	72368.22	253.0	263.0	262.96	0.52	1.03	4	5	
'HWS 1A '	50234.80	64885.10	225.2	255.2	244.89	0.34	1.87	30	5	
'HWS 2 '	50346.40	64786.30	215.3	245.3	245.48	0.40	2.11	28	4	
'HXB 1 '	52557.80	60549.70	214.2	244.2	251.71	0.57	3.00	28	5	
'HXB 2 '	52892.80	60866.50	212.1	242.1	252.90	0.63	3.27	27	5	
'HXB 3 '	52707.30	60631.20	212.2	242.2	252.21	0.61	3.17	27	5	
'HXB 4D '	52617.30	60685.70	234.9	254.9	253.85	0.46	2.31	25	5	
'HXB 5D '	52510.40	60587.70	234.2	254.2	253.00	0.46	2.32	25	5	
'IDP 3A '	37781.10	85104.30	-86.7	-81.3	167.18	0.24	1.09	20	6	?
'IDP 3B '	37785.30	85119.50	95.7	100.7	157.42	0.47	2.10	20	1	
'IDP 3C '	37790.10	85133.70	164.1	169.1	202.15	0.85	3.59	18	2	
'IDP 4 '	38615.40	82812.60	189.5	199.6	191.13	1.27	5.54	19	2	
'IDP 5 '	38284.50	83521.50	186.4	206.6	198.41	0.75	3.34	20	2	
'IDP 6 '	38248.50	84113.90	184.5	209.1	201.54	0.74	3.29	20	2	
'IDP 7 '	38713.90	84460.10	188.6	208.6	200.79	0.82	3.67	20	2	
'IDP 8 '	39174.30	84740.40	185.4	204.5	199.25	1.03	4.63	20	2	
'IDQ 3A '	35854.00	80553.70	-189.8	-184.3	166.06	0.27	1.20	20	6	?
'IDQ 3B '	35858.80	80578.40	108.4	113.4	140.21	1.28	5.87	21	1	
'IDQ 3C '	35863.50	80601.70	136.6	141.6	164.58	0.84	3.64	19	2	
'IDQ 4 '	36726.20	83125.10	185.6	205.6	198.39	0.71	3.17	20	2	
'IDQ 5 '	36851.80	82763.60	187.4	207.5	198.31	1.46	6.35	19	2	
'IDQ 6 '	37299.30	82414.40	181.9	202.1	193.81	0.66	3.02	21	2	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'IDQ 8 '	34688.10	83602.80	180.4	200.4	189.90	1.27	4.93	15	2	
'IDQ 12 '	37116.50	81913.70	164.9	184.9	187.30	0.67	2.50	14	2	
'K 301AP'	40034.00	54284.00	193.3	197.7	208.77	-1.00	-1.00	1	3	
'K 301P '	39842.00	54320.00	194.4	201.0	205.10	0.25	1.72	48	4	
'KAB 1 '	39919.70	53055.60	194.0	224.0	205.85	0.56	3.01	29	4	
'KAB 2 '	40277.90	52410.80	198.6	228.6	209.37	0.85	4.72	31	4	
'KAB 3 '	39918.40	51807.70	193.0	223.0	203.60	0.72	3.75	27	4	
'KAB 4 '	39457.00	52807.10	187.0	217.0	202.90	0.64	3.45	29	4	
'KAC 1 '	42614.80	53167.00	199.0	229.0	219.27	0.50	2.81	32	4	
'KAC 2 '	42677.20	53255.50	195.4	225.4	221.51	0.56	3.12	31	4	
'KAC 3 '	42723.90	53201.80	195.8	225.8	221.96	0.47	2.68	32	4	
'KAC 4 '	42676.40	53053.50	178.0	208.0	218.07	0.47	2.65	32	4	
'KAC 5 '	42716.30	53161.70	204.3	224.3	222.40	0.44	2.39	29	4	
'KAC 6 '	42693.50	53139.90	204.6	224.6	222.34	0.46	2.45	28	4	
'KAC 7 '	42574.50	53252.90	203.0	223.0	219.45	0.42	2.29	30	4	
'KAC 8 '	42641.90	53136.00	192.3	212.3	221.18	0.52	2.02	15	4	
'KAC 9 '	42588.10	53197.80	195.7	215.7	220.84	0.49	1.89	15	4	
'KBP 1D '	40418.96	52439.60	192.0	202.1	208.15	0.99	2.21	5	4	
'KCB 1 '	39523.10	53453.00	183.6	213.6	204.68	0.45	2.69	35	4	
'KCB 2 '	39337.20	53634.40	187.7	217.7	202.83	0.69	3.92	32	4	
'KCB 3 '	39139.20	53440.50	184.1	214.1	202.32	0.41	2.46	36	4	
'KCB 4 '	39315.60	53256.10	188.9	218.9	205.48	0.75	2.70	13	4	
'KCB 5 '	39090.70	53353.70	189.3	209.3	200.65	0.62	1.86	9	4	
'KCB 6 '	39108.00	53559.20	188.7	208.7	201.15	0.70	1.98	8	4	
'KCB 7 '	39812.30	53435.60	196.5	216.5	205.30	0.47	1.49	10	4	
'KDB 1 '	40425.90	54050.50	184.8	205.8	208.48	0.23	1.83	66	3	
'KDB 2 '	40241.40	53907.30	182.5	203.5	206.99	0.23	1.92	69	3	
'KDB 3 '	40393.70	53794.60	184.2	205.4	207.75	0.22	1.85	70	3	
'KDB 4 '	40150.30	53787.40	189.2	209.2	207.05	0.28	1.50	29	4	
'KDB 5 '	40033.10	54052.20	188.5	208.5	205.51	0.33	2.19	44	4	
'KDT 1D '	40380.00	54154.10	193.7	213.7	208.10	0.37	1.63	19	4	
'KRB 8 '	40302.10	54893.60	195.8	215.8	208.55	0.20	0.65	11	4	
'KRB 16D '	40390.30	54888.00	191.5	211.5	209.30	0.24	1.11	21	4	
'KRB 17D '	39991.90	55446.40	186.8	206.8	206.03	0.28	1.30	21	4	
'KRB 18D '	40084.90	55563.70	185.8	205.8	204.58	0.23	1.07	21	4	
'KRB 19D '	40207.40	55620.90	186.8	206.8	203.82	0.21	0.94	21	4	
'KRP 1 '	42471.20	54544.00	207.0	237.0	218.59	0.42	2.54	37	4	
'KRP 2 '	42681.60	54503.60	199.2	229.2	219.46	0.40	2.32	34	4	
'KRP 3 '	42814.30	54248.70	207.5	237.5	219.16	0.47	2.69	32	5	
'KRP 4 '	42590.30	54362.90	188.7	218.7	218.52	0.34	2.06	36	4	
'KRP 5 '	42181.80	54606.60	200.8	210.8	216.28	0.30	0.67	5	4	
'KRP 6 '	42226.90	54206.70	203.1	213.1	217.85	0.28	0.83	9	4	
'KRP 7 '	41871.70	54390.30	203.1	213.2	215.92	0.38	1.07	8	4	
'KRP 8 '	42280.42	54470.74	200.1	210.1	217.10	0.94	1.63	3	4	
'KRP 9 '	42400.03	54360.10	200.8	210.8	218.30	0.95	1.65	3	4	
'KSB 1 '	39806.80	54044.40	175.6	205.6	204.19	0.25	1.96	64	3	
'KSB 2 '	39703.40	53927.60	173.8	203.8	203.86	0.25	2.03	68	3	
'KSB 3 '	39625.30	54040.20	169.7	199.7	203.13	0.25	2.02	67	3	
'KSB 4A '	39756.70	54140.40	169.6	199.6	203.45	0.42	3.36	63	3	
'KSB 5C '	39969.90	54165.60	172.9	182.9	204.88	0.06	0.10	3	3	
'KSB 5D '	39970.50	54156.50	194.5	214.5	204.48	0.29	0.86	9	4	
'KSM 1D '	40328.20	54188.00	193.7	213.7	208.29	0.22	1.29	34	4	
'KSS 1D '	40219.10	47758.90	157.4	177.5	174.31	0.44	2.33	28	3	
'KSS 2D '	40437.00	46803.80	144.6	164.7	164.65	0.43	2.28	28	6	?
'KSS 3D '	40748.00	46644.30	139.3	159.3	163.82	0.56	2.96	28	6	?
'LAC 1 '	51318.80	45238.80	191.1	221.1	216.48	0.54	2.96	30	4	
'LAC 2 '	51270.20	45330.40	193.4	223.4	216.09	0.65	3.68	32	4	
'LAC 3 '	51186.80	45201.90	190.7	220.7	216.52	0.50	2.85	33	4	
'LAC 4 '	51270.40	45213.10	185.3	215.3	216.07	0.53	2.86	29	4	
'LAC 5DL'	51352.00	45365.40	176.2	186.2	219.74	0.89	2.18	6	3	
'LAC 5DU'	51348.60	45345.90	207.9	227.8	219.48	0.79	2.10	7	4	
'LAC 6DL'	51188.10	45272.80	175.9	185.9	217.89	0.90	2.21	6	3	
'LAC 6DU'	51185.80	45252.50	201.7	221.7	218.97	0.93	2.27	6	4	
'LAC 7DL'	51118.40	45097.10	177.4	187.4	215.11	0.93	2.29	6	4	
'LAC 7DU'	51120.10	45114.70	204.9	224.8	218.06	0.97	2.38	6	4	
'LAC 8DL'	51300.90	45096.60	180.4	190.4	217.45	0.87	2.12	6	4	
'LAC 8DU'	51301.80	45116.00	199.8	219.8	218.07	0.93	2.29	6	4	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'LAW 1C '	50603.60	44562.40	-34.0	-29.0	176.21	0.29	0.64	5	6	?
'LAW 1D '	50595.60	44562.00	6.6	11.6	176.50	0.17	0.55	10	1	
'LAW 1E '	50579.00	44561.20	90.1	95.1	205.04	0.59	1.33	5	2	
'LAW 1F '	50567.10	44562.10	165.9	185.9	203.89	0.96	2.87	9	3	
'LAW 2B '	49635.50	45641.00	-9.8	-4.8	176.23	0.17	0.52	10	1	
'LAW 2C '	49638.70	45610.90	171.2	191.2	209.19	0.34	2.24	44	4	
'LAW 3B '	52269.50	45600.70	-1.0	4.0	178.20	0.17	0.55	10	1	
'LAW 3C '	52272.90	45616.10	194.9	214.9	235.20	0.58	2.01	12	4	
'LCO 1 '	50957.70	45198.20	195.8	225.8	214.76	0.60	3.35	31	4	
'LCO 2 '	51043.40	45317.80	196.6	226.6	215.14	0.58	3.30	32	4	
'LCO 3 '	51113.20	45203.00	196.3	226.3	229.09	0.51	2.81	30	4	
'LCO 4 '	51036.10	45087.40	192.3	222.3	212.57	0.61	3.52	33	4	
'LCO 5A '	50866.00	44987.00	30.0	40.0	177.24	0.28	0.68	6	1	
'LCO 5C '	50881.80	44988.50	110.5	120.5	210.99	0.60	1.48	6	2	
'LCO 5DL'	50887.50	44974.50	174.9	184.9	212.95	0.86	2.10	6	4	
'LCO 6DL'	50921.20	45069.30	178.0	188.0	213.67	0.83	2.02	6	4	
'LCO 7DL'	51055.90	44946.90	170.2	180.2	213.31	0.83	2.03	6	3	
'LCO 8DL'	51380.60	45586.10	178.4	188.4	220.55	0.83	2.04	6	3	
'LCO 8DU'	51361.70	45586.10	211.1	226.1	220.60	0.84	2.05	6	4	
'LDB 1 '	50590.50	45886.50	185.0	215.0	217.40	0.38	3.03	63	4	
'LDB 2 '	50784.60	46007.40	184.5	214.5	219.44	0.37	2.97	65	4	
'LDB 3 '	50525.80	46068.90	199.3	219.3	218.93	0.38	2.55	44	4	
'LDB 4 '	50339.50	45809.00	200.7	220.7	216.92	0.41	2.69	43	4	
'LFW 6 '	45241.20	84537.80	141.1	160.4	154.01	0.31	1.86	35	1	
'LFW 6R '	45194.00	84413.90	134.3	154.3	153.81	0.35	1.20	12	1	
'LFW 7 '	45318.90	84310.30	140.5	159.8	152.18	0.22	1.29	34	1	
'LFW 8 '	45415.30	84032.60	139.9	159.2	150.00	0.20	1.19	36	1	
'LFW 8R '	45414.60	83949.00	134.9	154.9	150.75	0.24	0.82	12	1	
'LFW 10A '	45935.60	84369.60	134.4	164.4	157.05	0.42	2.77	43	1	
'LFW 16 '	45852.60	84748.90	131.2	161.2	155.48	0.28	1.59	33	1	
'LFW 17 '	45607.30	84602.80	128.5	158.5	153.68	0.51	2.92	33	1	
'LFW 18 '	45459.40	84577.30	137.7	167.7	161.41	0.59	3.85	42	1	
'LFW 19 '	45135.40	84817.20	130.0	160.0	156.16	0.29	1.67	33	1	
'LFW 20 '	45582.90	85262.60	135.0	165.0	159.04	0.31	1.81	34	1	
'LFW 21 '	46149.40	84178.30	137.9	167.9	157.52	0.62	4.04	43	1	
'LFW 22 '	46325.20	84223.60	122.4	152.4	151.34	0.30	1.75	34	1	
'LFW 23 '	46456.10	84251.30	125.1	155.1	151.36	0.63	3.74	35	1	
'LFW 23R '	46512.90	84206.10	118.2	138.2	149.44	0.74	2.56	12	1	
'LFW 24 '	46520.80	84544.20	124.5	154.5	154.38	0.36	2.04	33	1	
'LFW 25 '	46425.70	84967.20	123.2	153.2	156.78	0.35	2.03	33	1	
'LFW 26 '	45633.80	85654.60	143.2	164.2	161.19	0.33	1.88	32	1	
'LFW 27 '	45596.10	85839.10	142.9	163.9	162.11	0.33	1.91	33	1	
'LFW 28 '	45555.30	86079.60	141.1	162.1	163.56	0.30	1.94	41	1	
'LFW 29 '	45503.30	86372.70	143.9	164.9	164.72	0.36	2.07	33	1	
'LFW 30 '	45170.90	86318.40	141.7	162.7	164.97	0.34	2.11	38	1	
'LFW 31 '	44869.00	86262.20	145.0	166.0	164.82	0.37	2.54	47	1	
'LFW 32 '	44935.90	85836.80	144.3	165.3	162.39	0.27	1.78	42	1	
'LFW 32C '	44923.00	85837.80	98.6	113.6	161.61	0.38	0.76	4	1	
'LFW 33 '	44973.00	85633.80	144.4	165.4	161.01	0.31	1.84	35	1	
'LFW 34 '	45016.90	85409.50	143.7	164.7	159.94	0.28	1.73	39	1	
'LFW 35 '	45378.80	85237.40	143.4	164.4	158.79	0.31	1.76	33	1	
'LFW 36 '	45582.30	83535.50	130.3	151.3	145.93	0.20	1.19	35	1	
'LFW 36R '	45519.10	83537.30	121.8	141.8	146.10	0.23	0.82	13	1	
'LFW 37 '	45667.70	83113.20	129.8	150.8	142.84	0.17	0.98	35	1	
'LFW 38 '	46018.50	83172.30	130.5	151.5	143.36	0.32	1.79	32	1	
'LFW 39 '	46218.50	83213.10	131.2	152.2	143.71	0.32	1.81	32	1	
'LFW 40 '	46395.10	83248.80	131.2	152.2	143.54	0.32	1.68	28	1	
'LFW 41 '	46626.90	83304.90	130.3	151.3	145.20	0.43	2.54	35	1	
'LFW 41R '	46635.30	83238.30	120.2	140.2	142.17	1.38	5.33	15	1	
'LFW 42 '	46532.90	83776.20	130.2	151.2	147.42	0.43	2.52	34	1	
'LFW 43B '	45240.50	86459.20	90.4	100.4	166.04	0.19	1.17	36	1	
'LFW 43C '	45234.90	86480.60	128.5	138.5	166.27	0.19	1.19	37	1	
'LFW 43D '	45244.50	86443.20	150.9	170.9	166.70	0.24	1.43	36	1	
'LFW 44D '	45022.60	84524.40	139.5	159.3	155.33	0.15	0.67	19	1	
'LFW 45D '	45142.00	84217.80	134.7	154.7	152.55	0.15	0.83	32	1	
'LFW 46D '	45162.80	84054.00	137.3	157.1	151.48	0.14	0.62	19	1	
'LFW 46D '	45162.80	84054.00	109.5	119.6	151.48	0.14	0.62	19	1	
'LFW 47C '	45161.60	83823.30	105.7	115.8	148.91	0.11	0.46	19	1	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'LFW 47D '	45150.80	83838.60	134.9	154.7	149.44	0.10	0.57	34	1	
'LFW 48C '	45413.30	83856.40	108.2	118.2	148.98	0.13	0.63	22	1	
'LFW 48D '	45426.70	83856.90	134.9	155.0	149.40	0.13	0.60	22	1	
'LFW 55C '	45205.90	83613.20	94.1	104.1	146.97	0.09	0.40	19	1	
'LFW 55D '	45189.30	83601.30	121.2	141.4	147.10	0.09	0.41	19	1	
'LFW 56D '	45306.60	83398.00	131.3	151.4	145.48	0.08	0.45	34	1	
'LFW 57B '	45440.60	83196.70	68.4	78.4	143.76	0.09	0.40	21	1	
'LFW 57C '	45411.10	83200.10	107.8	117.9	143.94	0.08	0.38	21	1	
'LFW 57D '	45417.40	83190.20	130.6	150.4	143.96	0.08	0.39	21	1	
'LFW 58D '	45700.20	82940.60	127.5	147.6	141.98	0.09	0.51	34	1	
'LFW 59B '	46047.40	83027.10	66.0	76.0	142.81	0.12	0.53	21	1	
'LFW 59C '	46052.00	83011.00	100.3	110.3	142.62	0.14	0.60	18	1	
'LFW 59D '	46056.10	83000.10	129.3	149.3	142.83	0.36	2.12	35	1	
'LFW 60B '	45710.20	82517.50	67.7	77.7	137.86	0.07	0.21	10	1	
'LFW 60C '	45711.90	82529.60	98.3	108.3	138.27	0.29	1.43	24	1	
'LFW 60D '	45722.30	82531.50	123.8	143.8	138.25	0.07	0.45	37	1	
'LFW 61C '	46489.60	83084.40	111.0	121.1	142.09	0.17	0.80	21	1	
'LFW 61D '	46471.10	83089.10	130.3	150.4	144.12	0.27	1.42	28	1	
'LFW 62B '	45915.50	83001.20	62.8	72.8	142.30	0.10	0.44	21	1	
'LFW 62C '	45906.70	83012.70	108.4	118.4	142.75	0.13	0.59	21	1	
'LFW 62D '	45922.90	82991.60	127.6	147.6	143.49	0.18	1.00	30	1	
'LFW 63B '	45550.70	82740.80	66.1	76.1	140.19	0.07	0.33	24	1	
'LFW 63C '	45559.20	82746.10	96.2	106.2	140.21	0.08	0.39	23	1	
'LFW 63D '	45569.10	82751.80	126.4	146.4	140.56	0.13	0.62	24	1	
'LFW 64B '	45268.80	82736.40	51.9	61.9	140.04	0.07	0.24	11	1	
'LFW 64C '	45271.30	82744.80	83.0	93.0	140.30	0.17	0.82	24	1	
'LFW 64D '	45280.70	82737.80	115.2	135.2	140.35	0.05	0.27	25	1	
'LFW 65B '	46061.80	82589.20	53.5	63.5	137.94	0.06	0.30	22	1	
'LFW 65C '	46064.40	82592.90	86.1	96.1	137.93	0.09	0.41	23	1	
'LFW 65D '	46071.80	82598.40	111.5	131.5	138.39	0.17	0.84	25	1	
'LFW 66B '	46195.90	82838.30	70.3	80.3	140.84	0.12	0.38	10	1	
'LFW 66C '	46186.00	82836.50	100.0	110.0	140.68	0.34	1.09	10	1	
'LFW 66D '	46173.70	82835.10	121.8	141.8	141.90	0.26	1.01	15	1	
'LFW 67B '	46517.10	82847.10	55.6	65.6	139.11	0.10	0.49	23	1	
'LFW 67C '	46527.50	82844.20	86.1	96.1	138.75	0.15	0.68	21	1	
'LFW 67D '	46529.90	82855.00	120.6	140.6	141.94	0.31	1.50	24	1	
'LFW 68B '	46885.30	83023.30	56.7	66.7	140.21	0.15	0.47	10	1	
'LFW 68C '	46876.20	83027.50	88.3	98.3	139.61	0.22	0.71	10	1	
'LFW 68D '	46868.00	83031.60	124.6	144.6	142.66	0.33	1.62	24	1	
'LFW 69B '	45492.00	82451.20	52.0	57.0	137.56	0.06	0.18	10	1	
'LFW 69C '	45494.50	82458.60	79.1	89.1	137.78	0.06	0.29	23	1	
'LFW 69D '	45501.00	82452.00	119.0	139.0	137.87	0.06	0.31	24	1	
'LFW 70B '	45825.50	82300.50	61.5	66.5	136.20	0.07	0.22	10	1	
'LFW 70C '	45833.40	82309.00	78.8	88.8	136.23	0.06	0.20	10	1	
'LFW 70D '	45839.80	82316.30	118.3	138.3	135.67	0.12	0.37	10	1	
'LFW 71B '	46340.40	82616.70	57.0	67.0	137.77	0.09	0.44	24	1	
'LFW 71C '	46329.80	82615.80	80.4	90.4	137.92	0.08	0.37	24	1	
'LFW 71D '	46319.80	82615.10	115.5	135.5	137.39	0.13	0.63	23	1	
'LFW 72B '	46944.30	82872.10	50.9	60.9	138.08	0.16	0.54	11	1	
'LFW 72C '	46937.10	82875.80	87.8	97.8	137.63	0.24	0.76	10	1	
'LFW 72D '	46943.00	82881.50	120.0	140.0	138.74	0.27	0.87	10	1	
'LFW 74C '	45097.80	85813.80	101.0	116.0	163.30	0.25	0.78	10	1	
'LFW 74D '	45098.00	85828.10	152.7	167.7	163.16	0.22	0.82	14	1	
'LFW 75C '	45357.00	85856.80	100.6	115.6	162.91	0.29	0.99	12	1	
'LFW 75D '	45355.60	85868.00	151.0	166.0	163.24	0.31	1.06	12	1	
'LFW 76 '	44758.60	85682.10	142.9	157.9	160.77	0.27	0.61	5	1	
'LFW 77 '	44866.50	86461.70	144.2	159.2	164.94	0.91	1.29	2	1	
'LFW 78 '	44726.50	86064.90	149.9	164.9	162.53	0.31	0.62	4	1	
'LRP 1 '	49128.70	48548.60	185.8	215.8	209.30	0.55	3.07	31	6	?
'LRP 2 '	49214.40	48352.90	184.7	214.7	210.15	1.00	5.67	32	4	
'LRP 3 '	49057.70	48333.60	191.4	221.4	209.47	0.53	3.01	32	4	
'LRP 4 '	48964.70	48440.20	173.3	203.3	208.61	0.53	2.98	32	3	
'LSB 1 '	50700.90	45153.10	192.7	222.7	211.61	0.48	2.91	37	4	
'LSB 2 '	50824.50	45224.00	195.0	225.0	212.39	0.51	3.02	35	4	
'LSB 3 '	50729.70	45388.70	196.6	226.6	217.16	0.51	3.15	38	4	
'LSB 4 '	50513.00	45321.60	191.5	221.5	216.84	0.74	4.53	38	4	
'MGA 36 '	57891.50	73904.00	234.2	254.2	240.63	1.37	5.66	17	5	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'MGC 9 '	55610.70	75372.10	217.3	237.3	229.55	0.29	1.50	27	4	
'MGC 11 '	55770.70	75252.30	219.2	239.2	233.42	0.81	2.94	13	4	
'MGC 19 '	56408.70	74770.10	230.6	234.6	232.22	0.39	2.05	27	4	
'MGC 23 '	56726.60	74528.30	227.9	247.9	234.29	1.11	4.46	16	4	
'MGC 32 '	57448.80	73982.10	232.0	252.0	245.08	0.37	1.89	26	5	
'MGC 36 '	57776.00	73738.90	234.4	254.4	236.08	0.38	1.93	26	5	
'MGE 9 '	55489.40	75215.10	218.1	238.1	227.47	0.77	3.91	26	4	
'MGE 21 '	56446.20	74487.80	227.9	247.9	230.59	1.16	5.43	22	4	
'MGE 30 '	57175.40	73935.80	229.3	249.3	236.14	0.64	3.18	25	4	
'MGE 34 '	57495.10	73695.00	237.2	257.2	241.03	1.23	5.34	19	5	
'MGG 15 '	55851.50	74699.00	223.3	243.3	232.82	1.20	4.97	17	4	
'MGG 19 '	56174.30	74456.00	226.0	246.0	231.38	1.03	4.81	22	4	
'MGG 23 '	56491.80	74214.00	227.1	247.1	232.19	1.25	5.86	22	4	
'MGG 36 '	57541.70	73413.00	232.5	252.5	238.45	0.82	4.12	25	5	
'NBG 1 '	53879.30	79300.40	200.9	232.3	224.47	0.18	1.06	35	5	
'NBG 2 '	53958.40	79099.80	203.6	233.6	224.96	0.18	1.06	34	5	
'NBG 3 '	54068.10	78939.60	202.1	233.5	217.54	0.36	2.08	33	5	
'NBG 4 '	54329.20	78942.10	196.1	227.5	217.05	0.31	1.80	34	6	?
'NBG 5 '	54515.60	78943.40	194.9	226.4	217.77	0.35	2.06	34	6	?
'NPM 1 '	56851.60	62153.40	257.1	277.1	287.37	0.67	2.23	11	5	
'NPM 2 '	58252.00	63056.80	244.2	264.2	271.77	0.74	2.58	12	5	
'NPM 3 '	55417.60	62109.20	247.2	267.2	274.61	0.63	2.17	12	5	
'NPM 4 '	57215.00	60883.20	256.7	276.7	284.21	0.67	2.33	12	5	
'NPM 4DD'	57218.80	60893.10	296.4	306.4	305.60	1.40	4.64	11	5	
'NPM 19A '	57551.80	62970.70	248.2	268.2	270.74	0.74	2.56	12	5	
'NPM 19B '	57558.30	62981.80	217.7	227.7	268.88	0.73	2.52	12	4	
'NPM 19C '	57575.40	62977.10	193.5	203.5	268.05	0.72	2.48	12	3	
'NPM 19D '	57567.90	62960.90	97.5	107.5	243.32	0.44	1.53	12	2	
'NPM 19E '	57582.60	62991.70	33.9	43.9	188.33	0.84	2.92	12	1	
'NPM 34A '	56301.20	60774.50	279.8	289.8	290.75	0.68	2.35	12	5	
'NPM 34B '	56315.10	60768.90	225.6	235.6	271.12	0.53	1.85	12	5	
'NPM 34C '	56329.10	60764.20	181.8	191.8	267.71	0.53	1.83	12	3	
'NPM 34D '	56354.90	60752.00	86.4	96.4	253.85	0.47	1.62	12	2	
'NPM 34E '	56342.80	60758.80	33.1	43.1	187.16	0.19	0.66	12	1	
'PAC 1 '	66753.40	43543.30	253.9	283.9	284.74	0.22	1.27	32	5	
'PAC 2 '	66980.90	43527.70	247.9	277.9	271.02	0.29	1.64	31	5	
'PAC 3 '	66861.40	43585.60	252.9	282.9	271.35	0.38	2.15	32	5	
'PAC 4 '	66863.20	43495.40	250.6	280.6	284.42	0.17	0.92	31	5	
'PAC 5 '	66907.10	43561.70	255.1	275.1	275.05	0.48	2.56	29	5	
'PAC 6 '	66894.70	43580.10	255.2	275.2	274.58	0.38	2.02	28	5	
'PCB 1A '	65070.60	41988.20	263.5	293.5	280.71	0.50	2.70	29	5	
'PCB 2A '	64891.40	41821.40	257.8	287.8	279.52	0.49	2.65	29	5	
'PCB 3A '	64706.30	42036.00	262.7	292.7	281.55	0.50	2.82	32	5	
'PCB 4A '	64901.40	42171.00	262.9	292.9	279.71	0.47	2.56	30	5	
'PDB 2 '	64743.10	43513.10	247.7	268.7	278.00	0.38	2.36	39	4	
'PDB 3 '	64938.20	43542.20	248.1	269.1	278.27	0.37	2.30	39	4	
'PDB 4 '	64623.80	43455.10	266.2	286.2	279.16	0.40	1.44	13	5	
'PDB 5 '	64584.40	44106.60	264.2	284.2	277.79	0.33	1.19	13	5	
'PRP 1A '	63032.70	45349.80	232.9	262.9	249.50	0.47	2.70	33	4	
'PRP 2 '	63229.00	45389.50	234.1	264.1	255.57	0.78	4.58	34	4	
'PRP 3 '	63165.50	45200.70	228.6	258.6	255.97	0.66	3.80	33	4	
'PRP 4 '	63345.90	45268.90	232.9	262.9	257.79	0.43	2.54	35	4	
'PSB 1A '	64141.40	43619.30	257.4	287.4	276.87	0.46	3.00	42	5	
'PSB 2A '	63916.50	43612.40	257.2	287.2	276.72	0.48	3.08	42	5	
'PSB 3A '	63590.40	43599.80	256.5	286.5	275.57	0.50	3.22	42	5	
'PSB 4A '	63347.00	43534.20	255.5	285.5	274.83	0.54	3.57	43	5	
'PSB 5A '	63606.50	43440.50	262.3	292.3	276.11	0.52	3.40	43	5	
'PSB 6A '	63975.70	43436.00	262.1	292.1	277.59	0.49	3.15	42	5	
'PSB 7A '	64301.00	43553.30	259.0	289.0	277.46	0.45	2.97	43	5	
'PSS 1D '	75773.30	37298.40	182.1	202.1	198.15	0.69	3.69	29	6	?
'PSS 2D '	75910.10	36037.90	177.1	197.1	195.25	0.67	3.53	28	6	?
'PSS 3D '	76138.70	35974.10	178.5	198.5	198.73	1.43	5.71	16	6	?
'PW 83N '	52202.00	61394.00	4.0	9.0	168.43	-1.00	-1.00	1	1	
'RAC 1 '	74570.70	55107.30	247.3	277.3	273.98	0.33	1.85	31	5	
'RAC 2 '	74555.50	55026.30	243.4	273.4	272.59	0.23	1.24	30	5	
'RAC 3 '	74667.50	55015.30	242.3	272.3	272.37	0.26	1.47	31	5	
'RAC 4 '	74588.80	54984.00	238.2	268.2	271.71	0.30	1.65	30	5	
'RBW 1CL'	74227.40	62038.50	105.5	115.5	255.93	0.37	0.64	3	2	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'RBW 1CU'	74214.00	62047.40	156.1	166.1	255.80	0.40	0.69	3	2	
'RBW 1D '	74237.50	62031.60	243.0	263.1	259.01	0.45	0.78	3	5	
'RBW 2CL'	71795.10	58712.00	96.4	106.4	269.44	0.53	0.91	3	2	
'RBW 2CU'	71785.90	58715.40	145.1	155.1	269.85	0.57	0.99	3	2	
'RBW 2D '	71776.70	58719.90	284.9	304.9	297.55	0.72	1.25	3	5	
'RCP 1A '	74238.30	56968.10	46.8	56.8	194.29	0.20	0.67	11	1	
'RCP 1D '	74223.50	56967.90	261.3	281.3	281.78	0.64	2.20	12	5	
'RDB 1D '	74844.50	57097.30	265.5	285.5	286.02	0.24	1.26	27	5	
'RDB 2D '	74782.20	56879.80	265.7	285.7	285.28	0.21	1.07	27	5	
'RDB 3D '	74899.00	56881.90	265.8	285.8	282.97	0.30	1.56	27	5	
'RPC 1CL'	74261.86	57923.24	103.3	113.3	256.90	0.17	0.30	3	2	
'RPC 1D '	74215.65	57931.26	264.5	284.5	276.77	0.16	0.28	3	5	
'RPC 7DL'	74726.38	58812.32	209.9	219.9	274.90	0.67	0.95	2	4	
'RPC 7DU'	74720.18	58803.87	240.8	277.8	275.68	0.57	0.81	2	5	
'RPC 8DL'	74671.66	58276.90	204.1	214.1	278.92	0.92	1.29	2	3	
'RPC 8DU'	74664.76	58279.13	273.0	288.0	290.58	1.11	1.56	2	5	
'RPC 9DL'	74507.87	57908.37	216.4	226.4	279.10	0.70	0.99	2	4	
'RPC 9DU'	74507.71	57898.35	268.3	283.3	280.96	0.54	0.76	2	5	
'RPC 10DL'	74551.49	57380.20	200.5	210.5	280.56	0.87	1.22	2	3	
'RPC 10DU'	74540.11	57380.29	272.5	287.4	290.42	0.10	0.14	2	5	
'RPC 11DL'	75240.08	57380.02	180.2	190.2	278.49	0.54	0.76	2	3	
'RPC 11DU'	75250.01	57380.43	271.2	286.2	289.45	0.00	0.01	2	5	
'RRP 1 '	75634.60	54563.50	242.4	272.4	265.61	0.85	4.76	31	5	
'RRP 2 '	75829.80	54468.30	242.5	272.5	264.76	0.65	3.41	28	5	
'RRP 3 '	75853.00	54303.00	238.1	268.1	264.33	0.91	5.14	32	5	
'RRP 4 '	75723.30	54294.50	238.3	268.3	264.37	0.67	3.65	30	5	
'RSB 7 '	75044.30	57692.80	272.7	292.6	286.01	0.82	4.41	29	5	
'RSB 8 '	75178.20	57612.90	274.3	294.3	288.00	0.87	4.24	24	5	
'RSC 2 '	74378.60	58543.00	261.9	281.9	278.28	0.73	3.42	22	5	
'RSC 3 '	74699.70	58724.70	258.6	278.6	276.72	0.90	4.29	23	5	
'RSC 9 '	74565.30	59241.20	251.6	271.6	271.79	0.79	3.63	21	5	
'RSD 1 '	75035.10	57440.80	267.9	287.7	286.45	0.60	3.32	31	5	
'RSD 3 '	74702.30	57451.60	269.3	289.1	286.84	0.72	4.06	32	5	
'RSD 4 '	75154.60	57441.40	270.6	290.6	288.51	0.52	2.73	28	5	
'RSD 5 '	75207.00	57439.90	269.6	289.6	287.18	0.55	2.89	28	5	
'RSD 6 '	75256.60	57441.30	270.1	290.1	287.07	0.47	2.50	28	5	
'RSD 7 '	75178.40	57394.30	267.3	287.3	285.23	0.46	2.46	29	5	
'RSD 8 '	75229.60	57394.00	267.3	287.3	285.51	0.44	2.33	28	5	
'RSD 9 '	75185.90	57245.60	251.7	271.7	283.77	0.34	1.75	26	5	
'RSE 1A '	74712.70	57734.50	274.8	294.8	288.55	0.75	4.43	35	5	
'RSE 1B '	74698.10	57731.40	275.7	295.7	288.84	0.99	5.32	29	5	
'RSE 1C '	74684.10	57730.80	268.5	288.5	288.72	1.11	5.88	28	5	
'RSE 2 '	74743.50	57594.90	269.7	289.5	286.72	1.09	5.76	28	5	
'RSE 3A '	74931.20	57445.80	268.2	288.0	285.20	0.75	4.03	29	5	
'RSE 4A '	75101.10	57528.40	260.6	270.6	286.61	0.63	3.41	29	5	
'RSE 7 '	74783.70	58481.50	266.5	286.3	280.80	0.86	4.79	31	5	
'RSE 8 '	74869.40	58538.80	271.2	291.0	284.00	1.32	6.99	28	5	
'RSE 9 '	74971.10	58463.30	266.7	286.7	279.23	0.77	4.15	29	5	
'RSE 10 '	74848.30	58420.70	270.7	290.5	281.74	1.14	5.93	27	5	
'RSE 11 '	74787.70	58357.60	262.1	272.1	282.84	1.35	6.99	27	5	
'RSE 12 '	74842.30	58318.20	259.1	269.1	276.42	0.49	1.69	12	5	
'RSE 18 '	74839.50	58247.20	268.1	288.1	279.61	0.74	3.84	27	5	
'RSE 19 '	74791.20	58318.40	262.5	282.5	280.91	1.14	5.92	27	5	
'RSE 24 '	74638.90	57370.40	237.6	257.6	279.63	0.57	3.00	28	5	
'RSE 25 '	74544.50	55824.50	237.5	257.5	275.41	0.47	2.56	29	5	
'RSF 1 '	74869.40	58505.30	228.8	238.8	277.64	0.68	3.66	29	5	
'RSF 2 '	74628.60	57670.40	224.8	235.3	278.38	0.60	3.25	29	4	
'RSF 3 '	75206.70	57621.40	229.8	239.8	279.63	0.64	3.39	28	5	
'RSP 1D '	74426.80	56879.40	274.7	289.7	289.71	1.19	1.68	2	5	
'RSP 2D '	75568.60	55947.10	260.3	280.3	278.40	-1.00	-1.00	1	5	
'SBG 1 '	63749.10	74619.40	190.7	220.7	237.91	0.29	1.52	27	6	?
'SBG 2 '	64939.60	74570.20	205.9	235.9	237.86	0.33	1.76	29	6	?
'SBG 3 '	65265.60	73699.90	206.6	236.6	237.08	0.47	2.60	31	6	?
'SBG 4 '	65010.20	72399.80	185.6	215.6	241.00	0.27	1.39	27	6	?
'SBG 5 '	64499.00	72208.30	199.4	219.4	249.51	0.31	1.62	27	3	
'SBG 6 '	63860.00	73599.30	208.1	238.1	244.56	0.32	1.74	29	6	?
'SCA 2 '	64697.10	73850.60	215.9	245.9	242.49	0.36	1.70	22	4	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'SCA 3 '	64571.20	73959.30	220.3	240.3	241.40	0.32	1.06	11	4	
'SCA 3A '	64571.20	73965.00	267.1	277.1	270.91	0.49	2.01	17	5	
'SCA 4 '	64563.50	73856.50	220.4	240.4	241.75	0.37	1.55	18	4	
'SCA 4A '	64567.20	73855.20	265.3	275.3	268.78	0.42	1.47	12	5	
'SCA 5 '	64630.80	74092.90	223.7	243.7	241.50	0.26	1.12	19	4	
'SCA 6 '	64637.50	73706.20	221.3	241.1	242.18	0.27	1.17	18	4	
'SLP 1 '	64449.10	72958.40	228.0	248.0	245.33	0.36	1.96	30	4	
'SLP 2 '	64529.70	72863.40	217.7	237.7	244.92	0.31	1.70	30	4	
'TBG 1 '	17134.70	71429.50	89.1	109.1	100.39	0.21	1.47	50	2	
'TBG 3 '	17177.70	71324.10	88.9	108.9	103.01	0.30	2.08	48	2	
'TBG 4 '	17177.70	71267.10	89.3	109.3	103.14	0.25	1.62	42	2	
'TBG 5 '	17354.50	71226.50	92.4	112.4	102.80	0.32	2.01	40	2	
'TBG 5A '	17348.80	71206.80	70.0	80.0	103.75	0.27	1.72	39	2	
'TBG 5B '	17354.80	71216.80	46.2	56.2	113.16	0.42	2.71	41	1	
'TBG 6 '	17290.50	71482.30	89.1	109.1	102.73	0.23	1.53	43	2	
'TBG 7 '	17548.10	71298.50	84.7	104.7	105.49	0.31	2.12	46	2	
'TIR 1L '	16169.25	71019.05	65.7	67.7	93.14	0.27	0.93	12	6	?
'TIR 1M '	16170.12	71024.12	84.6	86.6	93.73	0.65	2.15	11	2	
'TIR 1U '	16170.93	71028.98	90.0	92.0	93.16	0.24	0.75	10	2	
'TIR 2 '	16096.27	71068.64	84.2	86.2	92.42	0.23	0.77	11	2	
'TIR 3B '	16522.86	71099.07	83.5	85.5	95.72	0.40	1.43	13	2	
'TNX 1D '	16699.60	71613.50	79.6	99.6	99.31	0.16	1.02	41	2	
'TNX 2D '	16788.20	71452.00	82.8	102.8	99.07	0.18	1.17	42	2	
'TNX 3D '	17043.10	71236.70	84.9	104.9	99.62	0.20	1.38	49	2	
'TNX 4D '	17223.00	71002.70	85.5	105.5	103.09	0.30	2.07	48	2	
'TNX 5D '	17363.70	70995.30	88.5	108.5	105.08	0.33	2.22	45	2	
'TNX 6D '	17428.70	70717.60	89.8	109.8	105.45	0.35	2.32	44	2	
'TNX 7D '	17080.60	71738.10	83.6	103.6	101.04	0.19	1.27	47	2	
'TNX 8D '	16168.30	70591.90	74.0	94.0	94.01	0.16	1.04	41	2	
'TNX 9D '	16145.80	70791.40	75.4	95.4	93.79	0.15	1.01	48	2	
'TNX 10D '	16166.70	70999.30	77.0	97.0	94.08	0.17	1.09	41	2	
'TNX 11D '	16165.50	71199.30	73.2	93.2	94.04	0.16	1.03	42	2	
'TNX 12D '	16176.30	71598.30	73.1	93.1	94.93	0.11	0.74	41	2	
'TNX 13D '	15938.80	70842.00	87.9	89.9	91.36	0.47	1.25	7	2	
'TNX 14D '	15971.10	70931.80	85.8	87.8	91.39	0.48	1.18	6	2	
'TNX 15D '	16002.10	71021.10	85.9	87.9	91.01	0.66	2.20	11	2	
'TNX 16D '	16012.20	71111.30	86.1	88.1	90.75	0.48	1.81	14	2	
'TNX 17D '	16047.40	71583.80	89.7	91.7	92.54	0.53	1.39	7	2	
'TNX 18D '	15898.00	70748.20	84.9	86.9	91.58	0.08	0.16	4	2	
'TNX 19D '	15848.40	70626.70	84.9	86.9	91.03	0.48	1.28	7	2	
'TNX 20D '	15826.10	70579.00	86.2	88.2	91.13	0.49	1.30	7	2	
'TNX 21D '	15833.50	70446.80	86.9	88.9	91.96	0.41	1.08	7	2	
'TNX 22D '	15757.70	70184.70	85.8	87.8	89.91	0.34	0.91	7	2	
'TNX 23D '	16927.00	71414.50	84.8	104.8	99.41	0.54	1.69	10	2	
'TNX 24D '	17534.60	71536.90	99.8	114.8	109.08	0.17	0.53	10	2	
'TNX 26D '	16251.00	70424.40	87.8	90.1	94.17	0.30	1.11	14	2	
'TNX 27D '	16609.14	71180.09	81.3	101.3	96.29	0.28	1.05	14	2	
'TRW 1 '	16947.00	71162.80	81.4	106.4	91.83	0.76	3.49	21	2	
'TRW 2 '	16803.80	71259.60	77.2	112.2	92.33	0.67	2.83	18	2	
'TRW 4 '	17144.60	71454.20	81.9	111.9	92.11	1.28	6.01	22	2	
'XSB 1 '	16901.00	71133.10	92.0	112.0	102.82	0.47	0.66	2	2	
'XSB 1A '	16883.00	71105.40	43.6	53.6	98.51	0.22	1.37	39	1	
'XSB 1B '	16872.90	71105.00	64.6	74.6	102.63	0.32	2.05	40	6	?
'XSB 1D '	16893.50	71104.80	87.9	107.9	98.82	0.28	1.85	45	2	
'XSB 2D '	16823.10	71086.00	84.0	104.0	98.55	0.24	1.69	49	2	
'XSB 3A '	16901.30	70915.30	87.4	103.2	100.31	0.43	3.00	48	2	
'XSB 4 '	16851.10	71024.50	94.3	114.3	98.27	0.36	0.63	3	2	
'XSB 4D '	16826.20	70997.90	83.9	103.9	98.63	0.25	1.69	46	2	
'YSB 1A '	17808.80	71162.20	98.4	128.4	117.87	0.87	6.02	48	2	
'YSB 2A '	17850.20	71010.00	97.7	127.7	118.65	0.90	6.21	48	2	
'YSB 3A '	17755.20	70859.00	96.7	126.7	119.57	0.42	2.94	49	2	
'YSB 4A '	17739.80	71020.70	97.6	127.6	117.58	0.86	5.96	48	2	
'YSC 1A '	65438.90	78039.90	76.8	136.9	163.25	0.42	1.11	7	1	
'YSC 1C '	65855.50	78186.20	197.5	207.5	217.59	0.69	2.94	18	2	
'YSC 1D '	65859.10	78170.70	216.8	236.8	221.17	0.23	0.40	3	3	
'YSC 2A '	66100.10	78311.50	134.7	144.7	162.93	0.18	0.75	18	1	
'YSC 2D '	66130.70	78320.40	197.9	218.0	216.51	0.50	2.35	22	6	?
'YSC 4C '	65901.90	77059.70	195.9	205.9	227.80	0.59	2.49	18	2	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

'YSC 5A '	67134.90	74295.90	116.0	121.0	181.23	1.18	5.02	18	1	
'Z 2 '	53181.60	74785.30	214.0	214.5	219.42	0.47	1.76	14	3	
'Z 3 '	51328.30	75086.20	206.6	207.1	212.57	0.71	2.02	8	3	
'Z 8 '	51584.90	76640.50	213.6	214.1	219.33	0.55	2.14	15	3	
'Z 9 '	50570.50	77732.00	207.5	227.5	215.04	0.43	2.19	26	4	
'Z 12 '	61400.90	71198.90	251.3	251.8	274.33	0.22	0.53	6	5	
'Z 13 '	62203.60	70785.80	256.6	257.1	276.13	0.79	2.95	14	5	
'Z 17 '	43797.80	72260.90	148.2	148.7	169.52	0.31	1.15	14	2	
'Z 18 '	43774.10	73077.20	159.9	160.4	184.80	0.58	2.17	14	6	?
'Z 20 '	43722.40	74080.70	173.4	193.4	184.74	0.36	0.80	5	3	
'Z 20B '	43721.00	74085.00	175.6	195.6	191.15	0.85	2.83	11	3	
'ZBG 1 '	65584.10	76584.20	220.0	240.1	234.17	0.48	3.02	39	3	
'ZBG 2 '	67472.90	76170.50	210.9	230.9	222.03	0.41	2.62	41	6	?
'ZDT 1 '	65114.80	71644.40	227.0	247.0	239.91	0.15	0.88	36	4	
'ZDT 2 '	65059.90	71696.50	225.1	245.1	241.45	0.16	0.97	36	4	
'ZW 2 '	54388.70	80701.50	194.8	204.8	207.29	0.58	2.45	18	3	
'ZW 3 '	57078.20	80746.50	194.6	205.1	200.78	0.42	1.84	19	6	?
'ZW 4 '	56556.90	77667.40	229.2	239.7	232.31	0.47	2.03	19	5	
'ZW 5 '	54708.60	75767.40	221.0	231.0	227.40	0.27	1.30	23	4	
'ZW 6 '	52030.80	76166.00	216.7	227.2	220.13	0.78	3.20	17	4	
'ZW 7 '	60300.70	72399.50	254.5	264.8	265.84	0.36	1.50	17	5	
'ZW 8 '	63801.50	70800.80	254.1	264.1	270.85	0.21	0.91	18	5	
'ZW 9 '	61400.30	73198.40	242.4	252.4	251.97	0.45	1.93	18	5	
'ZW 10 '	63401.00	73212.40	242.2	252.2	249.72	0.86	4.13	23	5	

avg sigm: 0.399174 num: 1307

'CMP 10C '	53994.30	51402.70	179.6	189.6	198.53	-1.00	-1.00	1	2	
'CMP 10D '	53994.30	51392.50	209.6	229.6	229.84	-1.00	-1.00	1	3	
'CMP 11D '	53647.00	51467.90	209.5	229.9	223.34	-1.00	-1.00	1	3	
'CMP 14D '	52589.50	52363.50	204.1	224.5	217.43	-1.00	-1.00	1	3	
'CMP 15C '	52907.80	51361.40	220.6	250.6	244.53	-1.00	-1.00	1	5	
'CMP 30B '	53166.90	51729.80	97.4	107.5	195.00	-1.00	-1.00	1	2	
'CMP 30C '	53208.20	51718.40	179.5	189.5	210.55	-1.00	-1.00	1	2	
'CMP 30D '	53202.90	51709.70	211.6	231.6	227.97	-1.00	-1.00	1	3	
'CMP 31C '	53255.70	52389.70	197.9	207.9	210.78	-1.00	-1.00	1	6	?
'CMP 32B '	54052.80	52220.00	97.7	107.7	195.31	-1.00	-1.00	1	2	
'CMP 32C '	54061.10	52214.60	185.2	195.2	195.44	-1.00	-1.00	1	2	
'CMP 32D '	54069.20	52209.20	218.6	228.6	220.77	-1.00	-1.00	1	6	?
'NPM 2 '	58252.00	63056.80	244.2	264.2	267.00	-1.00	-1.00	1	5	
'NPM 3 '	55417.60	62109.20	247.2	267.2	267.60	-1.00	-1.00	1	5	
'NPM 4 '	57215.00	60883.20	256.7	276.7	272.70	-1.00	-1.00	1	5	
'NPN 1 '	70879.60	66661.40	257.3	277.4	277.50	-1.00	-1.00	1	4	
'NPN 2 '	72541.50	67394.10	257.9	278.0	273.50	-1.00	-1.00	1	4	
'NPN 3 '	70029.20	67989.80	260.0	280.1	276.70	-1.00	-1.00	1	4	
'NPN 4 '	71021.80	65357.20	265.4	285.5	278.50	-1.00	-1.00	1	5	
'NTN 1 '	45562.30	56993.70	212.4	232.4	233.70	-1.00	-1.00	1	5	
'NTN 2 '	46735.10	57935.50	207.2	227.2	235.20	-1.00	-1.00	1	5	
'NTS 1 '	43893.90	46082.00	164.3	184.4	180.40	-1.00	-1.00	1	3	
'NTS 2 '	45825.20	46262.60	174.7	194.8	192.30	-1.00	-1.00	1	4	
'NTW 1 '	40257.70	48776.50	168.9	188.8	183.60	-1.00	-1.00	1	3	
'NTW 2 '	39353.20	49309.30	171.5	191.5	183.90	-1.00	-1.00	1	3	
'NTW 3 '	41208.70	50040.00	176.7	196.6	191.80	-1.00	-1.00	1	3	
'NTW 4 '	41678.20	48636.30	166.0	185.8	180.40	-1.00	-1.00	1	3	
'P 13A '	60000.00	35600.00	-67.3	-57.4	173.07	0.17	1.24	56	1	
'P 13B '	60000.00	35600.00	-7.2	3.0	175.65	0.22	1.64	56	1	
'P 15A '	51376.30	46755.30	-97.0	-87.0	176.77	0.23	1.63	51	6	?
'P 18A '	47688.10	67592.80	12.0	22.0	168.48	0.16	1.27	64	1	
'P 18B '	47680.90	67578.90	67.0	77.0	169.01	0.16	1.30	64	1	
'P 19A '	60031.30	55347.10	-36.7	-26.7	186.83	-1.00	1.60	-1	1	
'P 21B '	40757.60	24641.80	-82.2	-72.2	134.01	0.16	1.29	64	1	
'P 23A '	30914.50	48114.90	-38.8	-28.8	146.11	0.17	1.44	69	6	?
'P 23B '	30925.30	48101.20	41.5	46.5	137.85	0.19	1.58	69	1	
'P 24A '	66569.70	43142.20	-1.9	8.9	191.47	-1.00	1.00	-1	1	
'P 25B '	42241.90	52521.40	80.6	90.6	178.24	0.65	5.17	64	1	
'P 26A '	18055.90	72010.40	22.0	32.0	117.48	0.33	2.73	69	1	
'P 27B '	64000.30	70405.90	74.8	94.8	179.76	0.15	1.18	62	1	
'RGW 3C '	74059.23	53473.51	137.6	147.6	255.11	-1.00	-1.00	1	2	
'RGW 3D '	74067.32	53481.33	217.2	227.2	265.49	-1.00	-1.00	1	4	

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

’RGW 4C ’	63205.81	48635.55	130.2	140.2	250.81	-1.00	-1.00	1	2	
’RGW 4D ’	63213.96	48641.75	182.2	192.2	267.80	-1.00	-1.00	1	3	
’RGW 5C ’	67896.08	47463.29	107.2	117.2	232.58	-1.00	-1.00	1	6	?
’RGW 5D ’	67886.06	47468.17	184.6	194.6	248.14	-1.00	-1.00	1	3	
’RGW 6C ’	67124.84	42044.46	103.6	113.6	220.97	-1.00	-1.00	1	6	?
’RGW 6D ’	67118.09	42053.07	200.7	210.7	264.85	-1.00	-1.00	1	3	
’RGW 7C ’	62245.72	38729.51	84.3	94.3	240.45	-1.00	-1.00	1	2	
’RGW 7D ’	62249.43	38738.69	166.2	176.2	250.35	-1.00	-1.00	1	3	
’RGW 8C ’	51359.69	47832.32	115.2	125.2	216.43	-1.00	-1.00	1	2	
’RGW 8D ’	51356.06	47843.50	158.4	168.4	224.49	-1.00	-1.00	1	3	
’RGW 9C ’	56408.68	47427.16	102.2	112.2	231.60	-1.00	-1.00	1	2	
’RGW 9D ’	56408.77	47441.32	151.7	161.7	248.30	-1.00	-1.00	1	3	
’RGW 10C ’	54427.42	38255.31	78.4	88.4	225.03	-1.00	-1.00	1	2	
’RGW 10D ’	54425.48	38271.54	146.2	156.2	230.71	-1.00	-1.00	1	3	
’RGW 11C ’	51154.85	31798.00	71.1	81.1	177.90	-1.00	-1.00	1	2	
’RGW 11DD’	51160.88	31785.96	171.2	186.2	184.11	-1.00	-1.00	1	4	
’RGW 12C ’	37727.74	58948.75	126.2	136.2	187.96	-1.00	-1.00	1	6	?
’RGW 12D ’	37721.87	58955.48	164.3	174.3	208.63	-1.00	-1.00	1	3	
’RGW 13C ’	35130.99	57108.42	115.5	125.5	183.71	-1.00	-1.00	1	2	
’RGW 13D ’	35119.80	57110.02	169.6	179.6	204.14	-1.00	-1.00	1	3	
’RGW 14C ’	32085.50	52069.98	100.4	110.4	186.92	-1.00	-1.00	1	2	
’RGW 14D ’	32094.16	52068.82	154.0	164.0	189.45	-1.00	-1.00	1	3	
’RGW 15C ’	37505.91	41218.32	107.9	117.9	182.89	-1.00	-1.00	1	2	
’RGW 15D ’	37516.84	41220.29	156.3	166.3	185.16	-1.00	-1.00	1	3	
’RGW 16C ’	43135.58	65997.84	123.8	133.8	191.22	-1.00	-1.00	1	2	
’RGW 16D ’	43143.89	66000.77	173.2	183.2	200.90	-1.00	-1.00	1	3	
’RGW 17C ’	48329.64	64164.57	151.0	161.0	228.37	-1.00	-1.00	1	6	?
’RGW 17D ’	48340.14	64178.45	173.4	183.4	228.43	-1.00	-1.00	1	3	

avg sigm: 0.235455 num: 11

Hydraulic Head Residuals

The complete contents of the FACT code observation well file are listed in Table F-2. FACT does not compute a hydraulic head for wells outside of the saturated zone and model domain (model area). Wells outside the model area are denoted by a simulated head of “0.0” in Table F-2. The associated (large negative) residual is meaningless, and ignored in the calculation of summary statistics.

Table F-2. Summary of Group Statistical Parameters

```
  Group Statistics for Steady-state Analysis Only
          Overall rms hydraulic head difference:      5.45

** GROUP  1 **  rms of (FACT-data) differences:      3.366
                avg of (FACT-data) differences:     -0.737
                avg of |FACT-data| differences:      1.983
                max of {FACT-data} differences:    -16.208
```

"BGO 3A "	57666.62	55791.31	103.7	113.7	163.0	163.5	0.5
"BGO 6A "	57379.75	56798.46	107.5	117.5	159.3	159.9	0.6
"BGO 8A "	56713.52	57023.70	105.3	115.3	161.0	159.1	-1.9
"BGO 8AR"	56718.93	57053.02	94.6	104.6	160.9	159.1	-1.8
"BGO 9AA"	56557.06	57472.74	73.8	83.8	158.0	157.8	-0.2
"BGO 10A "	56207.63	57372.71	111.1	121.1	170.7	157.9	-12.8
"BGO 10AA"	56188.61	57573.76	80.8	90.8	157.6	157.4	-0.2
"BGO 10AR"	56220.41	57370.81	96.5	106.5	158.5	158.0	-0.5
"BGO 12AR"	55433.62	57535.80	99.3	109.3	157.8	157.3	-0.5
"BGO 12AX"	55438.21	57566.51	99.5	109.5	157.4	157.2	-0.2
"BGO 14A "	54932.60	57206.47	109.6	119.6	157.3	158.0	0.7
"BGO 14AR"	54878.94	57191.60	96.8	106.8	159.1	158.1	-1.0
"BGO 16A "	55151.72	56525.53	102.5	112.5	161.0	160.0	-1.0
"BGO 16AR"	55171.25	56507.27	103.7	113.7	161.0	160.1	-0.9
"BGO 18A "	55613.51	56266.77	99.5	109.5	161.2	161.0	-0.2
"BGO 20A "	55873.74	55563.80	86.3	96.3	163.5	163.2	-0.3
"BGO 25A "	54720.59	57027.64	104.1	114.1	160.8	158.4	-2.4
"BGO 26A "	54078.09	57150.00	81.0	91.0	160.7	157.8	-2.9
"BGO 29A "	53065.74	56767.52	102.5	112.5	159.7	157.8	-1.9
"BGO 39A "	56289.81	54051.04	84.8	94.8	167.7	168.1	0.4
"BGO 41A "	54526.63	57386.82	103.3	113.3	158.6	157.3	-1.3
"BGO 43A "	55480.82	57789.12	105.9	115.9	159.0	156.5	-2.5
"BGO 43AA"	55496.65	57790.46	62.2	72.2	156.7	156.7	0.0
"BGO 44A "	56980.04	57157.41	98.0	108.0	158.1	158.7	0.6
"BGO 44AA"	57009.08	57153.08	61.2	71.3	158.7	159.0	0.3
"BGO 47A "	53685.72	55785.97	86.8	96.8	162.4	161.0	-1.4
"BGO 49A "	54776.87	54709.58	75.1	85.1	166.8	164.7	-2.1
"BGO 50A "	53065.78	56400.69	90.5	100.5	160.2	158.8	-1.4
"BGO 51A "	56425.66	54594.46	75.1	85.1	166.0	166.6	0.6
"BGO 52A "	55886.11	55219.91	81.7	91.7	163.8	164.2	0.4

Table F-2. Summary of Group Statistical Parameters (Continued)

"BGO 52AA"	55881.46	55226.42	36.6	46.6	163.1	164.7	1.6
"BGO 53A "	54463.49	56992.63	78.7	88.7	159.1	158.5	-0.6
"BGO 53AA"	54469.72	56985.38	38.9	48.9	155.7	158.6	2.9
"BGX 1A "	57719.04	57078.74	114.1	124.1	158.7	158.9	0.2
"BGX 4A "	56592.03	58389.00	106.8	116.8	155.2	154.4	-0.8
"CMP 8A "	48469.95	34344.23	13.7	23.5	182.9	186.1	3.2
"CMP 12A "	47590.53	33793.03	22.1	32.1	181.6	185.1	3.5
"CMP 15A "	46853.37	33344.49	14.2	24.2	180.6	184.0	3.4
"DCB 20D "	17380.30	52486.69	46.2	48.7	114.3	110.7	-3.6
"DCB 23D "	16894.13	52535.54	49.1	51.6	111.4	109.4	-2.0
"FC 1A "	52952.32	60987.82	96.7	101.7	143.5	145.2	1.7
"FC 3B "	57173.69	59132.82	61.2	66.2	150.6	151.9	1.3
"FC 3C "	57182.65	59131.22	121.0	126.0	151.8	151.5	-0.3
"FC 4B "	54258.68	63352.39	76.1	81.1	141.0	138.2	-2.8
"FC 4C "	54264.51	63357.69	116.3	121.3	137.6	138.8	1.2
"FIW 2MA"	50287.63	57737.11	100.5	110.5	151.8	152.0	0.2
"FNB 1A "	54202.25	61223.09	107.9	117.9	144.3	145.1	0.8
"FNB 2A "	54330.20	61502.80	111.1	121.1	143.6	144.3	0.7
"FNB 3A "	54117.53	61652.79	109.2	119.2	143.1	143.8	0.7
"FSB 76A "	50532.01	57890.76	36.9	47.4	155.3	151.8	-3.5
"FSB 76B "	50532.38	57880.96	99.2	109.7	151.8	151.9	0.1
"FSB 78A "	49054.13	56799.99	27.0	37.5	156.3	152.6	-3.7
"FSB 78B "	49061.71	56806.76	82.4	92.8	154.7	152.4	-2.3
"FSB 79A "	48804.15	55735.50	24.0	34.4	158.2	155.2	-3.0
"FSB 79B "	48813.87	55735.07	80.7	91.2	158.3	154.8	-3.5
"FSB 87A "	49173.86	57637.40	33.1	43.6	154.0	150.4	-3.6
"FSB 87B "	49162.22	57635.06	90.0	100.5	150.8	150.3	-0.5
"FSB 96A "	48694.53	57003.71	85.7	95.7	152.1	151.3	-0.8
"FSB 96AR"	48669.93	57042.37	79.0	89.0	153.5	151.1	-2.4
"FSB 97A "	48937.53	57247.51	85.8	95.8	152.3	151.0	-1.3
"FSB 98A "	49135.47	57428.92	84.7	94.7	150.6	150.9	0.3
"FSB 98AR"	49114.24	57405.01	82.1	92.1	151.9	150.9	-1.0
"FSB 99A "	49383.87	57668.31	92.9	102.9	150.8	150.6	-0.2
"FSB100A "	49984.05	57396.38	95.8	105.8	151.6	152.4	0.8
"FSB101A "	50250.24	57528.52	92.9	102.9	151.8	152.5	0.7
"FSB112A "	47610.81	56568.72	81.0	91.0	153.6	150.4	-3.2
"FSB113A "	49807.16	56036.54	81.0	91.3	159.0	155.6	-3.4
"FSB114A "	50999.20	56938.31	95.2	105.0	155.8	155.1	-0.7
"FSB120A "	48241.24	57771.43	99.0	109.0	152.8	148.2	-4.6
"HAA 1A "	60555.31	49367.75	94.9	104.9	181.2	181.7	0.5
"HAA 2A "	59118.96	50747.84	107.3	117.3	177.2	178.0	0.8
"HAA 3A "	58169.46	51502.24	96.8	106.8	175.8	175.8	0.0
"HAA 4A "	60017.63	51878.30	105.4	115.3	174.9	176.1	1.2
"HAA 4AA"	60027.07	51876.50	32.2	42.2	175.1	175.3	0.2
"HAA 5A "	60401.71	50138.53	100.7	110.7	179.2	180.1	0.9
"HAA 6A "	61762.41	50707.86	95.6	105.6	178.9	179.5	0.6
"HAA 6AA"	61752.85	50710.00	31.2	35.8	178.6	178.4	-0.2
"HC 1A "	59868.49	51431.54	89.5	94.5	175.8	176.8	1.0
"HC 2A "	59875.62	51469.90	72.2	77.2	175.8	176.5	0.7
"HC 2B "	59883.53	51459.02	85.7	90.7	175.0	176.7	1.7
"HC 8B "	59291.27	57414.80	132.5	137.5	155.5	157.2	1.7
"HC 10A "	60443.26	55451.59	114.0	117.0	163.3	165.3	2.0
"HCA 4A "	61066.28	51954.44	103.7	113.7	175.7	176.3	0.6
"HIW 2A "	55177.01	53956.84	78.3	88.3	167.5	167.1	-0.4

Table F-2. Summary of Group Statistical Parameters (Continued)

"HSB 65A "	56654.09	52811.20	62.5	73.2	171.5	171.6	0.1
"HSB 68A "	54954.88	52242.77	47.5	58.0	171.9	171.0	-0.9
"HSB 69A "	54541.89	52353.55	83.1	93.1	171.7	170.4	-1.3
"HSB 83A "	56656.73	52005.45	65.2	76.0	173.1	173.3	0.2
"HSB 84A "	54445.85	52411.59	64.7	75.9	172.0	170.2	-1.8
"HSB 85A "	57432.27	54031.78	61.1	71.1	168.9	169.3	0.4
"HSB 86A "	54275.00	53402.77	63.1	73.9	168.8	167.6	-1.2
"HSB117A "	53521.40	53781.12	84.8	94.8	166.8	165.8	-1.0
"HSB120A "	54893.16	54165.82	91.0	101.0	166.4	166.2	-0.2
"HSB121A "	55545.03	52626.35	88.3	98.3	171.7	171.0	-0.7
"HSB122A "	55930.58	52719.32	85.4	95.4	171.6	171.2	-0.4
"HSB124AR"	56699.16	52562.91	94.6	104.6	172.2	172.4	0.2
"HSB139A "	55334.77	51753.59	87.6	97.6	173.7	172.7	-1.0
"HSB141A "	57116.59	51462.98	80.6	90.6	175.1	174.9	-0.2
"HSB144A "	54354.32	52743.78	78.6	88.6	171.4	169.3	-2.1
"HSB146A "	56264.76	50892.93	85.5	95.5	176.1	175.3	-0.8
"HSL 6A "	58773.03	52614.66	104.7	114.7	168.4	173.8	5.4
"HSL 6AA"	58780.78	52621.29	18.6	28.6	169.1	173.0	3.9
"HSL 8A "	59332.69	52533.01	108.8	118.8	172.8	174.3	1.5
"HSL 8AA"	59334.34	52541.25	28.7	38.7	175.7	173.6	-2.1
"LAW 1D "	43189.65	27176.23	6.6	11.6	176.5	176.3	-0.2
"LAW 2B "	42474.87	28431.27	-9.8	-4.8	176.2	175.4	-0.8
"LAW 3B "	45042.93	27844.21	-1.0	4.0	178.2	179.9	1.7
"LCO 5A "	43542.51	27535.73	30.0	40.0	177.2	177.2	0.0
"NPM 19E "	53855.72	43750.52	33.9	43.9	188.3	184.4	-3.9
"NPM 34E "	52178.77	41824.18	33.1	43.1	187.2	185.2	-2.0
"PW 83N "	48260.52	43306.42	4.0	9.0	168.4	179.3	10.9
"TBG 5B "	16217.09	60159.71	46.2	56.2	113.2	99.8	-13.4
"XSB 1A "	15732.44	60148.84	43.6	53.6	98.5	98.4	-0.1
"YSC 1A "	64669.04	56836.46	76.8	136.9	163.3	160.8	-2.5
"YSC 2A "	65372.26	56964.66	134.7	144.7	162.9	160.8	-2.1
"YSC 5A "	65549.56	52821.66	116.0	121.0	181.2	173.5	-7.7
"P 13A "	50525.24	16454.79	-67.3	-57.4	173.1	177.3	4.2
"P 13B "	50525.24	16454.79	-7.2	3.0	175.7	177.2	1.5
"P 18A "	45134.06	50308.26	12.0	22.0	168.5	164.1	-4.4
"P 18B "	45124.13	50296.16	67.0	77.0	169.0	164.2	-4.8
"P 19A "	54661.51	35763.86	-36.7	-26.7	186.8	191.8	5.0
"P 23B "	24685.04	34727.78	41.5	46.5	137.8	139.1	1.3
"P 24A "	58519.49	22466.26	-1.9	8.9	191.5	192.4	0.9
"P 25B "	36673.35	36698.53	80.6	90.6	178.2	164.4	-13.8
"P 26A "	17067.87	60790.20	22.0	32.0	117.5	101.3	-16.2
"P 27B "	61674.68	49668.39	74.8	94.8	179.8	181.5	1.7

```
** GROUP  2 **  rms of (FACT-data) differences:      6.304
                avg of (FACT-data) differences:      1.404
                avg of |FACT-data| differences:      5.068
                max of {FACT-data} differences:     17.737
```

"BG 94 "	57485.58	61253.82	152.8	182.8	191.2	174.8	-16.4
"BG 95 "	58210.78	60274.34	152.5	182.5	192.9	177.4	-15.5
"BG 96 "	57966.00	59647.94	177.2	207.2	197.8	196.6	-1.2
"BG 103 "	59074.01	57865.93	169.5	199.5	199.9	199.6	-0.3
"BGO 3C "	57663.88	55780.34	178.7	188.7	225.9	225.6	-0.3
"BGO 5C "	57844.87	56689.07	183.2	193.2	216.3	221.1	4.8

Table F-2. Summary of Group Statistical Parameters (Continued)

"BGO 6B "	57422.52	56856.84	139.7	149.7	219.1	221.5	2.4
"BGO 6C "	57370.14	56800.40	158.0	168.0	220.3	222.3	2.0
"BGO 8C "	56716.03	57033.59	174.3	184.3	224.3	224.5	0.2
"BGO 10B "	56173.88	57560.73	139.0	149.0	219.9	223.6	3.7
"BGO 10C "	56198.04	57374.75	157.3	167.3	220.4	224.4	4.0
"BGO 12C "	55415.52	57541.08	153.6	163.6	220.1	225.4	5.3
"BGO 12CR"	55390.36	57547.24	144.0	154.0	221.9	225.2	3.3
"BGO 12CX"	55411.15	57571.96	141.2	151.2	230.4	225.1	-5.3
"BGO 14C "	54931.25	57196.74	192.1	202.1	221.4	227.1	5.7
"BGO 14CR"	54876.13	57177.89	190.1	200.1	223.8	227.0	3.2
"BGO 16B "	55143.73	56537.96	136.0	146.0	218.4	225.6	7.2
"BGO 20B "	55889.62	55545.19	131.0	141.0	227.6	226.7	-0.9
"BGO 20C "	55873.23	55534.46	174.0	184.0	228.8	227.5	-1.3
"BGO 27C "	53643.34	56753.42	154.9	163.9	220.9	223.5	2.6
"BGO 29C "	53065.14	56785.84	176.8	186.8	223.1	222.6	-0.5
"BGO 30C "	53386.81	56311.81	178.4	188.4	219.1	222.0	2.9
"BGO 31C "	53641.87	56050.06	176.4	186.4	225.6	222.0	-3.6
"BGO 33C "	54384.56	55382.76	177.8	187.8	225.2	223.3	-1.9
"BGO 35C "	55120.65	54688.75	161.9	171.9	228.9	224.8	-4.1
"BGO 37C "	55743.38	54090.51	168.8	178.8	230.9	226.8	-4.1
"BGO 39C "	56282.08	54042.56	174.9	184.9	231.1	228.9	-2.2
"BGO 42C "	54629.16	57298.77	185.9	195.9	223.4	226.9	3.5
"BGO 43CR"	55459.53	57766.86	178.4	188.4	225.4	225.6	0.2
"BGO 44B "	56994.49	57155.16	148.1	158.1	221.0	222.5	1.5
"BGO 45B "	53574.07	56946.03	137.0	147.0	219.1	223.5	4.4
"BGO 45C "	53586.46	56937.98	190.5	200.5	222.9	225.3	2.4
"BGO 46B "	53285.57	56160.65	140.4	150.4	218.2	219.8	1.6
"BGO 46C "	53277.11	56172.78	178.0	188.0	219.6	220.9	1.3
"BGO 47C "	53709.52	55804.63	178.6	188.6	222.9	221.4	-1.5
"BGO 48C "	53864.66	55615.85	176.7	186.7	223.6	221.5	-2.1
"BGO 49C "	54777.03	54724.27	166.0	176.0	228.2	223.4	-4.8
"BGO 50C "	53080.36	56386.55	162.5	172.5	218.1	220.5	2.4
"BGO 51B "	56430.92	54587.93	116.9	126.9	230.4	227.8	-2.6
"BGO 51C "	56435.93	54582.16	175.1	185.1	231.2	229.2	-2.0
"BGO 52B "	55890.68	55213.52	126.7	136.7	228.1	226.7	-1.4
"BGO 52B "	55890.68	55213.52	126.7	136.7	228.1	226.7	-1.4
"BGO 52C "	55895.16	55207.15	178.7	188.7	229.4	227.9	-1.5
"BGO 53B "	54457.17	57000.00	143.5	153.5	221.7	225.4	3.7
"BGO 53C "	54450.67	57007.32	183.2	193.2	222.6	226.6	4.0
"BGX 1C "	57725.76	57065.15	176.0	186.0	216.0	219.7	3.7
"BGX 2B "	57469.67	57511.55	137.2	147.2	212.9	218.2	5.3
"BGX 2D "	57476.29	57498.90	181.1	191.1	215.4	219.4	4.0
"BGX 4C "	56580.37	58398.63	170.7	180.7	214.3	219.2	4.9
"BGX 8DR"	58220.98	57746.68	183.1	203.1	205.7	212.2	6.5
"BGX 12C "	58280.41	54501.71	174.1	184.1	234.6	228.6	-6.0
"BRR 6C "	50435.16	58863.14	156.0	166.0	211.6	214.1	2.5
"BRR 7BR"	50162.98	59444.94	141.6	151.6	204.9	211.0	6.1
"BRR 7C "	50153.27	59444.45	175.9	185.9	209.8	212.2	2.4
"BRR 8B "	49597.22	59625.82	138.7	148.7	204.3	207.1	2.8
"CMP 8B "	48480.44	34345.48	156.6	166.6	198.5	206.4	7.9
"CMP 9B "	47847.73	33475.01	149.0	159.0	194.7	208.4	13.7
"CMP 10B "	47943.12	33136.89	137.4	147.4	195.0	209.8	14.8
"CMP 10C "	47936.35	33160.82	179.6	189.6	198.9	209.7	10.8
"CMP 11B "	47622.42	33282.65	139.7	149.7	195.1	208.6	13.5

Table F-2. Summary of Group Statistical Parameters (Continued)

"CMP 12B "	47582.56	33788.69	148.0	158.0	194.6	206.7	12.1
"CMP 13B "	47975.22	33615.47	134.2	144.2	194.7	208.2	13.5
"CMP 14B "	46762.54	34405.77	130.0	140.0	194.6	202.0	7.4
"CMP 15B "	46859.50	33335.32	145.1	155.1	202.9	206.7	3.8
"CMP 16B "	47831.28	33361.04	141.7	151.7	194.8	208.7	13.9
"CMP 30B "	47195.03	33652.79	97.4	107.5	194.7	206.1	11.4
"CMP 30C "	47233.06	33633.06	179.5	189.5	210.8	206.5	-4.3
"CMP 31B "	47408.43	34209.90	110.0	120.0	194.4	204.7	10.3
"CMP 32B "	48163.49	33948.09	97.7	107.7	195.5	207.6	12.1
"CMP 32C "	48170.49	33941.09	185.2	195.2	195.9	207.4	11.5
"CRP 3C "	41780.37	52154.68	121.1	131.1	196.7	181.5	-15.2
"CRP 5C "	42238.74	51887.54	110.1	120.1	198.3	184.2	-14.1
"CSB 1C "	42601.64	50326.00	141.4	161.4	205.0	198.8	-6.2
"CSB 3C "	42166.21	51112.99	137.9	157.9	206.1	191.4	-14.7
"DBP 1 "	16554.65	55461.46	93.2	121.4	120.0	121.2	1.2
"DBP 2 "	16261.38	55305.83	84.3	114.3	117.4	118.7	1.3
"DBP 3 "	16342.95	55592.44	86.4	116.4	121.1	119.8	-1.3
"DBP 4 "	16239.48	55516.39	84.2	114.2	119.0	118.9	-0.1
"DBP 5 "	16456.49	55271.93	96.1	116.1	117.5	120.3	2.8
"DCB 1A "	17169.39	52608.40	90.1	120.1	115.4	123.5	8.1
"DCB 2A "	18062.42	51812.95	97.4	127.4	124.8	131.1	6.3
"DCB 3A "	17908.76	51067.40	96.2	126.2	120.6	129.2	8.6
"DCB 4A "	17512.34	51155.65	92.5	122.5	119.1	126.5	7.4
"DCB 5A "	17259.08	51666.78	85.9	115.9	118.8	124.4	5.6
"DCB 6 "	17318.69	52719.18	109.5	128.2	116.8	125.0	8.2
"DCB 7 "	17339.83	52544.47	108.9	128.9	118.0	125.4	7.4
"DCB 8 "	18186.59	51825.20	110.3	130.3	126.4	132.1	5.7
"DCB 9 "	17155.27	52777.13	97.3	117.3	114.9	123.1	8.2
"DCB 10 "	17118.62	52388.76	99.8	119.8	116.6	123.3	6.7
"DCB 11 "	16701.76	53331.22	106.8	117.0	122.1	117.3	-4.8
"DCB 12 "	16105.05	53981.19	92.0	112.0	109.8	115.7	5.9
"DCB 13 "	16523.39	52555.56	102.0	117.6	117.2	117.5	0.3
"DCB 14 "	16898.86	53566.89	94.6	114.6	111.6	119.3	7.7
"DCB 15 "	15117.88	53636.30	99.8	114.5	111.6	110.8	-0.8
"DCB 16 "	14958.28	53004.27	100.1	114.7	112.0	111.2	-0.8
"DCB 17A "	17270.54	53154.00	109.4	119.4	116.5	123.8	7.3
"DCB 17B "	17274.54	53158.87	99.2	101.7	116.9	123.7	6.8
"DCB 17C "	17277.32	53163.29	87.4	89.9	116.0	123.6	7.6
"DCB 18A "	17198.69	52626.00	110.1	120.1	116.2	124.0	7.8
"DCB 18B "	17190.86	52621.83	100.5	103.0	113.2	123.6	10.4
"DCB 18C "	17184.89	52618.30	87.7	90.2	112.6	123.4	10.8
"DCB 19A "	17201.32	52595.07	111.9	121.9	120.1	124.1	4.0
"DCB 19B "	17195.27	52590.63	101.9	104.4	117.3	123.8	6.5
"DCB 19C "	17188.62	52586.32	89.1	91.6	116.3	123.5	7.2
"DCB 20A "	17393.86	52461.01	110.9	120.9	117.1	125.9	8.8
"DCB 20B "	17390.93	52466.03	100.3	102.8	116.4	125.7	9.3
"DCB 20C "	17387.59	52471.95	89.4	91.9	116.3	125.4	9.1
"DCB 21A "	17144.19	52497.52	110.1	120.1	116.8	123.7	6.9
"DCB 21B "	17142.14	52503.27	102.2	104.7	113.3	123.4	10.1
"DCB 21C "	17140.99	52508.93	88.3	90.8	112.8	123.1	10.3
"DCB 22A "	17083.51	52503.06	109.8	119.8	112.7	123.2	10.5
"DCB 22B "	17081.23	52509.16	100.9	103.4	112.7	122.8	10.1
"DCB 22C "	17080.53	52515.45	88.1	90.6	112.7	122.5	9.8
"DCB 23A "	16893.94	52505.32	105.7	115.7	111.8	121.3	9.5

Table F-2. Summary of Group Statistical Parameters (Continued)

"DCB 23B "	16893.90	52511.36	94.1	96.6	108.7	121.0	12.3
"DCB 23C "	16893.92	52517.70	86.6	89.1	108.9	120.9	12.0
"DCB 24A "	17146.45	51890.59	109.2	119.2	115.4	123.5	8.1
"DCB 24B "	17135.28	51889.49	100.6	103.1	115.1	123.2	8.1
"DCB 24C "	17128.89	51888.29	87.6	90.1	116.2	123.0	6.8
"DOB 1 "	21716.60	56149.98	114.7	144.7	143.2	148.9	5.7
"DOB 2 "	21521.56	56324.23	115.3	145.3	143.3	148.1	4.8
"DOB 3 "	21833.77	56386.18	115.9	145.9	143.1	149.3	6.2
"DOB 4 "	21974.85	56173.09	109.2	139.2	142.4	149.8	7.4
"DOB 7 "	21610.86	56047.42	125.7	145.7	143.2	148.7	5.5
"DOB 8 "	21854.23	56111.62	128.3	148.3	143.8	149.5	5.7
"DOB 9 "	21914.47	56489.76	128.5	148.5	144.1	149.6	5.5
"DOB 10 "	21457.21	56259.09	128.3	148.2	143.3	148.0	4.7
"DOB 11 "	21554.72	56191.64	126.7	131.7	140.9	148.3	7.4
"DOB 12 "	21553.76	56196.84	133.1	138.1	140.6	148.4	7.8
"DOB 14 "	21655.74	56057.51	132.6	137.6	139.7	148.8	9.1
"DOB 15 "	21284.89	55936.57	110.9	116.0	141.9	147.2	5.3
"DOB 16 "	21284.59	55930.81	103.5	108.6	141.4	147.1	5.7
"DOL 1 "	21808.58	56494.69	109.2	119.2	144.3	148.9	4.6
"FBP 1A "	50801.97	60656.16	161.8	191.8	206.7	208.1	1.4
"FBP 2A "	50437.47	61570.32	137.1	167.1	191.5	186.2	-5.3
"FBP 3A "	50834.99	61616.17	141.0	171.0	194.3	192.3	-2.0
"FBP 4 "	51171.97	61014.05	165.2	195.2	212.4	207.0	-5.4
"FBP 6D "	50442.18	61529.96	178.3	198.3	194.8	195.4	0.6
"FBP 7D "	50794.34	61590.87	183.2	203.2	194.1	197.2	3.1
"FBP 8D "	51183.90	60982.69	172.8	192.8	207.1	207.5	0.4
"FBP 9D "	50935.15	61314.97	177.9	197.9	200.3	201.7	1.4
"FBP 12D "	50893.28	60676.93	182.1	202.1	208.4	209.6	1.2
"FBP 13D "	50601.77	61573.73	172.7	192.7	194.9	195.4	0.5
"FC 1B "	52953.86	60995.57	151.8	156.8	210.8	213.8	3.0
"FC 1C "	52955.56	61003.08	183.9	188.9	214.0	214.5	0.5
"FC 3D "	57191.44	59129.76	165.9	170.9	206.4	209.3	2.9
"FC 3E "	57198.96	59128.57	185.7	190.7	205.3	209.9	4.6
"FC 4E "	54276.52	63368.94	176.4	166.4	185.2	0.0	-185.2
"FIW 2IC"	50304.02	57727.18	125.3	175.2	212.6	212.2	-0.4
"FIW 2MC"	50328.95	57551.56	127.9	167.9	210.1	211.8	1.7
"FOB 5C "	48589.99	56744.62	129.3	149.3	202.6	199.4	-3.2
"FOB 7C "	49389.26	58074.58	148.9	168.9	209.8	208.8	-1.0
"FOB 9C "	49876.26	57663.74	155.5	175.5	212.0	210.6	-1.4
"FOB 11C "	50941.71	57274.11	156.2	176.2	214.3	214.5	0.2
"FSB 76C "	50532.65	57870.68	154.8	165.3	213.0	214.0	1.0
"FSB 78C "	49054.67	56815.01	141.6	151.4	208.0	202.2	-5.8
"FSB 79C "	48826.10	55734.41	149.8	159.6	196.9	192.2	-4.7
"FSB 87C "	49149.91	57632.47	148.8	159.3	208.8	206.5	-2.3
"FSB 88C "	50549.09	57363.18	158.4	168.4	212.7	212.8	0.1
"FSB 89C "	50366.31	57334.35	156.1	166.1	212.1	211.7	-0.4
"FSB 90C "	50138.59	57208.65	158.1	168.1	211.1	210.2	-0.9
"FSB 91C "	49912.50	57083.32	149.1	159.1	210.9	208.1	-2.8
"FSB 92C "	49498.22	57007.70	147.6	157.6	209.4	205.7	-3.7
"FSB 93C "	49362.42	56877.18	142.0	152.0	208.9	204.0	-4.9
"FSB 94C "	49084.32	56907.36	139.8	149.8	208.0	202.8	-5.2
"FSB 95C "	48945.94	57041.77	145.8	155.8	205.6	203.2	-2.4
"FSB 95CR"	48923.95	57077.32	151.9	161.9	208.0	203.5	-4.5
"FSB 97C "	48944.07	57254.71	143.8	153.8	208.3	204.0	-4.3

Table F-2. Summary of Group Statistical Parameters (Continued)

"FSB 98C "	49128.70	57421.57	148.4	158.4	209.3	205.7	-3.6
"FSB 99C "	49391.23	57675.02	157.2	167.2	209.9	208.1	-1.8
"FSB102C "	49457.41	55513.22	145.9	155.9	195.4	192.5	-2.9
"FSB103C "	48430.15	56372.68	147.1	157.1	202.6	196.5	-6.1
"FSB104C "	47966.11	56126.38	150.7	160.7	201.1	192.5	-8.6
"FSB105C "	48815.94	57337.76	141.5	151.5	207.9	203.6	-4.3
"FSB106C "	49404.17	56145.31	156.0	166.0	201.5	199.4	-2.1
"FSB107C "	50106.53	57012.12	150.8	160.8	210.3	208.8	-1.5
"FSB110C "	48914.53	56249.99	137.2	147.2	201.3	197.3	-4.0
"FSB111C "	50508.12	57130.51	159.0	169.0	212.2	211.7	-0.5
"FSB112C "	47596.01	56567.88	129.1	139.1	201.9	193.7	-8.2
"FSB113C "	49821.49	56026.54	154.0	164.0	202.6	200.3	-2.3
"FSB114C "	50984.82	56932.27	158.0	168.0	213.7	213.1	-0.6
"FSB116C "	49094.38	54713.83	160.5	170.5	189.6	187.2	-2.4
"FSB120C "	48239.01	57783.04	150.7	160.7	206.3	202.4	-3.9
"FSB121C "	47415.63	57555.15	148.4	158.4	204.4	197.8	-6.6
"FSB122C "	46937.44	56354.44	160.0	170.0	200.1	190.1	-10.0
"FSB123C "	50557.64	56285.14	155.3	165.3	210.5	206.5	-4.0
"FSB150PC"	48736.60	56184.86	107.6	160.1	198.6	195.7	-2.9
"HAA 1B "	60561.80	49359.31	119.3	129.3	251.8	250.3	-1.5
"HAA 1C "	60567.40	49351.99	147.4	157.4	252.4	251.1	-1.3
"HAA 2B "	59111.69	50754.50	127.2	137.2	253.2	244.4	-8.8
"HAA 2C "	59104.31	50761.18	171.9	181.9	254.8	246.1	-8.7
"HAA 3B "	58154.04	51487.42	125.9	135.9	240.6	236.6	-4.0
"HAA 3C "	58139.89	51473.76	163.3	173.3	244.0	238.2	-5.8
"HAA 4C "	59997.99	51882.57	158.3	168.3	251.8	243.8	-8.0
"HAA 6B "	61771.90	50705.33	131.3	141.4	235.7	243.2	7.5
"HAA 6C "	61781.82	50703.43	161.1	171.1	235.9	243.9	8.0
"HC 2C "	59879.41	51458.87	135.7	140.7	253.7	244.6	-9.1
"HC 2D "	59873.54	51460.12	178.2	183.2	255.8	245.9	-9.9
"HC 4A "	61345.81	50965.20	150.0	155.0	244.7	244.4	-0.3
"HC 6A "	60139.40	51777.79	156.2	161.2	252.2	244.0	-8.2
"HC 8C "	59297.17	57410.38	187.3	192.3	197.5	201.2	3.7
"HC 10B "	60448.69	55444.91	164.8	169.8	208.9	207.4	-1.5
"HC 12B "	57839.58	53326.69	177.3	182.3	240.8	233.3	-7.5
"HCA 4B "	61082.03	51968.88	126.6	136.6	246.1	235.0	-11.1
"HCA 4C "	61071.73	51970.96	153.8	163.8	246.8	242.2	-4.6
"HIW 2MC"	55118.76	53945.40	154.0	184.0	228.3	223.5	-4.8
"HIW 2MC"	55118.76	53945.40	124.1	139.0	228.3	222.5	-5.8
"HIW 3MC"	55098.98	54086.60	156.1	186.1	230.2	223.8	-6.4
"HIW 3MC"	55098.98	54086.60	126.4	141.3	230.2	222.8	-7.4
"HIW 4MC"	54979.48	53907.23	150.4	180.4	219.7	222.5	2.8
"HIW 4MC"	54979.48	53907.23	120.8	135.7	219.7	221.6	1.9
"HIW 5MC"	54992.54	54311.14	154.2	184.1	228.6	223.7	-4.9
"HIW 5MC"	54992.54	54311.14	124.4	139.2	228.6	222.7	-5.9
"HMD 4D "	57810.04	59439.92	188.9	208.9	200.0	203.0	3.0
"HSB 50PC"	53911.20	53112.98	119.5	169.6	216.9	211.4	-5.5
"HSB 65B "	56659.37	52819.69	123.3	133.3	224.6	227.1	2.5
"HSB 68B "	54944.81	52243.48	123.5	134.5	216.8	213.4	-3.4
"HSB 68C "	54935.32	52244.06	168.4	179.5	217.7	214.1	-3.6
"HSB 70C "	54067.23	53525.76	164.9	174.9	223.1	215.4	-7.7
"HSB 71C "	53658.01	53888.06	171.9	181.9	222.6	213.8	-8.8
"HSB 83B "	56643.90	51998.97	121.2	132.1	223.0	224.9	1.9
"HSB 83C "	56662.80	51992.19	160.2	171.2	224.8	225.7	0.9

Table F-2. Summary of Group Statistical Parameters (Continued)

"HSB 84B "	54442.86	52429.71	121.8	132.9	210.8	211.1	0.3
"HSB 84C "	54449.10	52422.04	170.9	181.8	213.5	211.7	-1.8
"HSB 85B "	57441.42	54027.18	133.2	143.2	233.8	230.1	-3.7
"HSB 86B "	54265.95	53403.47	113.8	124.0	221.6	214.8	-6.8
"HSB100C "	56941.86	52383.02	153.0	163.0	226.9	228.6	1.7
"HSB100PC"	53918.88	53006.25	117.6	167.7	215.7	210.9	-4.8
"HSB101C "	56728.52	52351.38	166.3	176.3	226.2	227.4	1.2
"HSB102C "	56519.60	52353.05	166.7	176.7	224.7	226.0	1.3
"HSB103C "	56369.03	52010.68	159.2	169.2	223.5	223.3	-0.2
"HSB104C "	56088.16	51848.43	163.5	173.5	220.7	220.3	-0.4
"HSB105C "	55908.36	51958.72	152.2	162.2	219.7	219.3	-0.4
"HSB106C "	55738.02	52274.64	158.7	168.7	221.9	219.9	-2.0
"HSB107C "	55518.66	52298.37	159.3	169.3	219.5	218.5	-1.0
"HSB109C "	54991.13	52396.49	168.4	178.4	218.8	215.7	-3.1
"HSB110C "	54800.57	52533.61	171.4	181.4	219.1	215.3	-3.8
"HSB111C "	54654.81	52707.82	140.7	150.7	220.3	214.5	-5.8
"HSB112C "	54621.43	52957.21	140.6	150.6	221.6	215.7	-5.9
"HSB113C "	54402.46	53163.13	154.7	164.7	221.9	215.7	-6.2
"HSB113C "	54402.46	53163.13	151.7	161.7	221.9	215.6	-6.3
"HSB115C "	54358.70	53520.95	182.8	192.8	224.2	218.3	-5.9
"HSB116C "	54354.62	53761.97	180.5	190.5	225.0	218.9	-6.1
"HSB117C "	53515.83	53789.56	165.1	175.1	221.7	212.0	-9.7
"HSB125C "	56613.57	51866.38	145.6	155.6	223.5	224.8	1.3
"HSB126C "	55047.77	51303.73	176.3	181.3	204.0	205.8	1.8
"HSB127C "	54791.20	51953.68	148.4	158.4	210.4	210.5	0.1
"HSB129C "	53274.82	52910.16	147.8	157.8	205.7	205.1	-0.6
"HSB130C "	52596.56	51962.46	159.9	169.9	200.0	204.2	4.2
"HSB131C "	54718.06	51115.16	148.5	158.5	203.9	206.4	2.5
"HSB132C "	56797.72	51795.34	168.6	178.6	221.6	226.5	4.9
"HSB133C "	57212.47	52194.94	173.3	183.3	230.8	230.7	-0.1
"HSB134C "	56256.31	51642.47	149.1	159.1	221.0	220.9	-0.1
"HSB135C "	54602.40	52177.94	147.3	157.3	206.8	210.6	3.8
"HSB136C "	54110.61	52803.97	160.5	170.5	217.3	211.7	-5.6
"HSB137C "	53943.50	53217.34	163.8	173.8	220.0	212.9	-7.1
"HSB139C "	55344.17	51754.05	148.5	158.5	214.5	213.2	-1.3
"HSB140C "	54314.78	50868.11	161.6	171.6	205.6	206.9	1.3
"HSB141C "	57114.54	51446.14	154.7	164.7	229.1	229.0	-0.1
"HSB141CR"	57117.85	51476.11	152.1	162.1	229.3	228.9	-0.4
"HSB142C "	51973.10	54504.23	161.6	171.6	198.3	198.9	0.6
"HSB143C "	51385.74	55262.11	169.1	179.1	209.3	202.0	-7.3
"HSB145C "	55723.63	51641.80	164.7	174.7	213.5	215.5	2.0
"HSB146C "	56281.92	50881.82	152.3	162.3	210.0	219.5	9.5
"HSB148C "	53154.84	51219.25	158.9	168.9	201.8	209.1	7.3
"HSB150PC"	53783.65	53217.07	119.5	169.6	217.4	210.9	-6.5
"HSB151C "	52446.39	54279.83	170.6	180.6	207.8	202.7	-5.1
"HSB152C "	52565.96	53246.49	173.1	183.1	199.0	198.0	-1.0
"HSL 6B "	58765.56	52607.86	127.9	137.9	244.6	230.3	-14.3
"HSL 6C "	58757.86	52600.50	157.6	167.6	245.4	237.9	-7.5
"HSL 8B "	59331.52	52522.22	138.7	148.7	249.2	239.4	-9.8
"HSL 8C "	59330.38	52512.54	171.7	181.7	250.4	240.4	-10.0
"LAW 1E "	43173.25	27178.90	90.1	95.1	205.0	202.5	-2.5
"LCO 5C "	43558.27	27533.91	110.5	120.5	211.0	205.9	-5.1
"NPM 19D "	53834.94	43723.45	97.5	107.5	243.3	248.7	5.4
"NPM 34D "	52189.19	41815.02	86.4	96.4	253.9	251.5	-2.4

Table F-2. Summary of Group Statistical Parameters (Continued)

"TBG 1 "	16046.02	60413.52	89.1	109.1	100.4	109.9	9.5
"TBG 3 "	16066.17	60301.49	88.9	108.9	103.0	110.8	7.8
"TBG 4 "	16054.32	60245.73	89.3	109.3	103.1	111.0	7.9
"TBG 5 "	16218.81	60169.26	92.4	112.4	102.8	113.4	10.6
"TBG 5A "	16209.14	60151.18	70.0	80.0	103.7	112.7	9.0
"TBG 6 "	16209.40	60432.78	89.1	109.1	102.7	111.7	9.0
"TBG 7 "	16423.15	60199.44	84.7	104.7	105.5	115.3	9.8
"TIR 1M "	15018.24	60217.55	84.6	86.6	93.7	96.0	2.3
"TIR 1U "	15020.04	60222.14	90.0	92.0	93.2	96.0	2.8
"TIR 2 "	14955.26	60276.45	84.2	86.2	92.4	95.2	2.8
"TIR 3B "	15378.85	60217.52	83.5	85.5	95.7	101.3	5.6
"TNX 1D "	15658.69	60683.97	79.6	99.6	99.3	103.5	4.2
"TNX 2D "	15711.77	60507.57	82.8	102.8	99.1	105.0	5.9
"TNX 3D "	15916.34	60243.98	84.9	104.9	99.6	109.0	9.4
"TNX 4D "	16043.66	59977.69	85.5	105.5	103.1	112.4	9.3
"TNX 5D "	16179.74	59941.20	88.5	108.5	105.1	114.0	8.9
"TNX 6D "	16185.59	59656.06	89.8	109.8	105.4	115.1	9.7
"TNX 7D "	16057.27	60726.63	83.6	103.6	101.0	108.1	7.1
"TNX 8D "	14926.59	59795.15	74.0	94.0	94.0	95.7	1.7
"TNX 9D "	14946.06	59994.97	75.4	95.1	93.8	95.5	1.7
"TNX 10D "	15009.73	60193.98	77.0	95.9	94.1	95.9	1.8
"TNX 11D "	15050.14	60389.86	73.2	93.2	94.0	96.3	2.3
"TNX 12D "	15143.66	60777.90	73.1	93.1	94.9	95.7	0.8
"TNX 13D "	14754.11	60087.50	87.9	89.9	91.4	93.6	2.2
"TNX 14D "	14804.37	60168.63	85.8	87.8	91.4	94.0	2.6
"TNX 15D "	14853.26	60249.53	85.9	87.9	91.0	94.3	3.3
"TNX 16D "	14881.89	60335.66	86.1	88.1	90.8	94.5	3.7
"TNX 17D "	15014.56	60790.52	89.7	91.7	92.5	92.9	0.4
"TNX 18D "	14694.70	60004.24	84.9	86.9	91.6	93.2	1.6
"TNX 19D "	14620.92	59895.70	84.9	86.9	91.0	92.7	1.7
"TNX 20D "	14589.19	59853.68	86.2	88.2	91.1	92.4	1.3
"TNX 21D "	14568.94	59722.83	86.9	88.9	92.0	92.4	0.4
"TNX 22D "	14440.30	59482.22	85.8	87.8	89.9	91.5	1.6
"TNX 23D "	15839.74	60442.04	84.8	104.8	99.4	106.9	7.5
"TNX 24D "	16459.51	60435.43	99.8	114.8	109.1	115.2	6.1
"TNX 26D "	14972.66	59614.12	87.8	90.1	94.2	96.4	2.2
"TNX 27D "	15480.09	60278.84	81.3	101.3	96.3	102.9	6.6
"TRW 1 "	15806.97	60191.68	81.4	106.4	91.8	107.8	16.0
"TRW 2 "	15687.03	60316.14	77.2	112.2	92.3	105.6	13.3
"TRW 4 "	16060.84	60435.63	81.9	111.9	92.1	109.8	17.7
"XSB 1 "	15755.80	60172.19	92.0	112.0	102.8	107.5	4.7
"XSB 1D "	15742.58	60146.07	87.9	107.9	98.8	107.4	8.6
"XSB 2D "	15669.81	60142.32	84.0	104.0	98.5	106.1	7.6
"XSB 3A "	15710.81	59959.09	87.4	103.2	100.3	107.6	7.3
"XSB 4 "	15684.42	60076.34	94.3	114.3	98.3	107.1	8.8
"XSB 4D "	15654.53	60055.50	83.9	103.9	98.6	106.3	7.7
"YSB 1A "	16649.82	60011.91	98.4	128.4	117.9	118.9	1.0
"YSB 2A "	16658.67	59854.43	97.7	127.7	118.7	119.6	0.9
"YSB 3A "	16534.35	59726.48	96.7	126.7	119.6	118.9	-0.7
"YSB 4A "	16552.90	59887.85	97.6	127.6	117.6	118.4	0.8
"YSC 1C "	65106.95	56892.95	197.5	207.5	217.6	213.8	-3.8
"YSC 4C "	64918.13	55781.42	195.9	205.9	227.8	222.8	-5.0
"Z 17 "	42299.33	55683.19	148.2	148.7	169.5	171.2	1.7
"CMP 10C "	47936.35	33160.82	179.6	189.6	198.5	209.7	11.2

Table F-2. Summary of Group Statistical Parameters (Continued)

"CMP 30B "	47195.03	33652.79	97.4	107.5	195.0	206.1	11.1
"CMP 30C "	47233.06	33633.06	179.5	189.5	210.6	206.5	-4.1
"CMP 32B "	48163.49	33948.09	97.7	107.7	195.3	207.6	12.3
"CMP 32C "	48170.49	33941.09	185.2	195.2	195.4	207.4	12.0
"RGW 4C "	56371.24	28538.95	130.2	140.2	250.8	262.5	11.7
"RGW 7C "	53372.55	19049.00	84.3	94.3	240.4	241.7	1.3
"RGW 8C "	44616.98	30216.22	115.2	125.2	216.4	214.7	-1.7
"RGW 9C "	49471.40	28770.17	102.2	112.2	231.6	231.3	-0.3
"RGW 10C "	45626.50	20210.68	78.4	88.4	225.0	219.7	-5.3
"RGW 11C "	41082.90	14574.88	71.1	81.1	177.9	181.4	3.5
"RGW 13C "	30671.53	42663.76	115.5	125.5	183.7	193.4	9.7
"RGW 14C "	26645.04	38368.61	100.4	110.4	186.9	182.9	-4.0
"RGW 15C "	29690.81	26627.12	107.9	117.9	182.9	184.6	1.7
"RGW 16C "	40349.41	49694.67	123.8	133.8	191.2	183.1	-8.1

** GROUP 3 ** rms of (FACT-data) differences: 5.239
avg of (FACT-data) differences: 0.172
avg of |FACT-data| differences: 3.605
max of {FACT-data} differences: -16.838

"BG 92 "	56450.00	59585.06	197.2	227.2	209.0	218.7	9.7
"BG 115 "	57106.59	57592.61	198.9	218.9	215.8	228.2	12.4
"BG 122 "	56321.37	59164.11	189.9	209.9	211.3	222.6	11.3
"BGO 46D "	53265.93	56187.01	202.1	212.1	225.3	225.7	0.4
"BGO 47D "	53696.69	55794.78	203.4	213.4	226.2	225.9	-0.3
"BGO 48D "	53858.59	55603.64	202.0	212.0	226.8	225.8	-1.0
"BGX 3D "	57081.36	57976.03	201.6	221.6	214.9	227.3	12.4
"BGX 5D "	56791.69	58881.04	195.0	215.0	209.2	222.7	13.5
"BRD 1 "	24686.69	42660.07	148.9	178.9	167.3	180.4	13.1
"BRD 2 "	24812.76	42871.28	148.5	178.5	168.9	181.3	12.4
"BRD 3 "	24954.28	42662.69	158.5	188.5	170.8	183.8	13.0
"BRD 5D "	24681.93	42758.41	148.4	168.4	166.9	179.7	12.8
"BRR 1D "	50002.58	59264.14	200.4	220.4	217.1	216.9	-0.2
"BRR 2D "	49740.61	59387.51	196.1	216.1	215.5	215.1	-0.4
"BRR 3D "	49633.17	59376.50	197.1	217.1	215.3	214.5	-0.8
"BRR 4D "	49528.48	59360.11	198.7	218.7	215.1	213.9	-1.2
"BRR 5D "	49415.56	59288.22	202.1	222.1	214.9	213.5	-1.4
"BRR 7D "	50143.22	59444.34	201.9	221.9	217.9	217.5	-0.4
"BRR 8DR"	49620.92	59613.22	204.0	219.0	214.9	213.8	-1.1
"CDB 1 "	43158.97	50648.13	195.7	216.6	213.9	216.0	2.1
"CDB 2 "	43072.00	50565.10	195.1	216.1	214.7	215.8	1.1
"CMP 11D "	47610.19	33296.80	209.5	229.9	222.2	229.7	7.5
"CMP 14D "	46762.01	34392.70	204.1	224.5	216.2	216.0	-0.2
"CMP 30D "	47226.07	33625.65	211.6	231.6	221.1	228.5	7.4
"CRP 1 "	42103.71	52000.00	187.8	217.8	208.3	206.6	-1.7
"CRP 2 "	42157.12	52423.62	171.8	201.8	207.2	204.9	-2.3
"CRP 3 "	41750.56	52124.11	184.0	214.0	206.9	204.7	-2.2
"CRP 3D "	41768.04	52149.12	194.3	214.3	207.5	204.7	-2.8
"CRP 4 "	41803.23	51889.94	180.7	210.7	207.3	205.6	-1.7
"CRP 7D "	41940.04	52626.90	188.0	208.0	206.6	203.3	-3.3
"CRP 9D "	42089.59	52554.22	191.4	211.4	207.2	204.2	-3.0
"CRP 10D "	41567.41	52504.81	189.5	209.5	205.0	202.5	-2.5
"CRP 11D "	41920.37	52137.09	193.7	203.6	207.9	205.3	-2.6
"CSB 2A "	42252.86	50631.76	192.6	222.6	211.0	210.5	-0.5

Table F-2. Summary of Group Statistical Parameters (Continued)

"CSB 4A "	42125.10	50916.14	188.0	218.0	210.6	209.1	-1.5
"CSB 5A "	42164.95	51101.71	185.9	215.9	210.7	209.0	-1.7
"CSB 6A "	42417.14	51110.26	189.8	219.8	211.3	210.6	-0.7
"CSB 7D "	42604.20	50339.94	191.7	211.7	212.8	213.4	0.6
"F 2 "	50528.19	57426.91	207.0	217.0	218.4	218.3	-0.1
"F 18A "	48868.60	56238.80	194.4	204.4	203.8	203.2	-0.6
"FAC 9C "	54788.19	58927.09	197.4	207.4	217.4	229.1	11.7
"FAC 10C "	54766.72	59022.85	200.2	210.2	217.4	228.9	11.5
"FAC 11C "	54697.64	59017.70	201.4	211.4	217.5	229.1	11.6
"FAC 12C "	54681.22	58966.90	198.0	208.0	217.5	229.2	11.7
"FC 3F "	57206.55	59127.26	205.1	210.1	206.2	219.0	12.8
"FET 3D "	52094.87	57383.84	203.0	223.0	222.6	226.2	3.6
"FET 4D "	52215.12	57356.54	205.1	225.1	223.0	226.8	3.8
"FIW 1D "	50556.26	57868.22	198.9	218.9	214.7	219.6	4.9
"FIW 1ID"	50511.80	57935.64	194.0	214.0	219.0	219.4	0.4
"FIW 2MD"	50305.99	57737.40	190.9	220.8	217.1	217.8	0.7
"FNB 6 "	54152.82	61916.51	200.6	210.6	208.7	210.1	1.4
"FNB 8 "	54534.35	61527.65	195.4	205.4	202.8	212.2	9.4
"FOB 1D "	48714.66	55906.09	175.4	195.4	204.0	198.0	-6.0
"FOB 4D "	48169.62	56653.25	174.0	194.1	206.9	202.6	-4.3
"FOB 7D "	49400.09	58083.79	193.9	213.9	212.7	214.0	1.3
"FOB 8D "	49037.51	57840.62	191.4	211.4	212.3	211.7	-0.6
"FOB 9D "	49862.03	57668.28	192.6	212.6	214.8	215.3	0.5
"FOB 11D "	50928.38	57265.56	199.0	219.0	217.7	219.6	1.9
"FOB 12D "	48850.11	57700.96	179.3	199.3	211.5	210.1	-1.4
"FSB 0PD"	48694.84	56663.20	171.6	215.3	207.6	205.0	-2.6
"FSB 50PD"	48729.85	56708.61	174.7	219.8	207.2	205.6	-1.6
"FSB 76 "	50531.29	57900.83	197.0	227.0	218.2	219.6	1.4
"FSB 77 "	49659.91	57051.23	186.4	216.4	212.5	212.0	-0.5
"FSB 78 "	49047.52	56807.83	187.7	217.7	208.8	207.9	-0.9
"FSB 79 "	48794.18	55736.19	174.1	204.1	201.6	195.1	-6.5
"FSB 87D "	49136.71	57629.55	187.4	216.8	214.0	211.7	-2.3
"FSB 88D "	50558.40	57363.65	202.1	222.1	216.3	218.1	1.8
"FSB 89D "	50356.09	57331.51	201.9	221.9	215.7	216.9	1.2
"FSB 90D "	50129.62	57204.42	205.1	225.1	215.4	215.3	-0.1
"FSB 91D "	49904.56	57079.18	200.9	220.9	213.9	213.6	-0.3
"FSB 92D "	49490.42	57001.79	201.7	221.7	212.1	211.3	-0.8
"FSB 93D "	49354.82	56869.80	197.9	217.9	210.8	209.9	-0.9
"FSB 94DR"	49067.61	56911.01	183.3	203.4	210.2	208.4	-1.8
"FSB 95DR"	48929.85	57065.63	187.0	207.0	210.5	208.7	-1.8
"FSB 97D "	48950.80	57262.79	196.9	216.9	210.8	209.8	-1.0
"FSB 98D "	49121.97	57413.49	200.3	220.3	212.3	211.2	-1.1
"FSB 99D "	49399.05	57681.54	198.1	218.1	212.4	213.3	0.9
"FSB104D "	47971.22	56117.73	190.4	210.4	204.6	198.5	-6.1
"FSB105D "	48823.22	57346.54	203.7	223.7	208.3	209.7	1.4
"FSB105DR"	48833.62	57358.44	188.5	208.6	211.0	209.4	-1.6
"FSB106D "	49390.58	56151.16	202.9	222.9	207.1	205.0	-2.1
"FSB107D "	50097.00	57007.19	200.9	220.9	213.8	214.2	0.4
"FSB108D "	50314.94	58068.57	203.8	223.8	217.7	218.9	1.2
"FSB109D "	49591.36	57808.53	205.8	225.8	213.7	214.6	0.9
"FSB110D "	48906.27	56254.41	191.1	211.1	205.6	203.4	-2.2
"FSB111D "	50497.87	57132.28	201.7	221.7	215.6	216.8	1.2
"FSB112D "	47580.74	56567.24	188.9	208.9	206.2	200.4	-5.8
"FSB113D "	49834.16	56017.82	189.6	209.6	207.4	205.8	-1.6

Table F-2. Summary of Group Statistical Parameters (Continued)

"FSB114D "	50967.90	56925.74	197.7	217.8	217.2	218.3	1.1
"FSB115D "	48150.84	54688.25	182.5	185.6	191.4	0.0	-191.4
"FSB116D "	49078.92	54719.06	186.4	194.7	192.0	187.1	-4.9
"FSB117D "	49218.37	56062.42	189.7	209.7	205.2	203.1	-2.1
"FSB118D "	50121.08	56512.06	191.3	211.3	211.7	211.4	-0.3
"FSB119D "	49439.73	56556.50	193.1	213.1	208.4	208.4	0.0
"FSB120D "	48235.70	57803.07	196.5	216.5	209.7	207.8	-1.9
"FSB121DR"	47431.08	57547.99	191.3	211.3	207.2	203.1	-4.1
"FSB122D "	46940.61	56337.10	186.6	206.6	203.5	195.4	-8.1
"FSB123D "	50541.46	56284.49	194.1	214.1	212.3	211.9	-0.4
"FSB150PD"	48579.67	56755.77	176.2	221.3	208.0	205.3	-2.7
"FSL 6D "	50985.96	58408.90	202.1	222.1	220.2	222.9	2.7
"FSL 7D "	50664.69	58062.83	199.5	219.6	218.2	220.6	2.4
"FSL 8D "	50635.20	57789.90	202.7	222.8	217.6	219.9	2.3
"FSL 9D "	50605.41	57503.53	201.4	221.5	216.8	219.0	2.2
"FSS 2D "	52790.27	56359.37	204.4	224.4	222.9	224.9	2.0
"FSS 3D "	52397.74	56296.61	205.8	225.8	220.7	222.5	1.8
"FSS 4D "	51860.55	57000.99	202.6	222.6	219.0	223.5	4.5
"FTF 21 "	51767.59	58379.34	198.7	228.7	223.1	226.8	3.7
"HC 1D "	59866.62	51422.74	206.5	211.5	268.9	252.9	-16.0
"HC 2E "	59868.65	51461.16	205.7	210.7	269.5	252.7	-16.8
"HC 6B "	60149.18	51775.71	210.2	215.2	268.9	252.1	-16.8
"HMD 1D "	56532.27	59273.24	199.7	219.7	209.7	221.8	12.1
"HOB 2D "	55595.50	53420.36	200.4	220.4	230.4	229.7	-0.7
"HOB 6D "	55275.15	51204.47	186.9	196.9	206.9	206.7	-0.2
"HOB 7D "	54438.67	52713.30	197.4	217.4	220.9	218.2	-2.7
"HSB 84D "	54436.38	52411.25	199.5	219.5	218.9	215.0	-3.9
"HSB100PD"	54436.51	52269.53	195.0	214.9	217.1	212.8	-4.3
"HSB117D "	53510.12	53797.83	200.3	220.3	223.7	217.9	-5.8
"HSB125D "	56603.94	51862.91	199.4	219.4	221.3	224.4	3.1
"HSB126D "	55040.55	51311.10	190.5	200.5	205.2	204.8	-0.4
"HSB127D "	54789.02	51963.14	197.8	217.8	218.0	212.8	-5.2
"HSB129D "	53269.76	52918.08	185.2	205.2	208.4	206.8	-1.6
"HSB130D "	52603.41	51955.69	182.1	202.1	200.2	205.0	4.8
"HSB131D "	54712.33	51106.47	195.7	201.2	205.1	201.8	-3.3
"HSB135D "	54595.92	52185.96	199.9	219.9	218.3	213.8	-4.5
"HSB136D "	54104.07	52811.18	200.2	220.2	220.7	216.4	-4.3
"HSB140D "	54320.65	50853.37	194.1	214.1	213.9	206.3	-7.6
"HSB142D "	51959.92	54500.90	189.7	192.7	197.9	192.5	-5.4
"HSB143D "	51390.30	55277.30	196.9	216.9	213.2	206.4	-6.8
"HSB148D "	53168.04	51226.05	198.1	218.1	213.5	211.2	-2.3
"HSB151D "	52457.62	54277.34	197.6	200.9	207.2	200.9	-6.3
"HSB152D "	52580.96	53242.99	197.0	199.2	205.6	198.4	-7.2
"K 301AP"	34880.17	38881.66	193.3	197.7	208.8	206.5	-2.3
"KDB 1 "	35214.96	38571.78	184.8	205.8	208.5	209.6	1.1
"KDB 2 "	35004.72	38470.07	182.5	203.5	207.0	208.4	1.4
"KDB 3 "	35130.26	38328.17	184.2	205.4	207.8	209.3	1.5
"KSB 1 "	34608.12	38694.54	175.6	205.6	204.2	205.1	0.9
"KSB 2 "	34482.69	38601.79	173.8	203.8	203.9	204.4	0.5
"KSB 3 "	34429.71	38728.16	169.7	199.7	203.1	203.5	0.4
"KSB 4A "	34579.07	38798.85	169.6	199.6	203.4	204.4	1.0
"KSB 5C "	34792.85	38779.18	172.9	182.9	204.9	205.9	1.0
"KSS 1D "	33704.58	32460.67	157.4	177.5	174.3	177.8	3.5
"LAC 5DL"	44096.56	27804.81	176.2	186.2	219.7	213.8	-5.9

Table F-2. Summary of Group Statistical Parameters (Continued)

"LAC 6DL"	43916.99	27748.31	175.9	185.9	217.9	212.5	-5.4
"LAW 1F "	43161.80	27182.26	165.9	185.9	203.9	203.3	-0.6
"LCO 7DL"	43719.92	27457.02	170.2	180.2	213.3	209.3	-4.0
"LCO 8DL"	44170.42	28014.74	178.4	188.4	220.5	215.5	-5.0
"LRP 4 "	42400.72	31308.77	173.3	203.3	208.6	211.4	2.8
"NPM 19C "	53845.64	43737.74	193.5	203.5	268.0	269.6	1.6
"NPM 34C "	52166.49	41832.31	181.8	191.8	267.7	271.3	3.6
"SBG 5 "	62537.22	51327.71	199.4	219.4	249.5	246.1	-3.4
"YSC 1D "	65107.25	56877.04	216.8	236.8	221.2	222.0	0.8
"Z 2 "	52002.92	56201.42	214.0	214.5	219.4	219.5	0.1
"Z 3 "	50252.68	56881.07	206.6	207.1	212.6	214.3	1.7
"Z 8 "	50826.83	58348.05	213.6	214.1	219.3	221.9	2.6
"Z 20 "	42603.93	57478.90	173.4	193.4	184.7	182.3	-2.4
"Z 20B "	42603.46	57483.39	175.6	195.6	191.1	182.6	-8.5
"ZBG 1 "	64508.41	55382.39	220.0	240.1	234.2	232.5	-1.7
"ZW 2 "	54413.69	61737.37	194.8	204.8	207.3	210.5	3.2
"CMP 10D "	47934.22	33150.84	209.6	229.6	229.8	230.5	0.7
"CMP 11D "	47610.19	33296.80	209.5	229.9	223.3	229.7	6.4
"CMP 14D "	46762.01	34392.70	204.1	224.5	217.4	216.0	-1.4
"CMP 30D "	47226.07	33625.65	211.6	231.6	228.0	228.5	0.5
"NTS 1 "	36950.43	30056.38	164.3	184.4	180.4	183.5	3.1
"NTW 1 "	33953.91	33448.01	168.9	188.8	183.6	186.1	2.5
"NTW 2 "	33179.95	34157.22	171.5	191.5	183.9	186.0	2.1
"NTW 3 "	35146.82	34486.17	176.7	196.6	191.8	193.8	2.0
"NTW 4 "	35314.22	33015.53	166.0	185.8	180.4	183.2	2.8
"RGW 4D "	56380.50	28543.33	182.2	192.2	267.8	267.1	-0.7
"RGW 5D "	60706.50	26424.01	184.6	194.6	248.1	257.5	9.4
"RGW 6D "	58829.45	21286.91	200.7	210.7	264.9	262.6	-2.3
"RGW 7D "	53378.09	19057.21	166.2	176.2	250.3	247.2	-3.1
"RGW 8D "	44615.76	30227.91	158.4	168.4	224.5	223.1	-1.4
"RGW 9D "	49474.44	28784.01	151.7	161.7	248.3	235.6	-12.7
"RGW 10D "	45627.98	20226.96	146.2	156.2	230.7	227.3	-3.4
"RGW 12D "	33589.82	43931.78	164.3	174.3	208.6	204.8	-3.8
"RGW 13D "	30660.92	42667.65	169.6	179.6	204.1	201.7	-2.4
"RGW 14D "	26653.27	38365.68	154.0	164.0	189.4	189.4	0.0
"RGW 15D "	29701.92	26626.77	156.3	166.3	185.2	188.9	3.7
"RGW 16D "	40358.15	49695.81	173.2	183.2	200.9	198.3	-2.6
"RGW 17D "	45061.97	46832.95	173.4	183.4	228.4	235.3	6.9

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** GROUP  4 **  rms of (FACT-data) differences:      4.045
                avg of (FACT-data) differences:     -0.297
                avg of |FACT-data| differences:      2.929
                max of {FACT-data} differences:    -15.612
```

"BG 26 "	57336.11	54222.44	210.7	230.7	239.3	237.4	-1.9
"BG 31 "	57744.30	56171.67	223.3	243.3	233.7	231.4	-2.3
"BG 32 "	57827.27	56562.97	226.9	246.9	233.4	230.1	-3.3
"BG 33 "	57582.86	56747.83	221.2	241.2	232.9	230.3	-2.6
"BG 34 "	57176.26	56848.26	217.4	237.4	232.8	231.0	-1.8
"BG 36 "	56752.61	57197.98	223.3	243.3	232.5	231.3	-1.2
"BG 41 "	55003.77	57394.58	221.0	241.0	230.8	232.3	1.5
"BG 42 "	54921.81	57005.62	217.1	237.1	230.7	231.8	1.1
"BG 43 "	55020.15	56651.13	222.9	242.9	230.5	230.8	0.3
"BG 51 "	57110.74	54174.14	221.2	241.2	240.7	237.7	-3.0

Table F-2. Summary of Group Statistical Parameters (Continued)

"BG 52 "	54528.35	56814.86	223.8	243.8	229.3	230.5	1.2
"BG 53 "	54139.12	57150.01	214.7	234.7	228.0	231.2	3.2
"BG 54 "	53834.44	56888.23	215.2	235.2	228.6	230.2	1.6
"BG 55 "	53534.89	56632.32	214.9	234.9	226.6	228.8	2.2
"BG 56 "	53362.38	56343.07	210.9	230.9	225.0	227.3	2.3
"BG 57 "	53650.24	56071.18	214.6	234.6	225.3	227.3	2.0
"BG 58 "	53941.50	55795.09	218.2	238.2	226.8	227.5	0.7
"BG 59 "	54238.88	55529.97	217.7	237.7	229.8	227.9	-1.9
"BG 60 "	54530.35	55256.29	215.5	235.5	230.8	228.7	-2.1
"BG 61 "	54965.05	54846.04	225.0	245.0	232.8	230.3	-2.5
"BG 62 "	55109.85	54709.14	222.5	242.5	233.4	230.7	-2.7
"BG 63 "	55396.89	54426.18	224.2	244.2	235.2	231.7	-3.5
"BG 64 "	55688.22	54152.33	227.3	247.3	238.1	232.7	-5.4
"BG 65 "	55978.13	53879.49	230.9	250.9	235.7	234.1	-1.6
"BG 66 "	56275.73	54066.09	231.0	251.0	235.2	235.2	0.0
"BG 67 "	56447.94	54406.83	224.7	244.7	236.5	235.3	-1.2
"BG 68 "	57329.68	56876.99	216.5	242.9	232.2	230.5	-1.7
"BG 69 "	57304.98	56882.44	222.2	242.2	232.5	230.8	-1.7
"BG 80 "	57056.01	56979.02	226.2	248.6	232.7	231.2	-1.5
"BG 81 "	57081.25	57000.00	222.9	246.9	227.3	231.0	3.7
"BG 84 "	57069.64	57077.74	227.2	247.2	232.6	231.0	-1.6
"BG 85 "	57048.52	57105.85	228.0	248.0	232.6	231.1	-1.5
"BG 86 "	57098.42	57097.69	228.0	248.0	232.5	231.0	-1.5
"BG 87 "	57077.23	57130.31	226.2	245.8	232.3	230.9	-1.4
"BG 91 "	56069.82	58655.49	205.4	235.4	218.8	229.1	10.3
"BG 98 "	56712.64	58075.77	212.5	242.5	224.5	229.2	4.7
"BG 99 "	57551.92	57188.59	215.9	245.9	232.5	228.8	-3.7
"BG 100 "	58225.51	57976.77	203.3	233.3	224.8	218.1	-6.7
"BG 107 "	58793.60	54776.73	208.3	228.3	234.6	231.4	-3.2
"BG 108 "	58420.34	54426.07	217.3	247.3	239.0	237.3	-1.7
"BG 110 "	57667.88	53534.74	224.3	254.3	241.5	240.6	-0.9
"BG 119 "	56357.76	58300.26	209.2	229.2	215.4	229.6	14.2
"BG 124 "	56344.08	57802.53	214.8	234.8	231.8	231.0	-0.8
"BGO 1D "	57260.53	54013.08	225.0	245.0	238.5	238.6	0.1
"BGO 2D "	57459.71	54803.95	218.9	238.9	238.2	236.1	-2.1
"BGO 3D "	57625.22	55585.01	227.6	247.6	235.6	233.8	-1.8
"BGO 3DR"	57669.26	55740.24	217.5	237.6	231.9	232.8	0.9
"BGO 4D "	57785.92	56367.50	220.6	240.6	232.6	230.6	-2.0
"BGO 5D "	57835.51	56691.67	219.3	239.3	230.7	229.3	-1.4
"BGO 6D "	57360.50	56802.66	217.2	237.2	231.4	230.7	-0.7
"BGO 7D "	56990.40	56888.68	220.2	240.2	232.6	231.4	-1.2
"BGO 8D "	56717.15	57043.17	220.6	240.6	232.7	231.5	-1.2
"BGO 9D "	56627.61	57289.98	209.2	229.2	230.1	230.9	0.8
"BGO 10DR"	56229.85	57367.58	218.3	238.3	231.7	231.6	-0.1
"BGO 11D "	55816.74	57455.69	216.3	236.3	230.9	231.8	0.9
"BGO 11DR"	55825.05	57499.11	213.1	233.0	230.5	231.7	1.2
"BGO 12D "	55405.74	57543.15	217.8	237.8	231.4	232.1	0.7
"BGO 12DR"	55395.81	57575.32	212.7	232.8	220.1	232.0	11.9
"BGO 13DR"	55027.63	57643.46	210.3	220.3	231.0	231.8	0.8
"BGO 14DR"	54873.25	57162.45	218.1	238.1	230.6	231.9	1.3
"BGO 15D "	54868.95	56806.97	218.7	238.7	230.0	231.1	1.1
"BGO 16D "	55158.28	56518.41	217.3	237.3	231.0	230.7	-0.3
"BGO 17D "	55319.71	56328.91	204.0	224.0	232.4	230.7	-1.7
"BGO 17DR"	55328.25	56331.59	216.9	236.9	231.6	231.2	-0.4

Table F-2. Summary of Group Statistical Parameters (Continued)

"BGO 18D "	55624.78	56264.47	219.6	239.6	232.0	231.8	-0.2
"BGO 20D "	55885.97	55556.90	216.3	236.3	233.8	232.9	-0.9
"BGO 21D "	56178.17	55214.98	217.7	237.7	235.0	233.8	-1.2
"BGO 22DR"	56485.97	54927.71	219.2	239.2	236.4	234.9	-1.5
"BGO 22DX"	56445.03	55027.38	217.9	237.9	234.4	234.7	0.3
"BGO 23D "	56732.35	54636.72	222.0	242.0	236.0	235.9	-0.1
"BGO 24D "	56984.54	54352.38	221.0	241.0	237.1	237.0	-0.1
"BGO 26D "	54075.62	57133.55	213.4	233.5	227.7	231.2	3.5
"BGO 27D "	53654.23	56762.35	209.3	229.3	227.6	229.3	1.7
"BGO 28D "	53368.39	56486.76	210.1	230.1	226.3	227.8	1.5
"BGO 29D "	53068.49	56800.16	208.5	228.5	226.4	228.4	2.0
"BGO 30D "	53375.39	56321.08	207.8	227.8	225.7	227.1	1.4
"BGO 31D "	53668.33	56051.90	211.1	231.1	226.7	227.2	0.5
"BGO 32D "	54014.20	55714.31	214.5	234.5	227.7	227.4	-0.3
"BGO 33D "	54395.96	55369.09	213.1	233.1	230.2	228.2	-2.0
"BGO 34D "	54724.82	55053.93	212.7	232.7	232.8	229.1	-3.7
"BGO 35D "	55129.57	54678.78	219.4	239.4	234.7	230.7	-4.0
"BGO 36D "	55411.89	54412.06	223.3	243.3	237.1	231.7	-5.4
"BGO 37D "	55755.24	54080.42	226.1	246.1	238.6	232.9	-5.7
"BGO 38D "	55980.48	53867.44	222.3	242.3	236.5	233.7	-2.8
"BGO 39D "	56300.85	54059.22	224.7	244.7	235.6	235.0	-0.6
"BGO 40D "	53706.79	57209.70	216.6	226.5	222.5	231.0	8.5
"BGO 44D "	57038.45	57149.39	223.4	233.4	232.5	230.8	-1.7
"BGO 45D "	53598.50	56955.15	209.6	229.6	227.5	230.0	2.5
"BGO 49D "	54776.67	54738.97	218.5	238.5	234.4	229.4	-5.0
"BGO 50D "	53090.30	56375.14	208.0	228.0	225.3	226.5	1.2
"BGO 51D "	56440.93	54575.88	220.1	240.1	235.9	235.1	-0.8
"BGO 52D "	55899.95	55201.33	219.4	239.4	234.0	233.2	-0.8
"BGX 1D "	57732.18	57053.05	214.7	234.7	229.6	228.2	-1.4
"BGX 4D "	56566.33	58409.49	203.8	223.8	215.9	228.1	12.2
"BGX 9D "	58652.02	56986.86	212.4	232.4	226.7	221.7	-5.0
"BGX 10D "	58733.61	56200.00	216.2	236.2	225.6	225.3	-0.3
"BGX 11D "	58370.03	55374.96	216.7	236.7	235.6	231.6	-4.0
"BGX 12D "	58275.90	54485.29	223.7	243.7	239.0	237.5	-1.5
"CCB 1 "	44003.41	48346.16	198.4	228.4	225.6	227.0	1.4
"CCB 2 "	43881.49	48236.71	198.6	228.6	222.7	226.6	3.9
"CCB 3 "	43967.36	48097.21	205.6	235.6	225.2	227.7	2.5
"CCB 4 "	44164.05	48180.84	211.2	241.2	226.2	228.6	2.4
"CRP 5D "	42229.13	51903.38	194.6	214.6	210.8	207.4	-3.4
"CRP 6DR"	41693.10	51774.41	194.2	214.2	210.5	205.6	-4.9
"CRP 8D "	41435.10	52175.72	191.0	211.0	207.6	203.2	-4.4
"CSB 1A "	42479.31	50872.75	194.9	224.9	213.3	211.6	-1.7
"CSB 3A "	42117.61	50737.59	193.0	223.0	210.6	209.4	-1.2
"CSD 13D "	46092.11	45304.73	202.4	252.4	242.4	245.6	3.2
"FAB 1 "	54325.47	58788.57	215.4	235.4	228.4	233.0	4.6
"FAB 2 "	54474.28	58420.90	216.5	236.5	229.1	233.5	4.4
"FAB 3 "	54303.61	58131.15	211.8	231.8	228.9	232.4	3.5
"FAB 4 "	54128.54	58611.44	214.2	234.2	228.5	233.0	4.5
"FAC 4 "	54959.05	59088.39	207.8	237.8	228.5	231.0	2.5
"FAC 5 "	54677.73	58878.80	214.0	234.0	224.9	231.7	6.8
"FCA 9DR"	53338.69	59826.41	207.7	227.7	224.0	229.8	5.8
"FCA 19D "	53253.58	59500.00	209.7	229.7	217.2	231.4	14.2
"FCB 1 "	54082.43	57855.31	205.6	235.6	230.2	232.7	2.5
"FCB 2 "	54221.13	57666.65	205.2	235.2	228.6	232.3	3.7

Table F-2. Summary of Group Statistical Parameters (Continued)

"FCB 4 "	53810.90	57856.79	204.5	234.5	228.2	232.4	4.2
"FCB 5 "	53914.51	57540.54	217.1	237.1	228.8	232.3	3.5
"FCB 6 "	53894.39	57636.32	215.1	235.1	229.1	232.5	3.4
"FET 1D "	52405.62	57526.96	206.9	226.9	223.8	228.4	4.6
"FET 2D "	52068.97	57476.04	209.5	229.5	222.4	226.7	4.3
"FRB 1 "	53020.51	57461.61	212.2	232.2	227.7	231.0	3.3
"FRB 3 "	52677.52	57420.02	216.2	231.2	224.9	229.7	4.8
"FRB 4 "	52732.71	57366.03	214.6	229.6	224.3	229.6	5.3
"FSB 95D "	48939.51	57049.06	207.8	227.8	210.5	209.1	-1.4
"FSL 3D "	51921.73	59265.15	205.9	226.0	222.8	227.5	4.7
"FSL 4D "	51627.03	59008.00	204.0	224.1	217.5	226.3	8.8
"FSL 5D "	51222.93	58680.16	203.5	223.7	220.8	224.3	3.5
"FSS 1D "	52801.47	56514.53	209.9	229.9	223.7	226.0	2.3
"FTF 3 "	52574.12	58584.74	218.2	221.2	223.8	230.5	6.7
"FTF 5 "	52457.78	58405.31	215.3	235.3	223.5	231.7	8.2
"FTF 7 "	52422.54	58617.58	222.1	226.1	223.7	230.3	6.6
"FTF 10 "	52262.69	58753.89	215.1	235.1	220.1	231.2	11.1
"FTF 12 "	52008.76	58792.94	215.0	235.0	226.8	230.2	3.4
"FTF 13 "	52306.70	58030.74	216.1	236.1	228.2	229.6	1.4
"FTF 24A "	52124.69	58702.05	212.7	232.7	222.0	229.8	7.8
"FTF 25A "	52221.44	58734.44	212.8	232.8	223.2	230.3	7.1
"FTF 26 "	52215.85	58675.92	206.3	226.3	223.3	229.0	5.7
"H 6 "	56466.89	52414.35	225.2	235.2	231.0	231.6	0.6
"H 7 "	56455.12	52355.62	224.9	234.9	229.0	230.4	1.4
"H 8 "	56285.76	52050.36	218.4	228.4	227.0	224.6	-2.4
"H 9 "	56317.35	52000.00	207.4	217.4	226.8	223.6	-3.2
"H 10 "	55881.94	52127.81	222.5	232.5	227.3	225.5	-1.8
"H 11 "	55830.90	52096.44	212.0	222.0	227.7	223.6	-4.1
"H 18A "	55351.80	51966.92	217.5	227.5	224.1	219.0	-5.1
"H 19 "	55081.94	52120.99	219.6	221.1	227.6	0.0	-227.6
"HCB 1 "	61809.86	50683.36	222.6	252.6	263.6	254.1	-9.5
"HCB 3 "	61740.10	50362.86	233.6	263.6	266.6	256.8	-9.8
"HCB 4 "	61901.99	50477.10	235.9	265.9	264.4	255.1	-9.3
"HIW 1ID"	56711.83	52871.21	213.0	228.0	231.9	235.1	3.2
"HIW 1MD"	56725.89	52908.50	214.9	239.7	235.5	235.8	0.3
"HIW 1PD"	56636.55	52924.42	215.5	240.5	234.9	235.3	0.4
"HIW 2D "	55178.32	53976.50	210.9	230.8	231.1	230.0	-1.1
"HOB 3D "	56238.78	52787.04	207.7	227.7	230.3	231.4	1.1
"HOB 4D "	56545.37	52617.01	210.4	230.4	232.2	233.0	0.8
"HR3 11 "	58112.36	51444.75	200.4	230.0	259.7	246.5	-13.2
"HR3 13 "	58084.40	51702.80	205.1	234.8	258.9	246.0	-12.9
"HR8 11 "	57651.36	52097.77	207.9	237.6	245.8	241.6	-4.2
"HR8 12 "	57392.25	51983.55	206.3	235.9	239.4	238.3	-1.1
"HR8 13 "	57317.15	51774.08	201.7	231.4	237.2	236.7	-0.5
"HR8 14 "	57595.58	51583.84	202.3	231.9	242.3	241.4	-0.9
"HSB 65 "	56647.98	52801.67	212.4	242.4	232.7	234.8	2.1
"HSB 65C "	56665.66	52812.22	207.8	218.6	233.1	233.9	0.8
"HSB 66 "	55177.89	53117.82	198.1	228.1	224.7	226.5	1.8
"HSB 67 "	56449.04	51902.78	200.7	221.1	222.9	222.8	-0.1
"HSB 68 "	54963.81	52241.99	213.3	238.5	221.7	218.7	-3.0
"HSB 69 "	54551.15	52349.03	199.0	227.7	219.4	215.4	-4.0
"HSB 70 "	54070.99	53534.77	205.7	235.7	223.9	221.8	-2.1
"HSB 71 "	53657.70	53897.63	204.8	234.8	224.0	219.7	-4.3
"HSB 83D "	56648.16	51986.31	198.7	223.3	224.9	225.5	0.6

Table F-2. Summary of Group Statistical Parameters (Continued)

"HSB 85C "	57438.35	54041.12	214.2	224.2	239.2	238.0	-1.2
"HSB 86D "	54285.76	53402.43	206.6	236.6	223.4	222.6	-0.8
"HSB100D "	56931.76	52381.69	216.9	236.9	233.9	234.6	0.7
"HSB101D "	56718.21	52349.07	216.1	236.1	230.7	232.1	1.4
"HSB102D "	56511.84	52346.83	216.3	236.3	228.7	230.0	1.3
"HSB103D "	56360.00	52006.67	213.7	224.5	225.7	223.5	-2.2
"HSB104D "	56080.13	51843.39	210.6	224.8	224.8	221.2	-3.6
"HSB105D "	55903.66	51967.39	211.8	231.6	225.3	222.9	-2.4
"HSB106D "	55732.90	52282.78	210.7	230.7	226.0	224.9	-1.1
"HSB107D "	55498.90	52300.62	215.1	235.1	224.7	223.7	-1.0
"HSB108D "	55236.33	52347.64	212.0	232.0	223.5	222.0	-1.5
"HSB109D "	54981.42	52399.37	213.0	233.0	222.7	220.7	-2.0
"HSB110D "	54793.39	52541.16	211.4	231.4	222.1	220.2	-1.9
"HSB111E "	54643.22	52723.98	211.7	231.7	221.9	220.6	-1.3
"HSB112E "	54606.04	52970.91	211.7	231.7	222.5	222.6	0.1
"HSB113D "	54404.28	53152.93	216.2	236.2	222.5	222.7	0.2
"HSB114D "	54381.54	53333.10	212.8	232.8	223.2	223.2	0.0
"HSB115D "	54357.27	53530.56	213.9	233.9	223.9	224.2	0.3
"HSB116D "	54355.82	53771.94	214.5	234.5	225.9	225.1	-0.8
"HSB132D "	56808.47	51790.09	206.5	226.5	221.2	227.2	6.0
"HSB133D "	57203.40	52190.74	208.5	228.5	235.4	235.6	0.2
"HSB134D "	56264.22	51647.94	205.8	218.4	222.1	219.0	-3.1
"HSB137D "	53941.36	53227.00	205.3	225.3	222.0	218.9	-3.1
"HSB138D "	53698.71	54179.56	208.1	228.1	223.8	221.1	-2.7
"HSB139D "	55354.57	51755.32	206.7	222.5	222.5	214.2	-8.3
"HSB141D "	57112.67	51433.96	217.8	237.8	240.8	235.1	-5.7
"HSB146D "	56300.99	50875.82	204.0	224.1	222.6	222.7	0.1
"HSB147D "	54369.35	54719.63	215.2	235.2	231.5	227.5	-4.0
"HSB149D "	55301.36	51976.82	207.0	227.0	222.6	218.0	-4.6
"HSB150D "	56750.68	52030.46	206.9	226.9	226.8	227.1	0.3
"HSL 1D "	57079.06	52458.54	219.8	239.8	235.6	237.1	1.5
"HSL 2D "	57568.99	52365.85	225.2	245.3	242.1	241.8	-0.3
"HSL 6D "	58749.88	52594.22	239.4	243.9	260.1	247.9	-12.2
"HSS 1D "	61753.98	46793.47	236.5	256.5	268.8	268.1	-0.7
"HSS 2D "	61808.98	46521.70	234.5	254.5	267.9	267.9	0.0
"HWS 2 "	47150.77	47010.39	215.3	245.3	245.5	243.4	-2.1
"K 301P "	34699.85	38956.80	194.4	201.0	205.1	205.3	0.2
"KAB 1 "	34512.97	37703.87	194.0	224.0	205.9	205.6	-0.3
"KAB 2 "	34729.28	36998.69	198.6	228.6	209.4	205.8	-3.6
"KAB 3 "	34252.24	36483.51	193.0	223.0	203.6	199.7	-3.9
"KAB 4 "	34008.71	37557.00	187.0	217.0	202.9	201.4	-1.5
"KAC 1 "	37172.33	37252.49	199.0	229.0	219.3	219.3	0.0
"KAC 2 "	37251.77	37326.09	195.4	225.4	221.5	220.0	-1.5
"KAC 3 "	37286.28	37263.85	195.8	225.8	222.0	220.1	-1.9
"KAC 4 "	37208.99	37128.67	178.0	208.0	218.1	217.6	-0.5
"KAC 5 "	37270.51	37226.21	204.3	224.3	222.4	220.4	-2.0
"KAC 6 "	37243.68	37209.62	204.6	224.6	222.3	220.1	-2.2
"KAC 7 "	37150.77	37344.90	203.0	223.0	219.5	219.7	0.2
"KAC 8 "	37192.40	37216.54	192.3	212.3	221.2	218.3	-2.9
"KAC 9 "	37152.62	37288.17	195.7	215.7	220.8	218.5	-2.3
"KBP 1D "	34873.24	36997.53	192.0	202.1	208.2	206.2	-2.0
"KCB 1 "	34207.66	38175.04	183.6	213.6	204.7	202.9	-1.8
"KCB 2 "	34063.53	38391.13	187.7	217.7	202.8	201.6	-1.2
"KCB 3 "	33829.55	38242.63	184.1	214.1	202.3	199.6	-2.7

Table F-2. Summary of Group Statistical Parameters (Continued)

"KCB 4 "	33963.75	38025.59	188.9	218.9	205.5	201.2	-4.3
"KCB 5 "	33764.06	38167.82	189.3	209.3	200.7	199.3	-1.4
"KCB 6 "	33823.71	38365.23	188.7	208.7	201.2	199.5	-1.7
"KCB 7 "	34486.92	38097.90	196.5	216.5	205.3	205.6	0.3
"KDB 4 "	34890.68	38371.73	189.2	209.2	207.0	207.9	0.9
"KDB 5 "	34831.09	38655.12	188.5	208.5	205.5	207.0	1.5
"KDT 1D "	35191.60	38682.66	193.7	213.7	208.1	209.5	1.4
"KRB 8 "	35269.15	39422.20	195.8	215.8	208.5	207.3	-1.2
"KRB 16D "	35354.26	39398.39	191.5	211.5	209.3	207.8	-1.5
"KRB 17D "	35080.66	40027.41	186.8	206.8	206.0	201.9	-4.1
"KRB 18D "	35196.02	40122.82	185.8	205.8	204.6	201.7	-2.9
"KRB 19D "	35327.74	40153.30	186.8	206.8	203.8	202.2	-1.6
"KRP 1 "	37318.17	38629.26	207.0	237.0	218.6	221.2	2.6
"KRP 2 "	37515.57	38546.00	199.2	229.2	219.5	222.4	2.9
"KRP 4 "	37397.01	38427.35	188.7	218.7	218.5	221.0	2.5
"KRP 5 "	37048.11	38750.66	200.8	210.8	216.3	219.1	2.8
"KRP 6 "	37009.08	38350.12	203.1	213.1	217.9	219.7	1.8
"KRP 7 "	36699.81	38603.56	203.1	213.2	215.9	218.1	2.2
"KRP 8 "	37116.32	38597.27	200.1	210.1	217.1	219.7	2.6
"KRP 9 "	37210.32	38464.17	200.8	210.8	218.3	220.3	2.0
"KSB 5D "	34791.55	38770.15	194.5	214.5	204.5	206.6	2.1
"KSM 1D "	35147.98	38726.59	193.7	213.7	208.3	209.1	0.8
"LAC 1 "	44037.76	27687.88	191.1	221.1	216.5	214.4	-2.1
"LAC 2 "	44009.27	27787.58	193.4	223.4	216.1	214.9	-1.2
"LAC 3 "	43900.98	27679.23	190.7	220.7	216.5	213.6	-2.9
"LAC 4 "	43985.08	27672.80	185.3	215.3	216.1	213.8	-2.3
"LAC 5DU"	44089.18	27786.44	207.9	227.8	219.5	215.8	-3.7
"LAC 6DU"	43910.52	27728.93	201.7	221.7	219.0	214.3	-4.7
"LAC 7DL"	43812.28	27590.94	177.4	187.4	215.1	211.0	-4.1
"LAC 7DU"	43817.61	27607.80	204.9	224.8	218.1	213.3	-4.8
"LAC 8DL"	43990.69	27552.51	180.4	190.4	217.5	212.0	-5.5
"LAC 8DU"	43995.60	27571.30	199.8	219.8	218.1	213.8	-4.3
"LAW 2C "	42471.74	28401.16	171.2	191.2	209.2	207.8	-1.4
"LAW 3C "	45049.46	27858.57	194.9	214.9	235.2	219.9	-15.3
"LCO 1 "	43676.11	27723.24	195.8	225.8	214.8	212.8	-2.0
"LCO 2 "	43784.81	27822.41	196.6	226.6	215.1	214.0	-1.1
"LCO 3 "	43829.21	27695.61	196.3	226.3	229.1	213.5	-15.6
"LCO 4 "	43729.76	27598.57	192.3	222.3	212.6	212.2	-0.4
"LCO 5DL"	43560.94	27519.03	174.9	184.9	212.9	209.0	-3.9
"LCO 6DL"	43613.61	27604.75	178.0	188.0	213.7	210.1	-3.6
"LCO 8DU"	44151.94	28018.67	211.1	226.1	220.6	217.5	-3.1
"LDB 1 "	43460.04	28472.85	185.0	215.0	217.4	215.3	-2.1
"LDB 2 "	43675.04	28550.75	184.5	214.5	219.4	216.6	-2.8
"LDB 3 "	43434.68	28664.71	199.3	219.3	218.9	216.6	-2.3
"LDB 4 "	43198.42	28449.23	200.7	220.7	216.9	214.3	-2.6
"LRP 2 "	42626.81	31171.46	184.7	214.7	210.2	214.1	3.9
"LRP 3 "	42469.52	31185.16	191.4	221.4	209.5	214.2	4.7
"LSB 1 "	43415.55	27732.52	192.7	222.7	211.6	211.2	-0.4
"LSB 2 "	43551.19	27776.17	195.0	225.0	212.4	212.4	0.0
"LSB 3 "	43492.70	27956.99	196.6	226.6	217.2	213.2	-4.0
"LSB 4 "	43266.79	27936.41	191.5	221.5	216.8	211.5	-5.3
"MGC 9 "	54500.94	56270.36	217.3	237.3	229.6	229.5	-0.1
"MGC 11 "	54632.54	56119.91	219.2	239.2	233.4	229.5	-3.9
"MGC 19 "	55156.34	55515.60	230.6	234.6	232.2	230.9	-1.3

Table F-2. Summary of Group Statistical Parameters (Continued)

"MGC 23 "	55417.02	55212.99	227.9	247.9	234.3	231.8	-2.5
"MGE 9 "	54349.65	56142.01	218.1	238.1	227.5	229.0	1.5
"MGE 21 "	55134.33	55231.67	227.9	247.9	230.6	230.8	0.2
"MGE 30 "	55732.83	54540.13	229.3	249.3	236.1	233.0	-3.1
"MGG 15 "	54596.53	55561.90	223.3	243.3	232.8	229.3	-3.5
"MGG 19 "	54861.76	55257.10	226.0	246.0	231.4	229.9	-1.5
"MGG 23 "	55122.01	54954.38	227.1	247.1	232.2	230.9	-1.3
"NPM 19B "	53829.89	43745.89	217.7	227.7	268.9	270.4	1.5
"PDB 2 "	56809.92	23208.82	247.7	268.7	278.0	268.8	-9.2
"PDB 3 "	57006.81	23196.72	248.1	269.1	278.3	269.4	-8.9
"PRP 1A "	55518.77	25361.00	232.9	262.9	249.5	259.9	10.4
"PRP 2 "	55719.03	25359.02	234.1	264.1	255.6	261.7	6.1
"PRP 3 "	55617.66	25187.55	228.6	258.6	256.0	259.3	3.3
"PRP 4 "	55808.30	25216.75	232.9	262.9	257.8	261.9	4.1
"SCA 2 "	63072.44	52892.94	215.9	245.9	242.5	245.1	2.6
"SCA 3 "	62971.90	53025.44	220.3	240.3	241.4	245.3	3.9
"SCA 4 "	62942.99	52926.49	220.4	240.4	241.7	245.6	3.9
"SCA 5 "	63057.97	53143.73	223.7	243.7	241.5	244.9	3.4
"SCA 6 "	62984.12	52764.09	221.3	241.1	242.2	245.6	3.4
"SLP 1 "	62644.37	52071.80	228.0	248.0	245.3	247.9	2.6
"SLP 2 "	62703.45	51962.12	217.7	237.7	244.9	246.8	1.9
"Z 9 "	50061.53	59626.61	207.5	227.5	215.0	216.5	1.5
"ZDT 1 "	63022.32	50648.11	227.0	238.9	239.9	236.4	-3.5
"ZDT 2 "	62979.45	50710.48	225.1	244.0	241.4	238.4	-3.0
"ZW 5 "	53700.74	56844.58	221.0	231.0	227.4	230.0	2.6
"ZW 6 "	51164.33	57791.21	216.7	227.2	220.1	223.3	3.2
"NTS 2 "	38877.07	29831.49	174.7	194.8	192.3	193.2	0.9
"RGW 11DD"	41086.29	14561.85	171.2	186.2	184.1	190.5	6.4

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** GROUP  5 **  rms of (FACT-data) differences:      7.028
                avg of (FACT-data) differences:      0.014
                avg of |FACT-data| differences:      5.759
                max of {FACT-data} differences:    -17.087
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"BG 27 "	57419.22	54611.98	234.4	254.4	240.9	237.3	-3.6
"BG 28 "	57501.60	54998.60	239.7	259.7	247.1	0.0	-247.1
"BG 29 "	57584.39	55389.53	231.6	251.6	245.0	234.7	-10.3
"BG 30 "	57666.46	55779.48	231.7	251.7	237.5	233.2	-4.3
"BG 35 "	56803.94	56929.14	228.0	248.0	232.9	231.8	-1.1
"BG 37 "	56403.29	57330.81	227.8	247.8	232.9	231.8	-1.1
"BG 38 "	56012.15	57414.05	225.9	245.9	232.3	231.9	-0.4
"BG 39 "	55621.07	57497.08	226.0	246.0	231.7	232.1	0.4
"BG 40 "	55229.56	57580.50	221.9	241.9	231.4	232.2	0.8
"BG 109 "	58127.98	54021.21	228.4	258.4	240.8	240.0	-0.8
"BGO 53D "	54461.98	56977.82	225.3	245.3	229.7	230.6	0.9
"CBR 1D "	48664.46	42224.29	230.9	250.9	253.6	260.5	6.9
"CBR 2D "	48528.64	42201.43	233.8	253.8	253.1	260.8	7.7
"CBR 3D "	48467.37	42234.49	234.1	254.1	253.2	260.7	7.5
"CSA 1 "	46385.49	44128.63	232.0	262.0	243.4	254.2	10.8
"CSA 2 "	46396.93	44078.56	218.2	248.2	243.4	249.7	6.3
"CSA 3 "	46343.87	44047.31	218.6	248.6	242.6	249.7	7.1
"CSA 4 "	46317.09	44116.08	218.4	248.4	243.0	249.4	6.4
"CSD 1D "	46660.50	45549.91	238.4	273.4	245.0	253.1	8.1
"CSD 2D "	46607.64	45428.65	233.8	258.8	247.6	252.2	4.6

Table F-2. Summary of Group Statistical Parameters (Continued)

"CSD 4D "	46528.06	45463.56	213.5	263.5	244.0	248.4	4.4
"CSD 8D "	46386.31	45546.03	226.8	256.8	243.2	249.3	6.1
"CSD 9D "	46299.69	45447.80	226.2	256.2	243.2	249.1	5.9
"CSD 10D "	46270.84	45467.42	224.5	254.5	243.1	248.3	5.2
"CSD 11D "	46408.43	46319.64	220.9	250.9	243.0	245.1	2.1
"CSD 12D "	46380.19	45352.78	224.5	254.5	243.6	249.0	5.4
"CSF 1D "	45753.00	44835.79	228.2	248.2	243.4	247.5	4.1
"CSF 2D "	46897.26	43247.88	235.2	255.2	251.0	256.0	5.0
"CSO 1 "	48469.42	42931.91	232.0	262.0	251.4	261.9	10.5
"CSO 2 "	48551.57	42958.61	209.7	239.7	252.6	255.8	3.2
"CSR 1 "	49477.36	46134.32	237.2	267.2	256.5	255.8	-0.7
"CSR 3 "	50064.50	46849.58	238.1	268.1	254.5	254.3	-0.2
"CSR 4 "	49878.44	46048.77	237.6	267.6	256.7	258.3	1.6
"FAC 3 "	54769.41	58918.61	224.8	254.8	229.1	236.5	7.4
"FAC 5P "	54794.41	59074.22	225.7	235.7	229.7	233.9	4.2
"FAC 6 "	54804.95	59024.23	216.2	236.2	220.8	232.0	11.2
"FAC 7 "	54824.03	59014.45	215.7	235.7	223.2	231.8	8.6
"FAC 8 "	54826.86	58980.62	216.0	236.0	227.2	232.0	4.8
"FAL 1 "	53257.63	59339.73	207.0	238.5	218.7	233.5	14.8
"FC 1D "	52956.68	61011.23	217.2	222.2	223.6	222.4	-1.2
"FCA 2C "	53251.84	59525.09	295.3	299.3	297.4	0.0	-297.4
"FCA 2D "	53254.73	59524.27	219.0	239.0	225.0	235.8	10.8
"FCA 9D "	53335.59	59818.59	221.9	241.9	225.2	237.5	12.3
"FCA 10A "	53186.21	59891.13	221.0	241.0	225.3	236.7	11.4
"FCA 10D "	53342.73	59857.45	219.5	239.5	225.8	235.8	10.0
"FCA 16A "	53237.05	60145.21	215.1	235.1	225.2	232.1	6.9
"FCA 16B "	53238.89	60143.29	295.3	299.3	298.0	0.0	-298.0
"FCA 16D "	53384.25	60112.90	221.1	241.1	225.0	236.3	11.3
"FSL 1D "	52707.36	60425.06	208.5	228.6	224.7	227.0	2.3
"FTF 1 "	52547.55	58772.37	221.2	241.2	227.4	235.1	7.7
"FTF 2 "	52624.70	58676.94	219.4	239.4	225.2	234.3	9.1
"FTF 4 "	52575.72	58479.71	216.6	236.6	223.8	232.7	8.9
"FTF 6 "	52377.87	58540.68	216.9	236.9	223.4	232.2	8.8
"FTF 8 "	52414.24	58721.88	219.6	239.6	225.1	233.8	8.7
"FTF 9 "	52160.67	58925.65	216.4	236.4	221.1	231.4	10.3
"FTF 11 "	52077.61	58634.46	215.8	235.8	220.5	230.7	10.2
"FTF 27 "	52160.35	58664.41	213.5	243.5	223.3	231.4	8.1
"HAA 1D "	60573.75	49343.38	261.8	281.8	276.8	280.3	3.5
"HAA 2D "	59097.23	50767.79	260.3	280.4	276.6	275.3	-1.3
"HAA 3D "	58123.23	51458.39	246.7	264.3	264.6	258.6	-6.0
"HAA 4D "	59988.35	51884.83	255.7	275.7	270.1	268.2	-1.9
"HAA 6D "	61791.83	50700.99	247.1	267.2	264.8	256.8	-8.0
"HAC 1 "	59513.05	51932.39	258.8	278.8	269.4	268.7	-0.7
"HAC 2 "	59476.04	51990.55	258.8	278.8	269.0	267.5	-1.5
"HAC 3 "	59416.25	51965.64	255.0	275.0	269.1	267.3	-1.8
"HAC 4 "	59460.26	51891.78	254.1	274.1	269.6	267.7	-1.9
"HAP 1 "	61253.46	50579.78	256.3	276.3	270.9	269.7	-1.2
"HAP 2 "	61353.75	50469.62	243.8	263.8	270.4	261.4	-9.0
"HC 1E "	59863.68	51423.36	251.5	256.5	275.0	264.3	-10.7
"HC 2F "	59867.82	51457.24	250.7	255.7	274.3	263.6	-10.7
"HCA 1 "	61242.75	51923.26	253.7	273.7	269.4	261.5	-7.9
"HCA 2 "	61027.49	51707.50	242.0	273.4	270.3	260.2	-10.1
"HCA 3 "	61269.49	52050.48	253.8	273.8	269.2	260.7	-8.5
"HCA 4 "	61080.70	51959.75	241.9	273.3	269.3	258.7	-10.6

Table F-2. Summary of Group Statistical Parameters (Continued)

"HCB 2 "	61660.45	50574.96	239.9	269.9	268.1	257.4	-10.7
"HET 1D "	58616.55	51895.27	240.3	260.3	267.8	257.3	-10.5
"HET 2D "	58186.81	52045.60	239.7	259.7	258.6	252.0	-6.6
"HET 3D "	58220.83	52128.23	239.9	259.9	259.4	251.7	-7.7
"HET 4D "	58293.12	52198.95	239.5	259.6	259.4	252.0	-7.4
"HHP 1D "	58413.10	50996.42	260.4	270.1	271.4	267.1	-4.3
"HHP 2D "	58647.26	50803.30	263.2	273.2	274.8	270.8	-4.0
"HR3 18P "	58213.36	51574.78	244.3	264.3	267.7	258.2	-9.5
"HSL 3D "	57921.13	52353.06	233.7	253.8	250.4	245.0	-5.4
"HSL 4D "	58355.70	52467.41	245.0	265.1	262.0	250.1	-11.9
"HSL 5D "	58542.10	52538.71	247.8	267.7	265.9	251.7	-14.2
"HSL 5D "	58542.10	52538.71	242.6	247.7	265.9	248.8	-17.1
"HSL 6D "	58749.88	52594.22	243.9	264.0	260.1	251.2	-8.9
"HSL 7D "	58940.64	52568.70	242.3	262.4	260.0	251.9	-8.1
"HSL 8D "	59328.98	52500.00	248.4	268.4	260.9	255.7	-5.2
"HSS 3D "	61921.70	47419.48	262.6	282.6	281.9	277.9	-4.0
"HTF 1 "	60062.04	51380.18	236.9	256.9	272.9	259.9	-13.0
"HTF 2 "	60139.61	51225.68	237.0	257.0	274.3	260.6	-13.7
"HTF 4 "	59915.86	51293.68	235.2	255.2	274.3	259.7	-14.6
"HTF 5 "	60030.29	51024.00	264.3	284.3	279.6	280.6	1.0
"HTF 7 "	59978.19	50769.26	263.5	283.5	275.9	280.5	4.6
"HTF 8 "	59863.51	50936.77	263.6	283.6	273.9	280.1	6.2
"HTF 9 "	59681.77	51365.93	245.8	265.8	273.8	265.8	-8.0
"HTF 10 "	59791.26	51207.71	245.2	265.2	273.3	266.0	-7.3
"HTF 11 "	59652.43	51112.49	238.9	258.9	274.0	262.1	-11.9
"HTF 12 "	59551.62	51258.65	242.9	262.9	273.5	264.0	-9.5
"HTF 13 "	59614.63	51588.76	262.6	282.6	274.2	276.9	2.7
"HTF 14 "	59493.75	51616.50	261.9	281.9	273.2	276.0	2.8
"HTF 15 "	59354.29	51484.61	260.7	280.7	273.6	275.9	2.3
"HTF 16 "	60031.80	51800.66	248.3	268.3	269.7	264.2	-5.5
"HTF 17 "	59380.01	52399.25	238.4	258.4	262.5	254.0	-8.5
"HTF 18 "	59242.35	51581.81	251.7	271.7	271.6	268.4	-3.2
"HTF 19 "	59128.57	51739.61	245.7	265.7	269.2	263.0	-6.2
"HTF 20 "	59171.13	51905.18	251.9	271.9	267.9	266.5	-1.4
"HTF 21 "	59326.30	51795.42	242.6	262.6	269.6	260.6	-9.0
"HTF 22 "	60458.67	50905.75	251.4	271.4	275.5	270.9	-4.6
"HTF 23 "	60572.75	50881.19	256.8	276.8	274.6	274.5	-0.1
"HTF 24 "	60675.65	50858.81	257.8	277.8	274.1	274.6	0.5
"HTF 25 "	60770.53	50697.25	252.5	272.5	274.7	271.0	-3.7
"HTF 26 "	60658.34	50584.51	255.5	275.5	275.4	274.1	-1.3
"HTF 27 "	60500.00	50584.74	259.1	279.1	276.9	277.3	0.4
"HTF 28 "	60362.69	50636.52	251.9	271.9	276.0	272.2	-3.8
"HTF 29 "	60295.24	50804.00	259.9	289.9	275.8	281.4	5.6
"HTF 31 "	60437.03	50280.18	246.7	266.7	275.6	269.2	-6.4
"HTF 32 "	60607.03	50380.63	251.1	271.1	274.7	271.7	-3.0
"HTF 34 "	59850.54	50810.81	251.7	271.7	274.3	271.8	-2.5
"HWP 1D "	57981.82	52244.65	239.9	249.9	245.2	246.6	1.4
"HWP 2D "	58090.42	52436.40	253.0	263.0	263.0	0.0	-263.0
"HWS 1A "	47062.15	47130.24	225.2	255.2	244.9	244.3	-0.6
"HXB 1 "	48433.00	42406.60	214.2	244.2	251.7	256.4	4.7
"HXB 2 "	48826.55	42646.82	212.1	242.1	252.9	257.5	4.6
"HXB 3 "	48596.18	42455.23	212.2	242.2	252.2	256.6	4.4
"HXB 4D "	48519.48	42527.26	234.9	254.9	253.9	261.3	7.4
"HXB 5D "	48394.54	42453.62	234.2	254.2	253.0	260.6	7.6

Table F-2. Summary of Group Statistical Parameters (Continued)

"KRP 3 "	37592.37	38269.08	207.5	237.5	219.2	224.4	5.2
"MGA 36 "	56426.67	54360.14	234.2	254.2	240.6	235.6	-5.0
"MGC 32 "	56009.88	54528.57	232.0	252.0	245.1	234.1	-11.0
"MGC 36 "	56279.36	54222.66	234.4	254.4	236.1	235.2	-0.9
"MGE 34 "	55995.47	54238.12	237.2	257.2	241.0	0.0	-241.0
"MGG 36 "	55982.43	53952.59	232.5	252.5	238.4	234.2	-4.2
"NBG 1 "	53624.12	60472.79	200.9	232.3	224.5	227.3	2.8
"NBG 2 "	53659.78	60260.13	203.6	233.6	225.0	229.0	4.0
"NBG 3 "	53733.78	60080.63	202.1	233.5	217.5	229.6	12.1
"NPM 1 "	52966.40	43082.52	257.1	277.1	287.4	287.6	0.2
"NPM 2 "	54524.03	43675.02	244.2	264.2	271.8	279.7	7.9
"NPM 3 "	51554.55	43337.43	247.2	267.2	274.6	280.7	6.1
"NPM 4 "	53057.77	41764.52	256.7	276.7	284.2	288.2	4.0
"NPM 4DD"	53063.55	41773.42	296.4	306.4	305.6	297.4	-8.2
"NPM 19A "	53821.23	43736.38	248.2	268.2	270.7	282.4	11.7
"NPM 34A "	52141.34	41848.19	279.8	289.8	290.8	293.8	3.0
"NPM 34B "	52153.77	41839.82	225.6	235.6	271.1	274.5	3.4
"PAC 1 "	58782.57	22820.40	253.9	283.9	284.7	274.6	-10.1
"PAC 2 "	59001.85	22757.84	247.9	277.9	271.0	269.9	-1.1
"PAC 3 "	58897.00	22839.32	252.9	282.9	271.3	273.2	1.9
"PAC 4 "	58880.01	22750.72	250.6	280.6	284.4	272.2	-12.2
"PAC 5 "	58936.73	22806.44	255.1	275.1	275.1	270.9	-4.2
"PAC 6 "	58928.43	22827.02	255.2	275.2	274.6	271.0	-3.6
"PCB 1A "	56813.22	21649.15	263.5	293.5	280.7	281.9	1.2
"PCB 2A "	56603.25	21523.26	257.8	287.8	279.5	277.1	-2.4
"PCB 3A "	56466.82	21771.65	262.7	292.7	281.6	282.1	0.5
"PCB 4A "	56685.72	21863.14	262.9	292.9	279.7	282.0	2.3
"PDB 4 "	56681.17	23176.89	266.2	286.2	279.2	281.6	2.4
"PDB 5 "	56778.08	23822.35	264.2	284.2	277.8	278.9	1.1
"PSB 1A "	56243.45	23437.80	257.4	287.4	276.9	277.8	0.9
"PSB 2A "	56022.03	23477.81	257.2	287.2	276.7	277.5	0.8
"PSB 3A "	55700.43	23533.29	256.5	286.5	275.6	276.1	0.5
"PSB 4A "	55448.71	23519.73	255.5	285.5	274.8	274.8	0.0
"PSB 5A "	55683.06	23374.12	262.3	292.3	276.1	281.5	5.4
"PSB 6A "	56043.26	23292.96	262.1	292.1	277.6	281.9	4.3
"PSB 7A "	56385.84	23340.06	259.0	289.0	277.5	279.2	1.7
"SCA 3A "	62973.08	53031.02	267.1	272.4	270.9	0.0	-270.9
"SCA 4A "	62946.34	52924.45	265.3	274.0	268.8	0.0	-268.8
"Z 12 "	59296.96	50984.50	251.3	251.8	274.3	263.2	-11.1
"Z 13 "	59996.23	50413.54	256.6	257.1	276.1	269.4	-6.7
"ZW 4 "	55903.68	58318.78	229.2	239.7	232.3	231.9	-0.4
"ZW 7 "	58470.42	52387.61	254.5	264.8	265.8	255.7	-10.1
"ZW 8 "	61562.33	50095.99	254.1	264.1	270.8	262.9	-7.9
"ZW 9 "	59712.09	52940.43	242.4	252.4	252.0	250.3	-1.7
"ZW 10 "	61671.98	52538.16	242.2	252.2	249.7	251.7	2.0
"CMP 15C "	46865.00	33346.32	220.6	250.6	244.5	240.7	-3.8
"NPM 2 "	54524.03	43675.02	244.2	264.2	267.0	279.7	12.7
"NPM 3 "	51554.55	43337.43	247.2	267.2	267.6	280.7	13.1
"NPM 4 "	53057.77	41764.52	256.7	276.7	272.7	288.2	15.5
"NTN 1 "	40851.04	40382.75	212.4	232.4	233.7	232.9	-0.8
"NTN 2 "	42194.02	41060.13	207.2	227.2	235.2	235.7	0.5

APPENDIX G. MODIFICATIONS TO C-AREA HYDROSTRATIGRAPHY BASED ON CPTU CHARACTERIZATION

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APPENDIX G. MODIFICATIONS TO C-AREA HYDROSTRATIGRAPHY BASED ON CPTU CHARACTERIZATION

Overview

In C-area, initial groundwater modeling pathlines originating from the C-Reactor Seepage Basins (CRSB) did not agree with the tritium and TCE plume movement observed from Cone Penetration Test concentration data, for any reasonable variation in horizontal and vertical conductivities. Figure G-1 illustrates the CPT tritium data associated with the CRSB, while Figure G-2 shows CPT TCE data associated with the CRSB and C-area Burning/Rubble Pit (CBRP). Figure G-3 shows a typical example of simulated groundwater flow. Note that predicted pathlines from the CRSB travel towards Twin Lakes while the plume data suggests groundwater is migrating toward the confluence of Fourmile Branch and Caster Creek. The lack of calibration success in matching pathlines with plume migration suggested a flaw in the conceptual model for C-area and motivated a reexamination of the hydrostratigraphic framework.

Cone Penetration Tests (CPTu) were used almost exclusively at the C-area Burning/Rubble Pit and C-Reactor Seepage Basins to define contaminant plumes and local hydrostratigraphy, rather than conventional borehole techniques (e.g. monitoring wells, cores, electric well logs, slug and pumping tests). In this study, CPTu lithologic data are further used to identify dominant confining intervals and zones of high horizontal conductivity within the Upper Three Runs aquifer in C-area. The approach is to correlate tip, sleeve and pore pressure measurements to percent fines and hydraulic conductivity. Then the small-scale conductivity data are upscaled and interpolated onto the regional-scale flow model grid using stochastic theory.

The CPTu predictions indicate that, on the north side of Caster Creek, the tan clay largely disappears as a confining unit and is simultaneously underlain by a deeper confining zone within the "lower" UTRA. The underlying confining zone is interpreted to be a calcareous wackestone/mudstone based on the CPTu signature of low tip and sleeve resistance with high pore pressure. Also, the transmissive zone is significantly more conductive south of the CRSB. These predicted hydraulic conductivity variations suggest element layer 5 in the model should be redefined to coincide with the lower calcareous zone instead the tan clay near Caster Creek in C-area. With this modification, simulated groundwater flow paths, as shown in Figure G-4, are in much better agreement with observed plume migration from the CRSB and CBRP (Figures G-1 and G-2).

CPTu correlations

Several soil classification charts have been developed in the literature that correlate CPTu tip resistance, sleeve resistance, and pore pressure to soil categories (Syms and Others, 1999). Such charts define a discrete soil index, but do not predict gradation or percent fines content. Following Jefferies and Davies (1993), Robertson and Fear (1995) and Syms and Others (1999), concepts employed in soil classification were applied to prediction of percent fines. The predicted %fines and normalized pore pressure measurement were then correlated to small-scale hydraulic conductivity.

CPTu measurement and normalized parameters

CPTu data consist of uncorrected tip resistance, q_c, sleeve friction, f_s, and pore pressure, u, typically in units of tons per square foot (tsf). These dimensional parameters are commonly normalized in the recent literature to produce their dimensionless counterparts Q_{tn}, F_{sn} and B_q, respectively. Normalized tip resistance, Q_{tn}, is defined by

$$Q_{tn} = \frac{q_t - \sigma}{\overline{\sigma}} \tag{G.1}$$

where the corrected tip resistance, q_t, is

$$q_t = q_c + u\left(1 - \frac{A_N}{A_T}\right) \tag{G.2}$$

and σ and $\overline{\sigma}$ are the total and effective overburdens. In equation (G.2), the total tip stress, q_t, is equal to the mechanical rod stress (measured force/tip area), q_c, plus fluid pressure on the backside of the cone over the area $(A_T - A_N)$ divided by tip area. The numerator of equation (G.1) is the net stress required to advance the tip and deform the medium. The denominator is the grain-to-grain contact, or "effective", stress. Above the water table, the total overburden is

$$\sigma = (\gamma_d + \gamma\omega S_w)z \tag{G.3}$$

where z is depth below ground surface. The dry soil weight density per unit total volume (bulk density), γ_d, is approximately 100 lbf/ft^3. Water weight density per unit water volume, γ, is 62.4 lbf/ft^3. A reasonable total porosity, ω, is 45%, and an average vadose zone saturation might be 70%. Below the water table, the total overburden is

$$\sigma = (\gamma_d + \gamma\omega S_w)z_{WT} + (\gamma_d + \gamma\omega)(z - z_{WT}) \tag{G.4}$$

Effective overburden is computed from the relation

$$\sigma = \overline{\sigma} + p$$

where p is assumed to be hydrostatic pressure (deMarsily, 1986, §5.2; Freeze and Cherry, §2.9). Above the water table, the usual assumption is p = 0, or $\overline{\sigma} = \sigma$.

Normalized friction ratio (normalized sleeve friction) is defined by

$$F_{sn} = \frac{f_s}{q_t - \sigma} \times 100\% \qquad \text{(G.5)}$$

and represents sleeve friction relative to the net force required to advance the cone tip (deform the medium). Normalized pore pressure is similarly defined as

$$B_q = \frac{u - p}{q_t - \sigma} \qquad \text{(G.6)}$$

The numerator is net (measured - hydrostatic) pore pressure.

%Fines correlation

Syms and Others (1999) conducted an extensive literature review of soil classification charts based on CPTu measurements, and applied several to SRS sediments. They observed that the cited charts "do not work well for SRS soils". Syms and Others (1999) also considered the approach of Robertson and Fear (1995), who extended an approach introduced by Jefferies and Davies (1993) for correlating %fines (#200 sieve) to the CPTu parameters, Q_{tn} and F_{sn}. They achieved marginal success for sediments of the Altamaha, Tobacco Road / Dry Branch, and Santee formations within the General Separations Area. Much better results were obtained by optimizing coefficients in the correlation for each formation, using paired CPTu and sieve data from 3 locations in F-area. This study investigates the extent to which %fines are correlated to CPTu parameters, using data from F-, H- and R-areas.

An initial indication of the degree of correlation between %fines and CPTu can be gained by computing the correlation coefficient, r, for each CPTu parameter. Table G-1 summarizes the results. The parameter exhibiting the strongest (linear) correlation to %fines is $\log_{10} F_{sn}$, followed by B_q and then $\log_{10} Q_{tn}$. Table G-1 suggests choosing these parameters for the purpose of generating a %fines correlation. The correlation is apparently weak as a linear variation in $\log_{10} F_{sn}$ only explains 21.6% (r^2) of the variation in %FC, for example.

Following Syms and Others (1999), the CPTu data are next segregated into 4 %FC categories based on sieve results: 0-15% (group 1, blue), 15-30% (group 2, green), 30-50% (group 3, red) and 50%-100% (group 4, yellow/black). Figures G-5 and G-6 present the color-coded CPTu data in terms of $\log_{10} Q_{tn}$ versus $\log_{10} F_{sn}$, and B_q versus $\log_{10} F_{sn}$. Also plotted in these figures are the average positions (centers of mass) of each %FC group. Figures G-7 and G-8 show the same data, but with each %FC group displayed separately. The %FC groups significantly overlap, confirming the preliminary conclusion from Table G-1. The %FC groups would have to be substantially separated in order to develop an accurate correlation. Nevertheless, on average, the data from each group are separated, particularly with respect to $\log_{10} F_{sn}$ and B_q. This is most easily observed from the "center of mass" points depicted in each figure. The first three groups follow a definite, nearly linear, trend. Specifically, %FC increases with friction ratio and pore pressure as expected. The data show little dependence on normalized tip resistance. The 50-100% fines group deviates from this trend. This suggests that a significantly better correlation can be achieved for sieve data in the 0-50% range compared to the entire set. Table G-2 summarizes correlation statistics for the first 3 groups comprising the 0-50% fines data. Indeed, the degree of linear correlation is significantly improved compared to Table G-1. For example, r^2 has increased from 21.6% to 37.9% for normalized friction ratio.

The ultimate objective of this study is to distinguish between high and low conductivity sediments. This breakpoint occurs for a relatively low %fines content and lessens the need to correctly predict %fines at the high end. For this reason, and that a much better correlation can be achieved by ignoring data with greater than 50% fines, regression analysis will be performed only on the first three %FC groups. The following linear functional form is considered

$$\%FC = A + B * \log_{10} F_{sn} + C * B_q + D * \log_{10} Q_{tn} \qquad (G.7)$$

The regression is linear (in the regression coefficients) and produces the following result

$$\%FC = 5.009 + 15.98 * \log_{10} F_{sn} + 24.14 * B_q + 6.869 * \log_{10} Q_{tn} \qquad (G.8)$$

Regression statistics from JMP (SAS Institute, 1995) are presented in Table G-3. In summary, the correlation explains about 45% (r^2) of the variation in %FC. For the data used to develop the correlation (0-50% fines), Figure G-9 shows the variation in residuals with respect to each CPTu parameter, and compares predicted to measured %FC. Figure G-10 presents the same information for the entire paired data set. As expected, the correlation is a very poor predictor of high %fines.

Table G-1 Correlation measures for %fines and CPTu parameters.

PAIR	COV	r	r^2
FC & Qtn:	-19.418	-0.023	0.001
FC & Fsn:	13.216	0.348	0.121
FC & Bq:	1.164	0.393	0.155
FC & log10Qtn:	-1.346	-0.169	0.029
FC & log10Fsn:	2.948	0.465	0.216
FC & (1-Bq)log10Qtn:	-2.247	-0.250	0.062

Table G-2 Correlation measures for %fines and CPTu parameters; 0-50% fines.

PAIR	COV	r	r^2
FC & Qtn:	40.302	0.071	0.005
FC & Fsn:	12.015	0.484	0.234
FC & Bq:	0.666	0.392	0.154
FC & log10Qtn:	-0.676	-0.132	0.018
FC & log10Fsn:	2.535	0.616	0.379
FC & (1-Bq)log10Qtn:	-1.272	-0.220	0.048

Table G-3 Regression statistics.

Response: PctFines

Summary of Fit

RSquare	0.448083
RSquare Adj	0.444619
Root Mean Square Error	8.01564
Mean of Response	19.08112
Observations (or Sum Wgts)	482

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	5.0086203	1.59144	3.15	0.0018
logFsn	15.982605	1.024972	15.59	<.0001
Bq	24.144781	2.897954	8.33	<.0001
logQtn	6.8693266	0.980055	7.01	<.0001

Effect Test

Source	Nparm	DF	Sum of Squares	F Ratio	Prob>F
logFsn	1	1	15622.380	243.1481	<.0001
Bq	1	1	4460.053	69.4166	<.0001
logQtn	1	1	3156.486	49.1278	<.0001

Hydraulic conductivity correlation

Hydraulic conductivity can be directly correlated to CPTu measurements, as Parsons and ARA (1997) and Celeste (1998) have done for SRS sediments. Alternatively, conductivity can be correlated to %fines (e.g. Kegley, 1993; Parsons and ARA, 1997; Celeste, 1998; Flach and others, 1998; Flach and Harris, 1999), which may then be related to CPTu measurements using the correlation developed in the previous section. In this study we apply a hybrid approach which relates conductivity to CPTu measurements indirectly through predicted %fines, and directly through the B_q parameter. The approach is motivated by the absence of small-scale conductivity measurements in C-area that can be used to directly correlate conductivity to CPTu.

The %FC ranges of 0-15%, 15-30% and >30% are considered to correspond to "high", "medium" and "low" conductivity. Based on conductivity data taken at various scales, previous flow models, and preliminary model calibration, reasonable values for these conductivity categories appear to be 20, 2 and 0.01 ft/d. Recognizing that equation (G.8) is a poor predictor of fine-grained sediment while B_q is good predictor of low conductivity intervals, we also use $B_q > 0.1$ to define an "extra low" conductivity category. The "extra low" conductivity zone is assigned a value of 0.0001 ft/d, irrespective of predicted %fines. The chosen hydraulic conductivity relationship is summarized in Table G-4.

The conductivity settings listed in Table G-4 are based in part on qualitative knowledge of how conductivity varies with lithology and support scale. As with all models, the specific values of conductivity are ultimately based on model calibration. The settings in Table G-4 are typical values for small-scale conductivity measurements on sediments ranging from clean sand (high K) to clay (extra low K) (e.g. Kegley, 1993; Parsons and ARA, 1997; Celeste, 1998; Flach and others, 1998; Flach and Harris, 1999). Example small-scale tests include the laboratory falling head permeameter and mini-permeameter. After the correlation is applied to the CPT data, the small-scale conductivity estimates are scaled up to the flow model grid (field scale) through a process described in the next section. The upscaled estimates for horizontal conductivity compare favorably with average field-scale measurement data from slug and pumping tests, and previous calibrated flow models (see Figures G-28 to G-59 presented in next section). The predicted conductivity fields based on Table G-4 are viewed as a starting point for final flow model calibration to additional targets such as water level and plume data.

Table G-4 Hydraulic conductivity correlation.

Conductivity category	**Definition**	**Value** (ft/d)
High	0-15% fines predicted from equation (G.8)	20
Medium	15-30% fines predicted from equation (G.8)	2
Low	>30% fines predicted from equation (G.8)	0.01
Extra Low	Bq > 0.1 irrespective of predicted %fines	0.0001

Upscaling

CPTu measurements have a vertical resolution of 0.1 ft, and the radius of influence of the cone in the horizontal plane is equally small. Therefore, a method for upscaling

CPTu measurements to the coarser resolution of the flow model mesh is required. Before developing an appropriate approach for C-area, we first review upscaling approaches from the stochastic hydrology literature.

Review of upscaling in the stochastic hydrology literature

Upscaling refers to the process of replacing a heterogeneous conductivity field within a particular finite volume with a single, "equivalent", conductivity value. The equivalent conductivity is defined as the value that reproduces some average behavior of the block, such as mean flow for a given head difference. A closely related problem is that of determining the "effective" conductivity of a heterogeneous media. As stated by Sanchez-Vila and others (1995), "effective parameters are defined as representative values of the mean behavior through an ensemble of realizations, while equivalent parameters are associated with a certain geometry and defined as spatial averages computed on a single realization. These two definitions should converge to the same value for very large geometries and under the assumption of ergodicity." The problem of defining effective conductivity is considered first, as this topic is better developed in the literature.

Of principal importance to this study is the work of Gelhar and Axness (1983) who derived analytical expressions for the effective conductivity tensor of an infinite, ergodic, anisotropically-correlated medium subjected to a uniform mean flow. The three-dimensional anisotropy of the heterogeneous medium is defined in terms an exponential autocovariance function with distinct correlation scales for each coordinate direction, λ_1, λ_2 and λ_3. When the mean flow is aligned with the bedding ($\lambda_1 = \lambda_2 > \lambda_3$), the non-zero components of the conductivity tensor are

$$\overline{K}_{11} = \overline{K}_{22} = \overline{K}_h = K_g\left[1+\sigma^2\left(\frac{1}{2}-g_{11}\right)\right] \qquad \text{(G.9)}$$

$$\overline{K}_{33} = \overline{K}_v = K_g\left[1+\sigma^2\left(\frac{1}{2}-g_{33}\right)\right] \qquad \text{(G.10)}$$

where

$\overline{K}_h$ ≡ effective horizontal conductivity

$\overline{K}_v$ ≡ effective vertical conductivity

Kg ≡ geometric mean of point conductivity field

$\sigma^2 \equiv$ variance of the natural logarithm of point conductivities

and g_{11} and g_{33} are functions of the correlation scales. For case being considered here, they are defined in terms of the ratio of horizontal to vertical correlation, $\rho = \lambda_h/\lambda_v > 1$, as follows:

$$g_{11} = \frac{1}{2}\frac{1}{\rho^2 - 1}\left[\frac{\rho^2}{(\rho^2-1)^{1/2}}\tan^{-1}(\rho^2-1)^{1/2} - 1\right] \quad \text{(G.11)}$$

$$g_{33} = \frac{\rho^2}{\rho^2 - 1}\left[1 - \frac{1}{(\rho^2-1)^{1/2}}\tan^{-1}(\rho^2-1)^{1/2}\right] \quad \text{(G.12)}$$

The above analytical results are based on a first-order perturbation analysis, and strictly speaking, only exact in the limit as the variance approaches zero. Accurate results can be expected for small variances. For large variances, the predictions may become increasingly inaccurate, or even nonphysical. For example, $\overline{K}_v$ is negative when $\lambda_h/\lambda_v \rightarrow \infty$ and the variance of lnK exceeds 2. To remedy such nonphysical results and hopefully extend the range of applicability of effective conductivity predictions, Gelhar and Axness (1983) proposed the following generalization of equations (G.9) and (G.10)

$$\overline{K}_h = K_g \exp\left[\sigma^2\left(\frac{1}{2} - g_{11}\right)\right] \quad \text{(G.13)}$$

$$\overline{K}_v = K_g \exp\left[\sigma^2\left(\frac{1}{2} - g_{33}\right)\right] \quad \text{(G.14)}$$

The generalization is motivated by the observation that a Taylor series expansion of equations (G.13) and (G.14) contains equations (G.9) and (G.10), respectively, as the first two terms. Subsequent comparison of equation (G.9) to numerical simulations indicates that the exponential generalization is accurate for isotropic systems and variances up to 7, but overpredicts effective conductivity for anisotropic systems (Gelhar, 1997, p. 161).

Ababou and Wood (1990) point out that equations such as (G.13) and (G.14) can alternatively be written in terms of a "p-norm" defined by

$$K_p \equiv \left[\frac{1}{N}\sum_i (K_i)^p\right]^{1/p} = \left(\overline{K^p}\right)^{1/p} \quad \text{(G.15)}$$

because

$$K_p = K_g \exp\left(p\sigma^2 / 2\right) \tag{G.16}$$

Comparing equations (G.13) and (G.14) with (G.16), one finds

$$p_h = 1 - 2g_{11} \tag{G.17}$$

$$p_v = 1 - 2g_{33} \tag{G.18}$$

where p_h and p_v are the averaging exponent associated with horizontal and vertical effective conductivity. That is, equations (G.13) and (G.14) are exactly equivalent to

$$\overline{K}_h = \left(\overline{K^{p_h}}\right)^{1/p_h} \tag{G.19}$$

and

$$\overline{K}_v = \left(\overline{K^{p_v}}\right)^{1/p_v} \tag{G.20}$$

As explained by Ababou and Wood (1990), the p-norm encompasses the familiar averages of arithmetic ($p = 1$), geometric ($p \to 0$), and harmonic ($p = -1$) as well as any blend in between. In more recent years, numerous authors have developed expressions for effective conductivity based on less restrictive assumptions than those adopted by Gelhar and Axness (1995), such as bounded media with various boundary conditions, gradually varying mean flow, non-stationary conductivity, and radial flow. Frequently the effective conductivity is formulated as a power-average (G.15) with the power p having been determined from numerical simulations or a combined numerical-analytical approach (Sanchez-Vila and others, 1995).

The related problem of determining "equivalent" block conductivities has received less attention in literature, but is of great practical importance because "effective" conductivity estimates are strictly valid only for regions that span at least 10 or 100 times the integral correlation scale (Kitanidis, 1997). Frequently model blocks, and even the entire model domain, are not significantly larger than the scale of heterogeneity. This observation is especially supported by recent research that suggests variability exists at all scales without bound and motivates the use of fractal models. Sanchez-Vila and others (1995) summarize and compare upscaling approaches proposed to-date. Two out of the four approaches reviewed by Sanchez-Vila and others (1995) are practical in that a mechanism for computing block conductivity from point values was provided by the author(s). Of these approaches, Desbarats (1992) is particularly appealing because of its simplicity.

Desbarats (1992) conjectures that equivalent block conductivities can be formulated as a power-average, a reasonable hypothesis considering the successful use of p-norms in defining effective conductivity. Desbarats (1992) empirically determined the appropriate power through numerical experimentation. For cubic blocks and an isotropic conductivity field, the optimal averaging exponent was determined to be p = 1/3. Interestingly, this is the same power as is appropriate for the effective conductivity of an infinite domain, as can be seen from equations (G.11) and (G.17). As Desbarats (1992) notes, this observation further supports the empirical result. For an anisotropic media with $\lambda_h = 10\lambda_v$ and block dimensions of $L_h/\lambda_h = L_v/\lambda_v = 3$, the optimal averaging exponents were found through numerical experimentation to be $p_h = 0.59$ and $p_v = -0.33$. Unlike the isotropic case, these results differ from the averaging exponents for effective conductivity of an infinite medium with $\lambda_h = 10\lambda_v$. The latter results are $p_h = 0.86$ and $p_v = -0.72$ (see equations (G.11), (G.12), (G.17) and (G.18)). The discrepancy may be a reflection of equation (G.9) already overpredicting K_h in infinite anisotropic media for large variances, as previously stated. Desbarats (1992) recommends that numerical calibration experiments be used to define the power exponents for the specific combination of block geometry and correlation scales of interest. However as Desbarats (1992) notes, equations such as (G.17) and (G.18) give the correct values for the limiting cases of an isotropic or perfectly stratified medium, and "provide a convenient alternative to tedious numerical experiments".

Practical upscaling procedures frequently involve vertical averaging of borehole/CPT data over a stratigraphic layer, followed by horizontal averaging or interpolation across the layer. Assuming equivalent block conductivities can be expressed as a known power average, then certain restrictions apply to such a two-stage averaging/interpolation process in order to avoid biased estimates. First consider vertical averaging of three-dimensional point data, followed by horizontal averaging of the two-dimensional intermediate-scale estimates. The first stage can be written

$$\overline{K_q} = \left[\frac{1}{m} \sum_i (K_i)^q \right]^{1/q} \qquad \text{(G.21)}$$

where q is unspecified at the moment. The second stage involves averaging the 2D intermediate-scale data according to

$$\overline{K} = \left[\frac{1}{n} \sum_j \left(\overline{K_{qj}}\right)^r \right]^{1/r} \qquad \text{(G.22)}$$

where r is also unspecified. Combining (G.21) and (G.22) produces

$$\overline{K} = \left\{ \frac{1}{n} \sum_j \left[\frac{1}{m} \sum_i (K_i)^q \right]^{r/q} \right\}^{1/r} \tag{G.23}$$

which is the effective conductivity of the layer. Alternatively, the effective conductivity can be computed directly from the known power average of the 3D point data:

$$\overline{K} = \left[\frac{1}{N} \sum_i (K_i)^p \right]^{1/p} \tag{G.24}$$

where N = m×n. In order for the two-step averaging process (G.23) to be consistent (unbiased) with respect to (G.24) we require q = r = p so that equation (G.23) becomes

$$\overline{K} = \left\{ \frac{1}{n} \sum_j \left[\frac{1}{m} \sum_i (K_i)^p \right] \right\}^{1/p} \tag{G.25}$$

or

$$\overline{K}^p = \frac{1}{n} \sum_j \left[\frac{1}{m} \sum_i (K_i)^p \right] \tag{G.26}$$

Equation (G.26) implies that upscaling should be conducted according to the following sequence in order to avoid biased estimation:

1) Transform the point data K to K^p

2) Estimate K^p through one or more *arithmetic* averaging and/or interpolation steps

3) Transform $\overline{K^p}$ back to $\overline{K}$ through the transform $(\overline{K^p})^{1/p}$

Step 2), for example, could involve vertical averaging followed by two-dimensional block kriging.

C-area upscaling approach

Having reviewed the relevant stochastic hydrology literature on upscaling, we now consider an appropriate upscaling approach for C-area specifically. The conductivity estimates inferred from CPTu measurements have a vertical resolution of 0.1 ft and are

considered to be "point" measurements. Atlantic Coastal Plain sediments are clearly stratified and imply anisotropic correlation scales, λ_h and λ_v. Their ratio cannot be derived from the CPTu data because none of the 164 locations are close enough in the horizontal plane (i.e. within inches). However, judgement based on knowledge of the depositional environment and visual inspection of outcrops suggests a reasonable ratio is approximately $\lambda_h / \lambda_v = 10$. Furthermore, the vertical and horizontal correlation scales within stratigraphic zones are probably on the order of a few inches and feet, respectively. Considering that the typical model block will be a few feet thick and span on the order of 100 ft in the horizontal plane, the "equivalent" block conductivity should be close to the "effective" conductivity, in the terminology of Sanchez-Vila and others (1995). Therefore, power averaging parameters derived from Gelhar and Axness (1983) can reasonably be applied to upscaling of C-area CPTu data. For $\lambda_h / \lambda_v = 10$, the p-norm results are $p_h = 0.86$ and $p_v = -0.72$ for horizontal and vertical conductivity, respectively (see equations (G.11), (G.12), (G.17) and (G.18)). As mentioned previously, Gelhar and Axness' (1983) predictions overpredict p_h for anisotropic media. Considering this and many other uncertainties in the data and underlying assumptions, p_h and p_v are uncertain and may be viewed as calibration parameters.

To avoid introducing bias into the predicted conductivity fields, the following upscaling process is chosen for K_h and K_v:

1) Transform the point data K to K^p, where p = +0.86 for horizontal conductivity and p = -0.72 for vertical conductivity

2) For each CPTu push, arithmetically average K^p over the thickness of each model layer

3) Interpolate $\overline{K^p}$ within each layer using two-dimensional block kriging

4) Back transform K^p block estimates by computing $(K^p)^{1/p}$, where p takes on the value used in step 1)

Vertical averaging in step 2) reduces the three-dimensional CPTu data to a sequence of two-dimensional data sets, one per model layer. Model layers conform to stratigraphic units, zones or sub-zones. Kriging is chosen in step 3) because it is an exact interpolator for point estimation and can be optimized for the characteristics of individual formations through the variogram model. An isotropic exponential semivariogram model is chosen. The functional form is

$$\gamma(h) = c\left[1 - \exp\left(-\frac{3h}{a}\right)\right] \qquad (G.27)$$

where

$$\gamma \equiv \text{ semivariogram; } \frac{1}{2}E\left\{\left[K(\vec{x}+\vec{h})-K(\vec{x})\right]^2\right\}$$

$$h \equiv \text{ lag distance, } |\vec{h}|$$

$$c \equiv \text{ contribution}$$

$$a \equiv \text{ effective range}$$

A variogram analysis of the synthetic data for each hydrostratigraphic unit was performed to estimate the effective range, a. The estimated ranges varied from 500 to 1000 ft. The average of 750 ft was subsequently used in the block kriging performed for each unit. The contribution, c, does not affect the point or block estimates so its specification can be arbitrary. The contribution does affect the uncertainty of the estimates and an estimate would be needed if an uncertainty analysis were conducted.

Predicted conductivity fields for C-area

There were 164 lithologic CPTu pushes in C-area, among a larger total number that included groundwater sampling. The 131C series of pushes are located at and down-gradient of the C-area Burning/Rubble Pit. The CRSB series is located in the vicinity of the C-Reactor Seepage Basins and down-gradient. The CSB series are located further down-gradient of the CRSBs and also along Caster Creek, Fourmile Branch and the C-04 outfall. The 164 data locations are shown in Figure G-11.

Initial hydrostratigraphy (unaltered tan clay horizon)

Figures G-12 through G-27 show upscaled predicted horizontal and vertical hydraulic conductivity for model layers 3 through 8. The correspondence between model layers and hydrostratigraphy is defined in Table G-5. The upper half of each figure shows the point kriging estimates of K^p in units of $(ft/d)^p$, which are intermediate results prior to block kriging and back transformation. Of more interest is the lower half of each figure which shows the final (back-transformed) block kriging estimates $\overline{K}$ in units of ft/d.

Note in Figure G-21 that the predicted vertical conductivity of the "tan clay" confining zone abruptly increases by one to two orders of magnitude in the vicinity of Caster Creek. Simultaneously, the horizontal (Figure G-18) and vertical (Figure G-19) conductivity of the underlying "lower" UTRA aquifer zone decrease abruptly. Hence, the CPTu predictions indicate that, on the north side of Caster Creek, the tan clay largely disappears as a confining unit and is simultaneously underlain by a deeper, more

significant confining zone within the "lower" UTRA. The underlying confining zone is interpreted to be a calcareous wackestone/mudstone based on the CPTu signature of low tip and sleeve resistance with high pore pressure.

The predicted hydraulic conductivity variation in the transmissive zone shown in Figure G-22 is also notable. The transmissive zone is significantly more conductive near Caster Creek in general, and especially so midway between the C-04 outfall and Fourmile Branch. This variation is significant enough to justify a corresponding high conductivity zone in regional flow model.

Table G-5 Correspondence between model layers and hydrostratigraphy.

Model layer	Hydrostratigraphic zone	Abbreviation
8	A and uu horizons	A/uu
7	AA horizon	AA
6	transmissive zone	TZ
5	tan clay	TCCZ
4	upper half of "lower" UTRA	uLAZ
3	lower half of "lower" UTRA	lLAZ
2	Gordon confining unit	GCU
1	Gordon aquifer unit	GAU

Modified hydrostratigraphy (modified tan clay horizon)

Inspection of the CPTu logs and the predicted conductivity fields presented above indicates that additional hydrostratigraphic zones should be defined in C-area. Specifically, two additional confining zones should be delineated within the "lower" UTRA, as indicated in Table G-6. The vertical resolution of the regional flow model is insufficient to individually represent each hydrostratigraphic zone in the expanded framework. Given this limitation the best alternative is to redefine element layer 5 such that it coincides with the lower calcareous zone (CC1) instead the tan clay (TCCZ) near Caster Creek in C-area. The specific modifications made to the "tan clay" model layer are provided in Table G-7 as revised picks for the top of the TCCZ and LAZ . Figures G-28 through G-43 illustrate the predicted hydraulic conductivity results based on CPTu data for the redefined model stratigraphy. These plots correspond to Figures G-12 through G-27 presented previously. Note from Figure G-37 that the model "tan clay" layer (element layer 5) now functions as a confining unit throughout C-area.

Table G-6 Expanded hydrostratigraphy in C-area.

Hydrostratigraphic zone	Abbreviation
A and uu horizons	A/uu
AA horizon	AA
transmissive zone	TZ
tan clay	TCCZ
upper aquifer interval within "lower" UTRA	uLAZ
calcareous (confining) interval 1 within "lower" UTRA	CC1
middle aquifer interval within "lower" UTRA	mLAZ
calcareous (confining) interval 2 within "lower" UTRA	CC2
lower aquifer interval within "lower" UTRA	lLAZ
Gordon confining unit	GCU
Gordon aquifer unit	GAU

Table G-7 Modified hydrostratigraphic picks for defining model layer 5.

SiteID	TCCZ	LAZ	Comment
CSB-102	186	182	prior
CSB-102	158	127	revised
CSB-103	179	168	prior
CSB-103	148	121	revised
CSB-104	175	168	prior
CSB-104	144	130	revised
CSB-105	177	175	prior
CSB-105	147	129	revised
CSB-106	173	169	prior
CSB-106	152	127	revised
CSB-107	1.0E+20	1.0E+20	prior
CSB-107	156	132	revised
CSB-108	178	165	prior
CSB-108	156	128	revised
CSB-109	1.0E+20	1.0E+20	prior
CSB-109	149	132	revised
CSB-110	1.0E+20	171	prior
CSB-110	164	148	revised
CSB-111	1.0E+20	160	prior
CSB-111	154	134	revised
CSB-112	172	153	prior
CSB-112	151	129	revised
CSB-113	180	161	prior
CSB-113	159	144	revised
CSB-114	178	168	prior
CSB-114	160	148	revised
CSB-118	178	171	prior
CSB-118	154	137	revised
CSB-120	178	159	prior
CSB-120	157	145	revised
CSB-121	188	163	prior
CSB-121	161	151	revised
CSB-122	181	165	prior
CSB-122	150	129	revised
CSB-123	188	182	prior
CSB-123	158	139	revised
CSB-60	181	179	prior
CSB-60	162	149	revised
CSB-61	175	173	prior
CSB-61	155	146	revised
CSB-62	179	169	prior
CSB-62	146	140	revised
CSB-63	180	178	prior
CSB-63	157	142	revised
CSB-64	178	176	prior
CSB-64	156	140	revised
CSB-65	165	162	prior
CSB-65	160	131	revised
CSB-66A	1.0E+20	1.0E+20	prior
CSB-66A	162	143	revised

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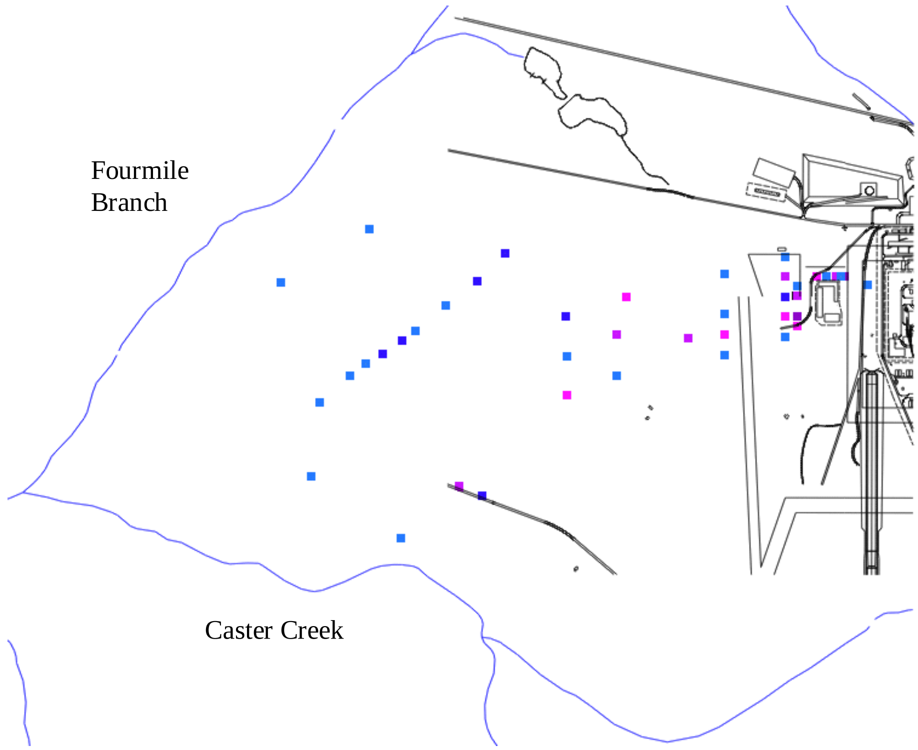


Figure G-1. Plan view of CPT tritium concentration data ≥ 400 pCi/ml.

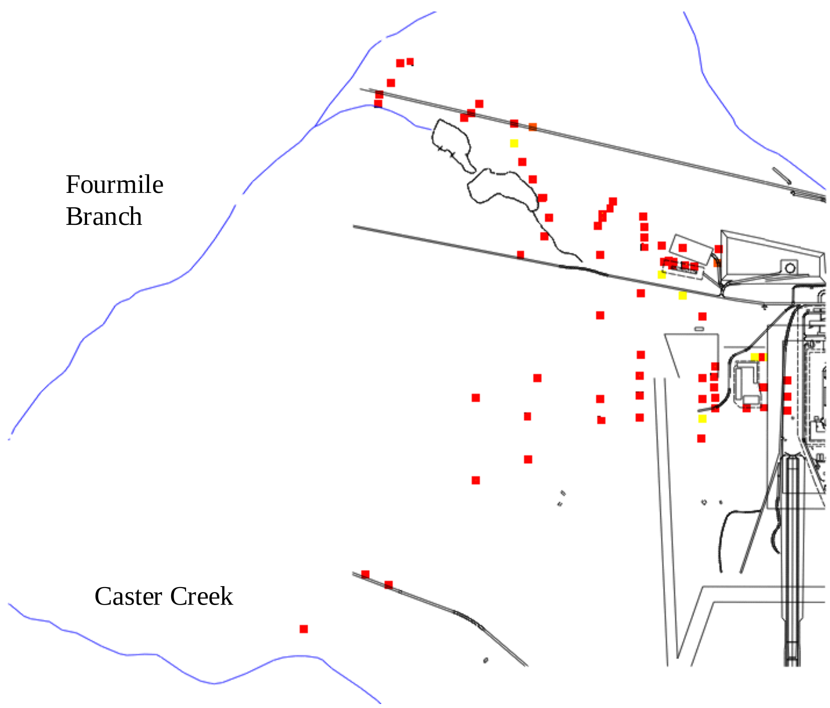


Figure G-2. Plan view of CPT TCE concentration data ≥ 5.2 ppb.

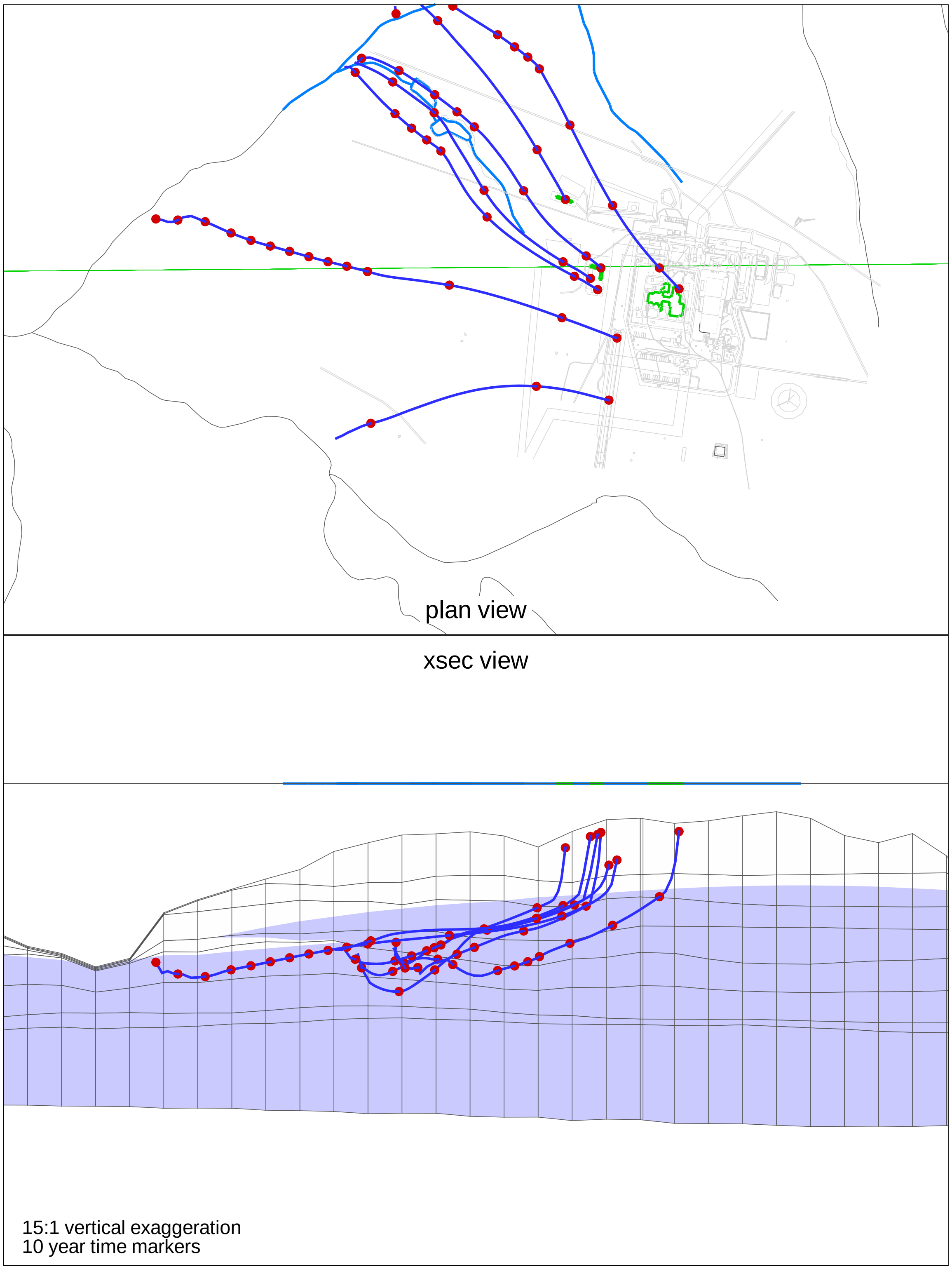


Figure G-3. Predicted groundwater flow paths *before* revising "tan clay" model layer in C-area near Caster Creek.

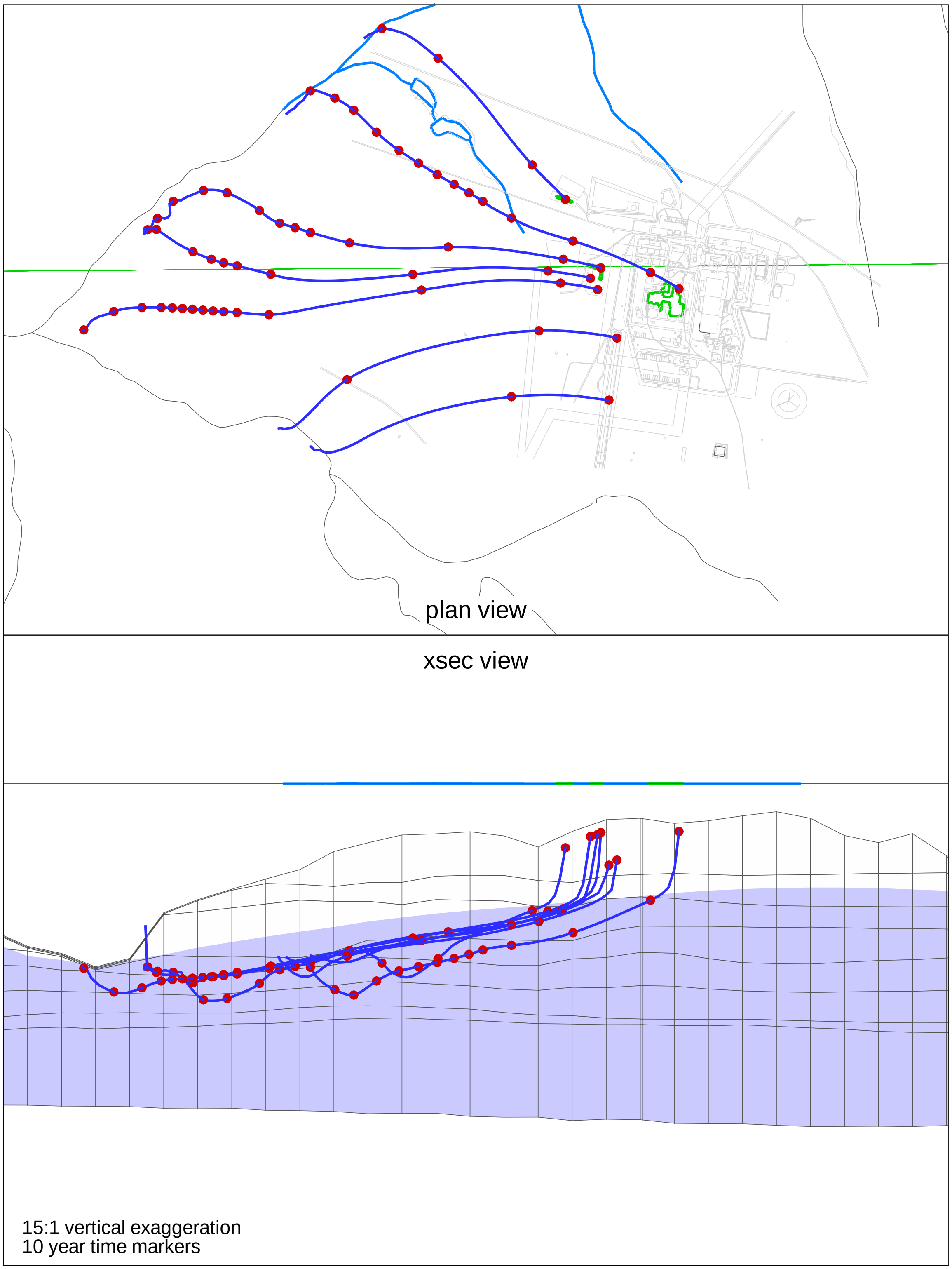


Figure G-4. Predicted groundwater flow paths *after* revising "tan clay" model layer in C-area near Caster Creek.

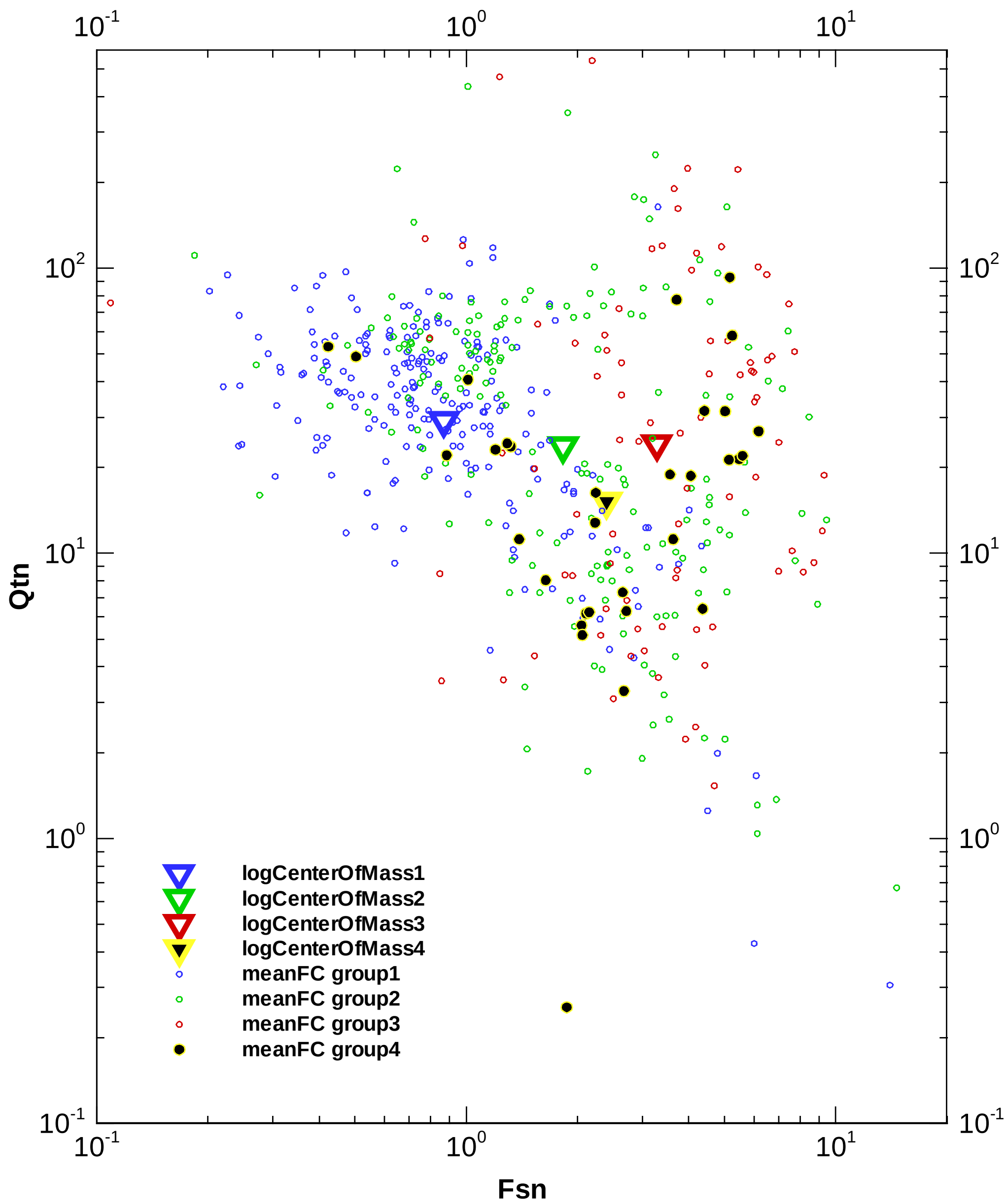


Figure G-5. Normalized tip resistance and friction ratio CPTu data, color-coded by %fines content (group 1 / blue = 0 to 15%; group 2/green = 15 to 30%; group 3 / red = 30 to 50%; group 4 / yellow & black = 50 to 100%).

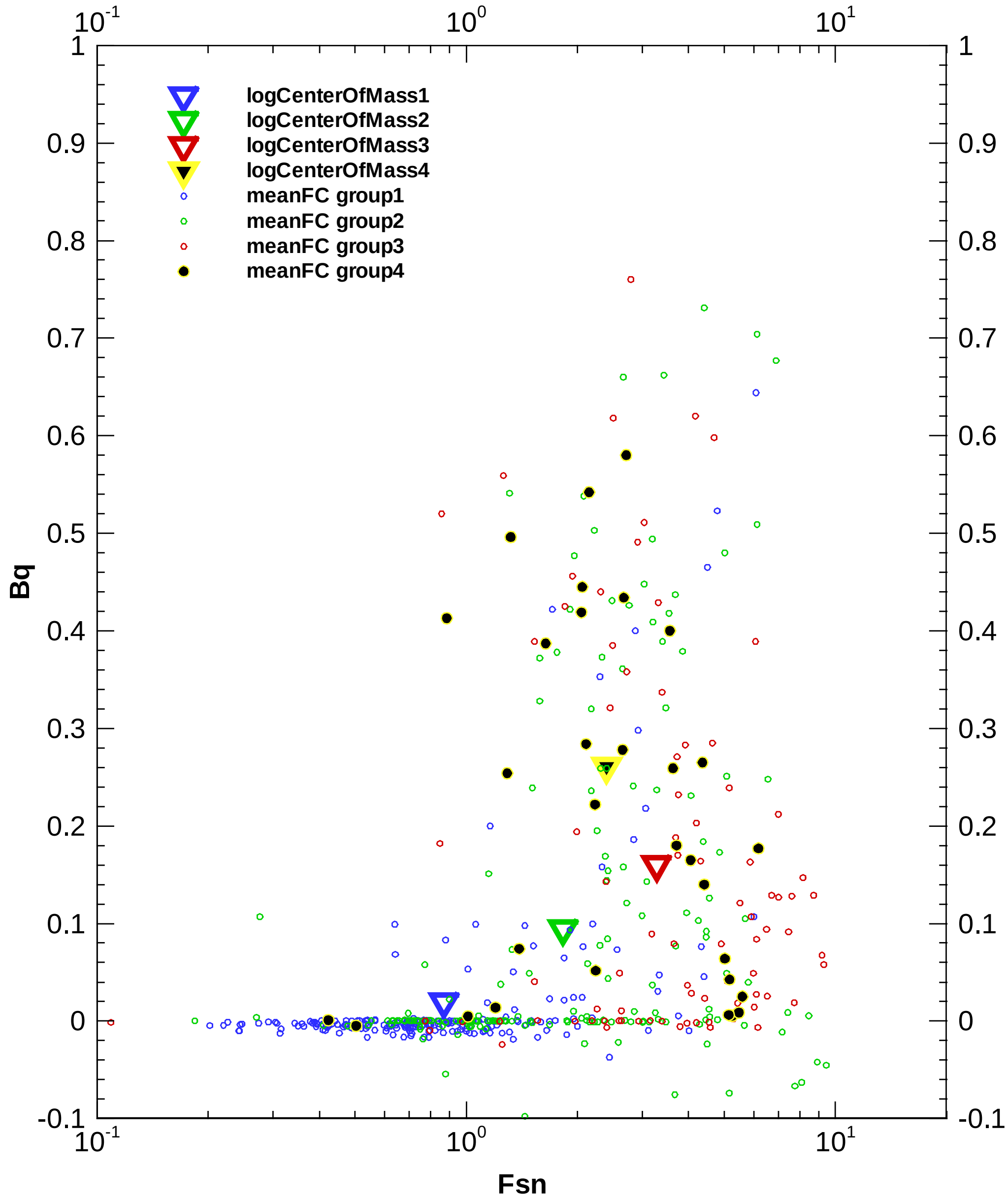


Figure G-6. Normalized pore pressure and friction ratio CPTu data, color-coded by %fines content (group 1 / blue = 0 to 15%; group 2/green = 15 to 30%; group 3 / red = 30 to 50%; group 4 / yellow & black = 50 to 100%).

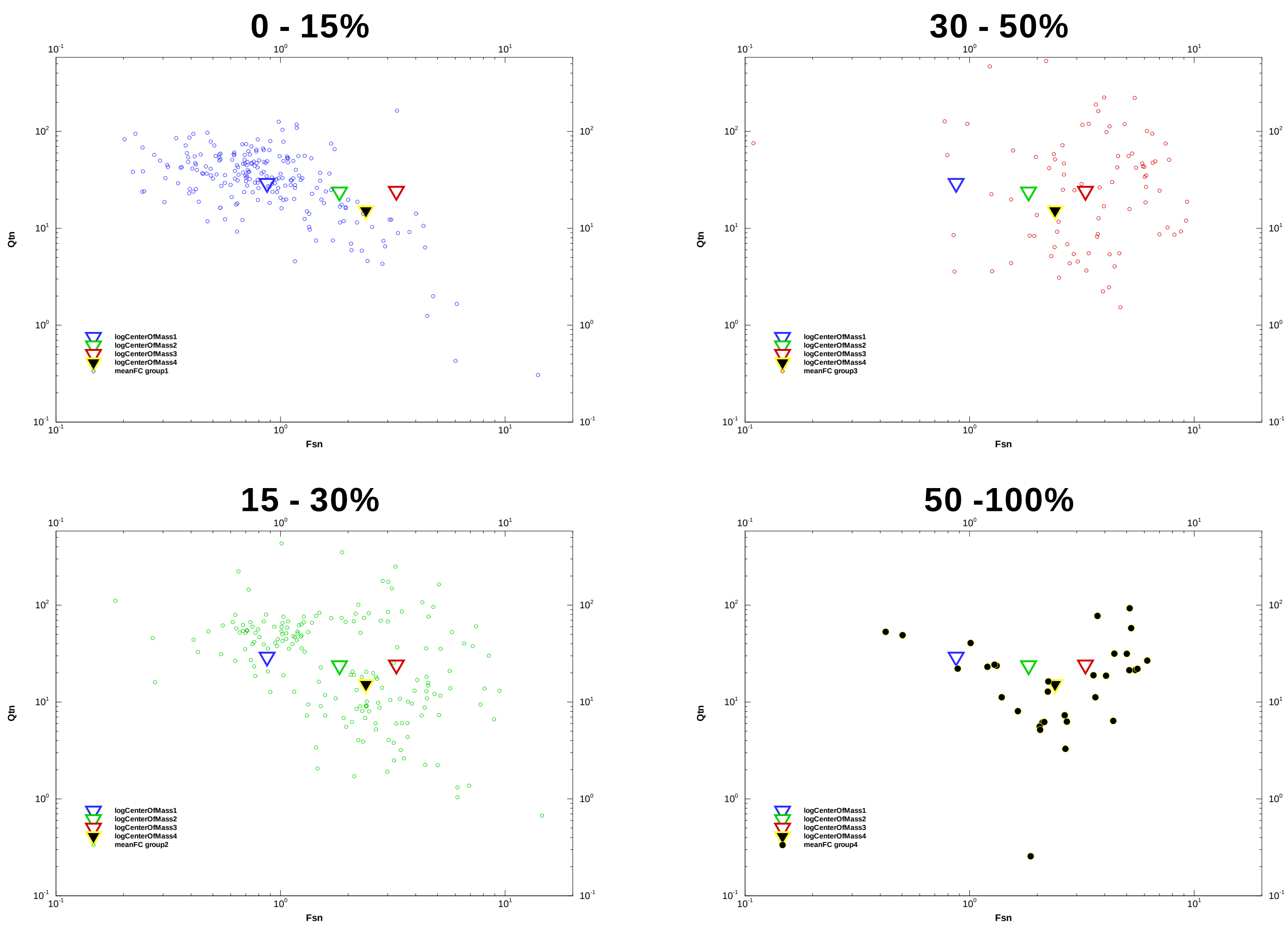


Figure G-7. Normalized tip resistance and friction ratio CPTu data, color-coded and plotted separately by %fines content.

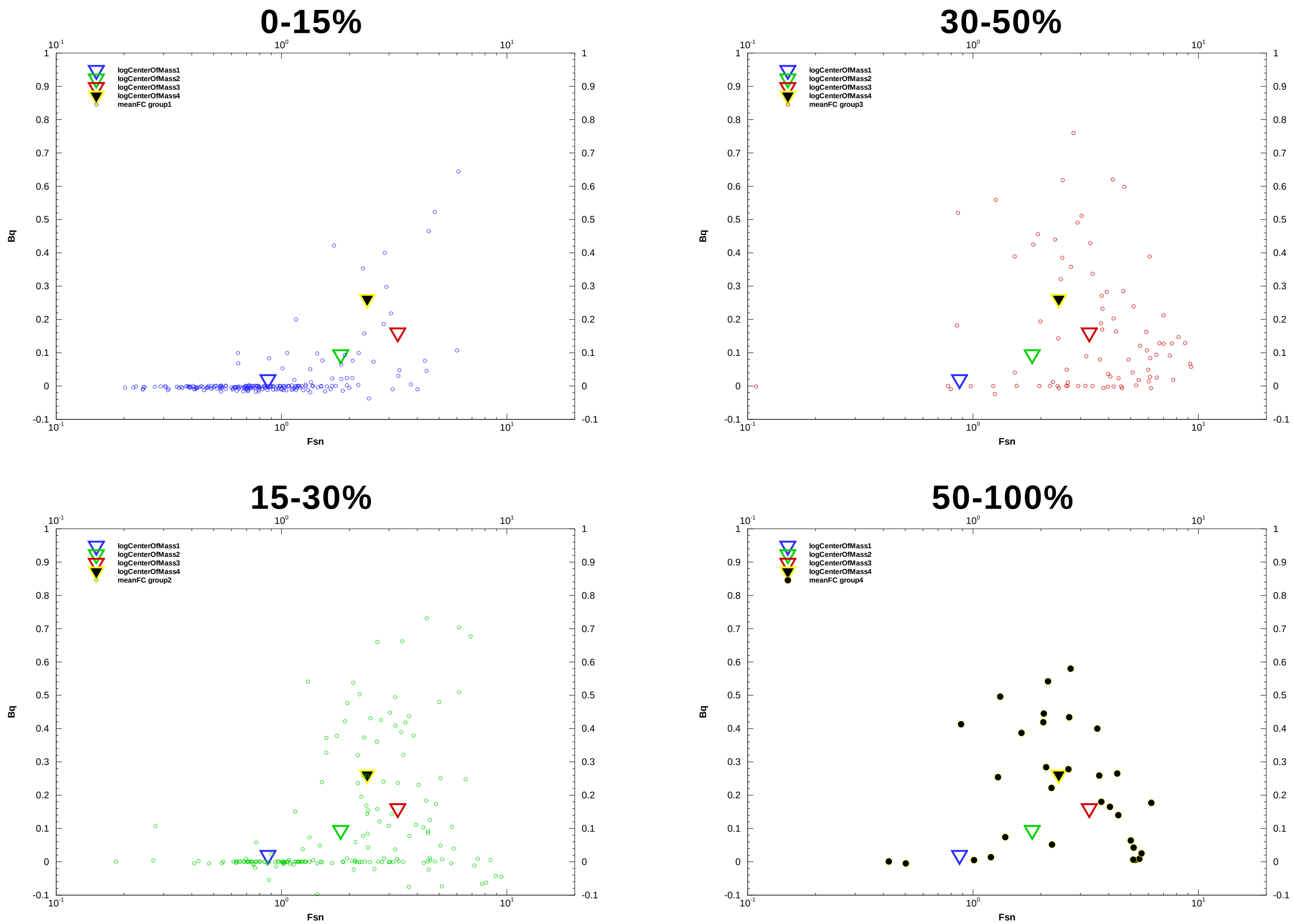


Figure G-8. Normalized pore pressure and friction ratio CPTu data, color-coded and plotted separately by %fines content.

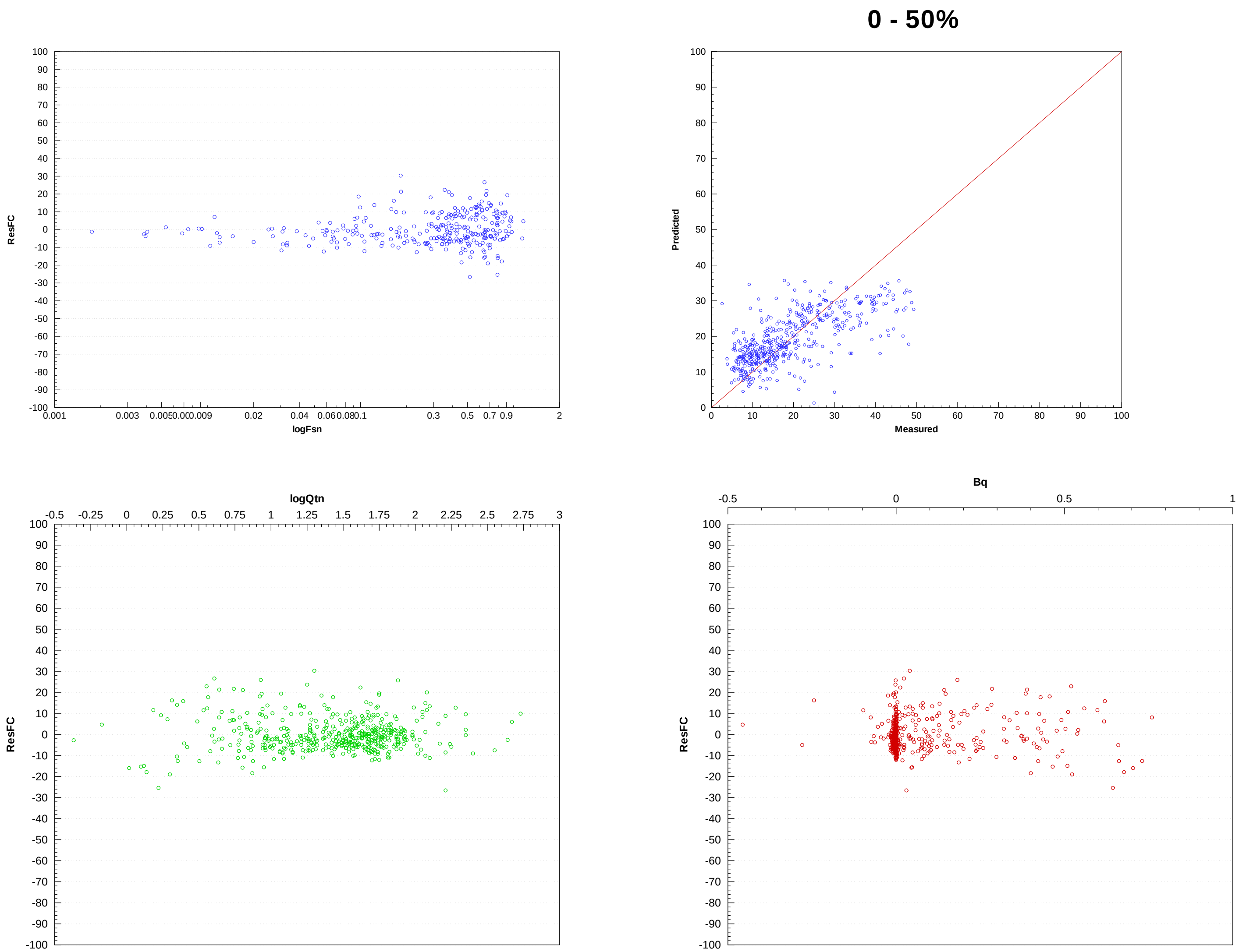


Figure G-9 Variation in residuals with respect to each CPTu parameter and predicted versus measured %FC; 0-50%

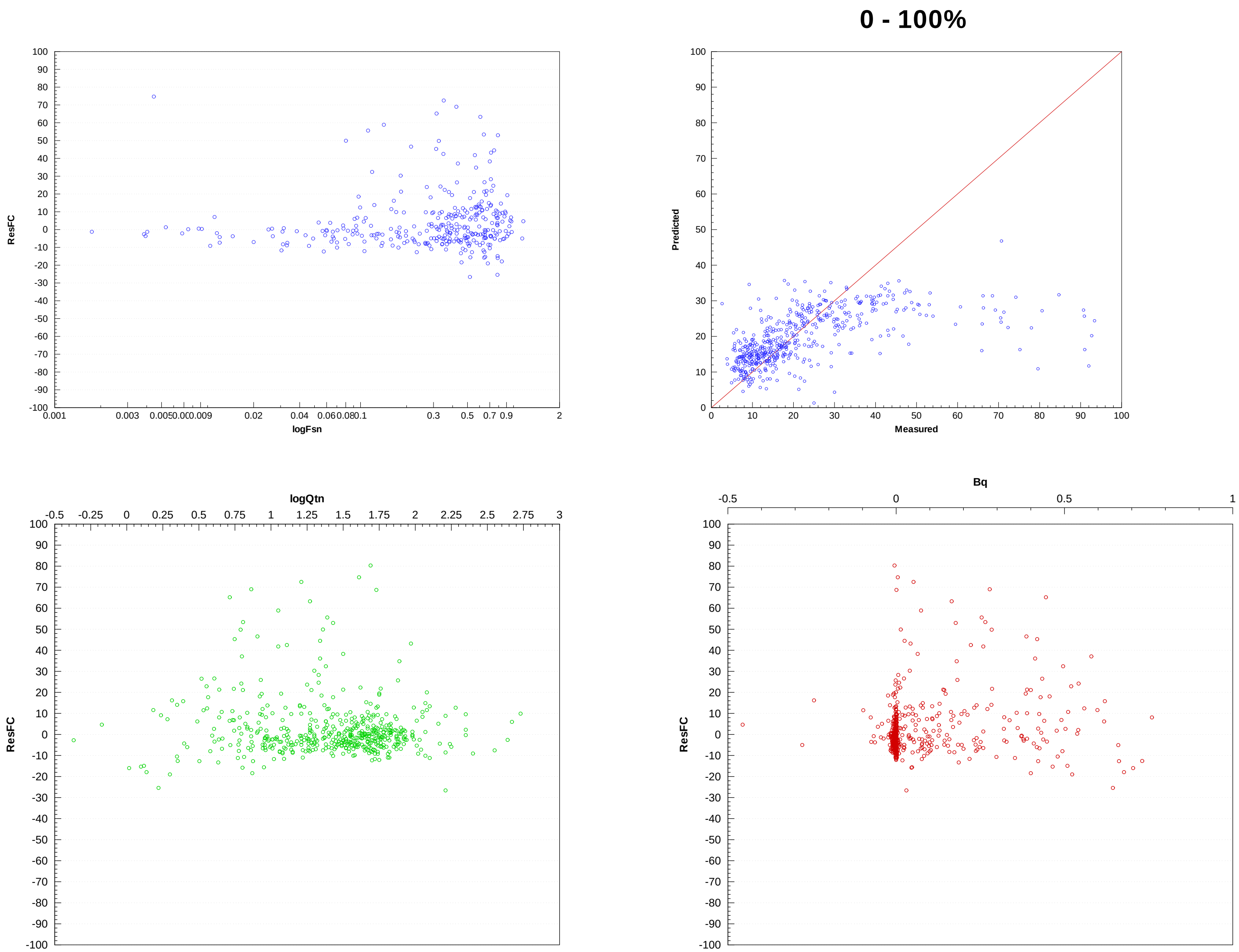


Figure G-10 Variation in residuals with respect to each CPTu parameter and predicted versus measured %FC; 0-100%

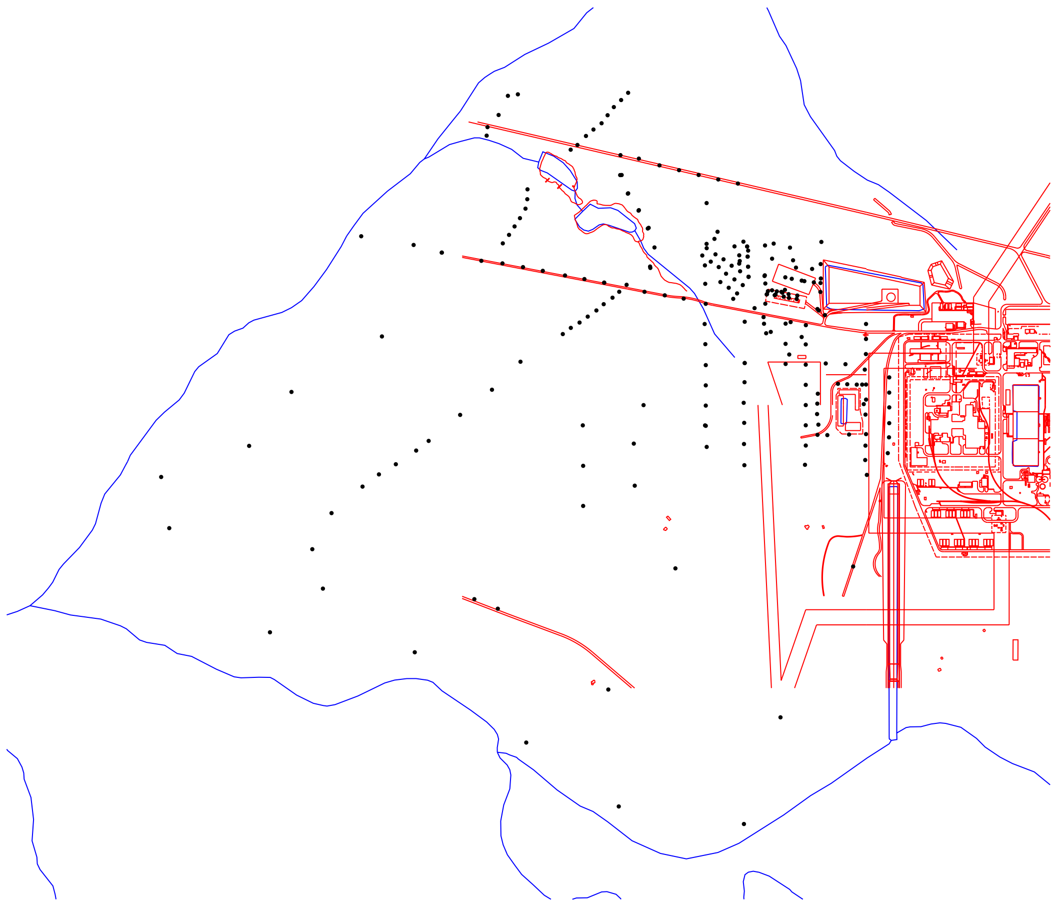
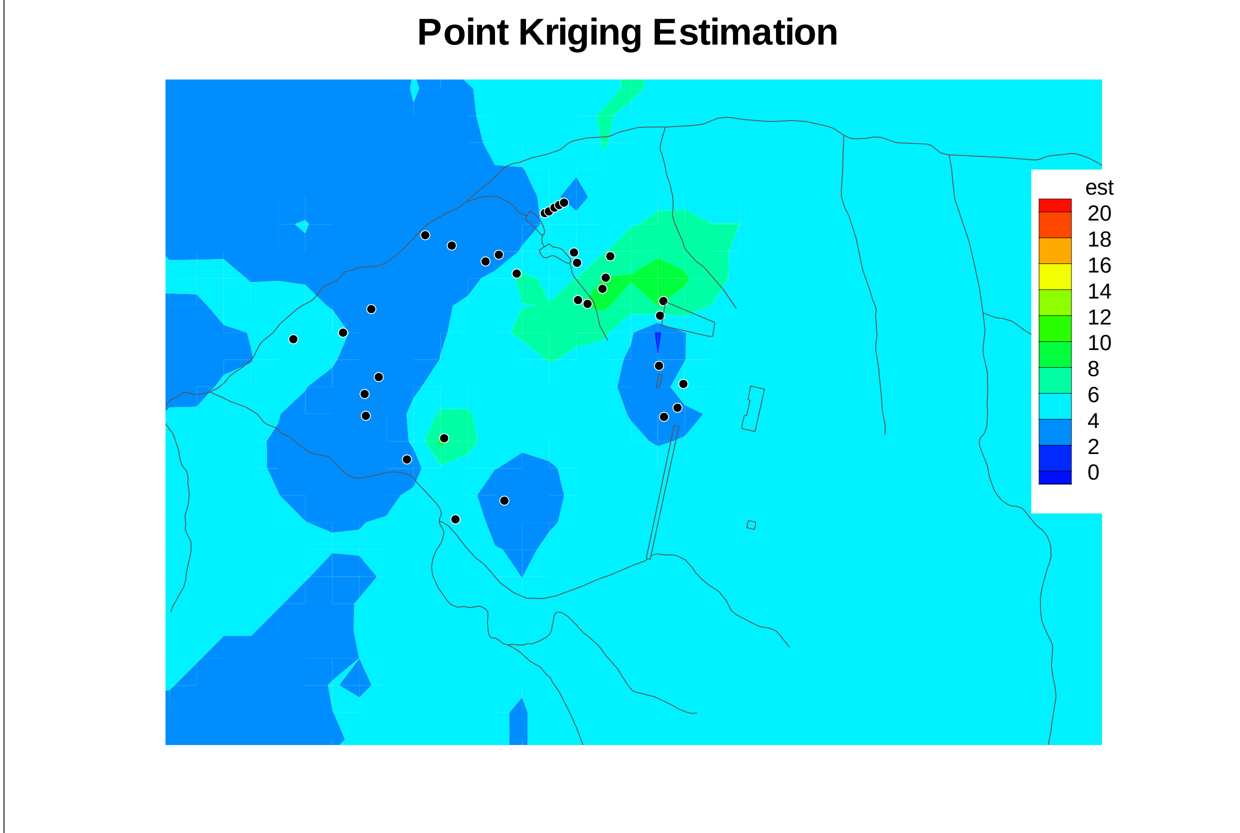


Figure G-11. Locations of C-area CPTu lithologic pushes.



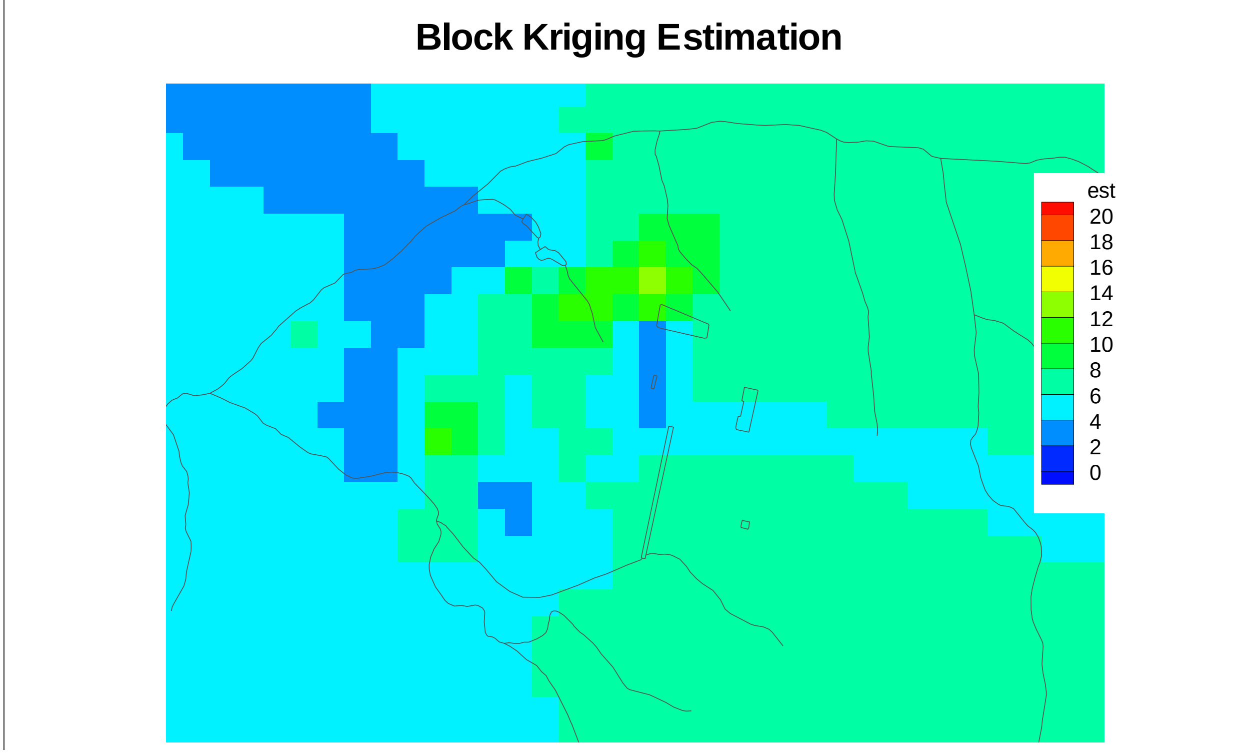
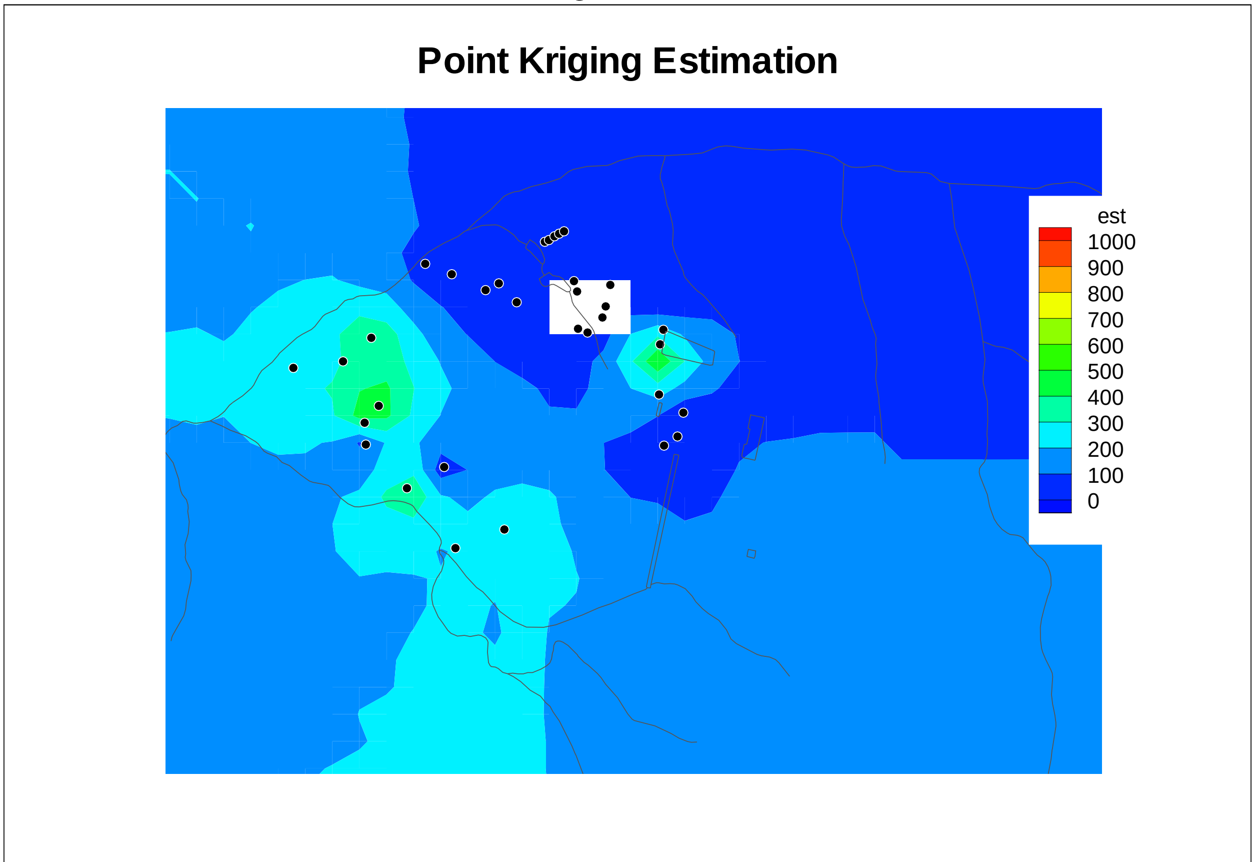


Figure G-12. Kriging estimates for Kh in model layer 1 (~GAU); before TCCZ mods.



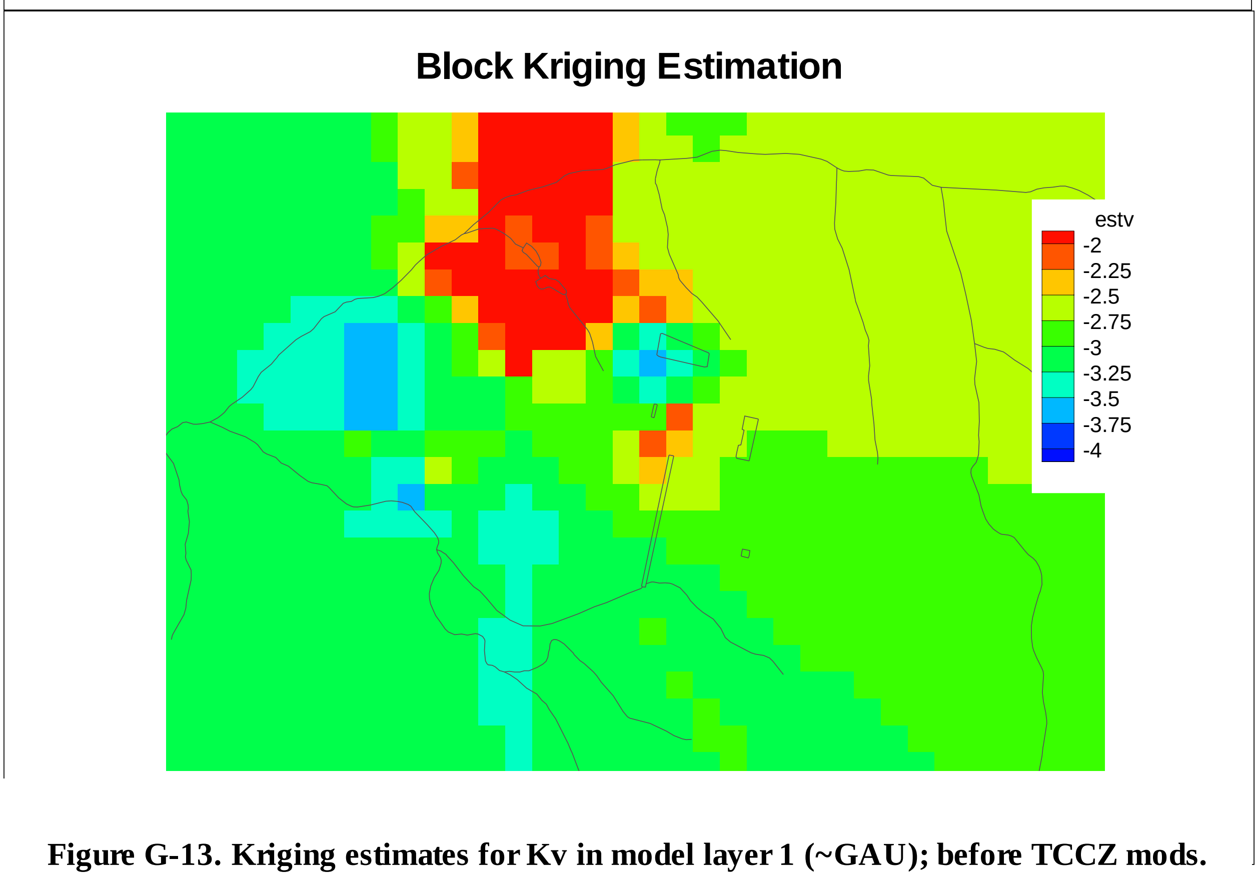
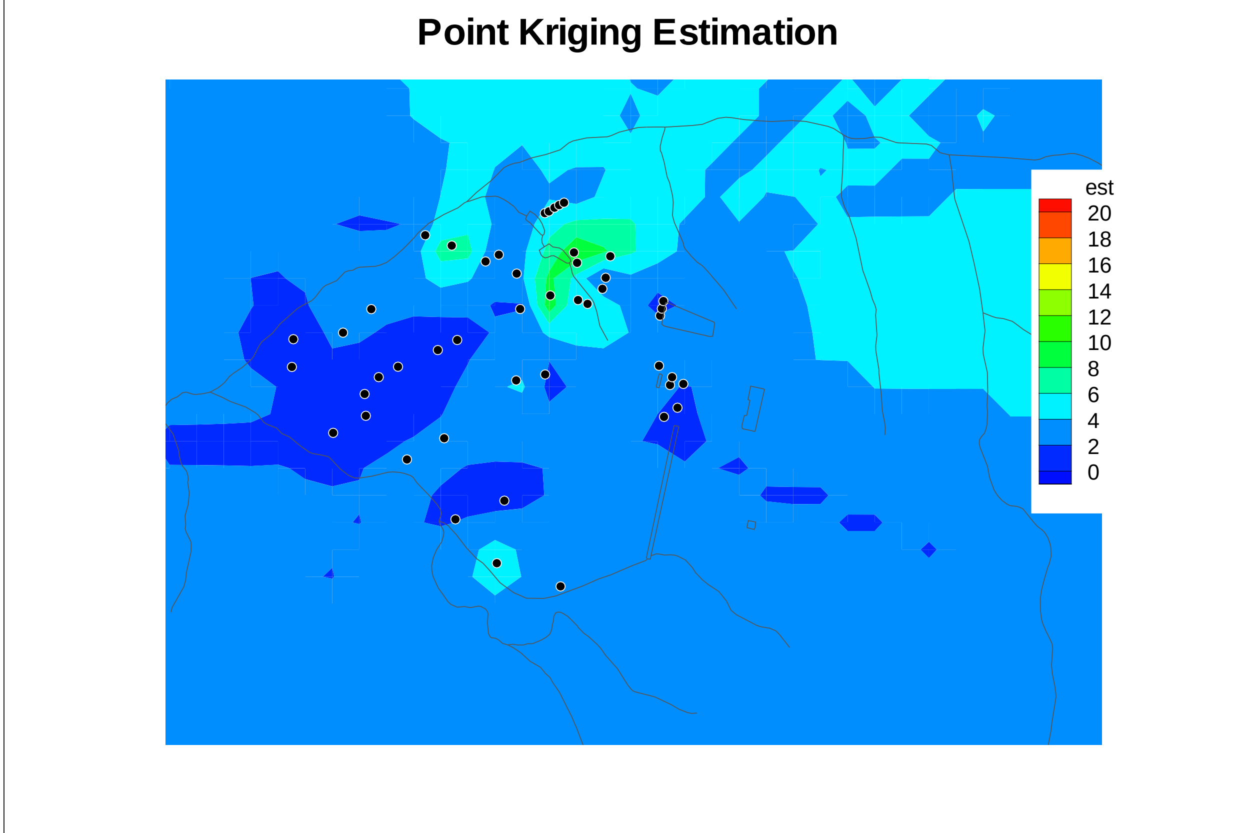


Figure G-13. Kriging estimates for Kv in model layer 1 (~GAU); before TCCZ mods.



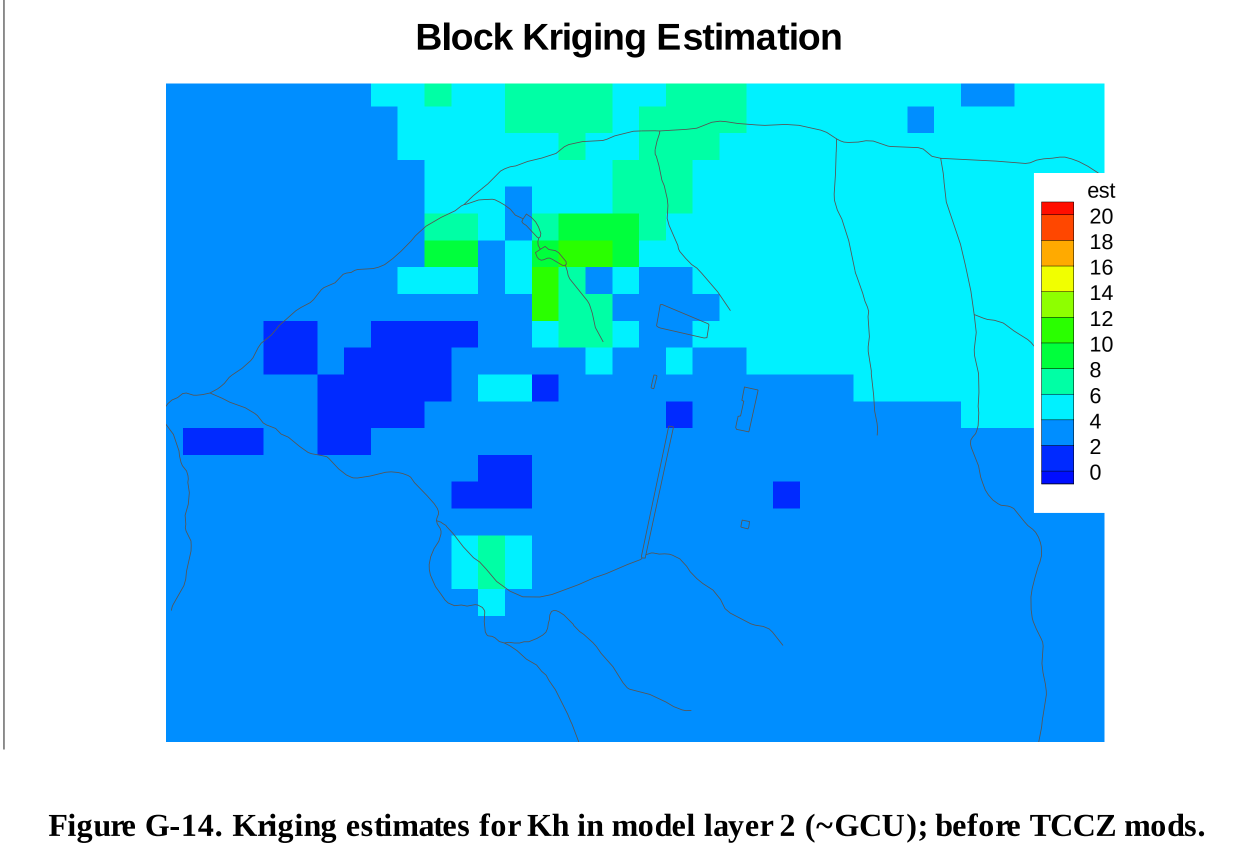


Figure G-14. Kriging estimates for Kh in model layer 2 (~GCU); before TCCZ mods.

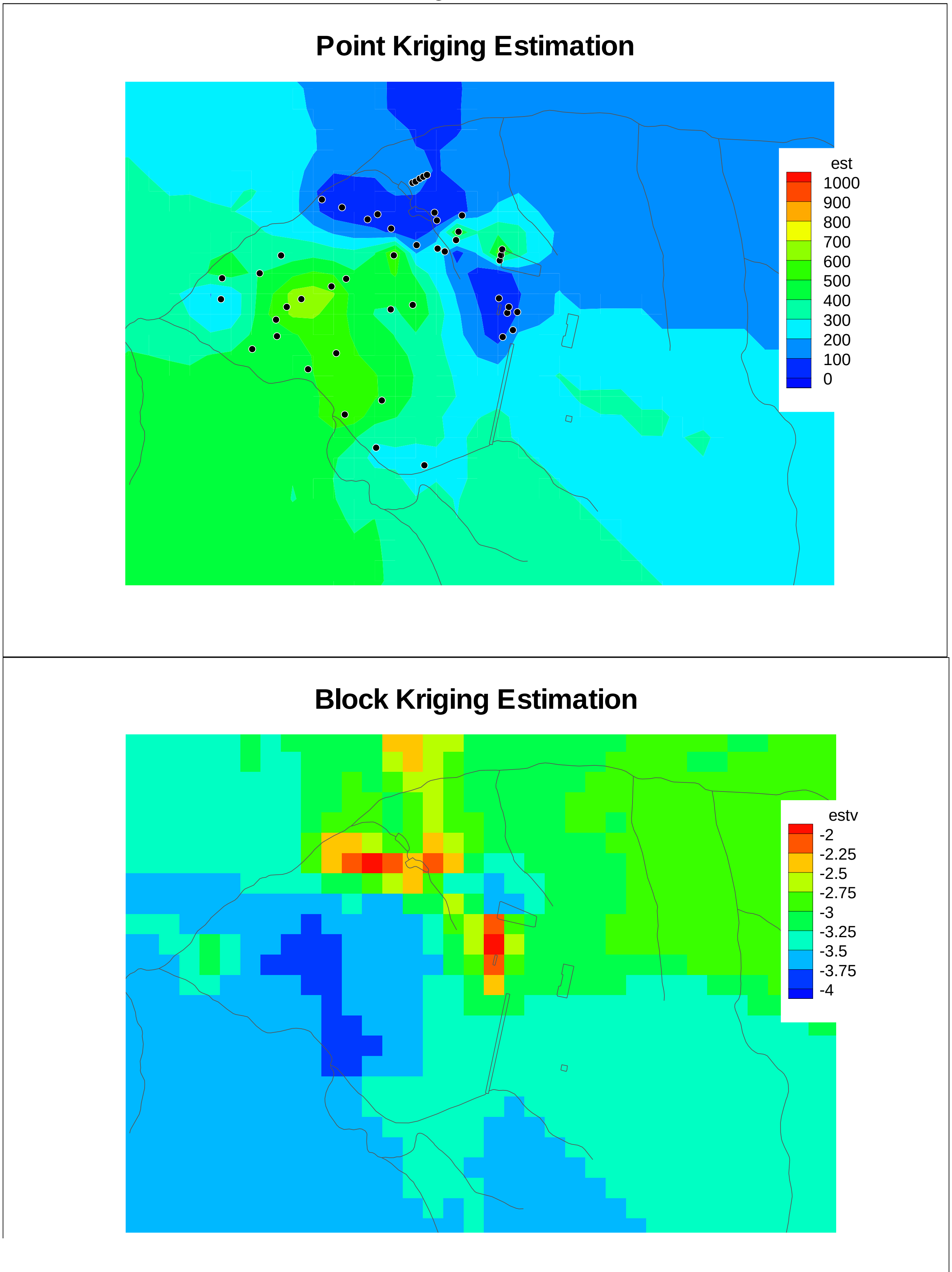
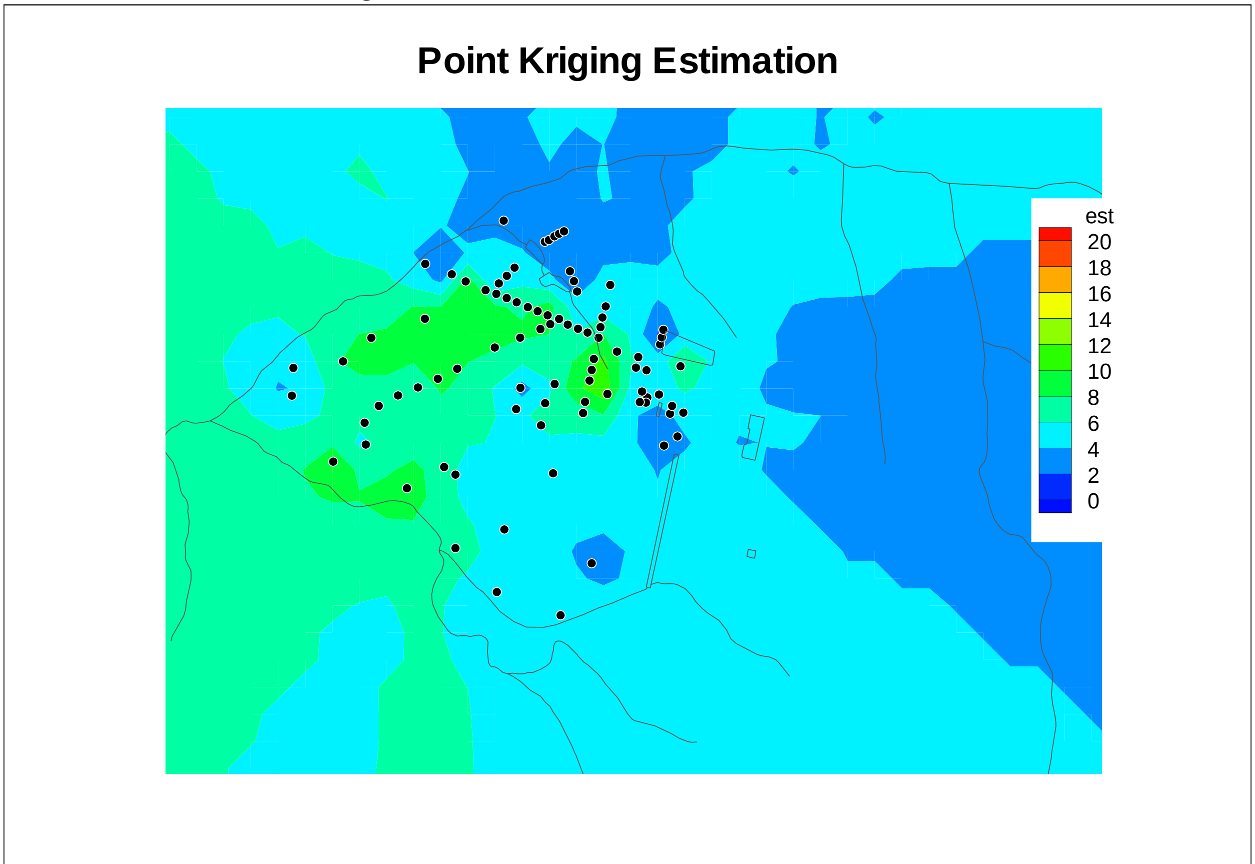


Figure G-15. Kriging estimates for Kv in model layer 2 (~GCU); before TCCZ mods.



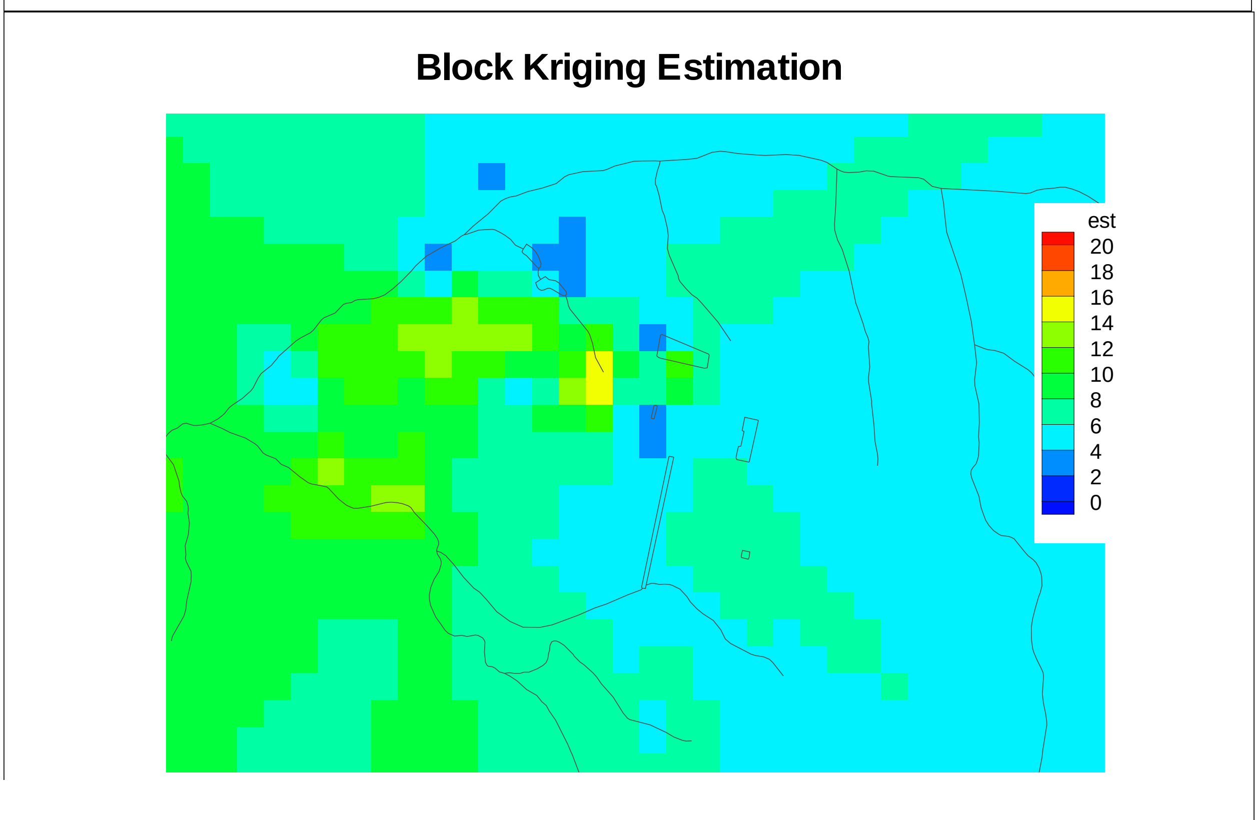
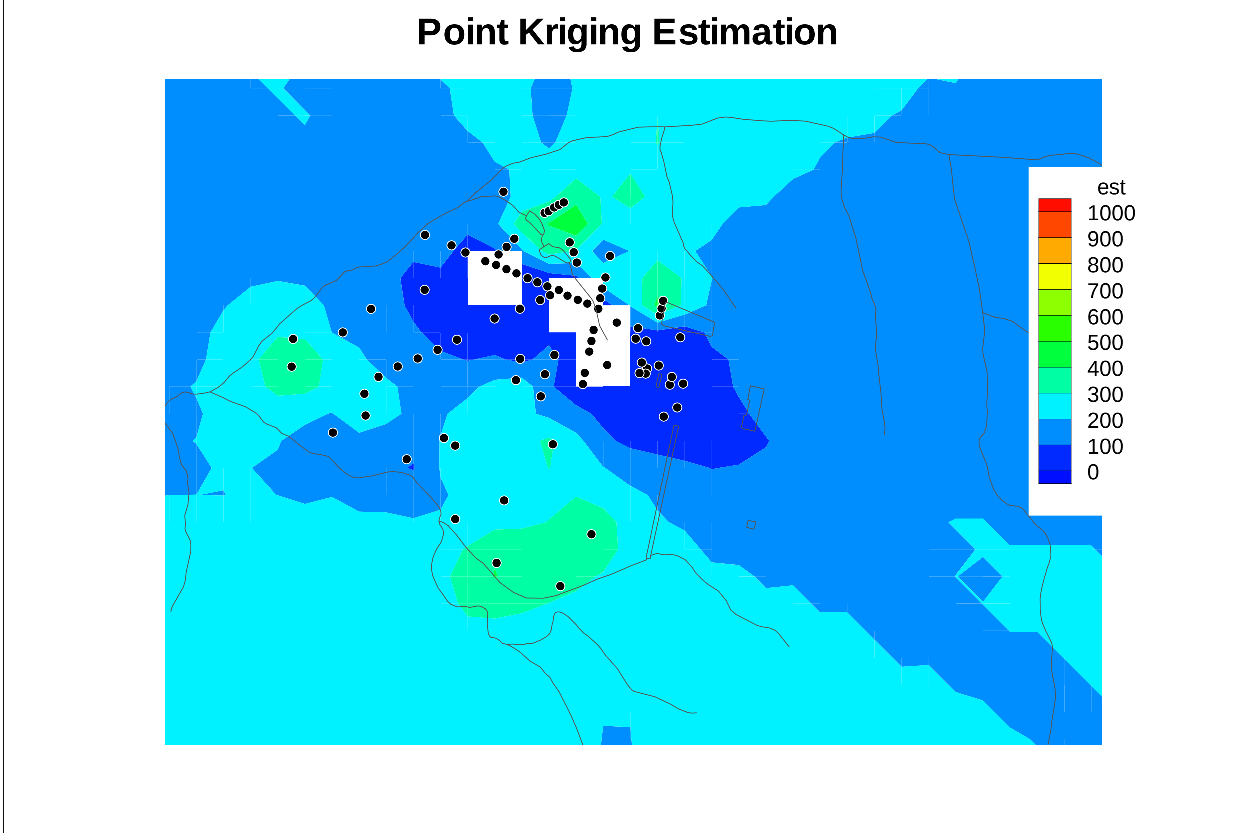


Figure G-16. Kriging estimates for Kh in model layer 3 (~lLAZ); before TCCZ mods.



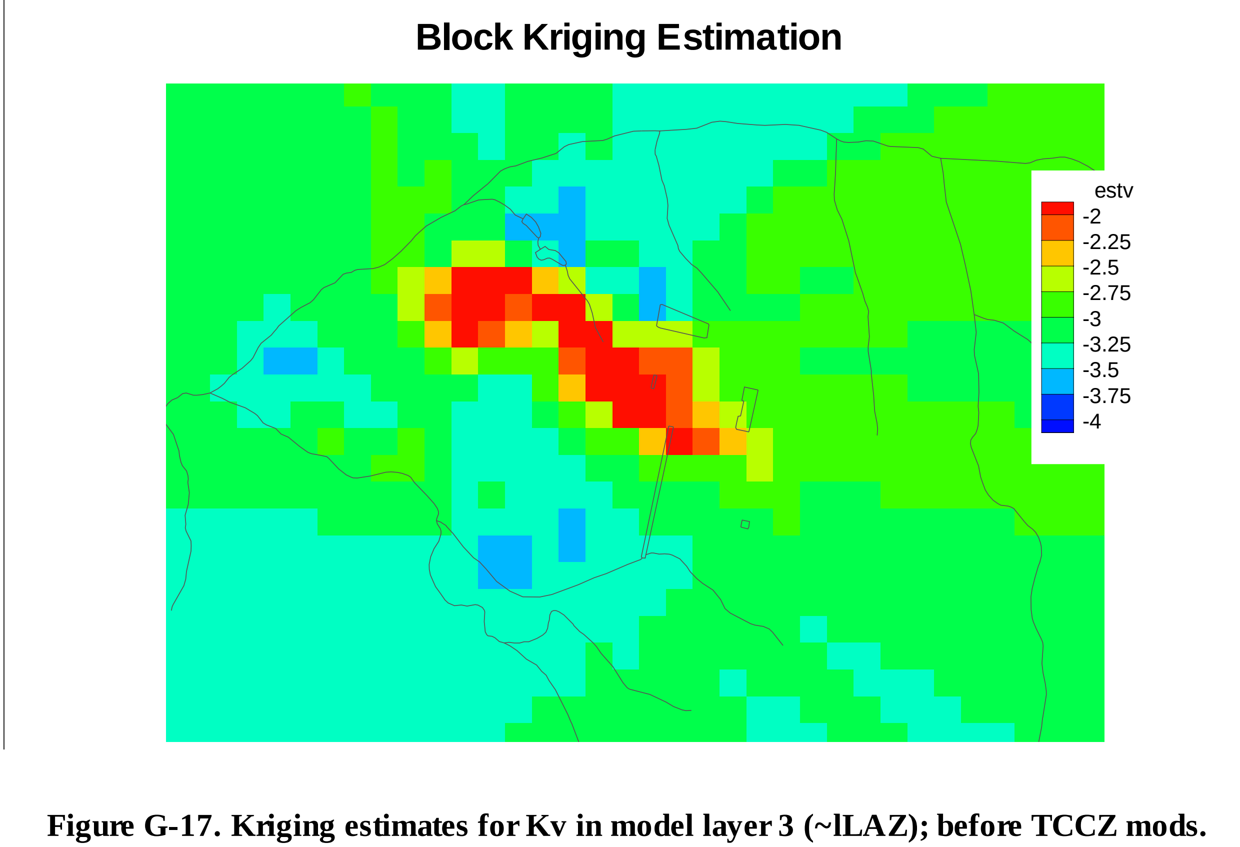
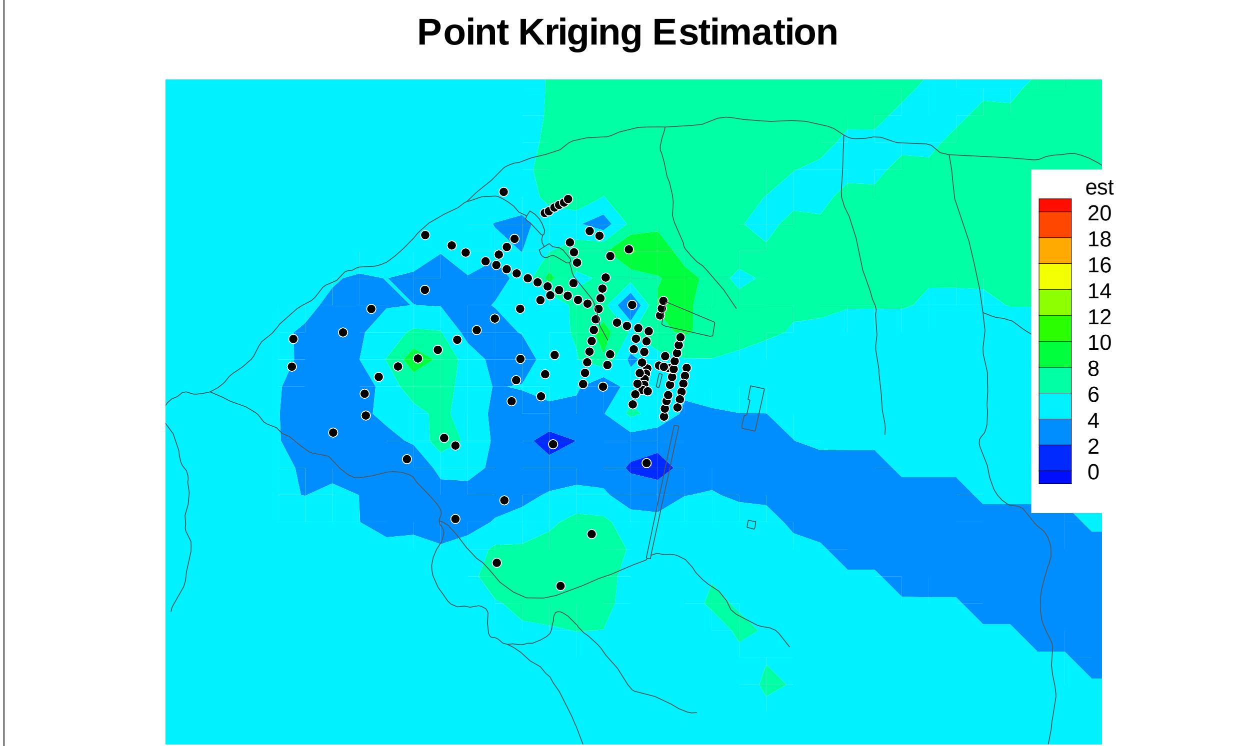


Figure G-17. Kriging estimates for Kv in model layer 3 (~lLAZ); before TCCZ mods.



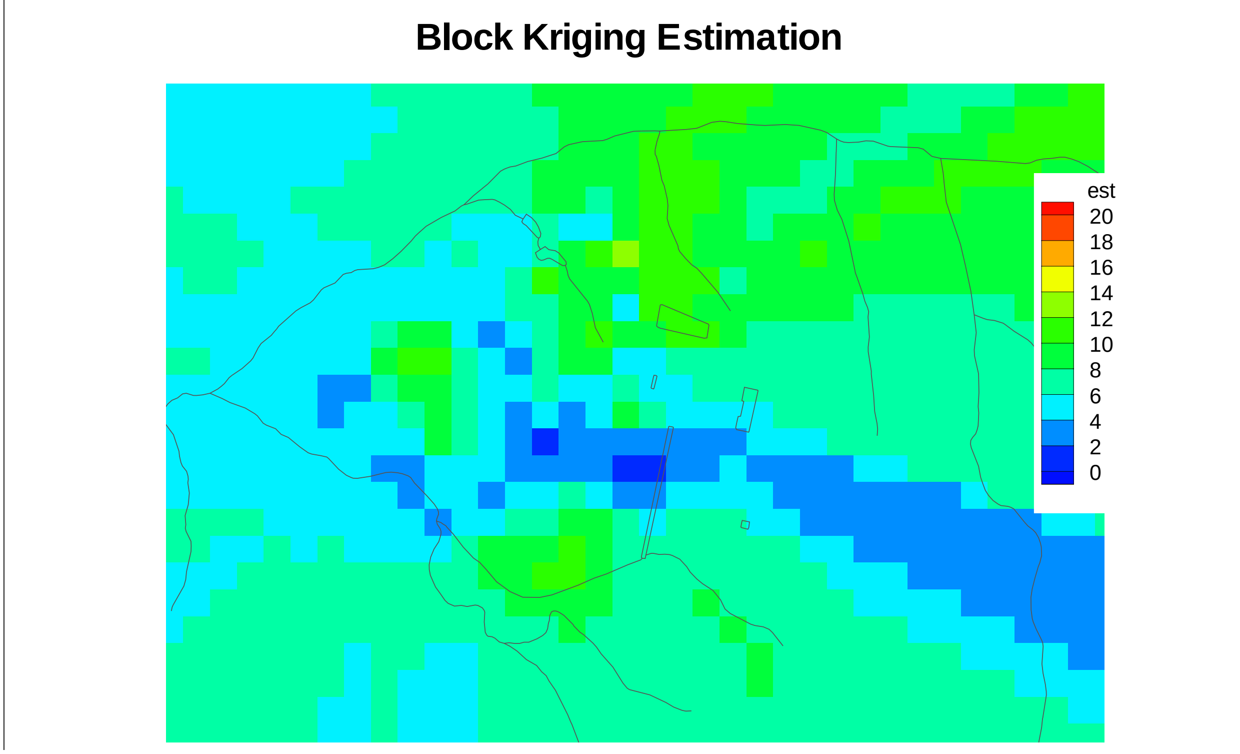
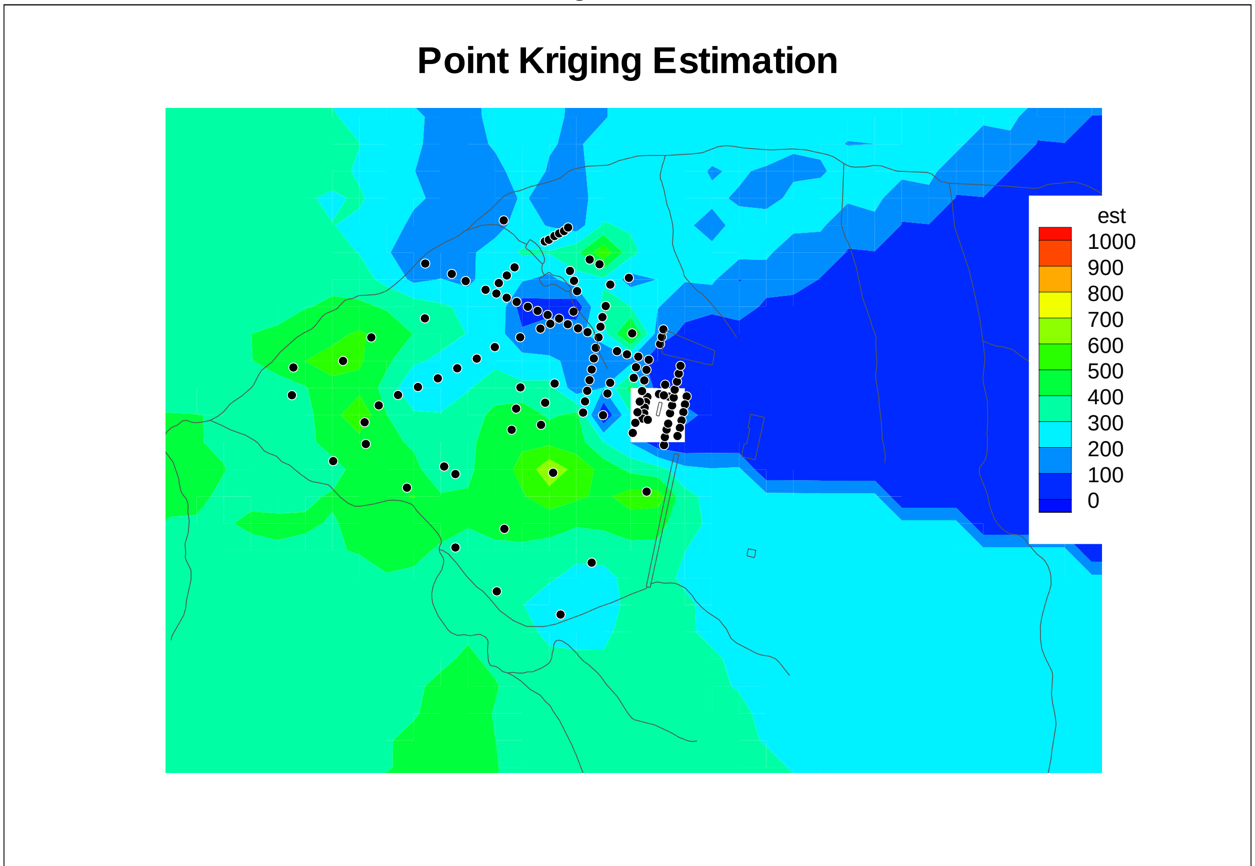


Figure G-18. Kriging estimates for Kh in model layer 4 (~uLAZ); before TCCZ mods.



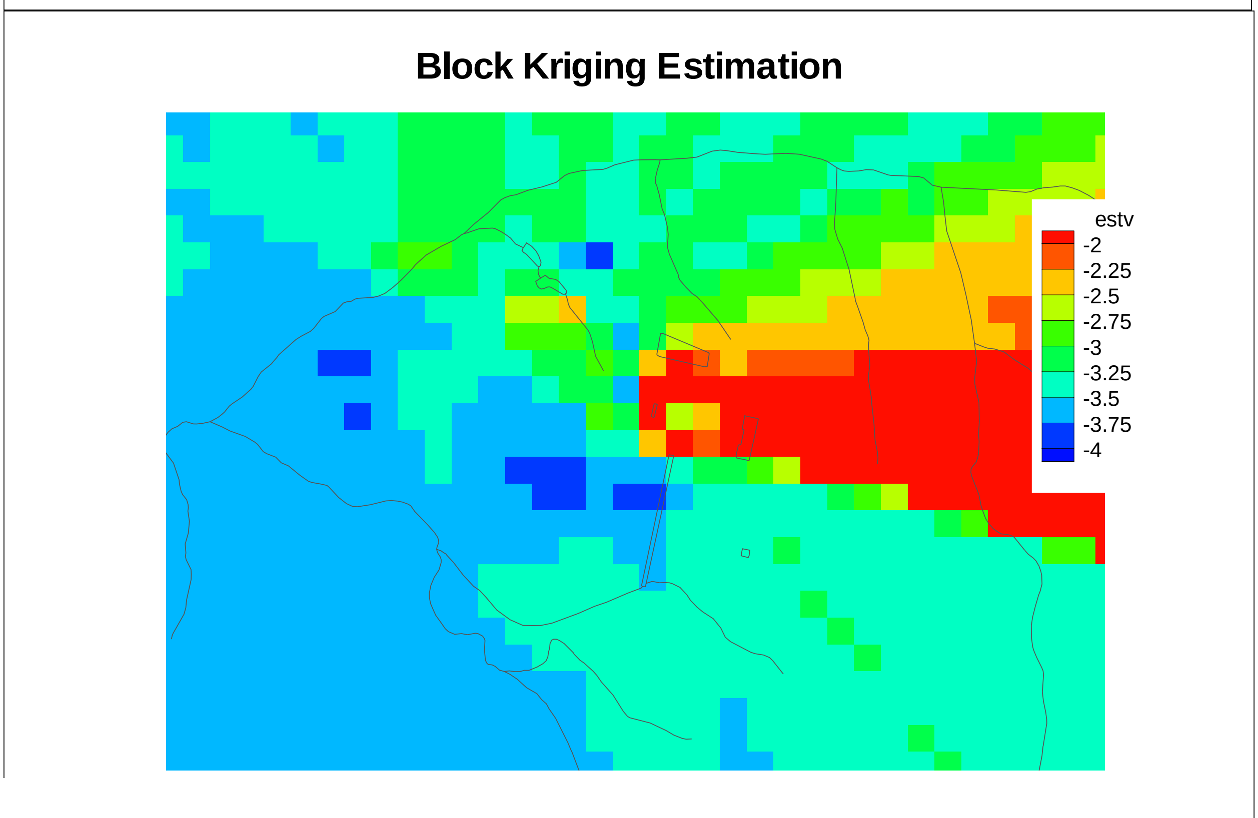
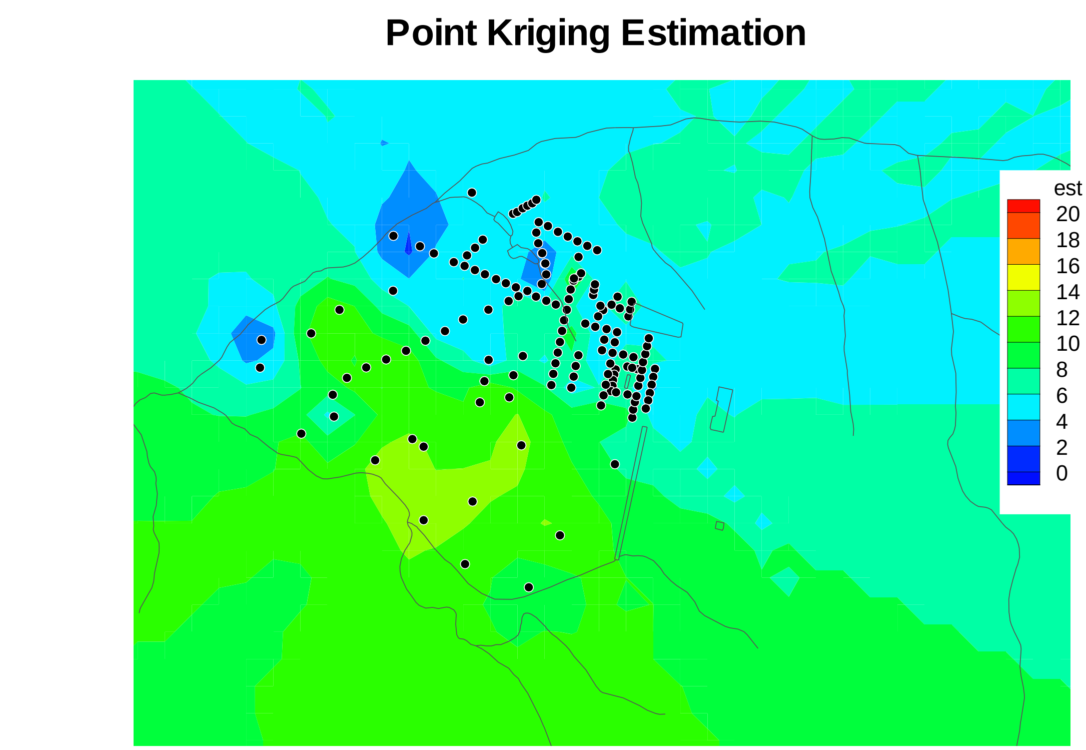


Figure G-19. Kriging estimates for Kv in model layer 4 (~uLAZ); before TCCZ mods.



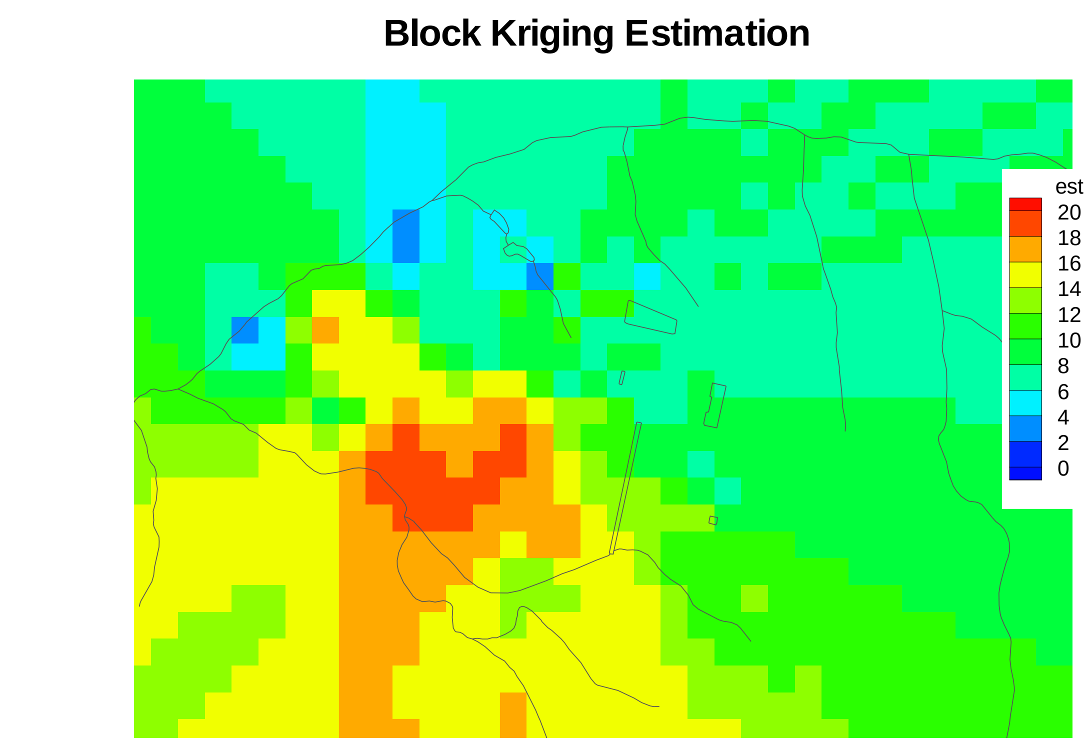
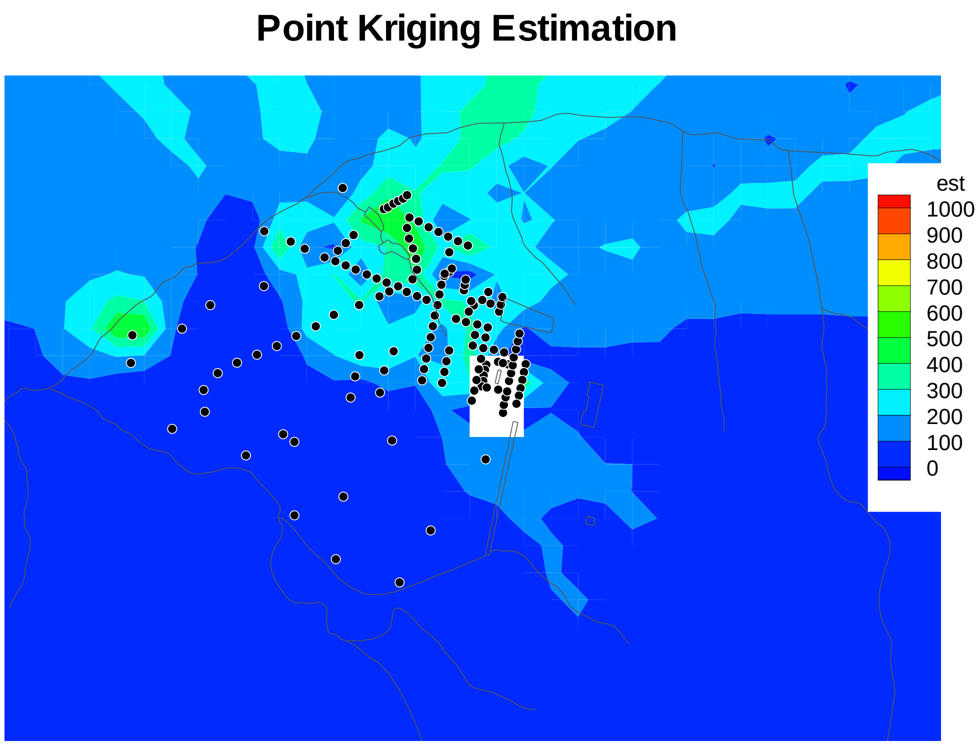


Figure G-20. Kriging estimates for Kh in model layer 5 (~TCCZ); before TCCZ mods.



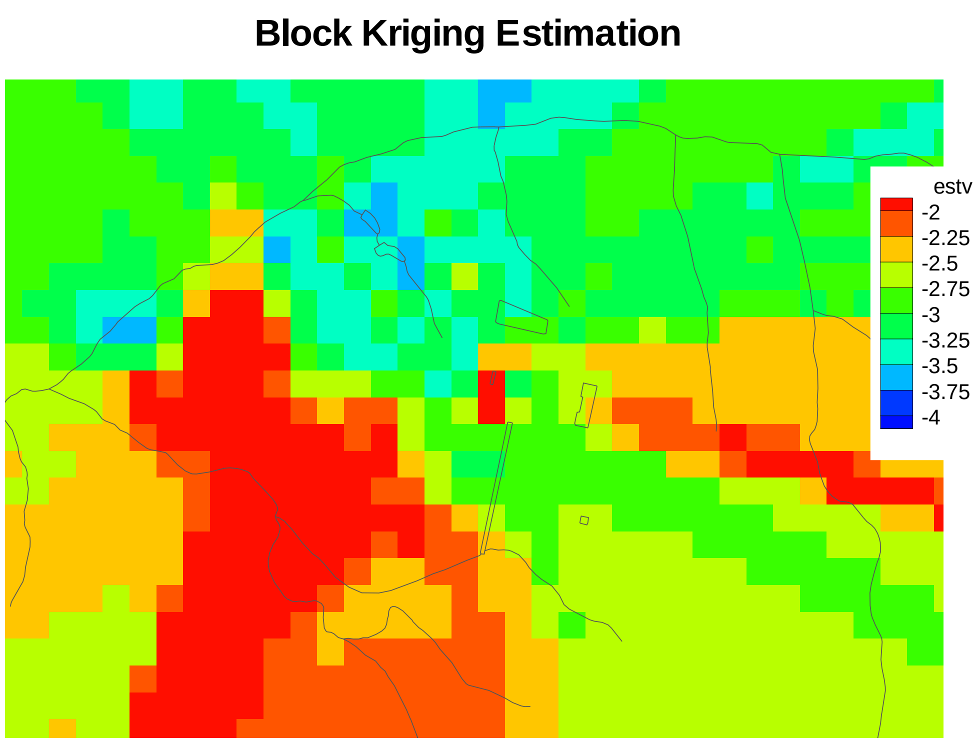
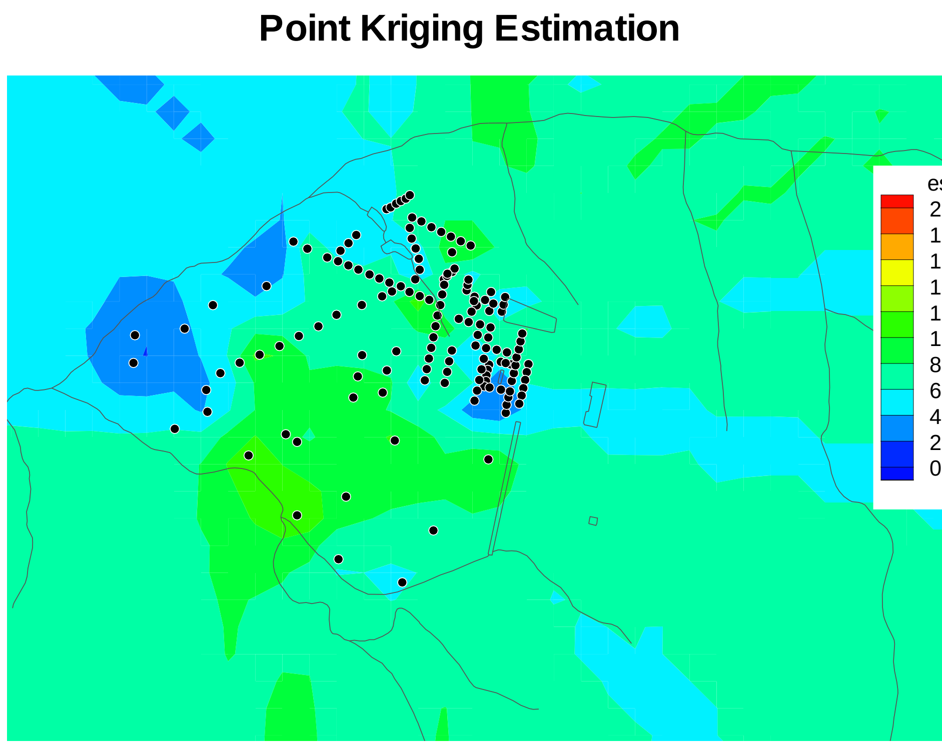


Figure G-21. Kriging estimates for Kv in model layer 5 (~TCCZ); before TCCZ mods.



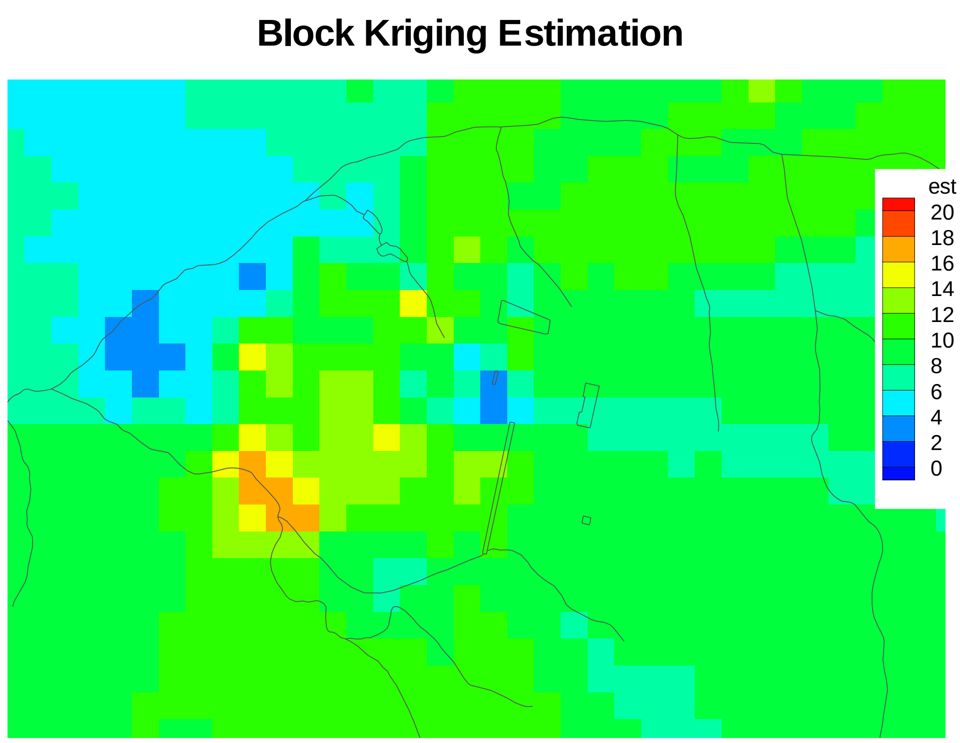


Figure G-22. Kriging estimates for Kh in model layer 6 (~TZ); before TCCZ mods.

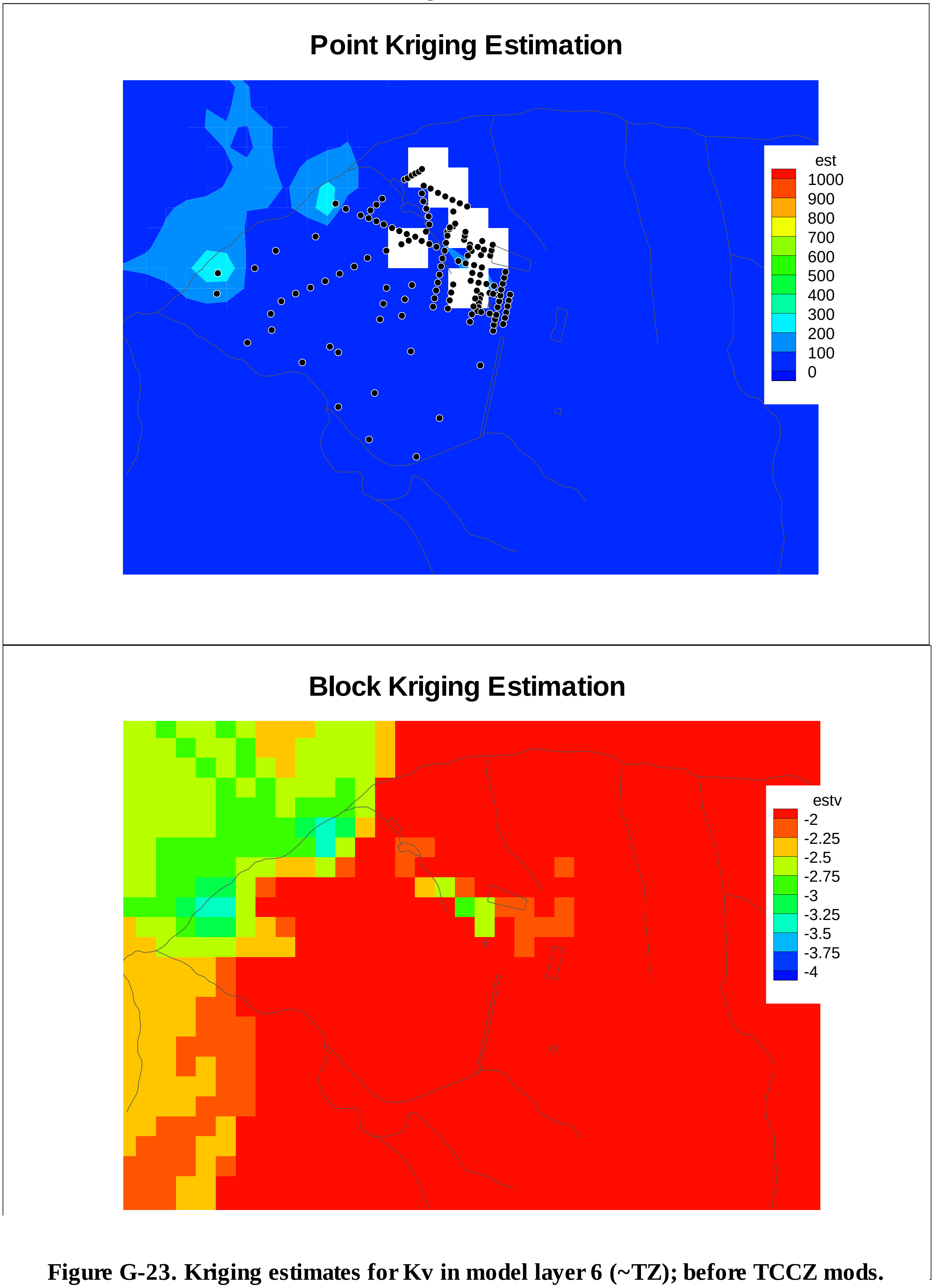
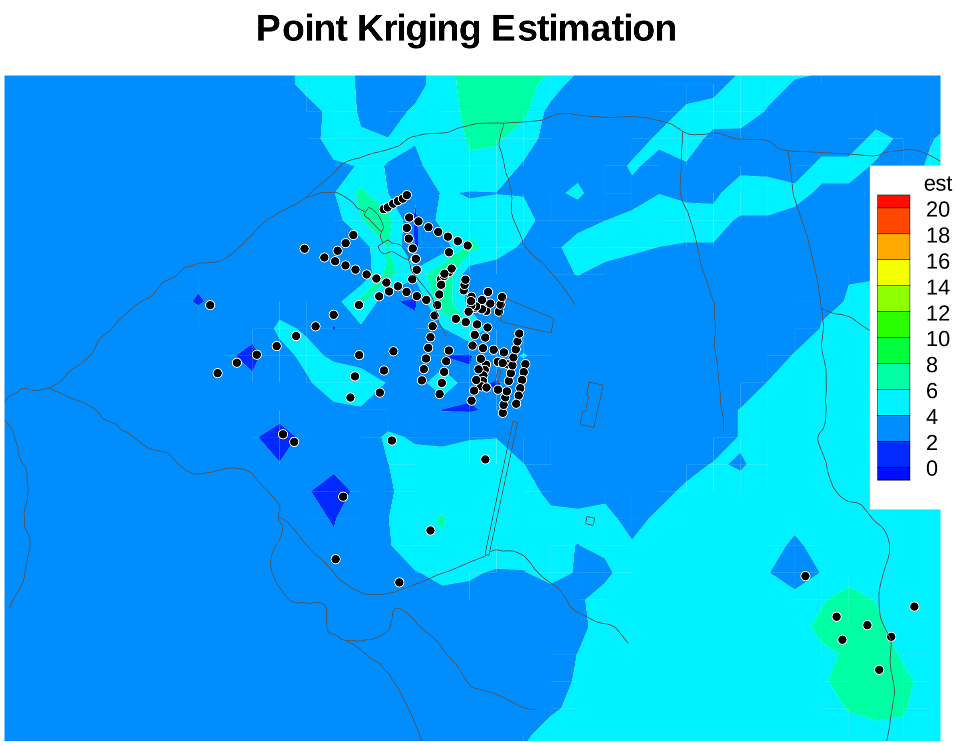


Figure G-23. Kriging estimates for Kv in model layer 6 (~TZ); before TCCZ mods.



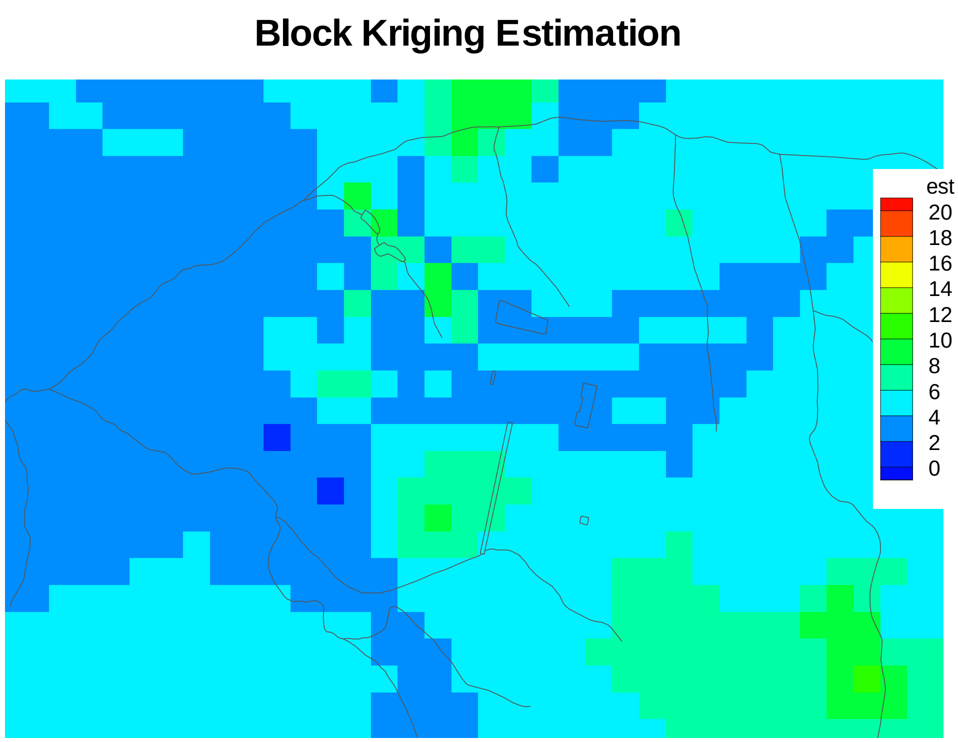
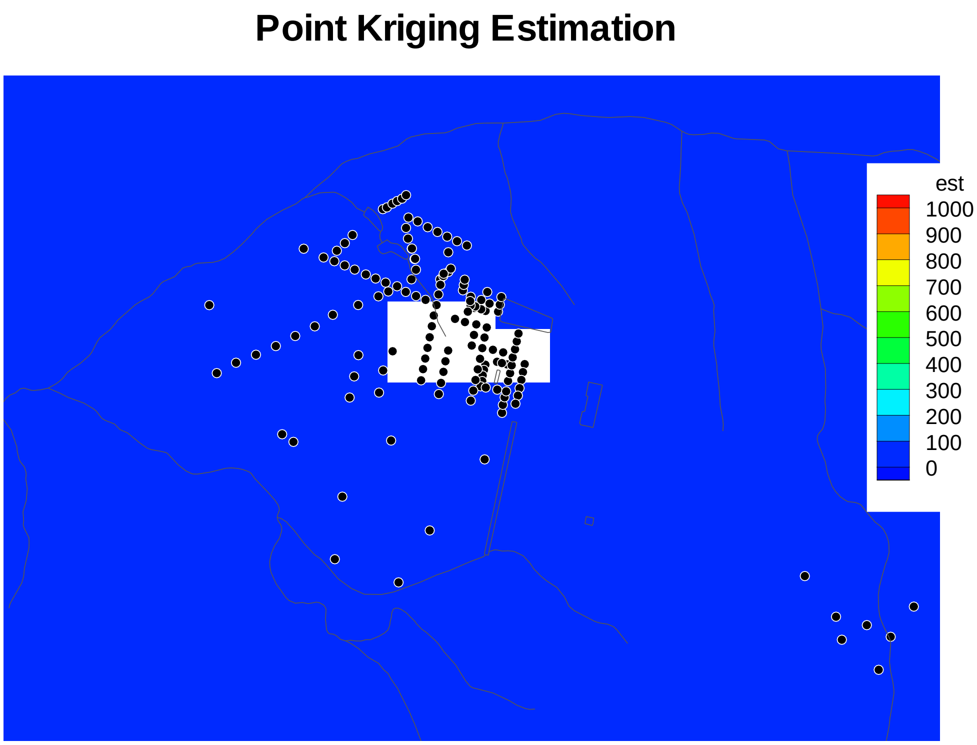


Figure G-24. Kriging estimates for Kh in model layer 7 (~AA); before TCCZ mods.



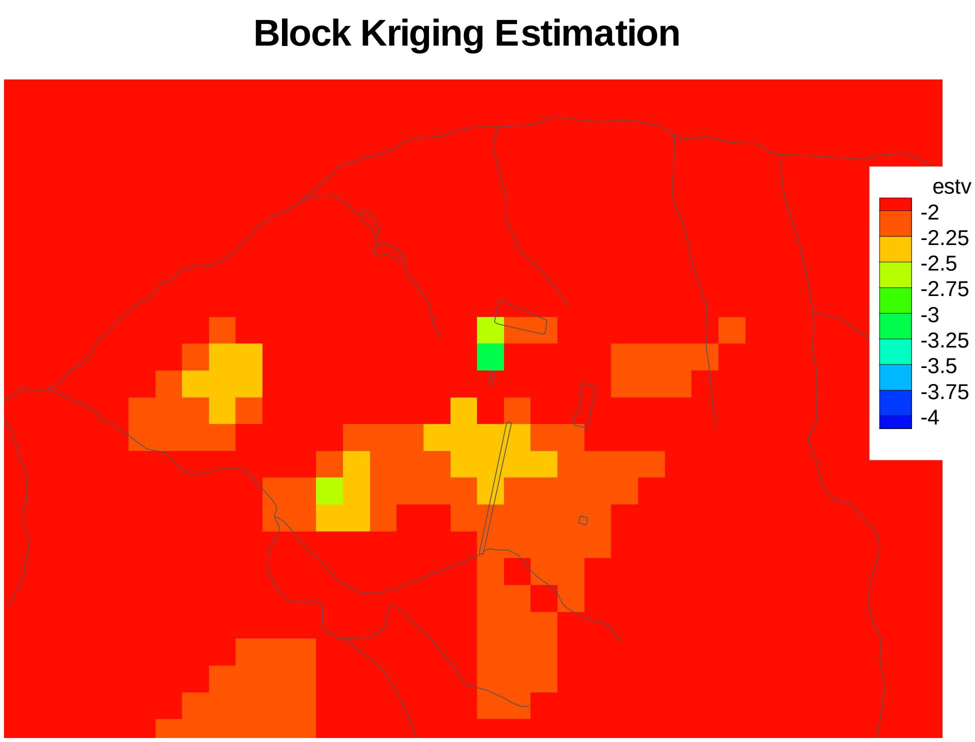
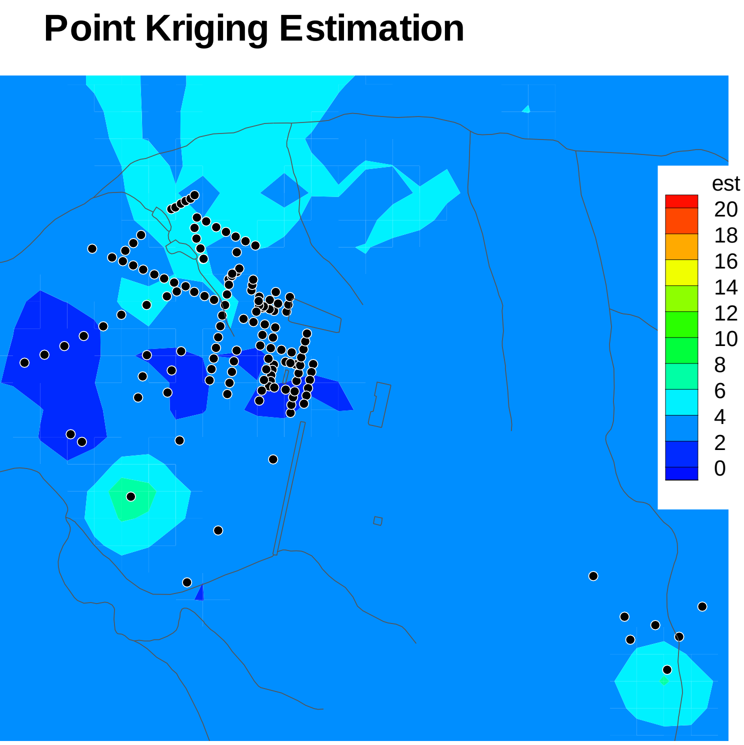


Figure G-25. Kriging estimates for Kv in model layer 7 (~AA); before TCCZ mods.



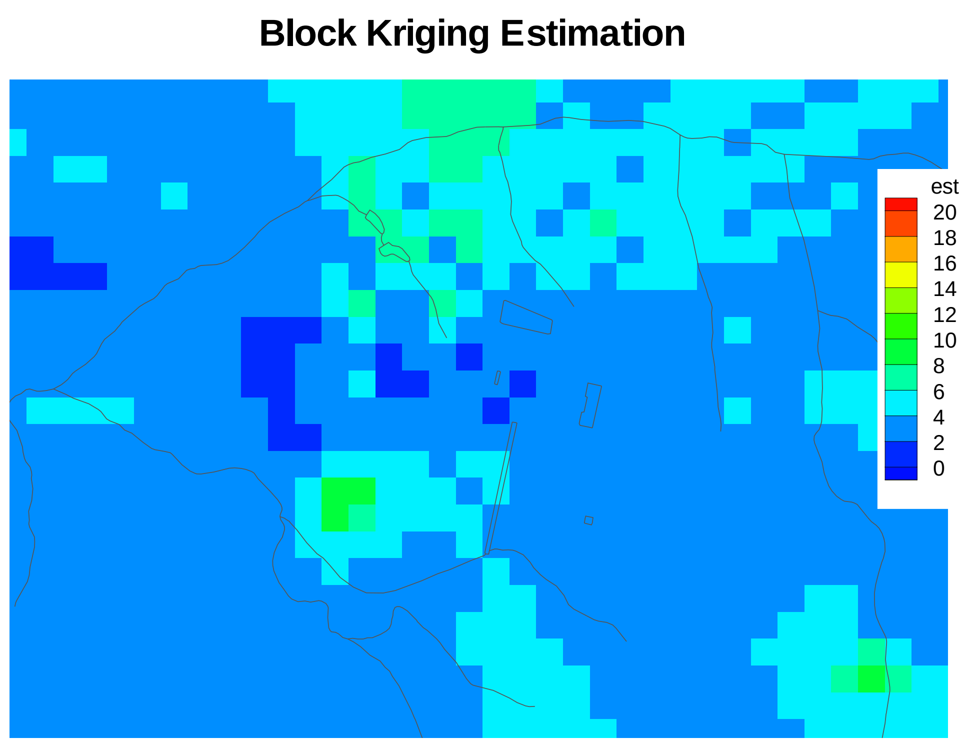
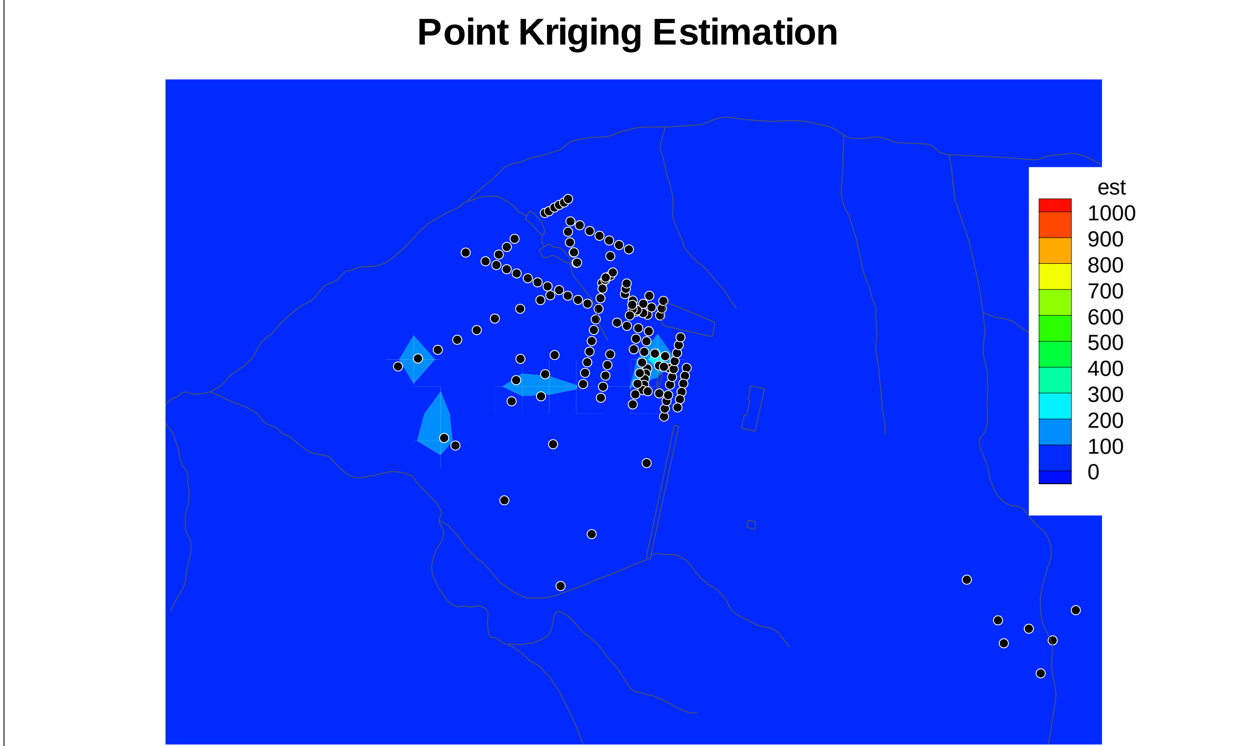


Figure G-26. Kriging estimates for Kh in model layer 8 (~A/uu); before TCCZ mods.



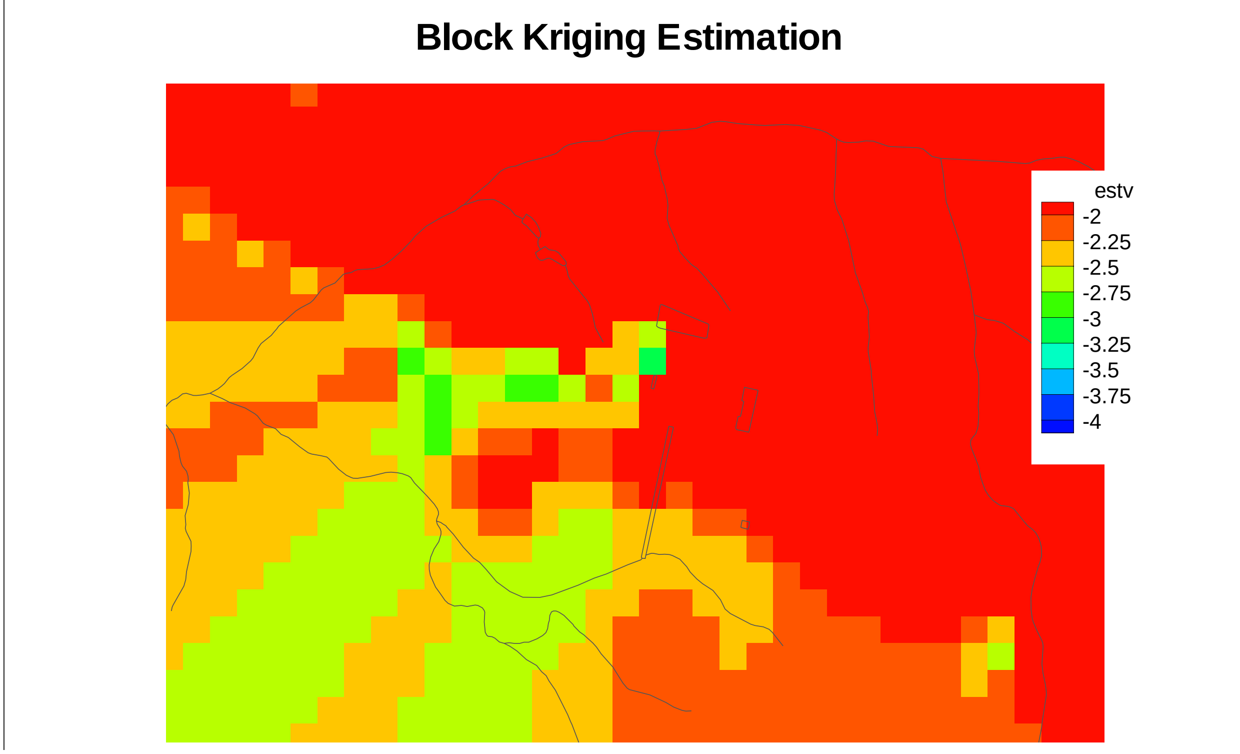


Figure G-27. Kriging estimates for Kv in model layer 8 (~A/uu); before TCCZ mods.

APPENDIX H. UNCERTAINTY ANALYSIS

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APPENDIX H. Uncertainty Analysis

Four uncertainty cases were considered as summarized in the table below. For each case, numerous plots of the simulated groundwater flow results are provided for comparison to the nominal case. Discussion of the comparison is provided in the Section 4.3 of the main text.

	GCU Kv		
Recharge	5×10^{-4} ft/day	10^{-4} ft/day	2×10^{-5} ft/day
15 in/yr	-	Case 1	-
12.5 in/yr	Case 3	Nominal	Case 4
10 in/yr	-	Case 2	-

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Simulation results for uncertainty case 1

Uncertainty case 1 involves an increase in recharge of 20% to 15 in/yr (Table 4-4). Summary calibration results are provided in Table 4-5. This appendix presents detailed simulation results for uncertainty case 1 for comparison to the nominal results shown in figures in the main text. The correspondence between figures for the nominal and uncertainty case 1 is as follows:

Plot type	Nominal case	Uncertainty case 1
Head residual summary	Figure 4-1	Figure H-1-1
Head residuals in Gordon aquifer	Figure 4-2	Figure H-1-2
Head residuals in "lower" UTRA	Figure 4-3	Figure H-1-3
Head residuals in transmissive zone	Figure 4-4	Figure H-1-4
Head residuals in AA horizon	Figure 4-5	Figure H-1-5
Head residuals in A/uu horizons	Figure 4-6	Figure H-1-6
Kh in element layer 1	Figure 4-7	Figure H-1-7
Kv in element layer 2	Figure 4-8	Figure H-1-8
Kh in element layer 3	Figure 4-9	Figure H-1-9
Kh in element layer 4	Figure 4-10	Figure H-1-10
Kv in element layer 5	Figure 4-11	Figure H-1-11
Kh in element layer 6	Figure 4-12	Figure H-1-12
Kh in element layer 7	Figure 4-13	Figure H-1-13
Kh in element layer 8	Figure 4-14	Figure H-1-14
Gordon aquifer head	Figure 4-16	Figure H-1-15
"Lower" UTRA head	Figure 4-17	Figure H-1-16
"Upper" UTRA head	Figure 4-18	Figure H-1-17
Head in aquifer containing water table	Figure 4-19	Figure H-1-18
Water table	Figure 4-20	Figure H-1-19
Recharge/discharge	Figure 4-25	Figure H-1-20
Example particle tracing	Figure 4-26	Figure H-1-21

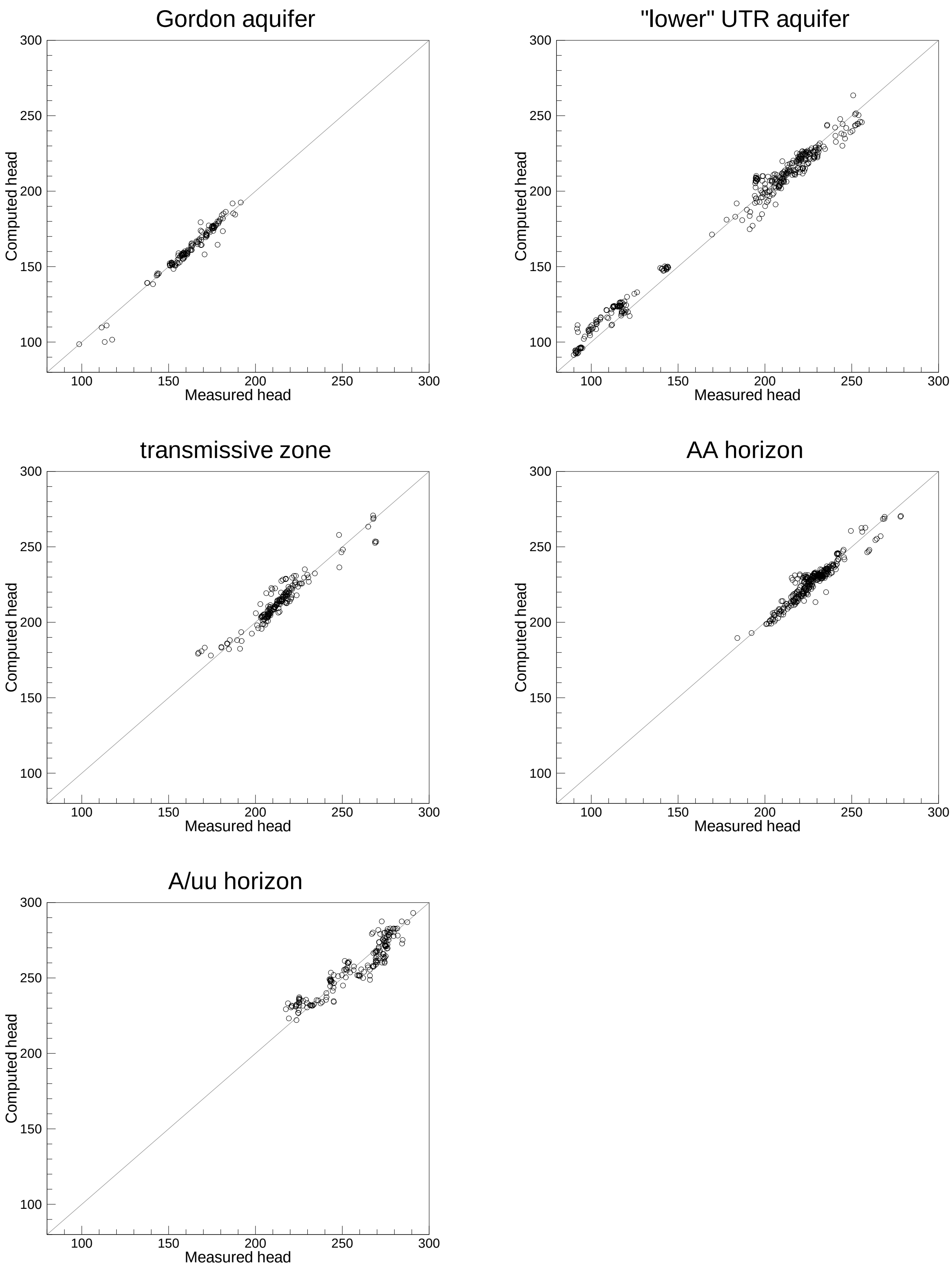

Figure H-1-1. (uncertainty case 1; compare to Figure 4-1)

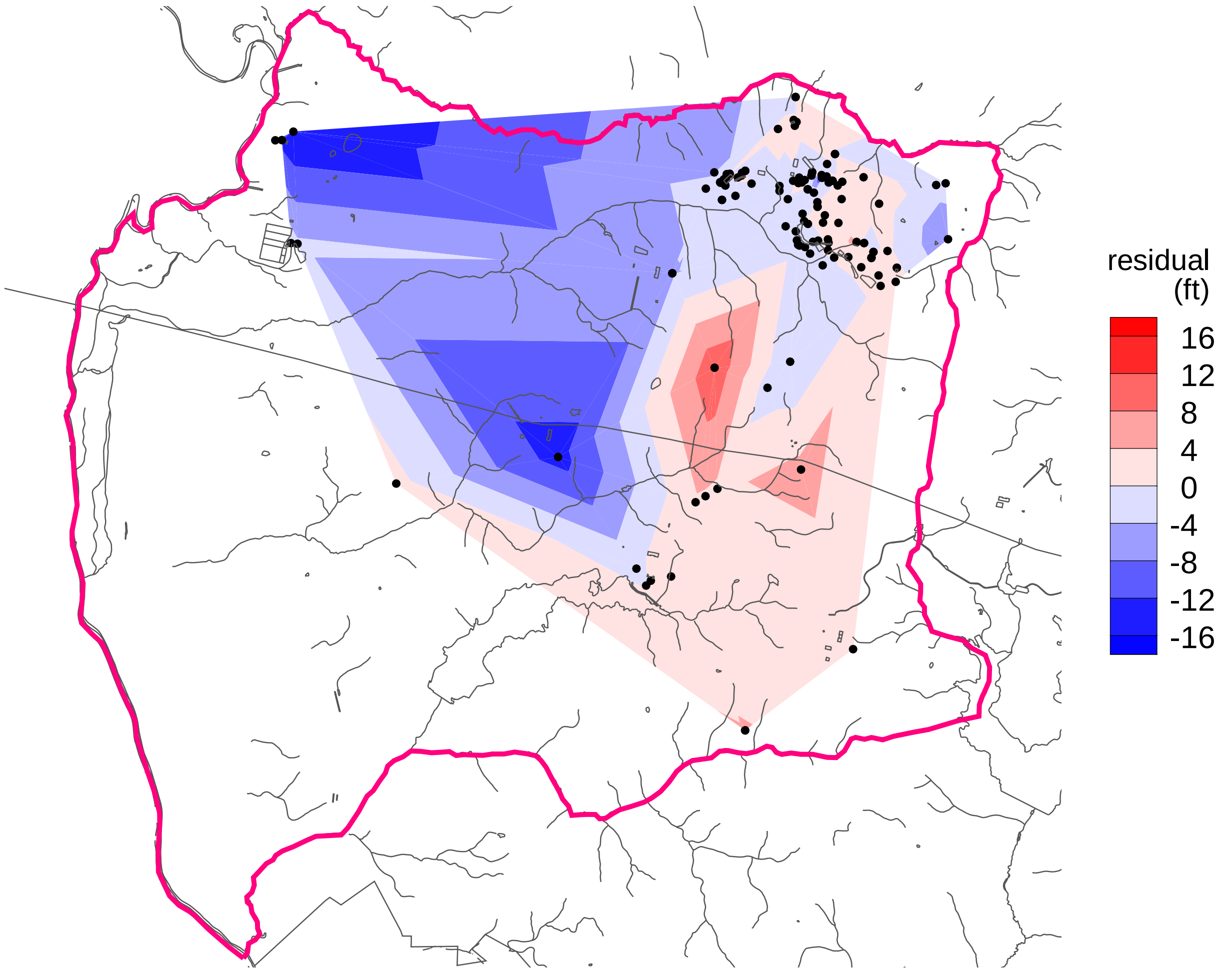

Figure H-1-2. (uncertainty case 1; compare to Figure 4-2)

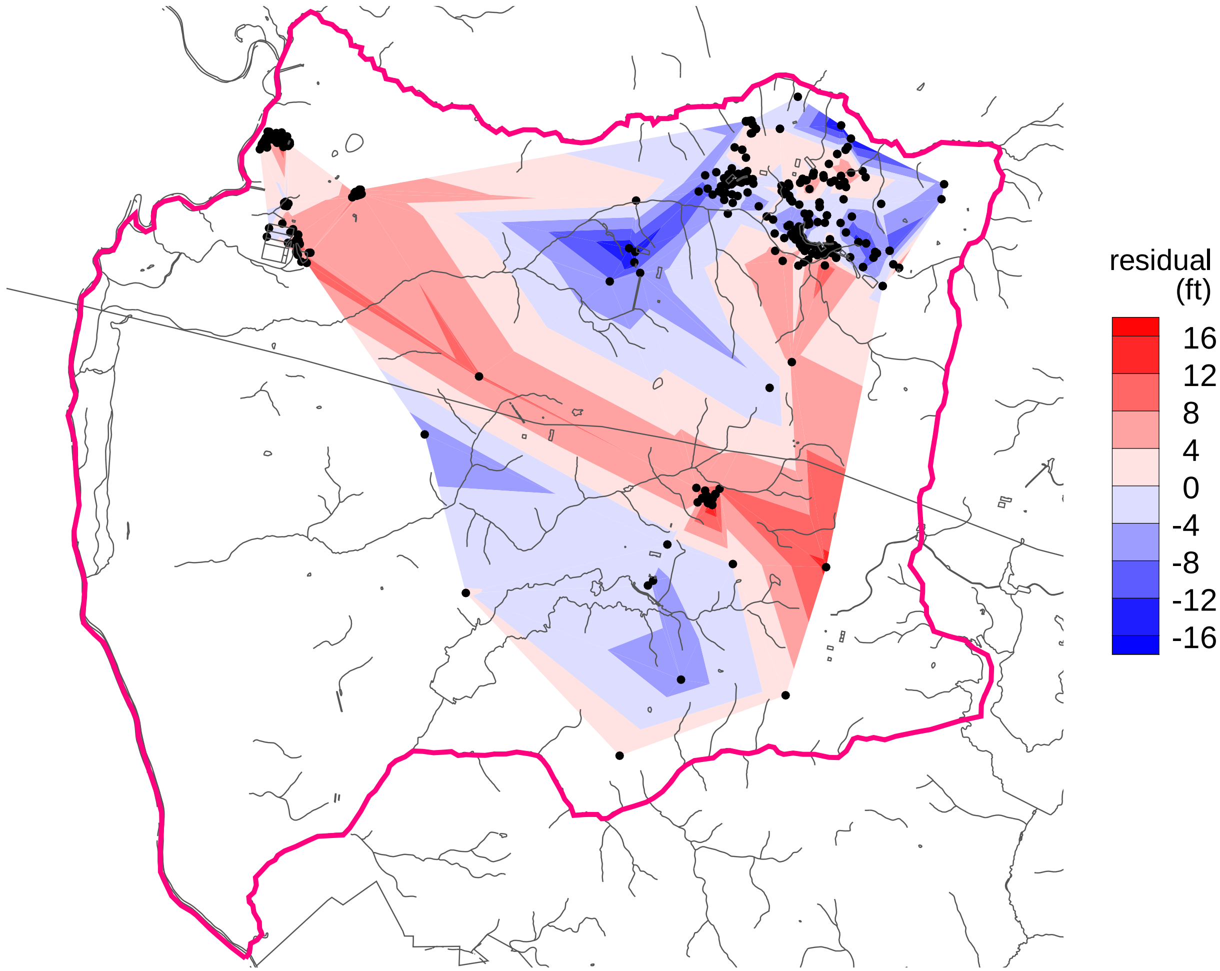

Figure H-1-3. (uncertainty case 1; compare to Figure 4-3)

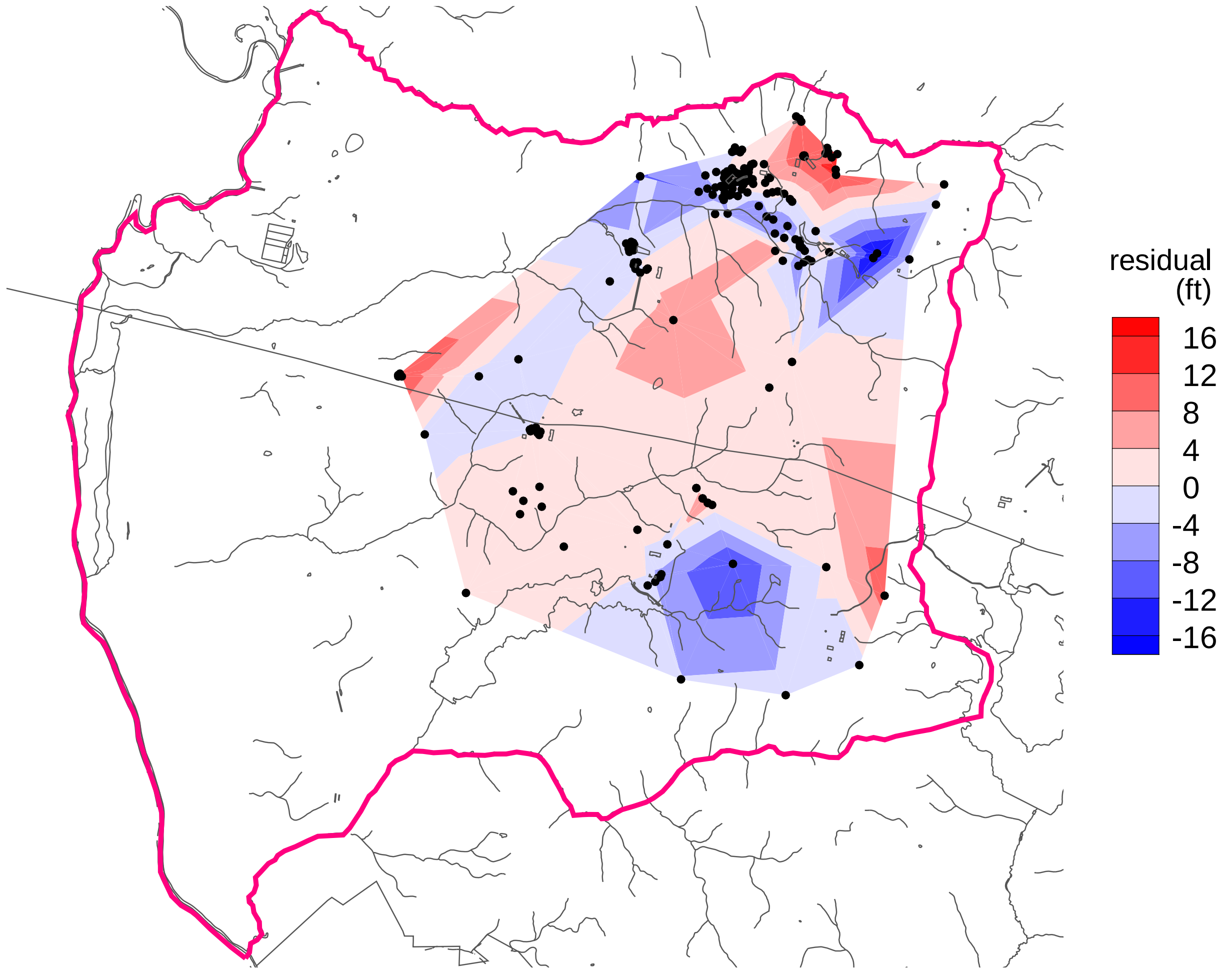

Figure H-1-4. (uncertainty case 1; compare to Figure 4-4)

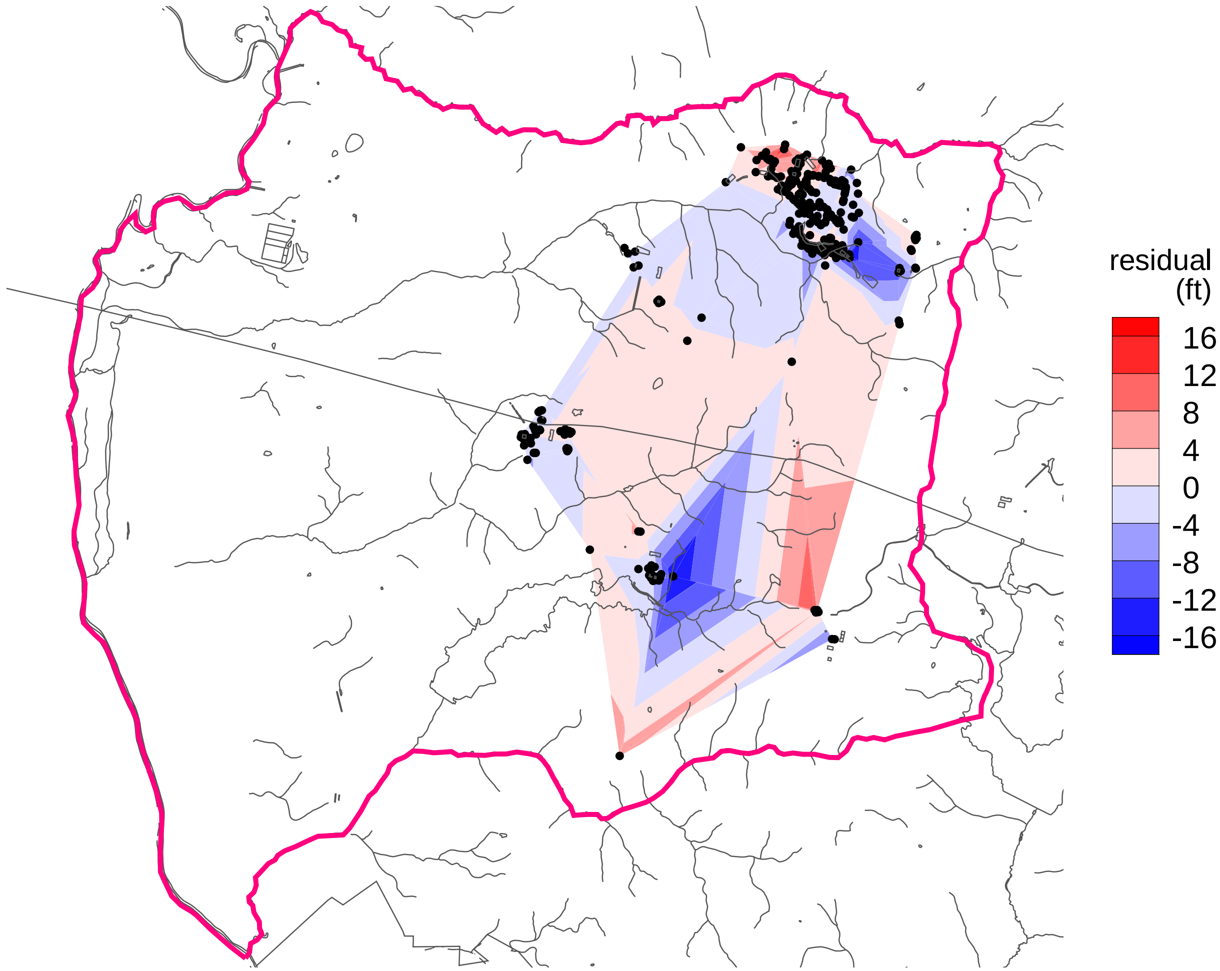

Figure H-1-5. (uncertainty case 1; compare to Figure 4-5)

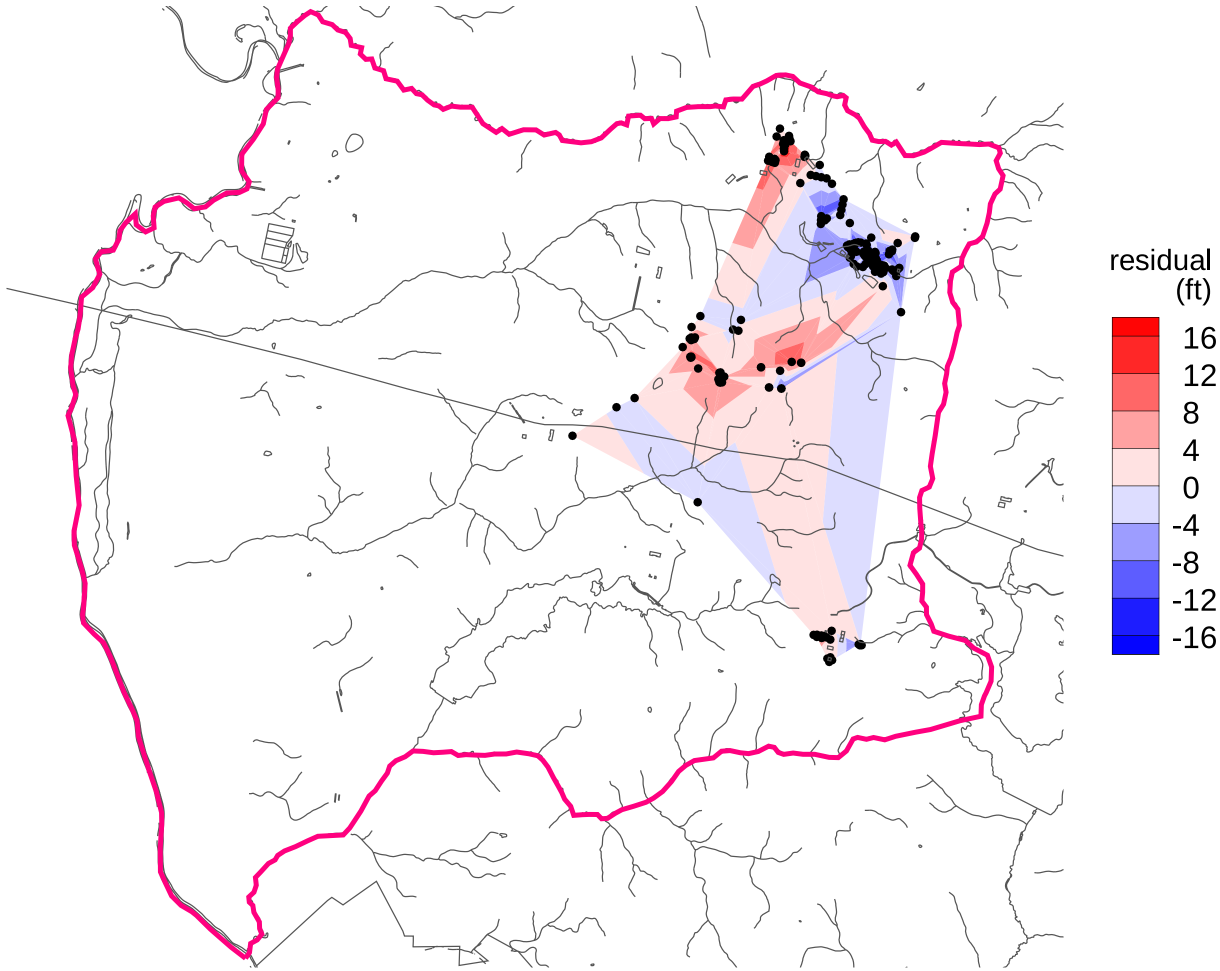

Figure H-1-6. (uncertainty case 1; compare to Figure 4-6)

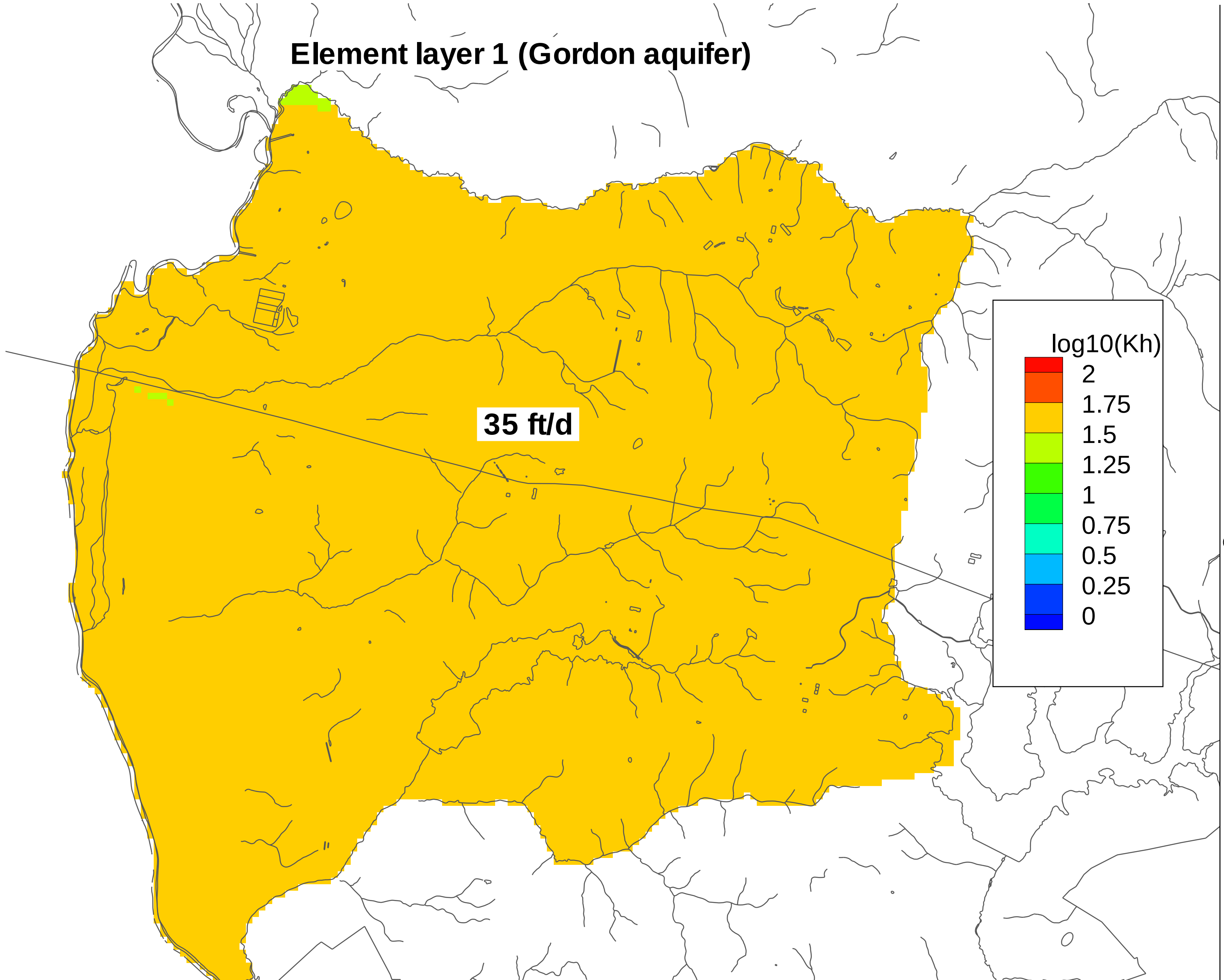

Figure H-1-7. (uncertainty case 1; compare to Figure 4-7)

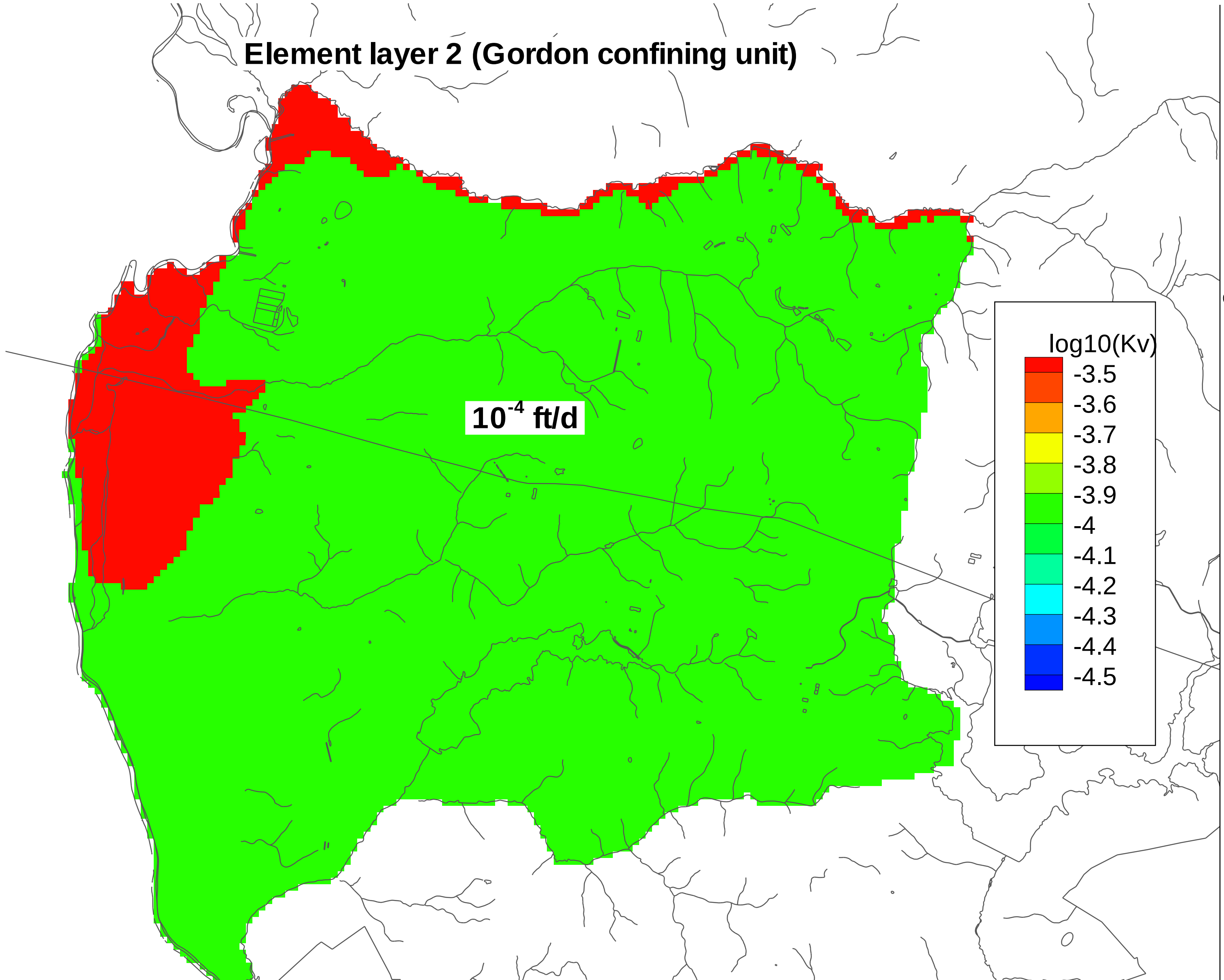

Figure H-1-8. (uncertainty case 1; compare to Figure 4-8)

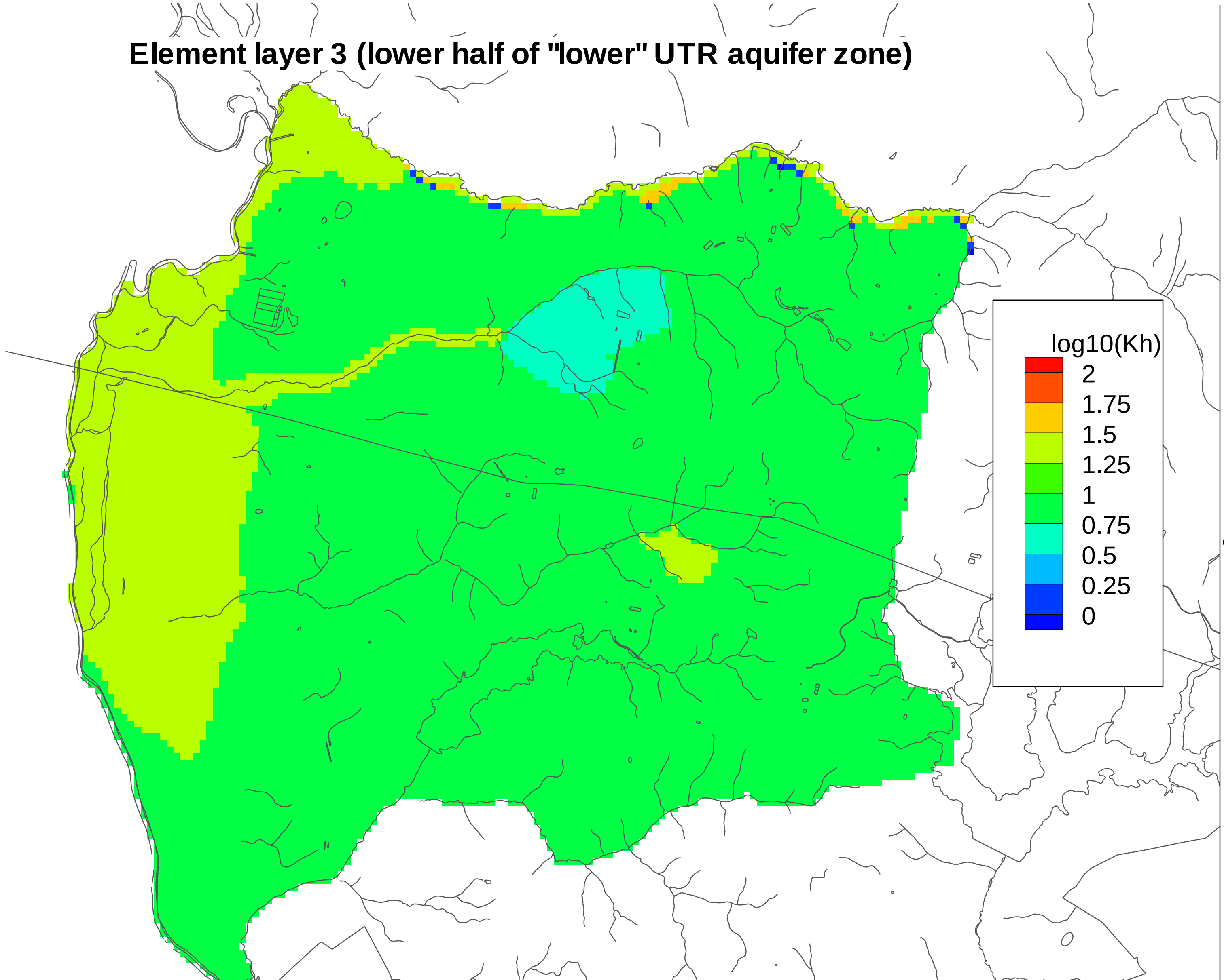

Figure H-1-9. (uncertainty case 1; compare to Figure 4-9)

Element layer 4 (upper half of "lower" UTR aquifer zone)

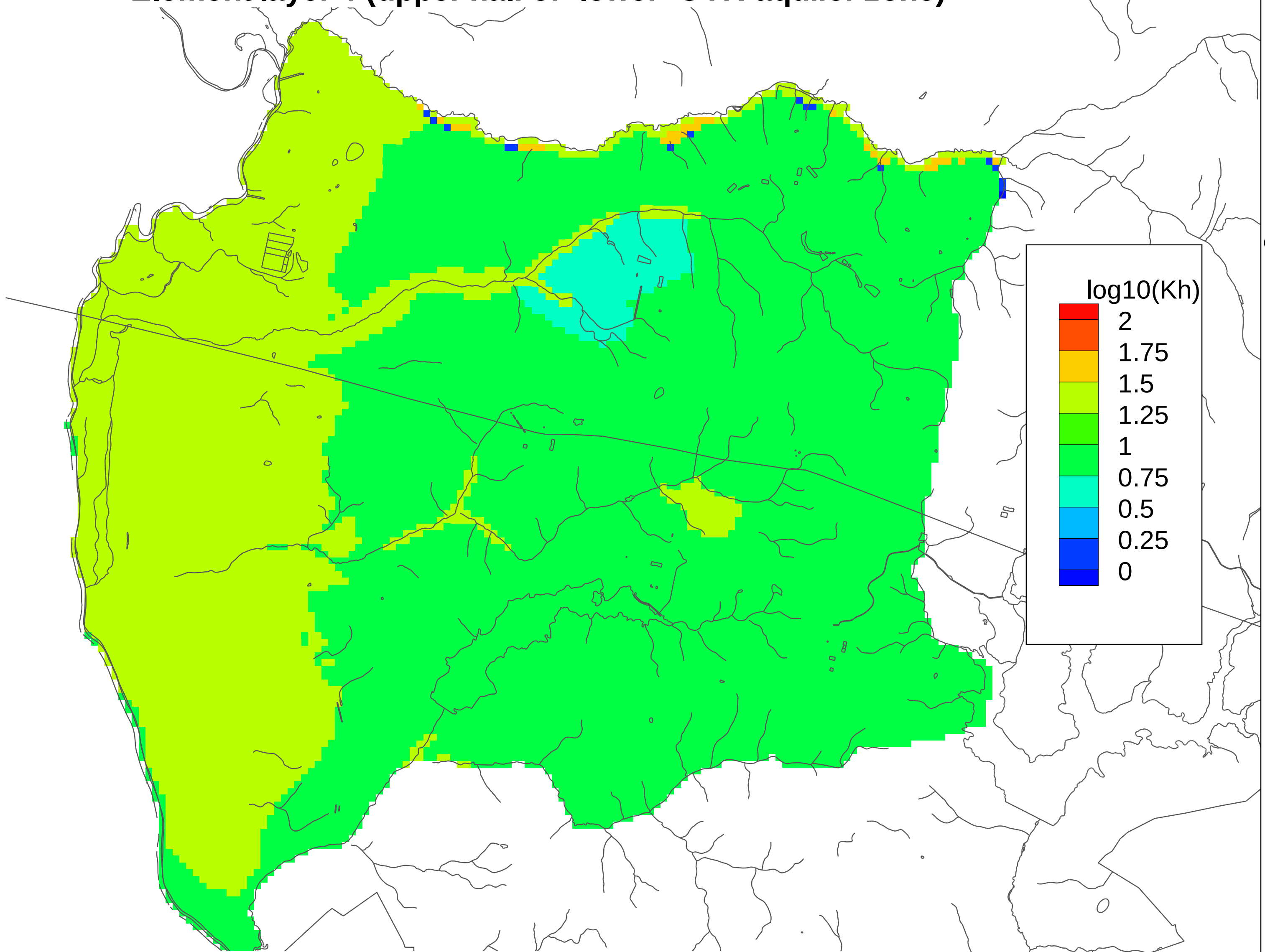

Figure H-1-10. (uncertainty case 1; compare to Figure 4-10)

Element layer 5 ("tan clay" confining zone)

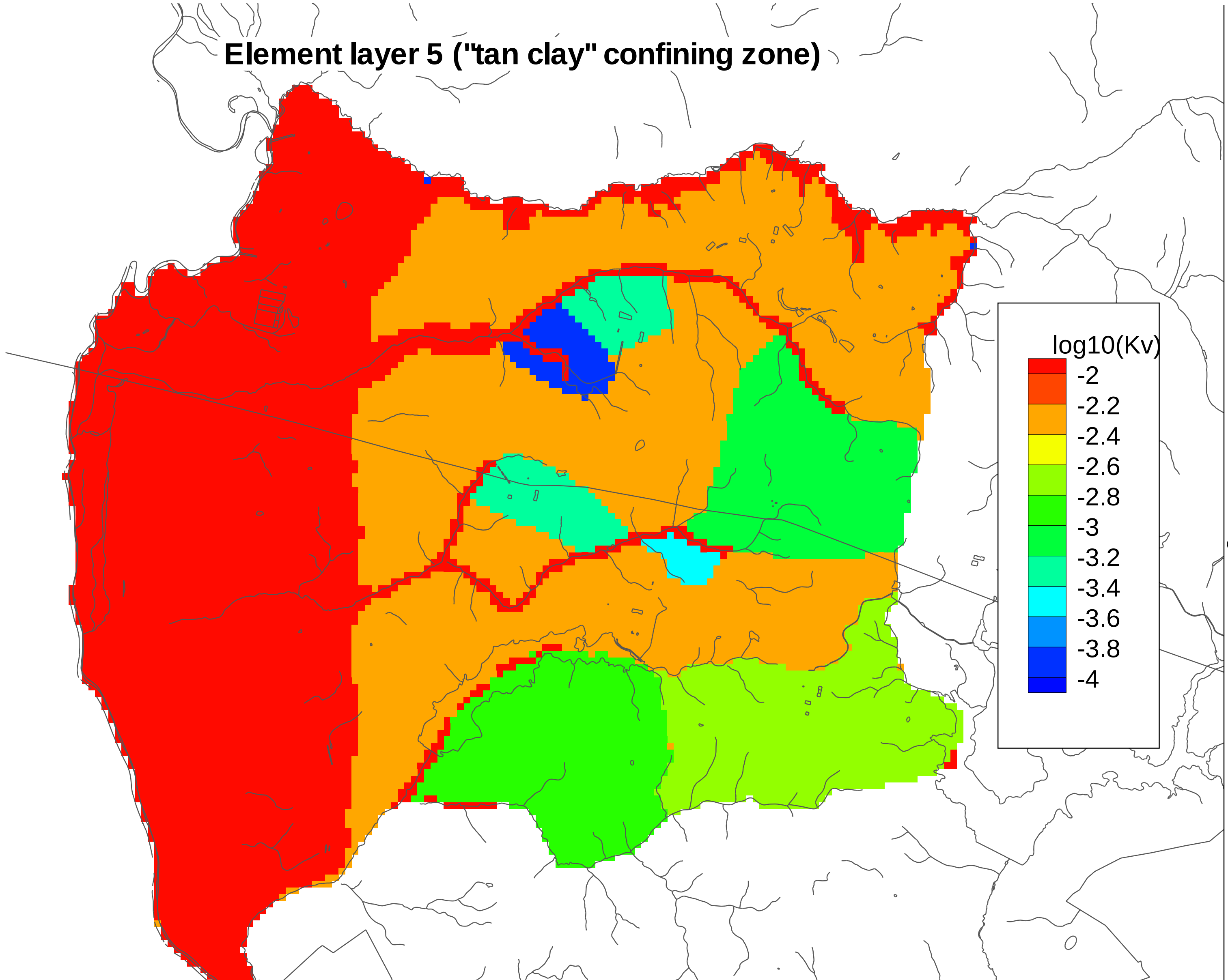

Figure H-1-11. (uncertainty case 1; compare to Figure 4-11)

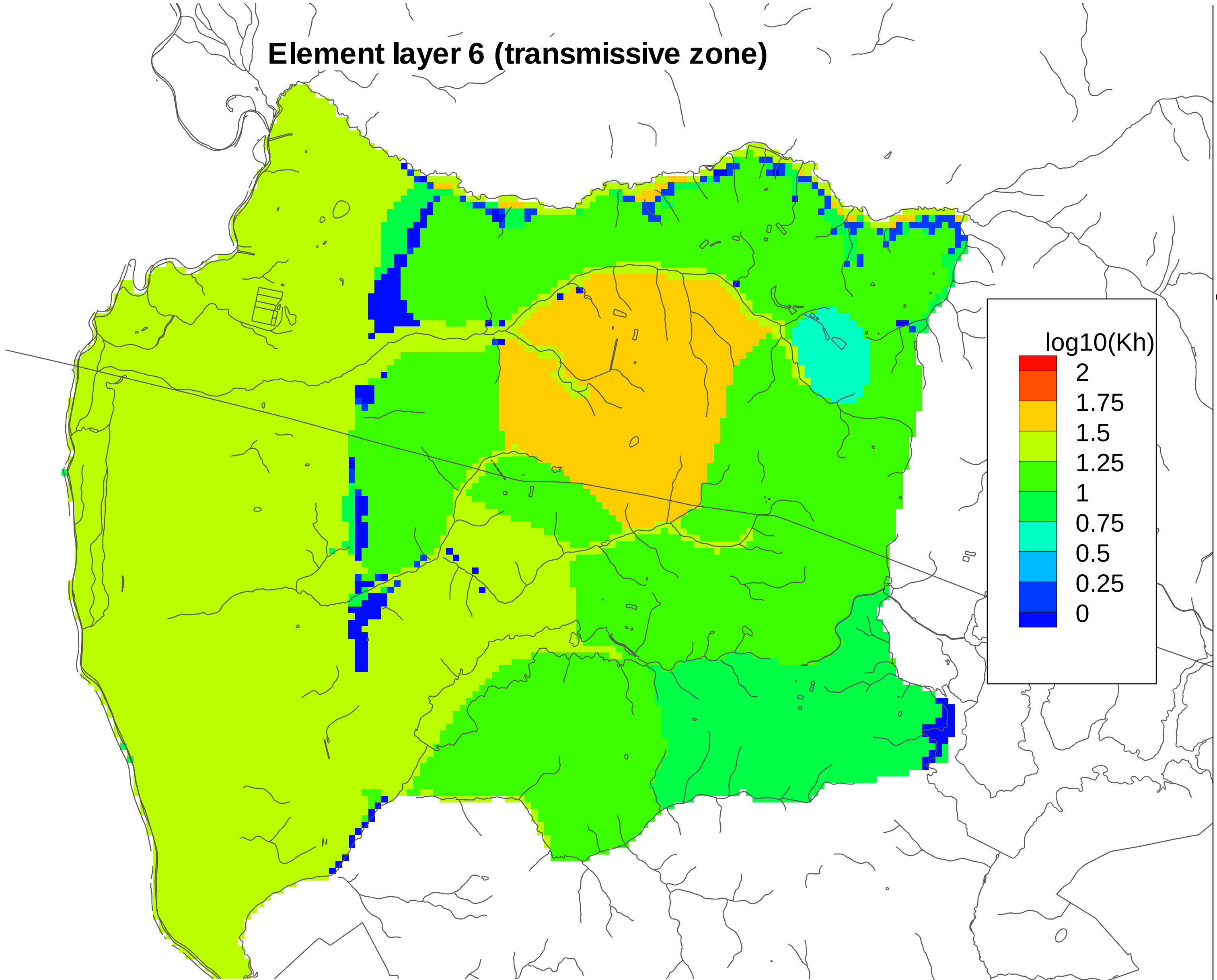

Figure H-1-12. (uncertainty case 1; compare to Figure 4-12)

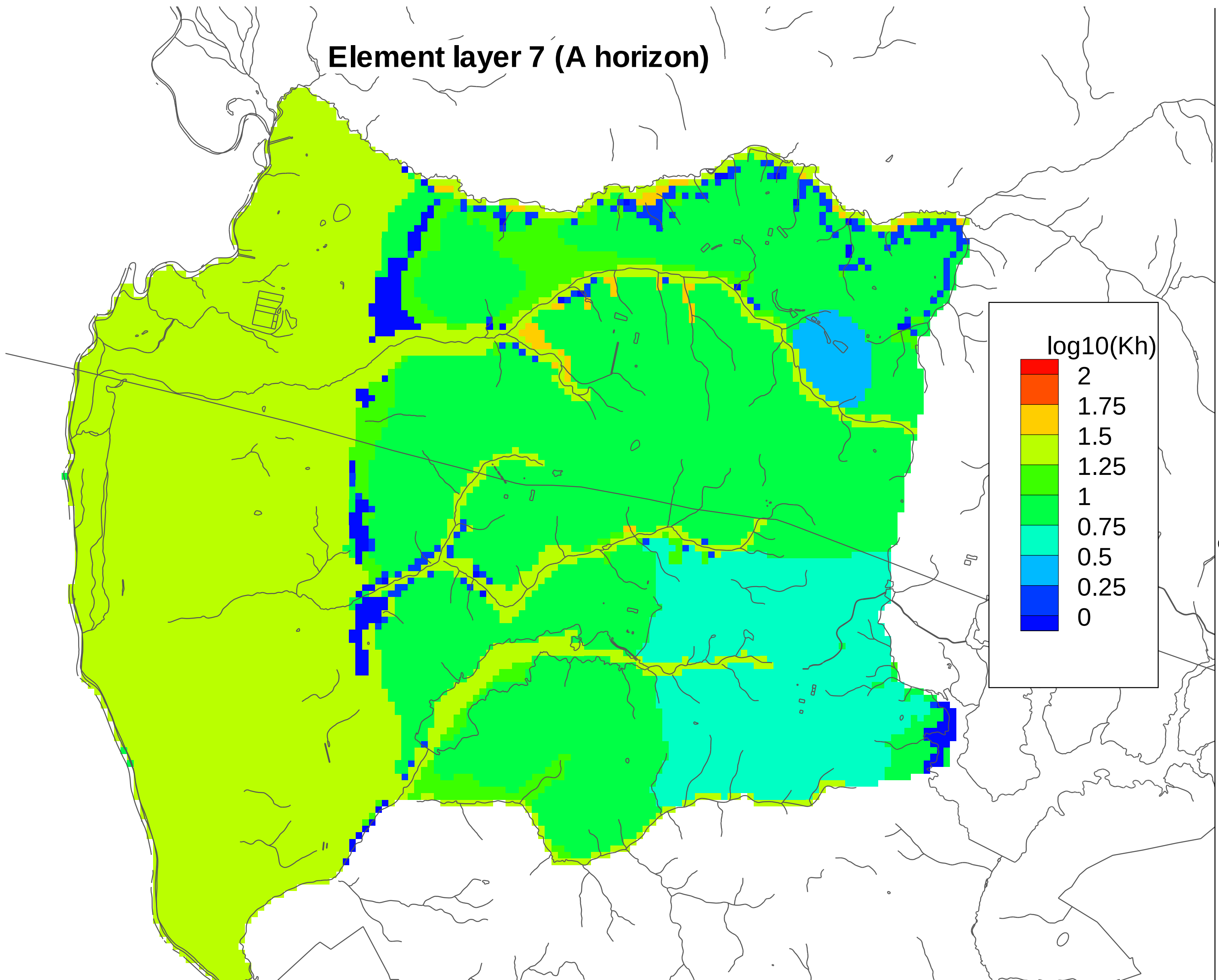

Figure H-1-13. (uncertainty case 1; compare to Figure 4-13)

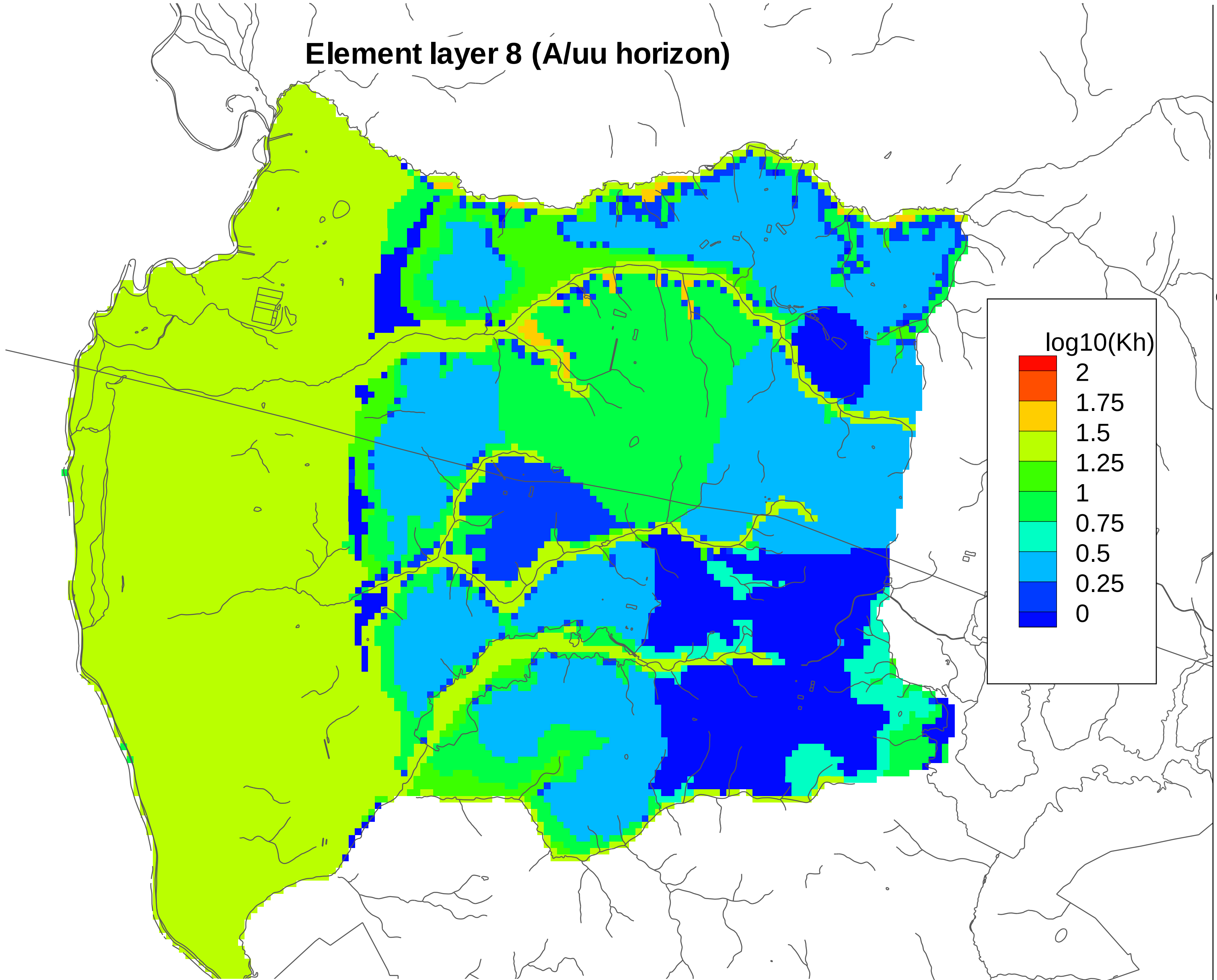

Figure H-1-14. (uncertainty case 1; compare to Figure 4-14)

Simulated hydraulic head in Gordon aquifer

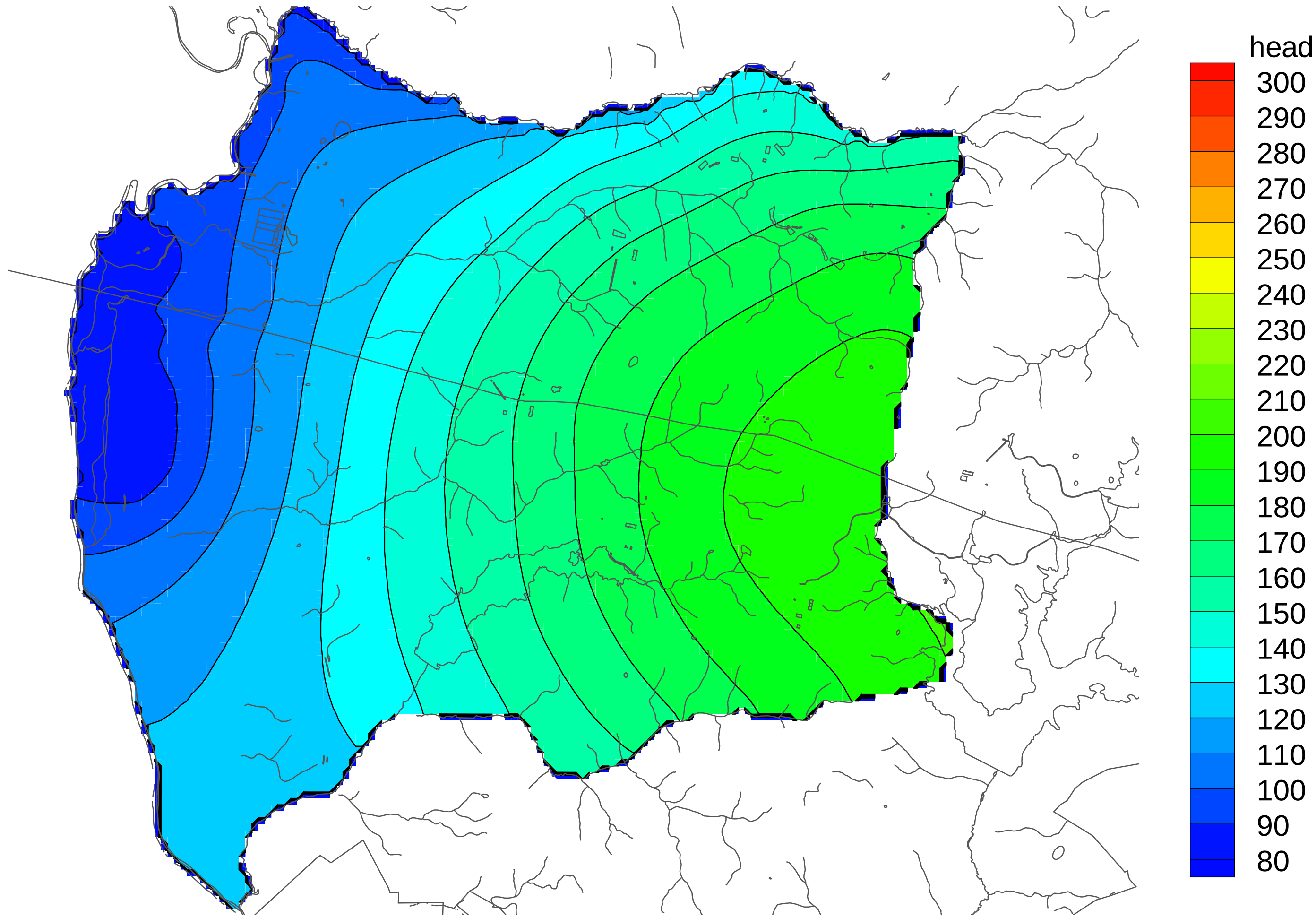

Figure H-1-15. (uncertainty case 1; compare to Figure 4-16)

Simulated hydraulic head in "lower" UTR aquifer zone

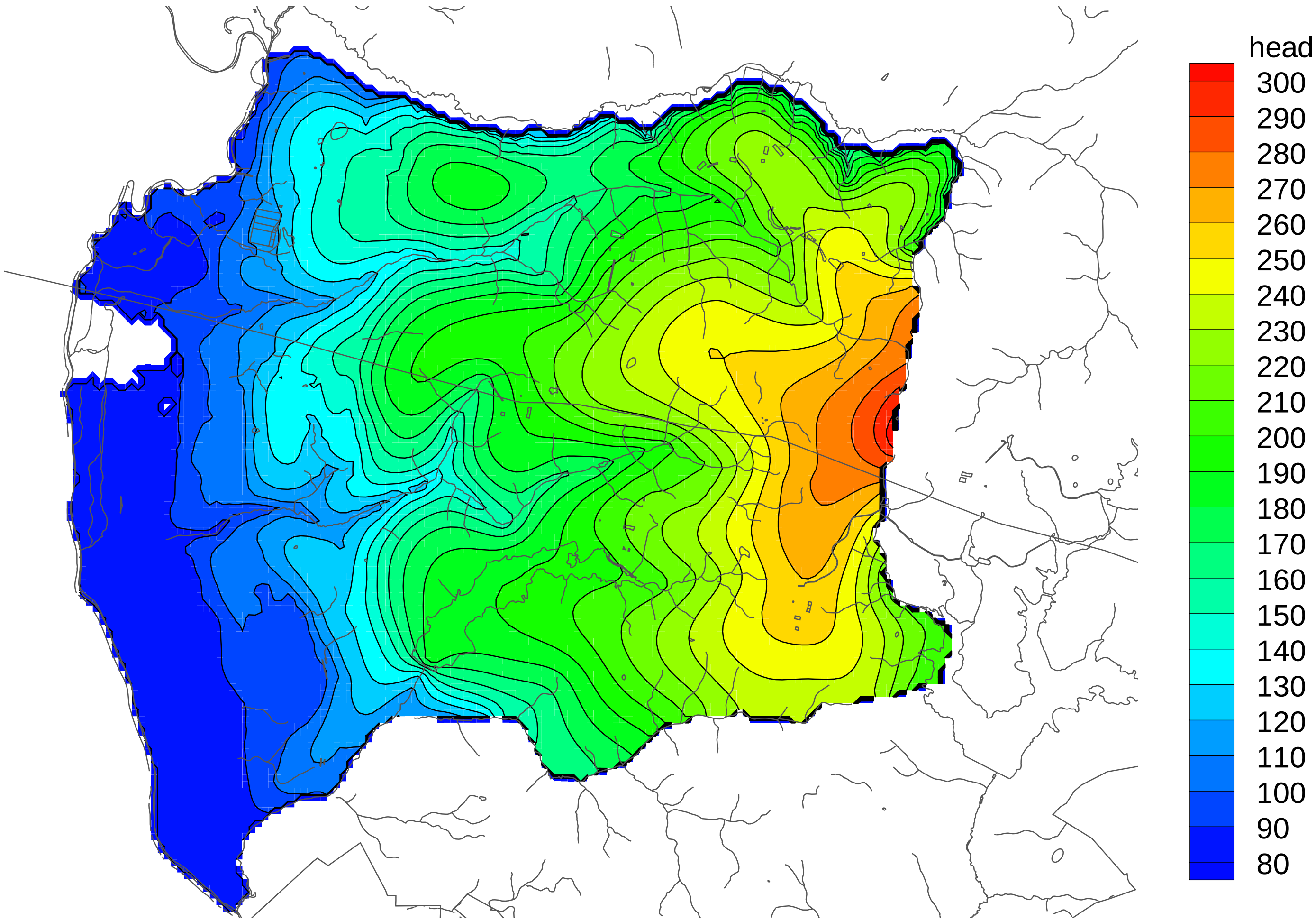

Figure H-1-16. (uncertainty case 1; compare to Figure 4-17)

Simulated hydraulic head in "upper" UTR aquifer zone

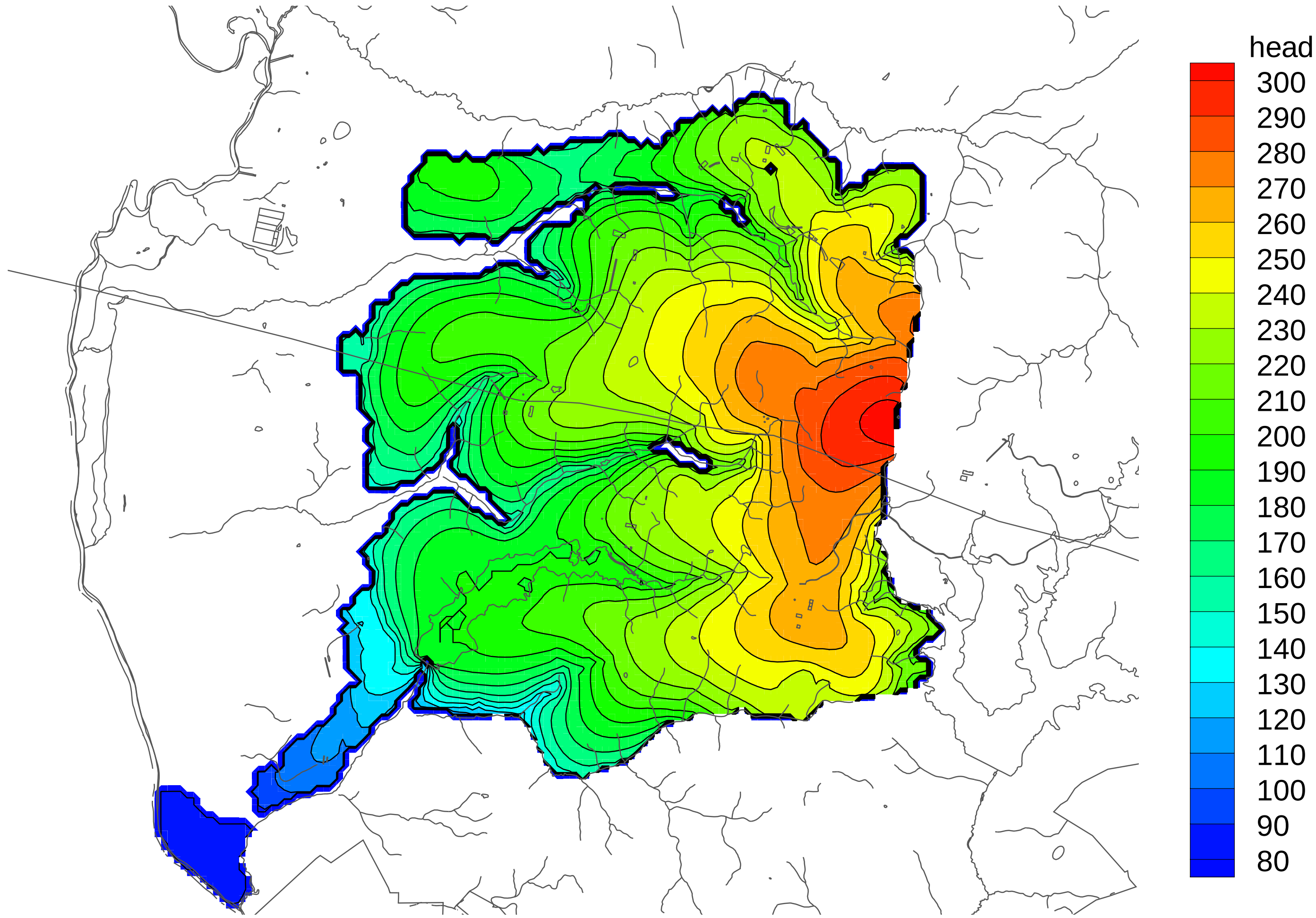

Figure H-1-17. (uncertainty case 1; compare to Figure 4-18)

Simulated hydraulic head in aquifer zone containing water table

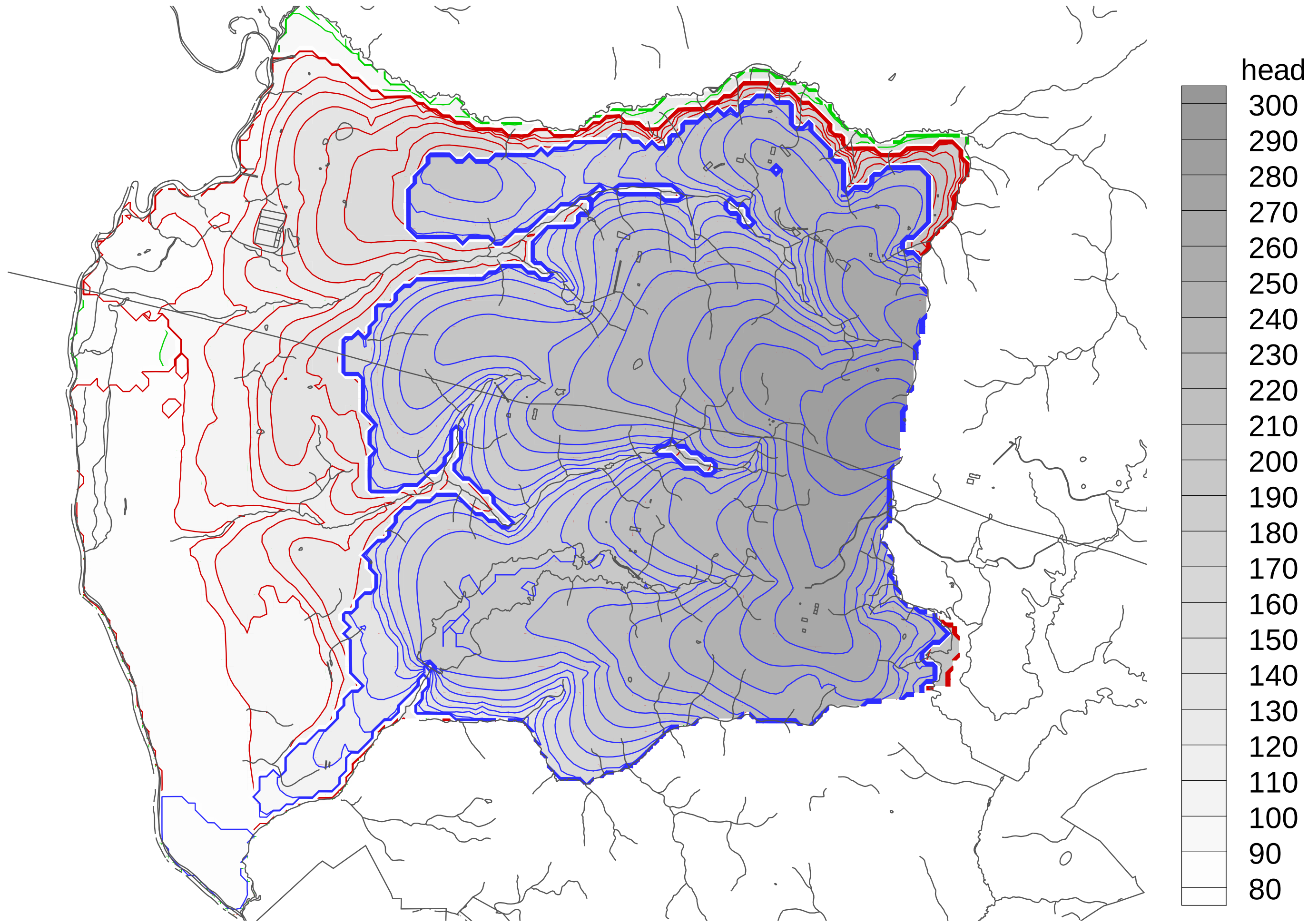

Figure H-1-18. (uncertainty case 1; compare to Figure 4-19)

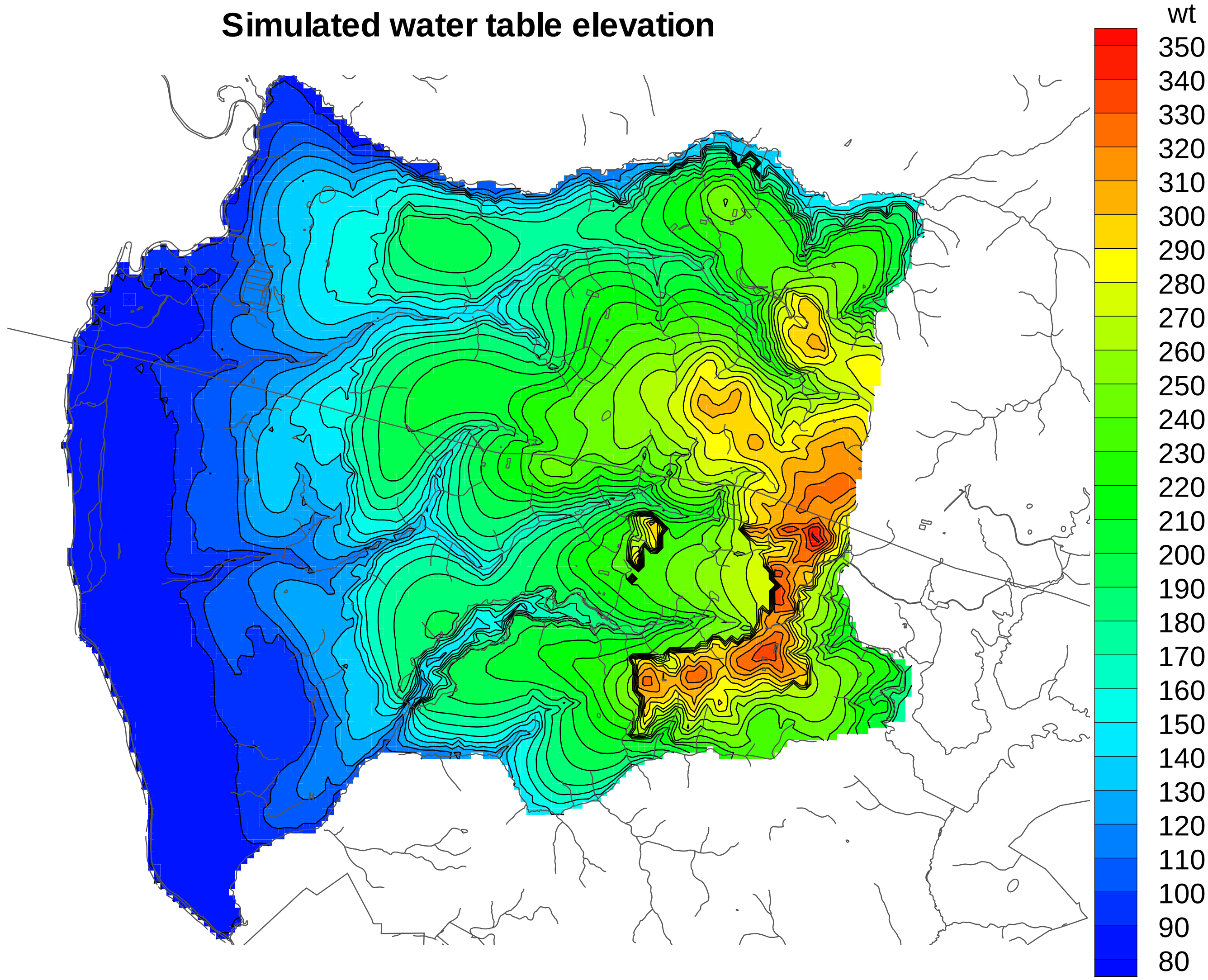

Figure H-1-19. (uncertainty case 1; compare to Figure 4-20)

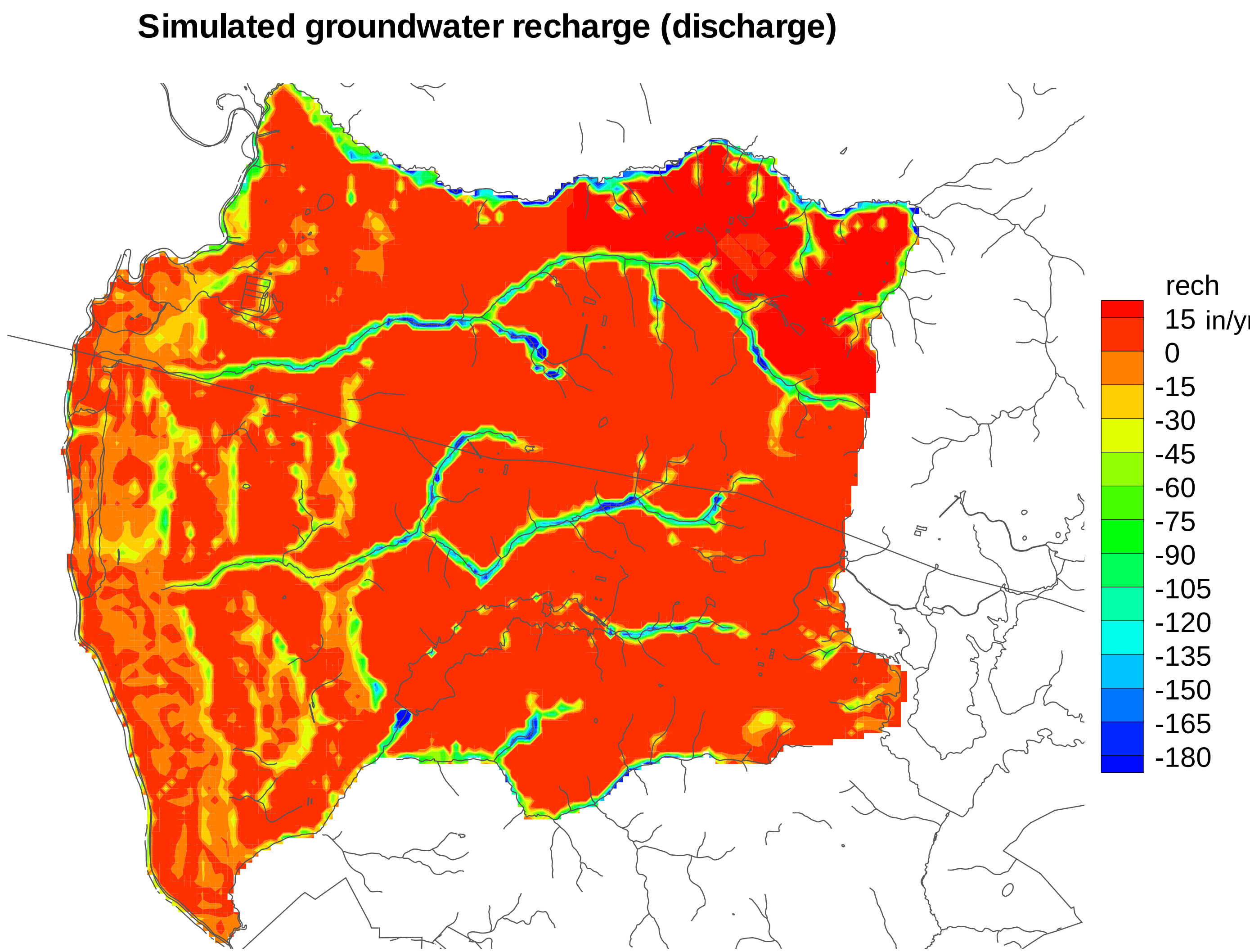

Figure H-1-20. (uncertainty case 1; compare to Figure 4-25)

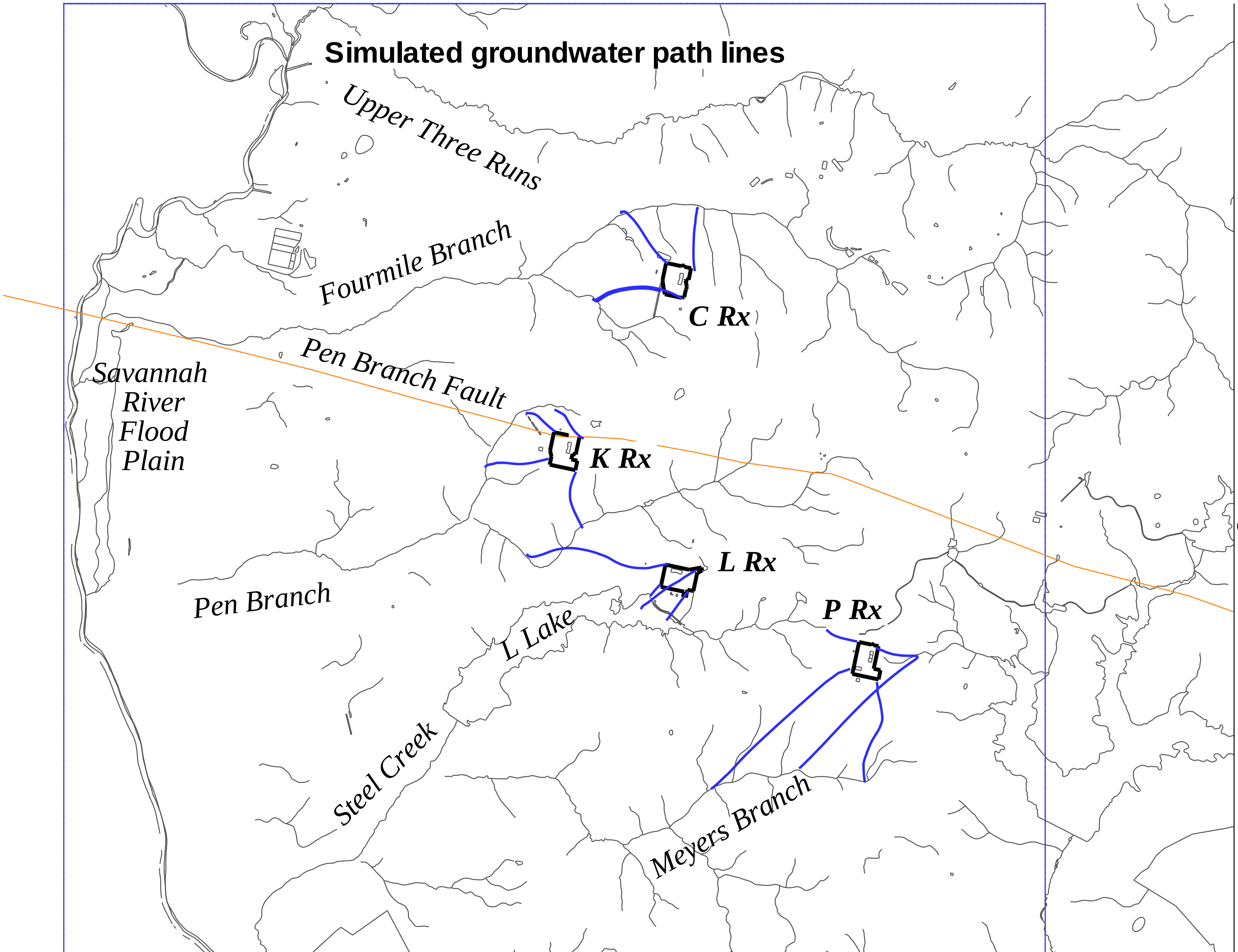

Figure H-1-21. (uncertainty case 1; compare to Figure 4-26)

Simulation results for uncertainty case 2

Uncertainty case 1 involves a decrease in recharge of 20% to 10 in/yr (Table 4-4). Summary calibration results are provided in Table 4-5. This appendix presents detailed simulation results for uncertainty case 2 for comparison to the nominal results shown in figures in the main text. The correspondence between figures for the nominal and uncertainty case 2 is as follows:

Plot type	Nominal case	Uncertainty case 2
Head residual summary	Figure 4-1	Figure H-2-1
Head residuals in Gordon aquifer	Figure 4-2	Figure H-2-2
Head residuals in "lower" UTRA	Figure 4-3	Figure H-2-3
Head residuals in transmissive zone	Figure 4-4	Figure H-2-4
Head residuals in AA horizon	Figure 4-5	Figure H-2-5
Head residuals in A/uu horizons	Figure 4-6	Figure H-2-6
Kh in element layer 1	Figure 4-7	Figure H-2-7
Kv in element layer 2	Figure 4-8	Figure H-2-8
Kh in element layer 3	Figure 4-9	Figure H-2-9
Kh in element layer 4	Figure 4-10	Figure H-2-10
Kv in element layer 5	Figure 4-11	Figure H-2-11
Kh in element layer 6	Figure 4-12	Figure H-2-12
Kh in element layer 7	Figure 4-13	Figure H-2-13
Kh in element layer 8	Figure 4-14	Figure H-2-14
Gordon aquifer head	Figure 4-16	Figure H-2-15
"Lower" UTRA head	Figure 4-17	Figure H-2-16
"Upper" UTRA head	Figure 4-18	Figure H-2-17
Head in aquifer containing water table	Figure 4-19	Figure H-2-18
Water table	Figure 4-20	Figure H-2-19
Recharge/discharge	Figure 4-25	Figure H-2-20
Example particle tracing	Figure 4-26	Figure H-2-21

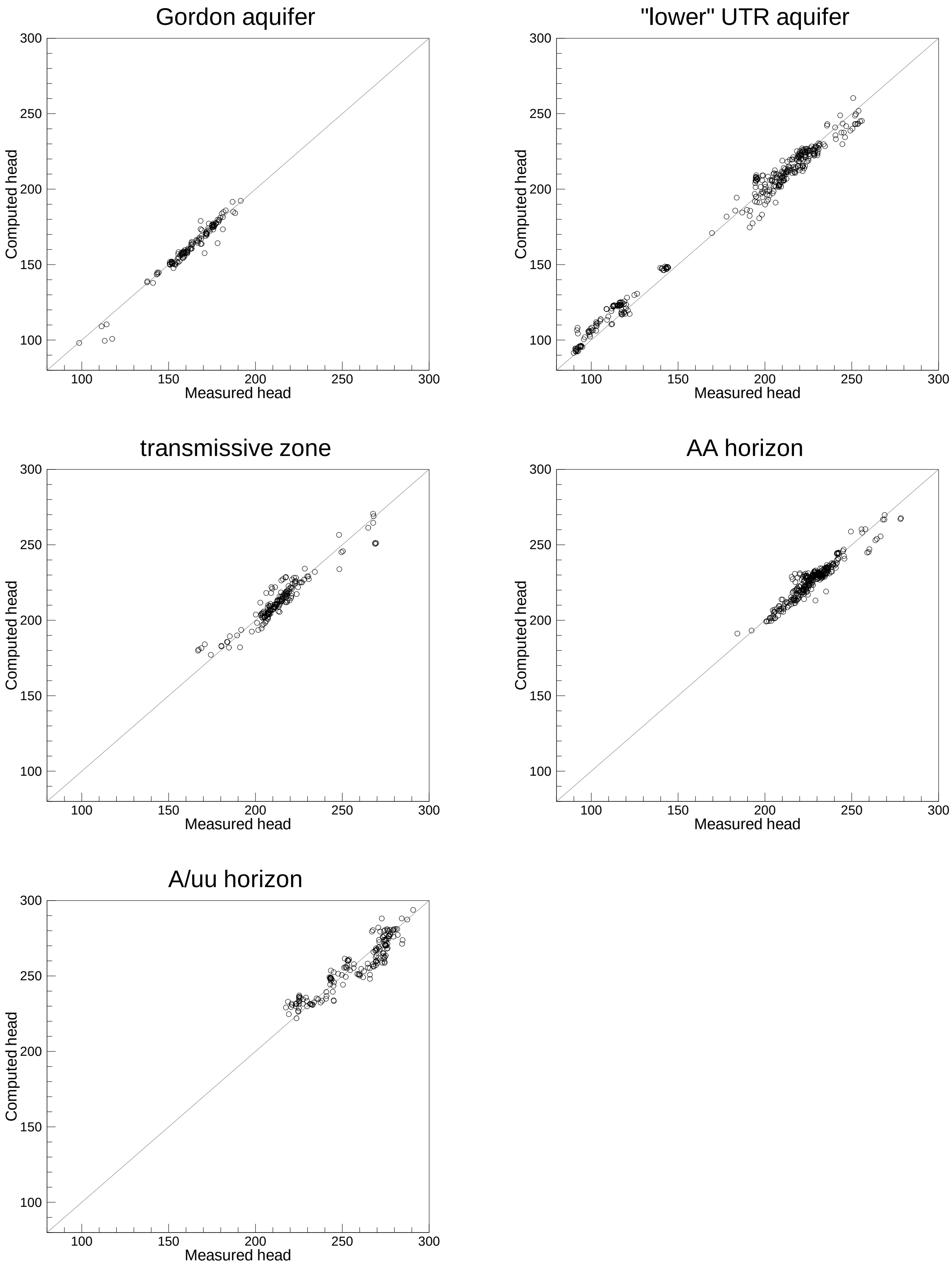

Figure H-2-1. (uncertainty case 2; compare to Figure 4-1)

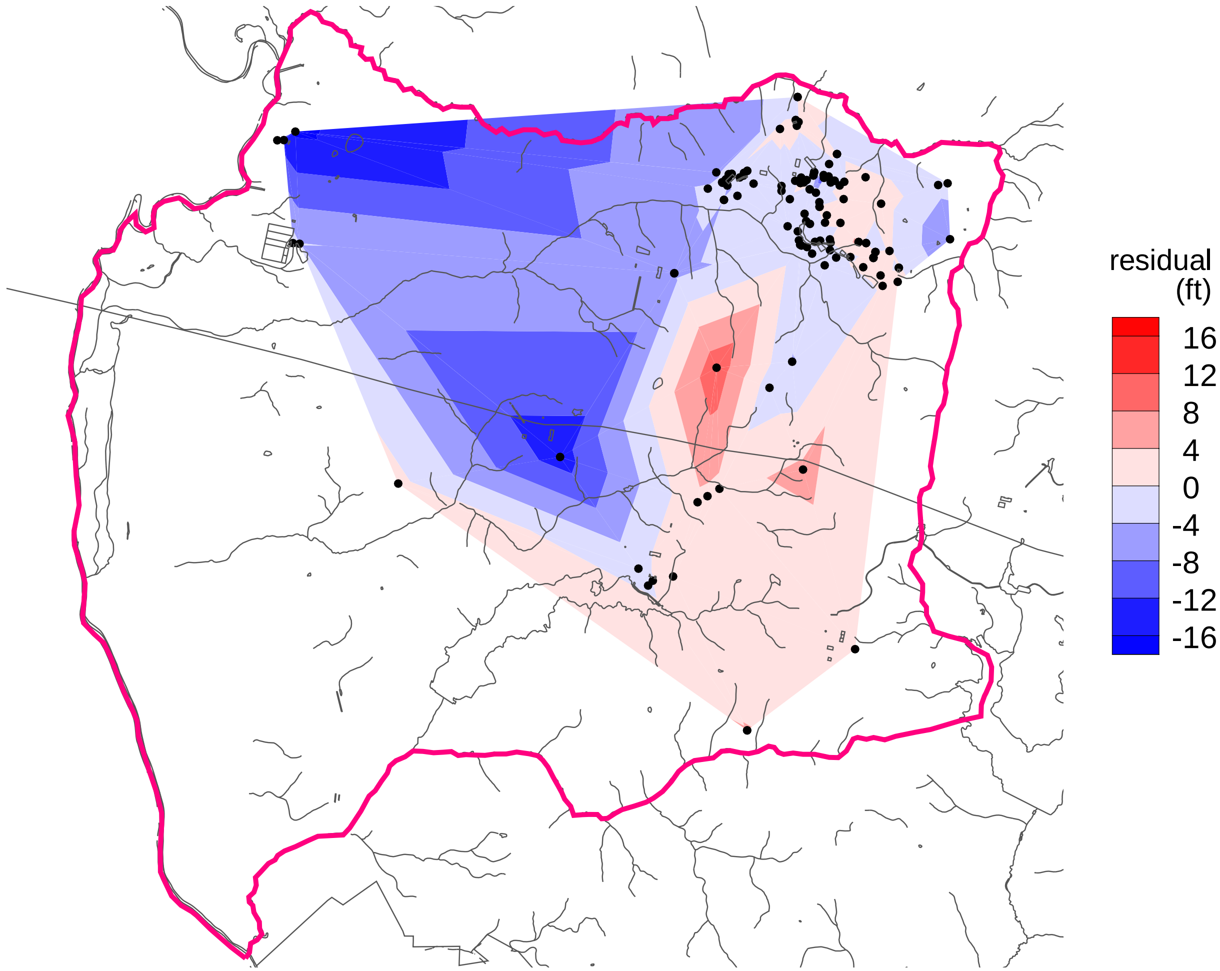

Figure H-2-2. (uncertainty case 2; compare to Figure 4-2)

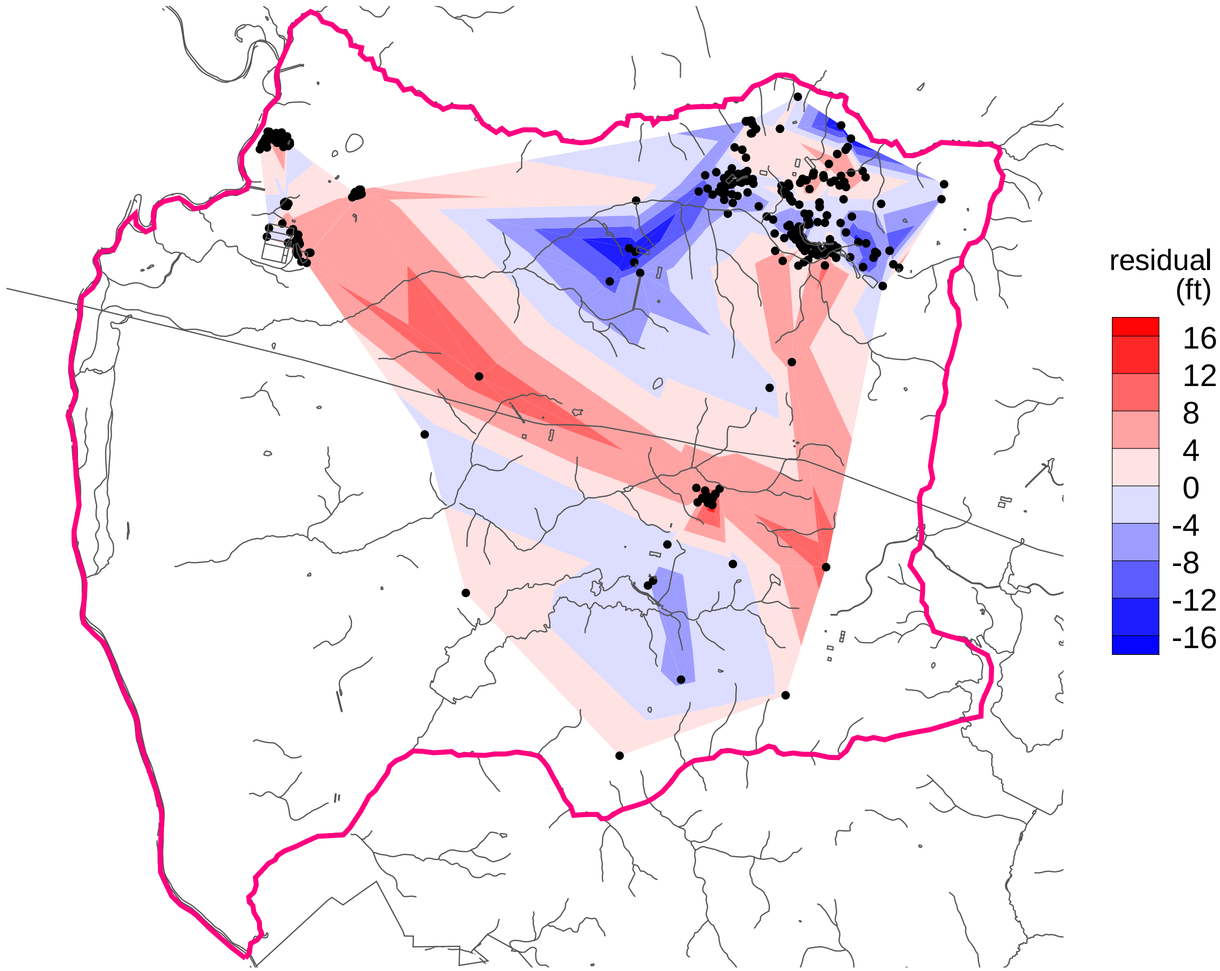

Figure H-2-3. (uncertainty case 2; compare to Figure 4-3)

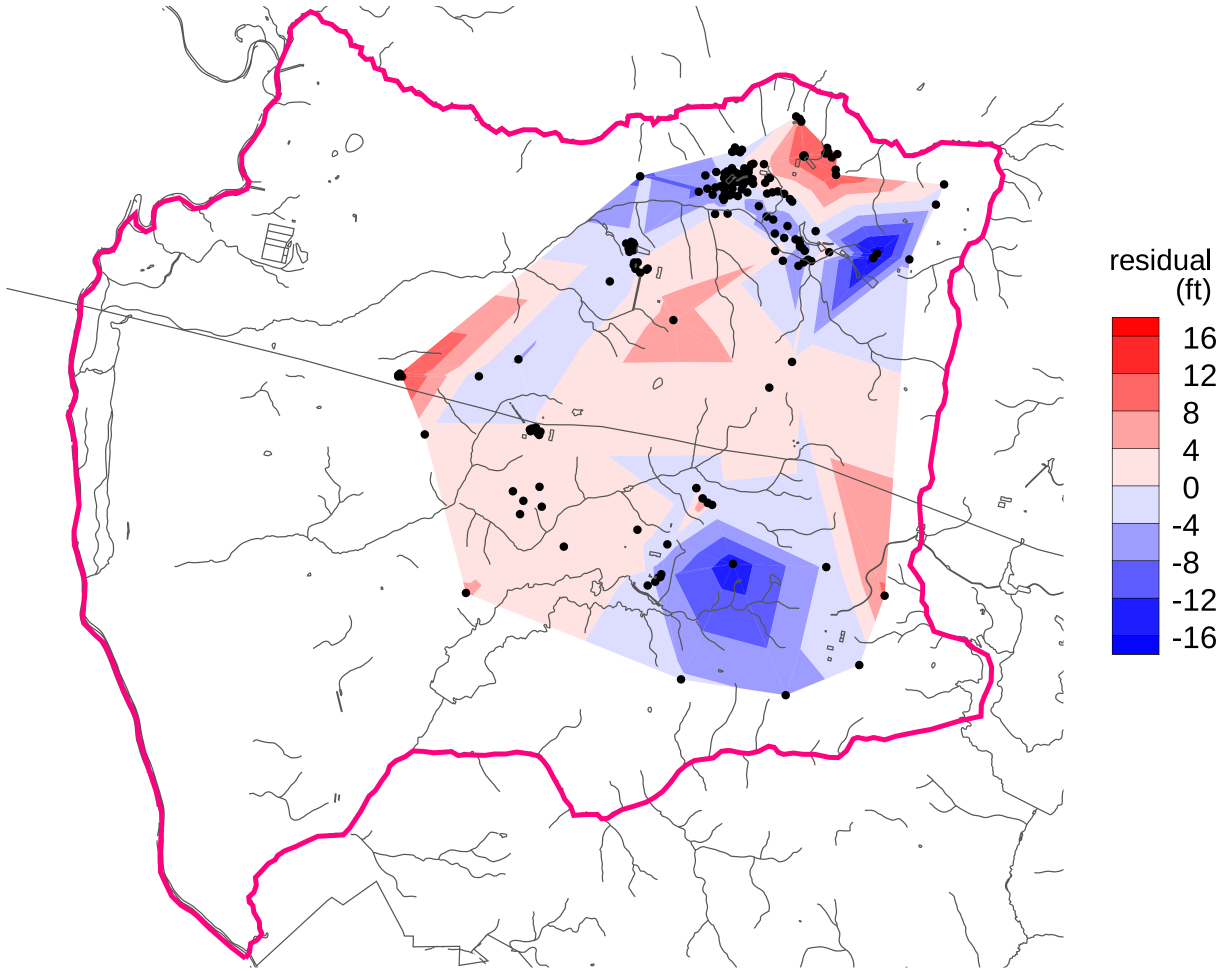

Figure H-2-4. (uncertainty case 2; compare to Figure 4-4)

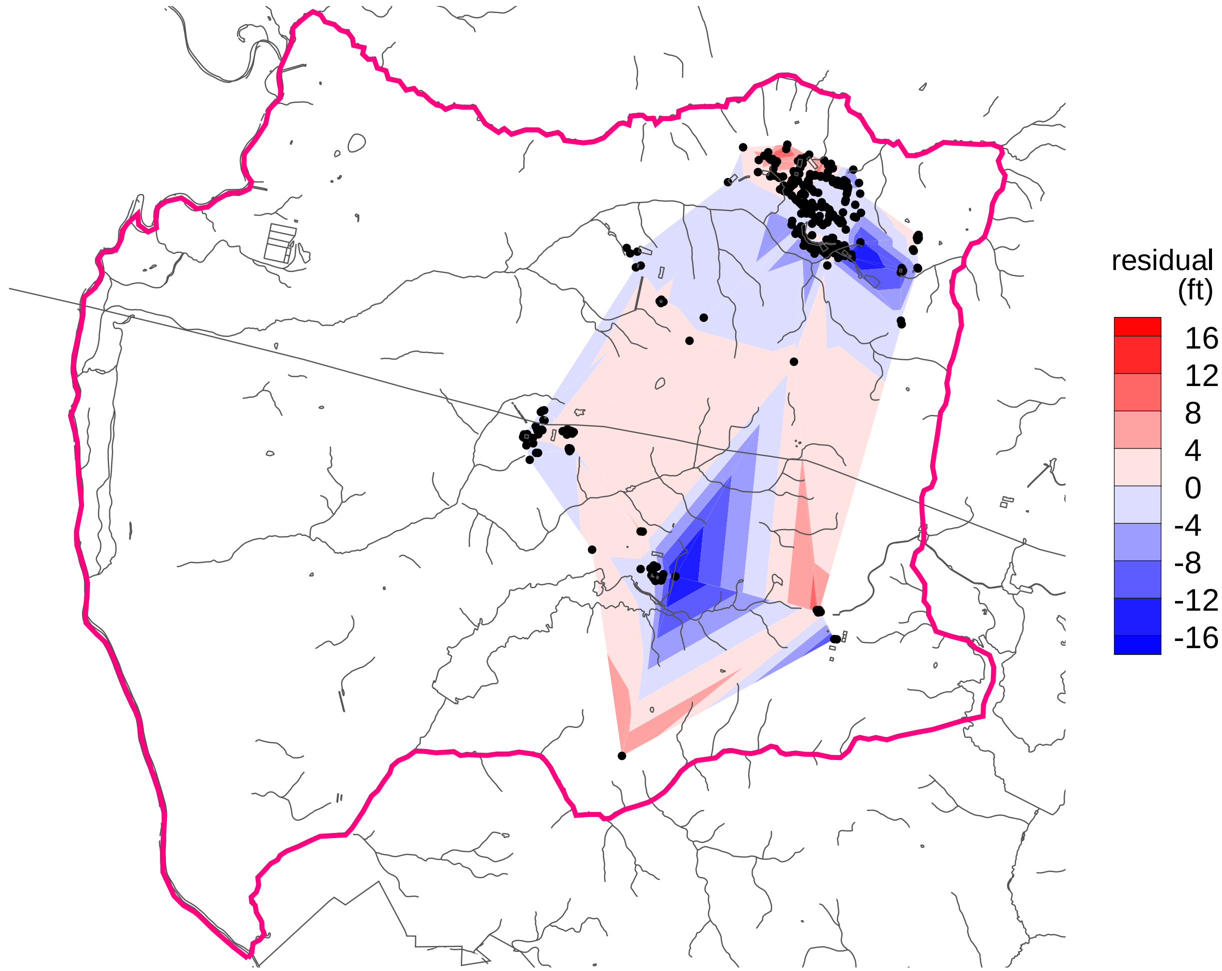

Figure H-2-5. (uncertainty case 2; compare to Figure 4-5)

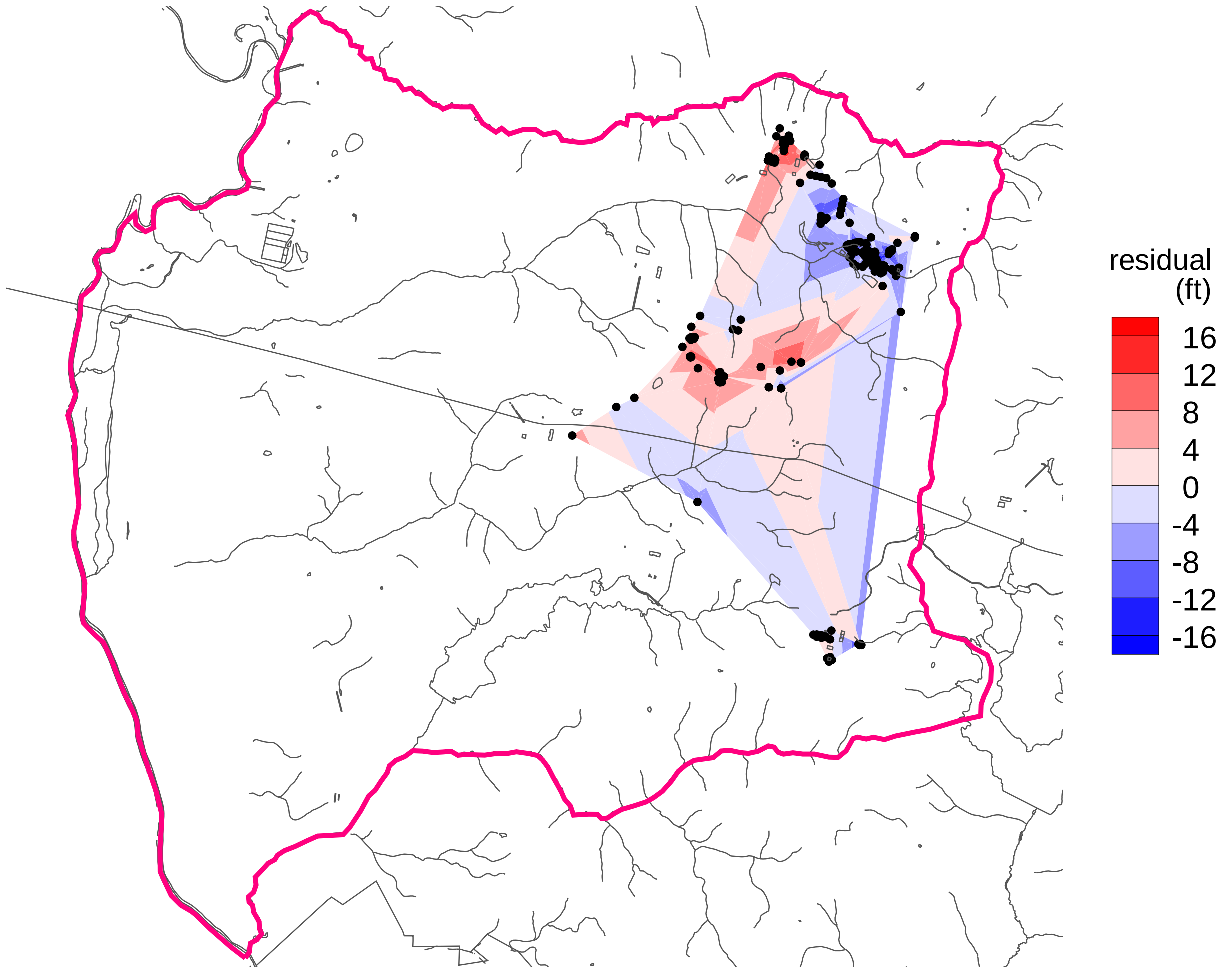

Figure H-2-6. (uncertainty case 2; compare to Figure 4-6)

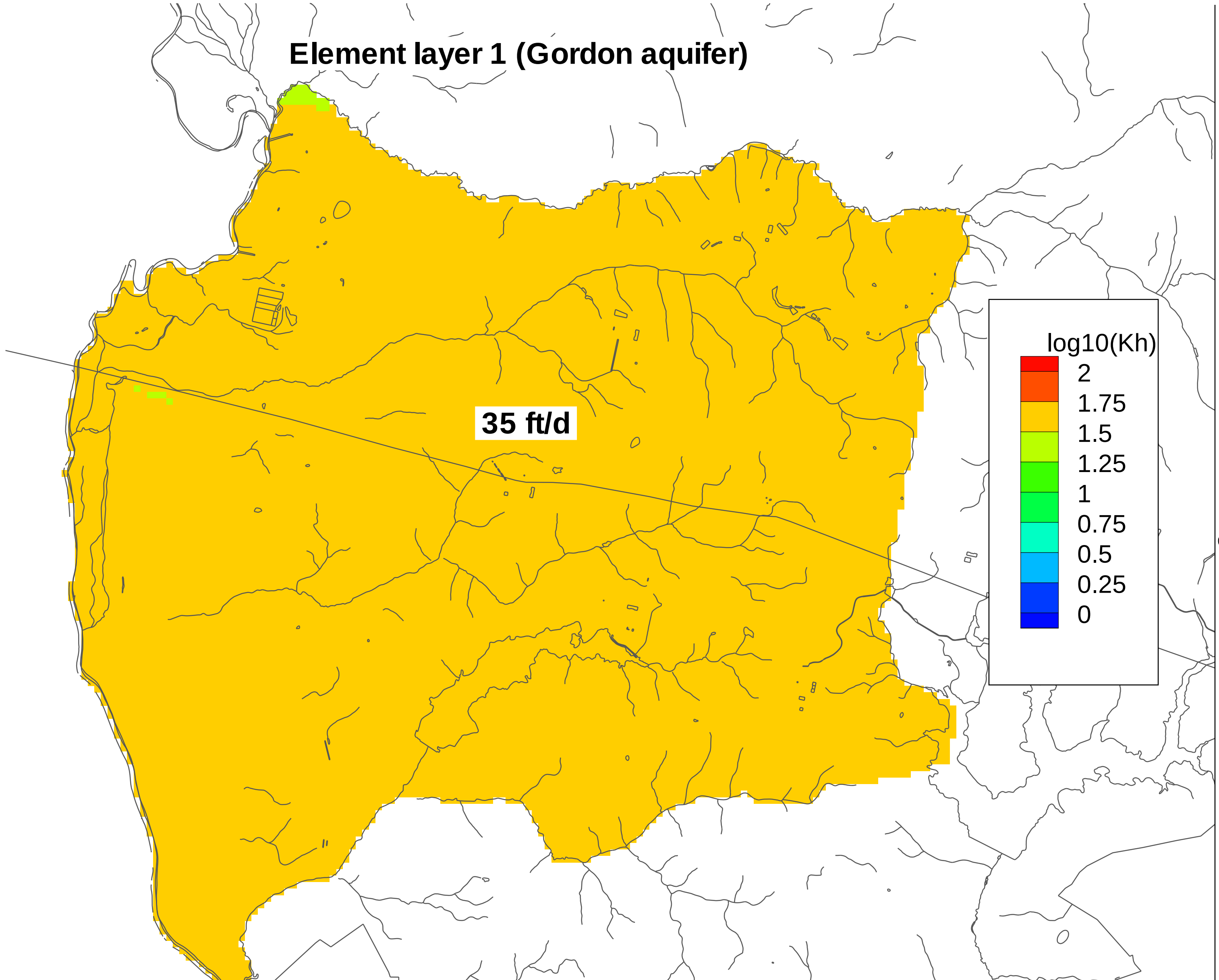

Figure H-2-7. (uncertainty case 2; compare to Figure 4-7)

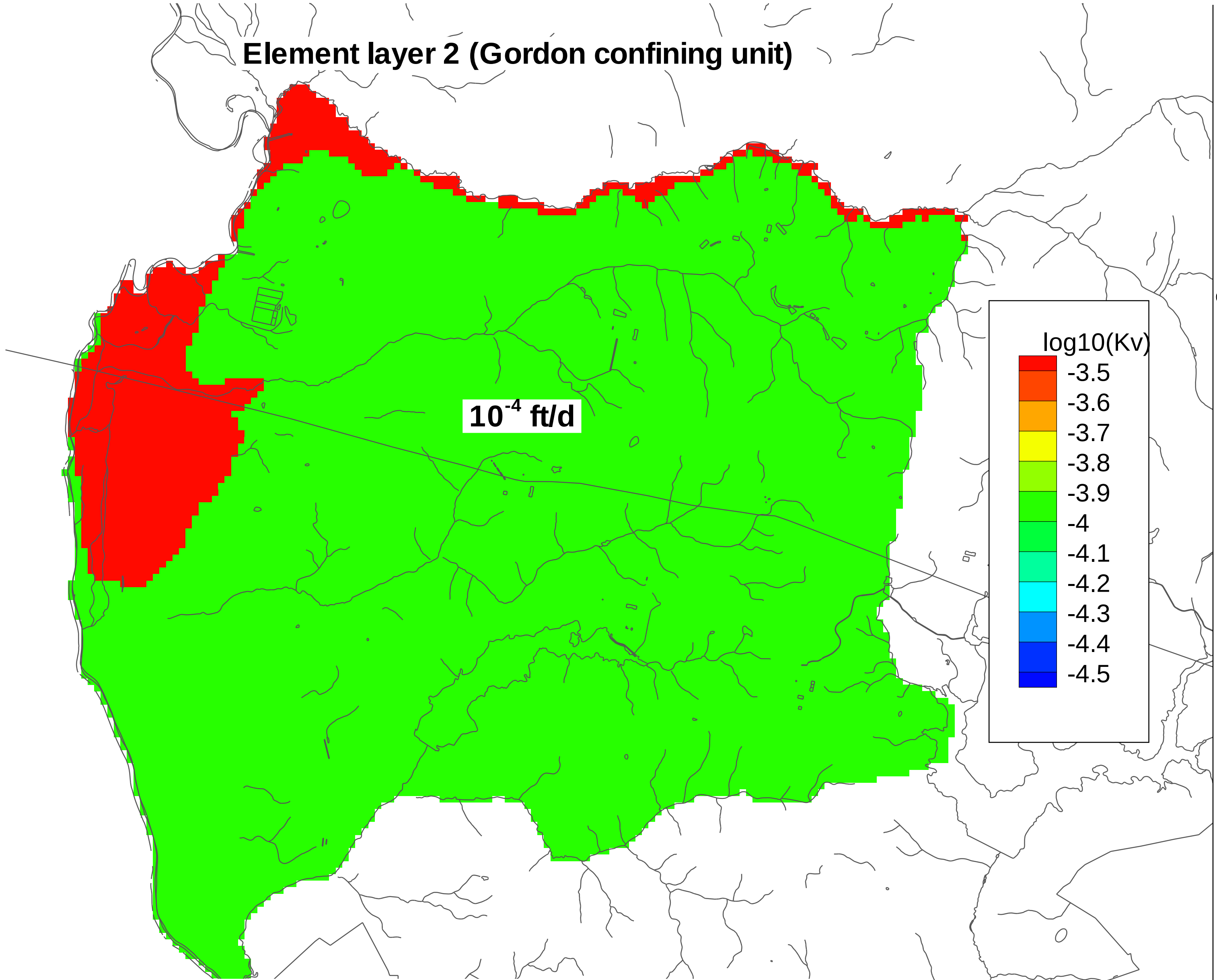

Figure H-2-8. (uncertainty case 2; compare to Figure 4-8)

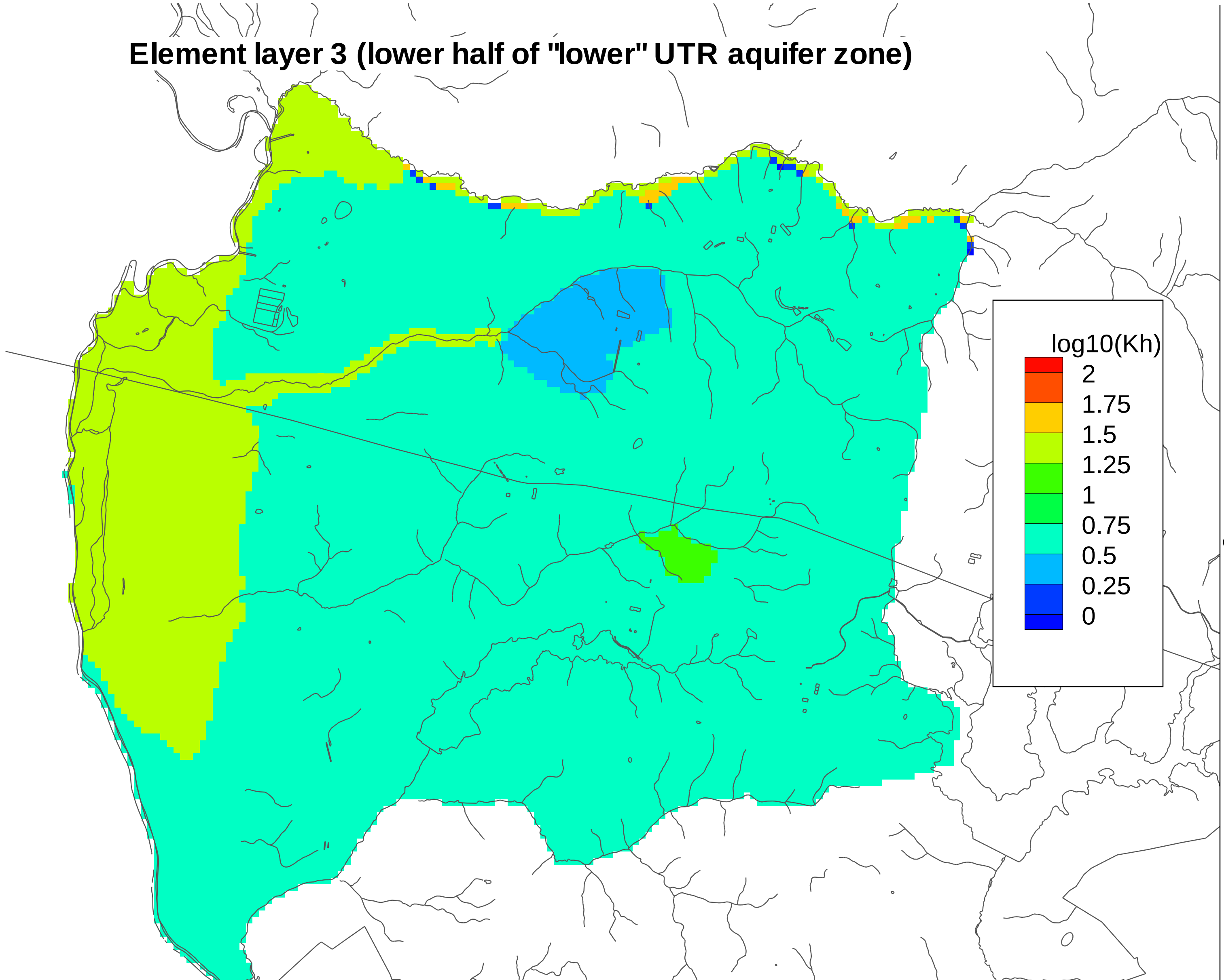

Figure H-2-9. (uncertainty case 2; compare to Figure 4-9)

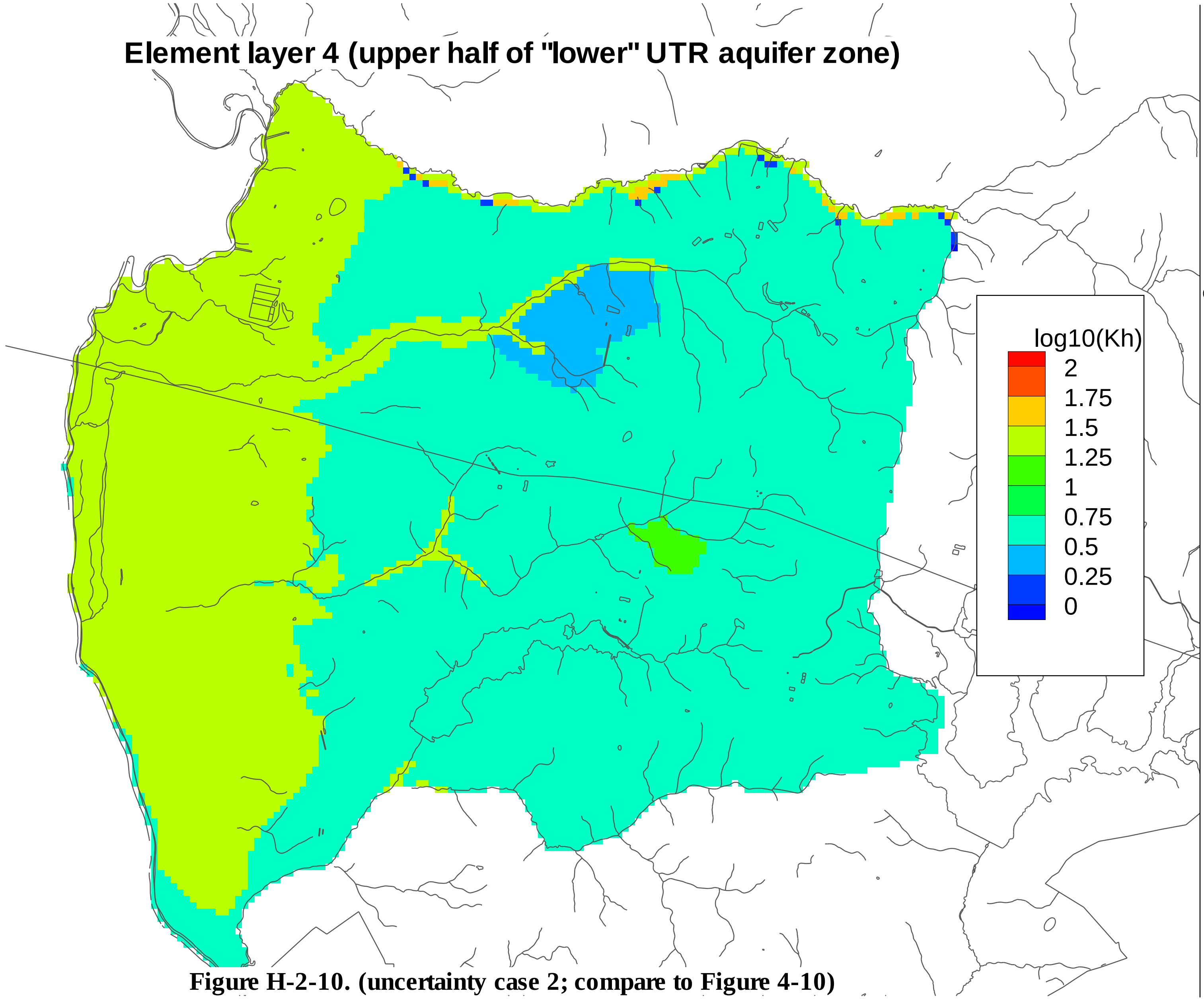

Figure H-2-10. (uncertainty case 2; compare to Figure 4-10)

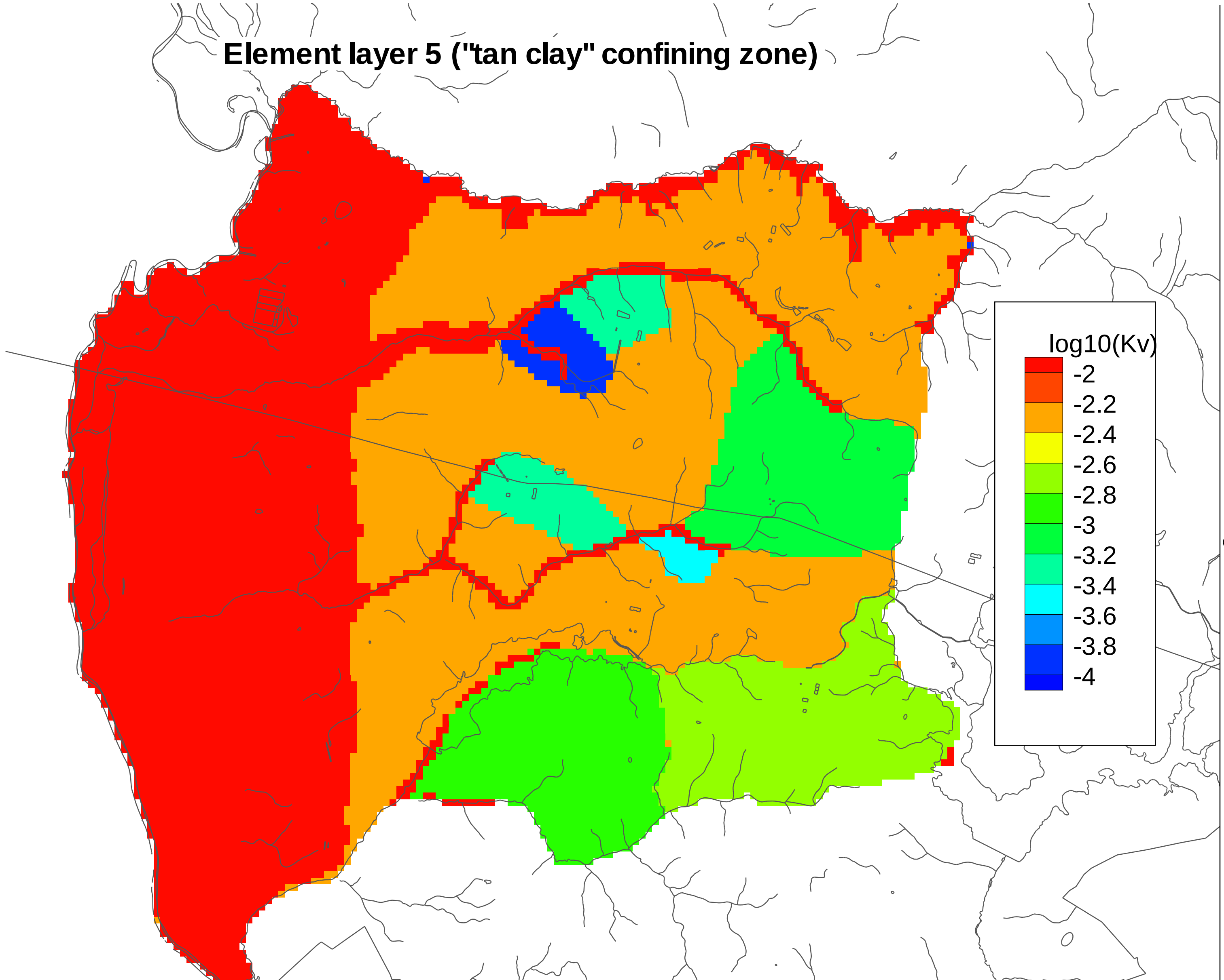

Figure H-2-11. (uncertainty case 2; compare to Figure 4-11)

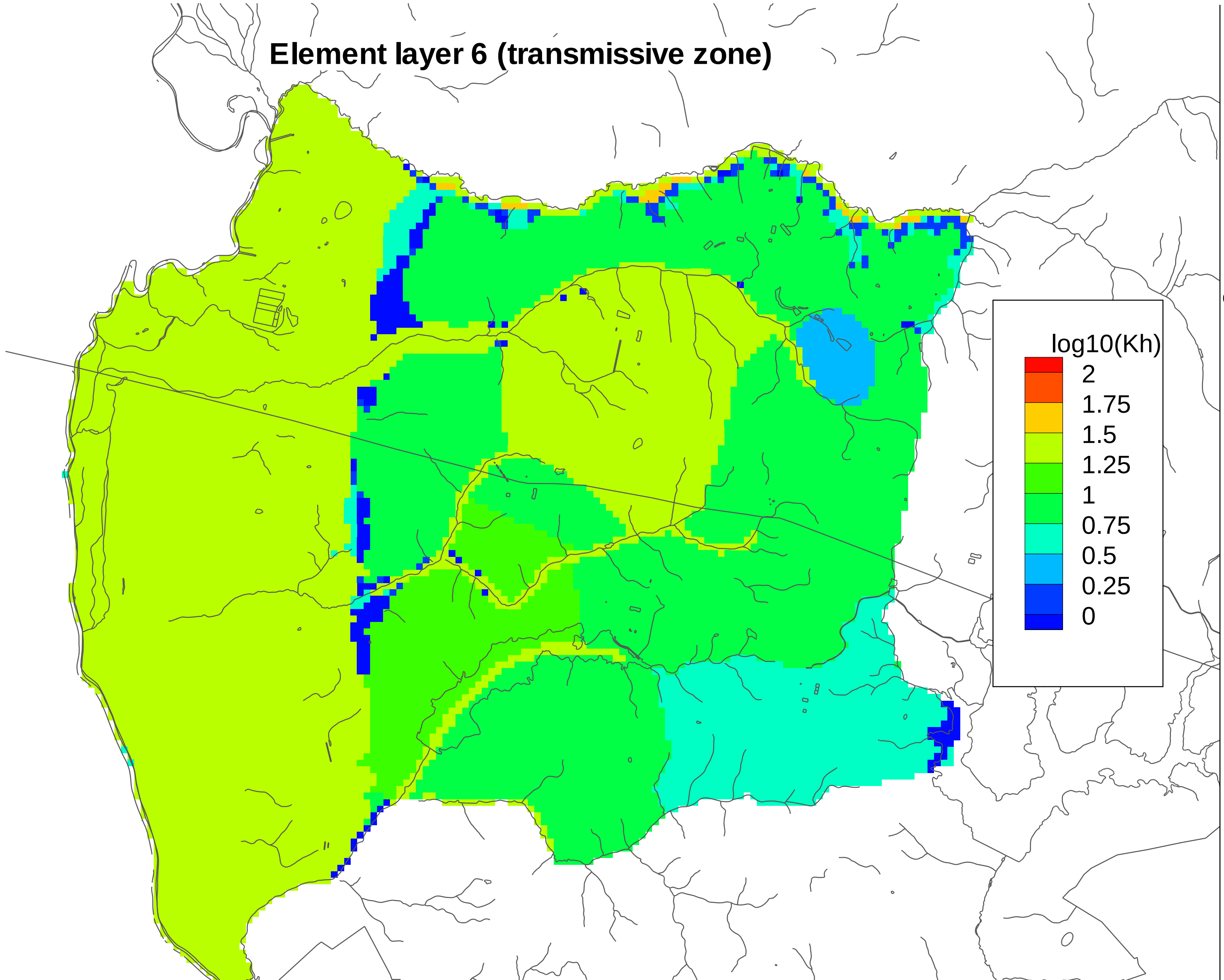

Figure H-2-12. (uncertainty case 2; compare to Figure 4-12)

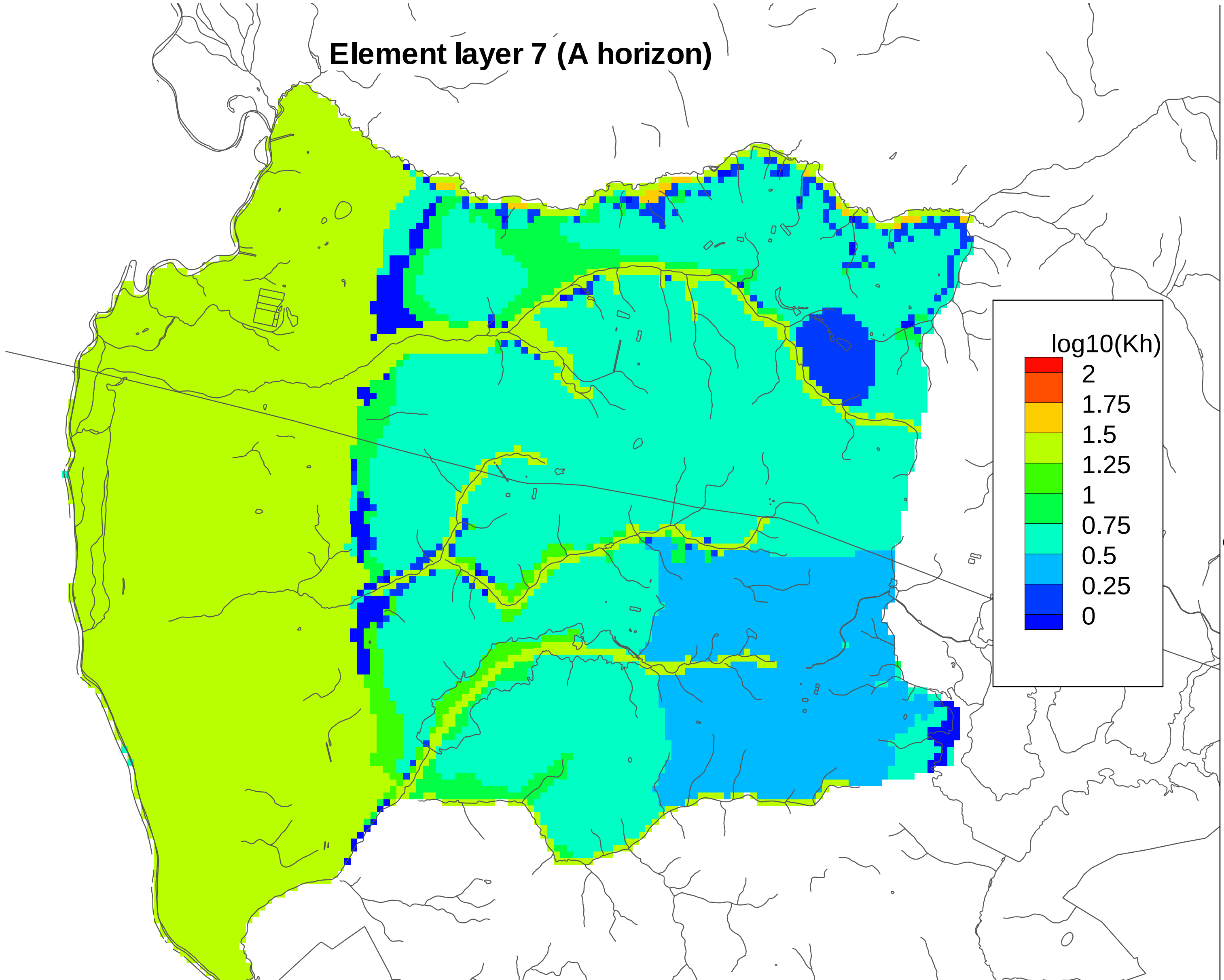

Figure H-2-13. (uncertainty case 2; compare to Figure 4-13)

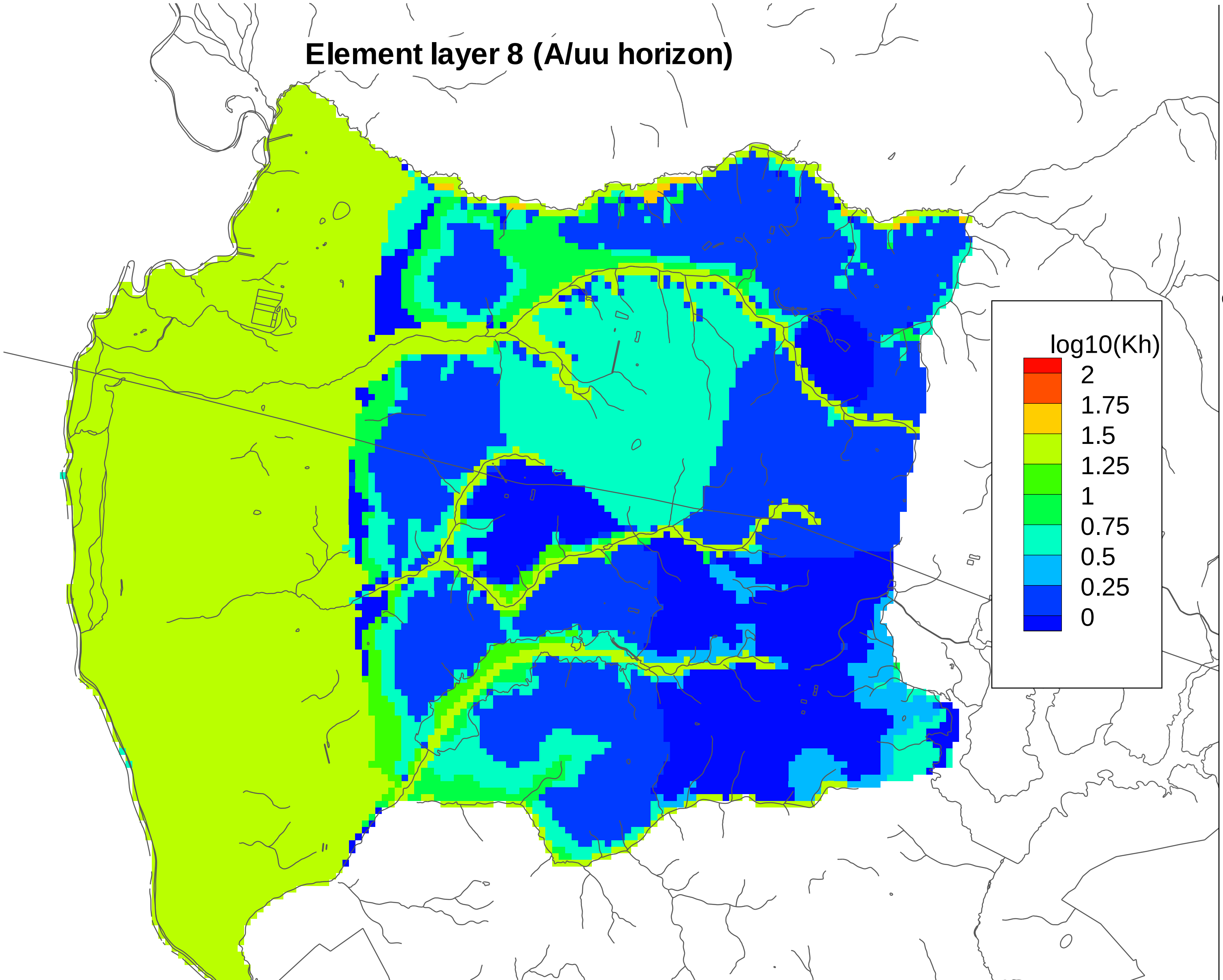

Figure H-2-14. (uncertainty case 2; compare to Figure 4-14)

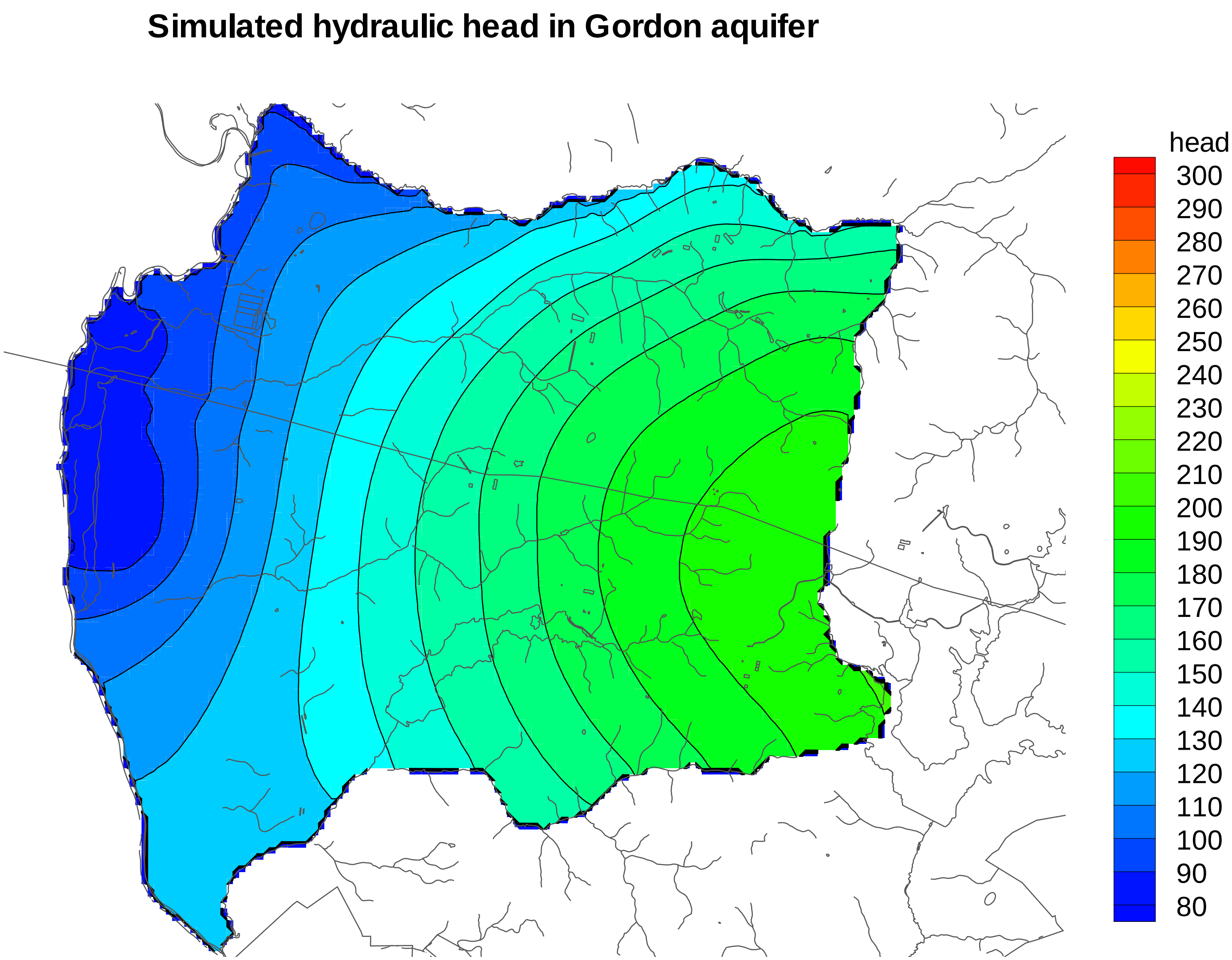

Figure H-2-15. (uncertainty case 2; compare to Figure 4-16)

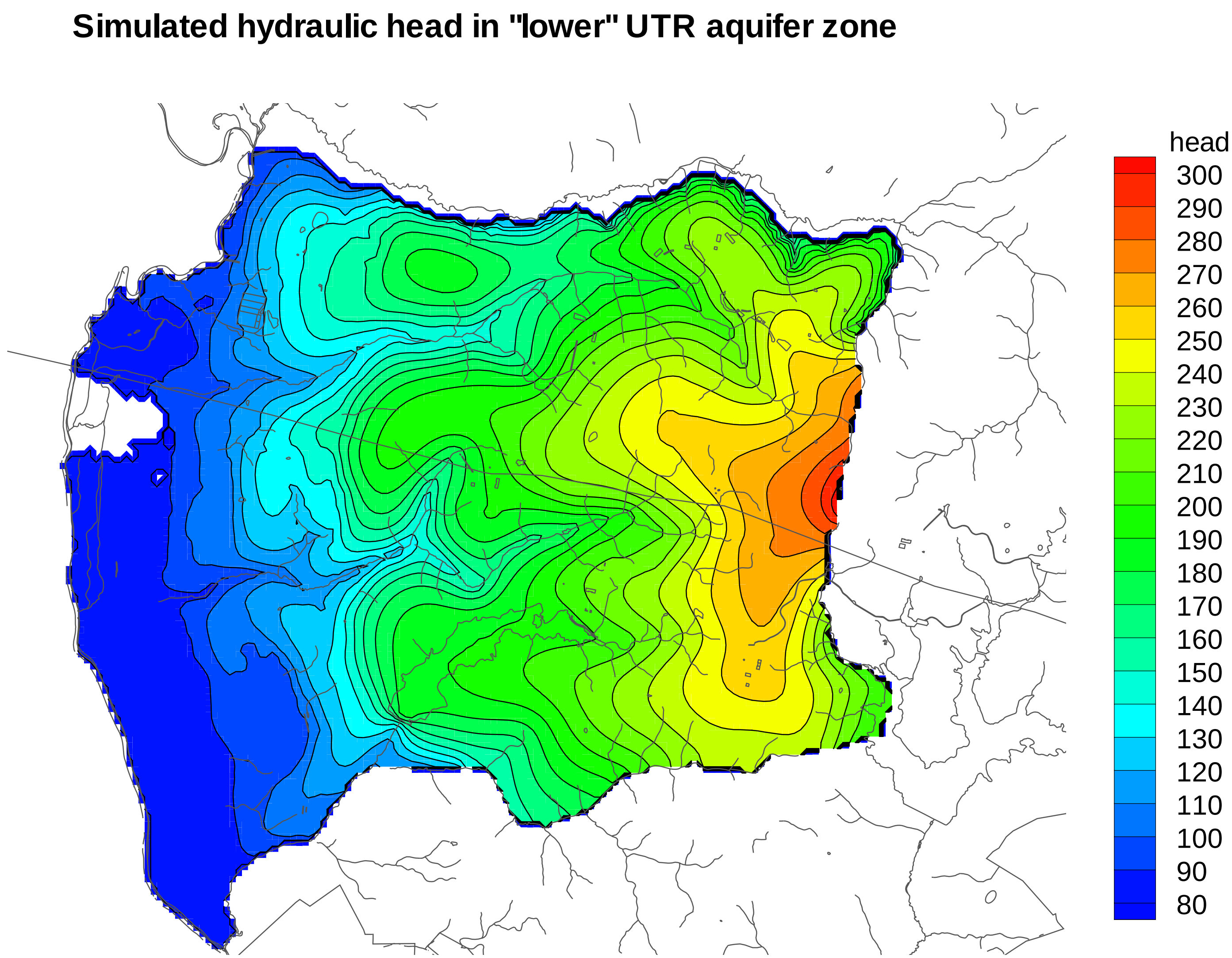

Figure H-2-16. (uncertainty case 2; compare to Figure 4-17)

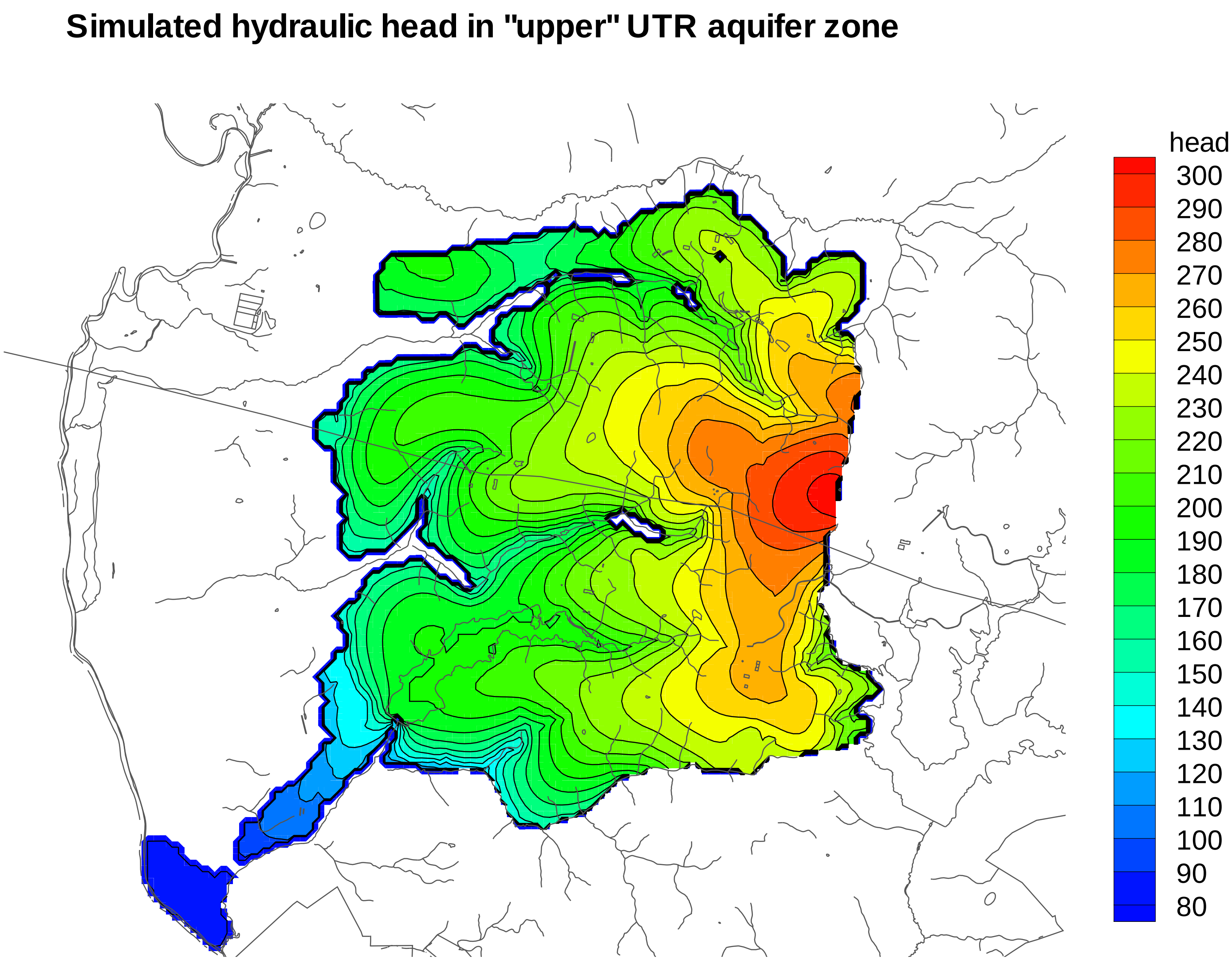

Figure H-2-17. (uncertainty case 2; compare to Figure 4-18)

Simulated hydraulic head in aquifer zone containing water table

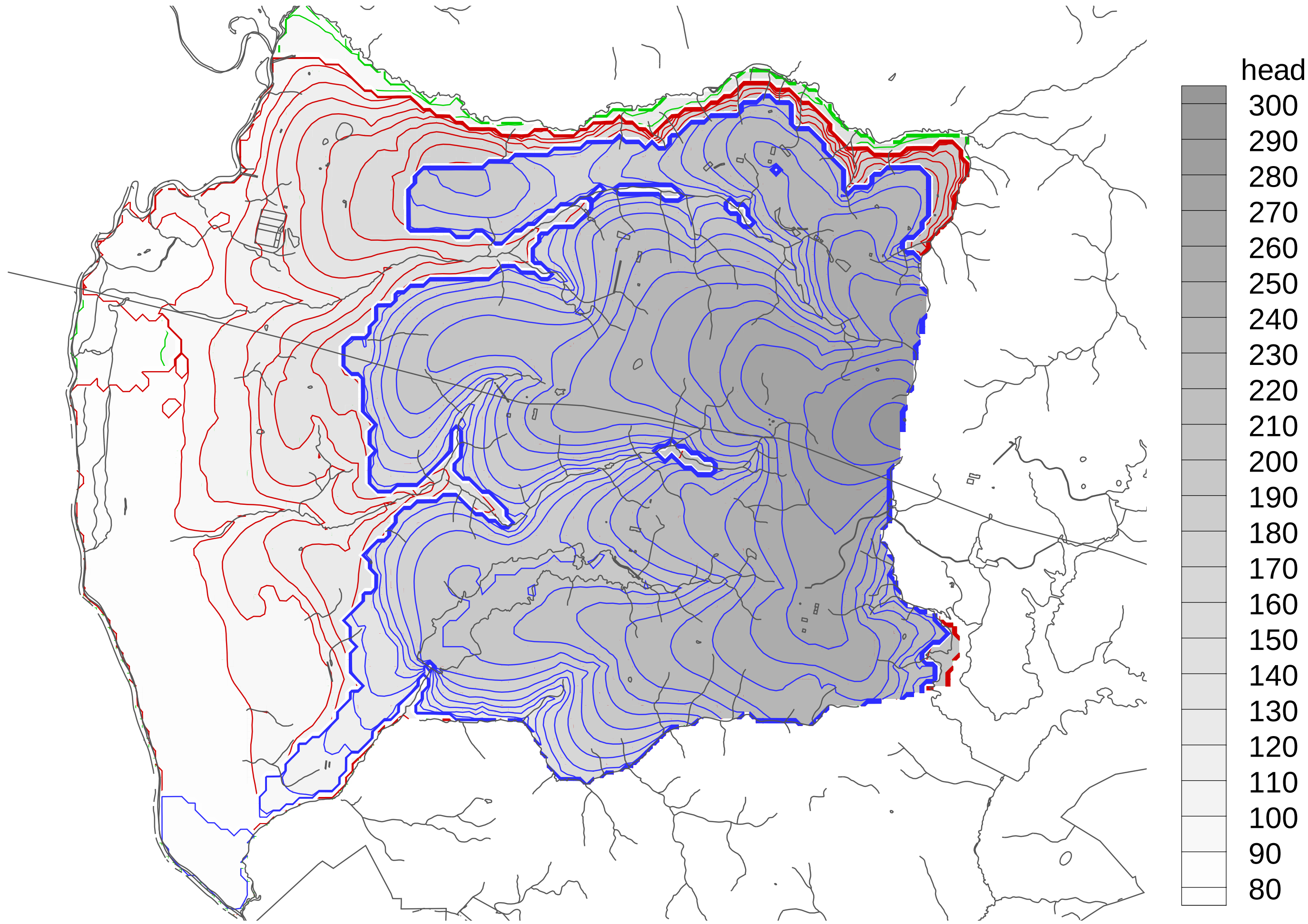

Figure H-2-18. (uncertainty case 2; compare to Figure 4-19)

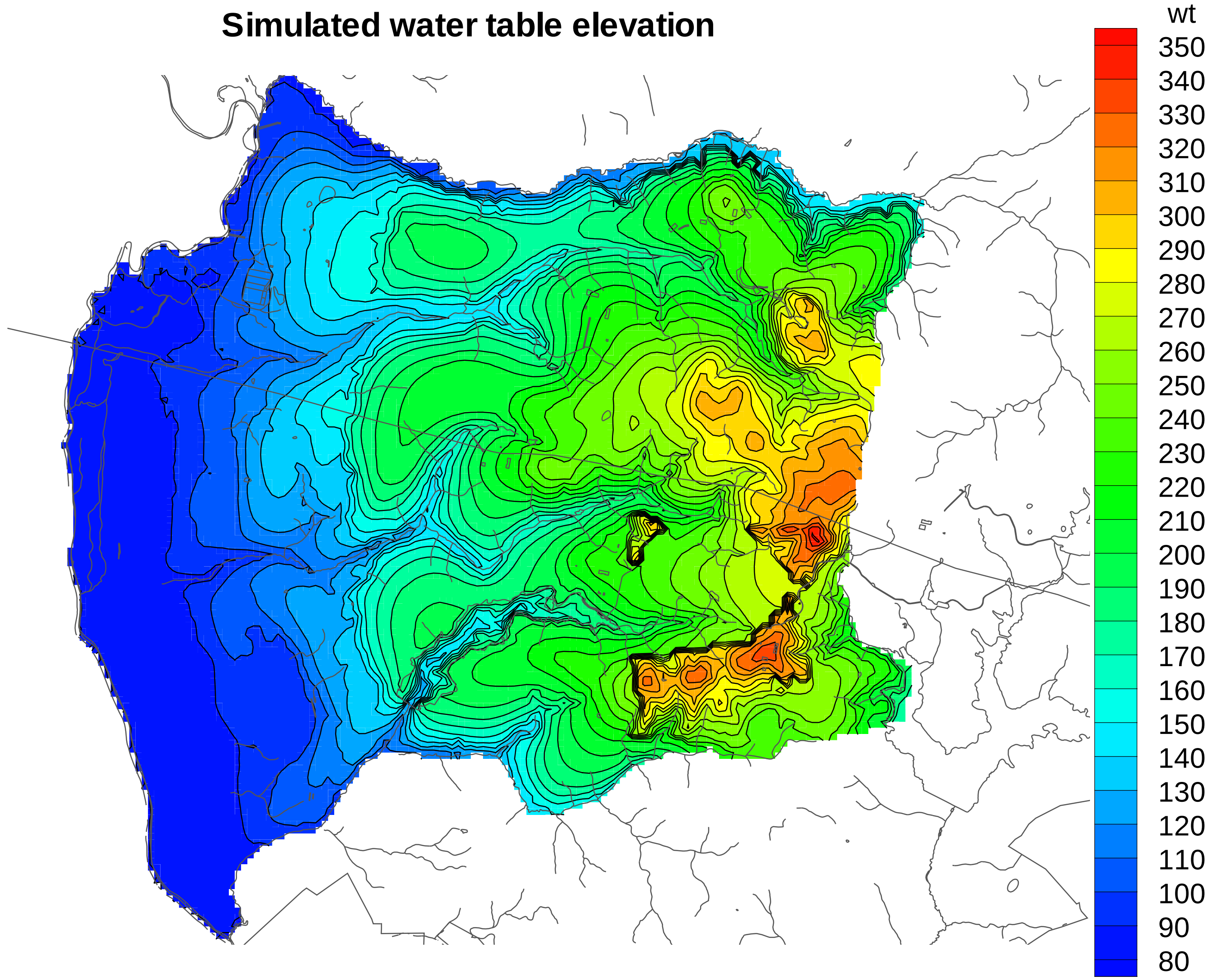

Figure H-2-19. (uncertainty case 2; compare to Figure 4-20)

Simulated groundwater recharge (discharge)

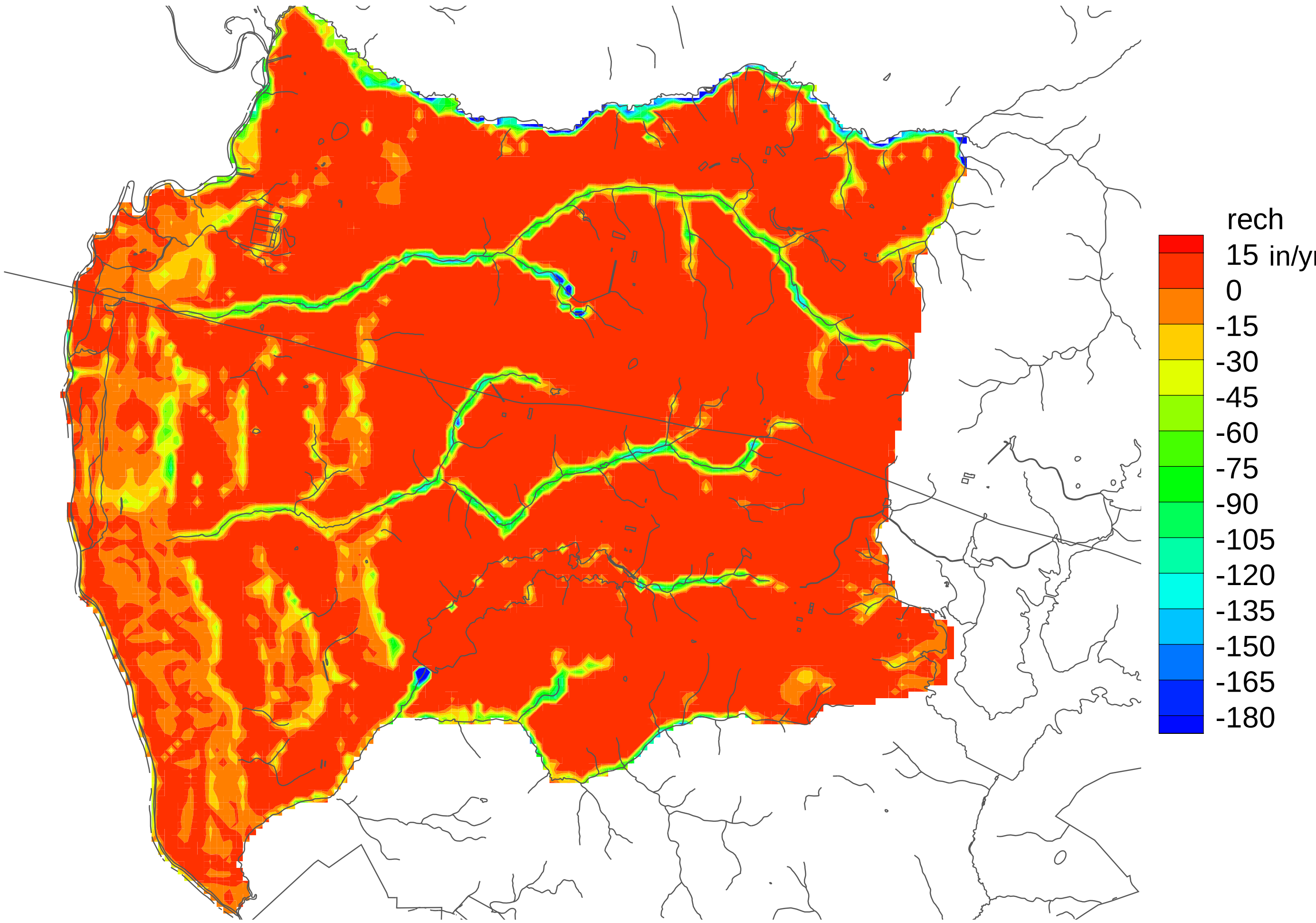

Figure H-2-20. (uncertainty case 2; compare to Figure 4-25)

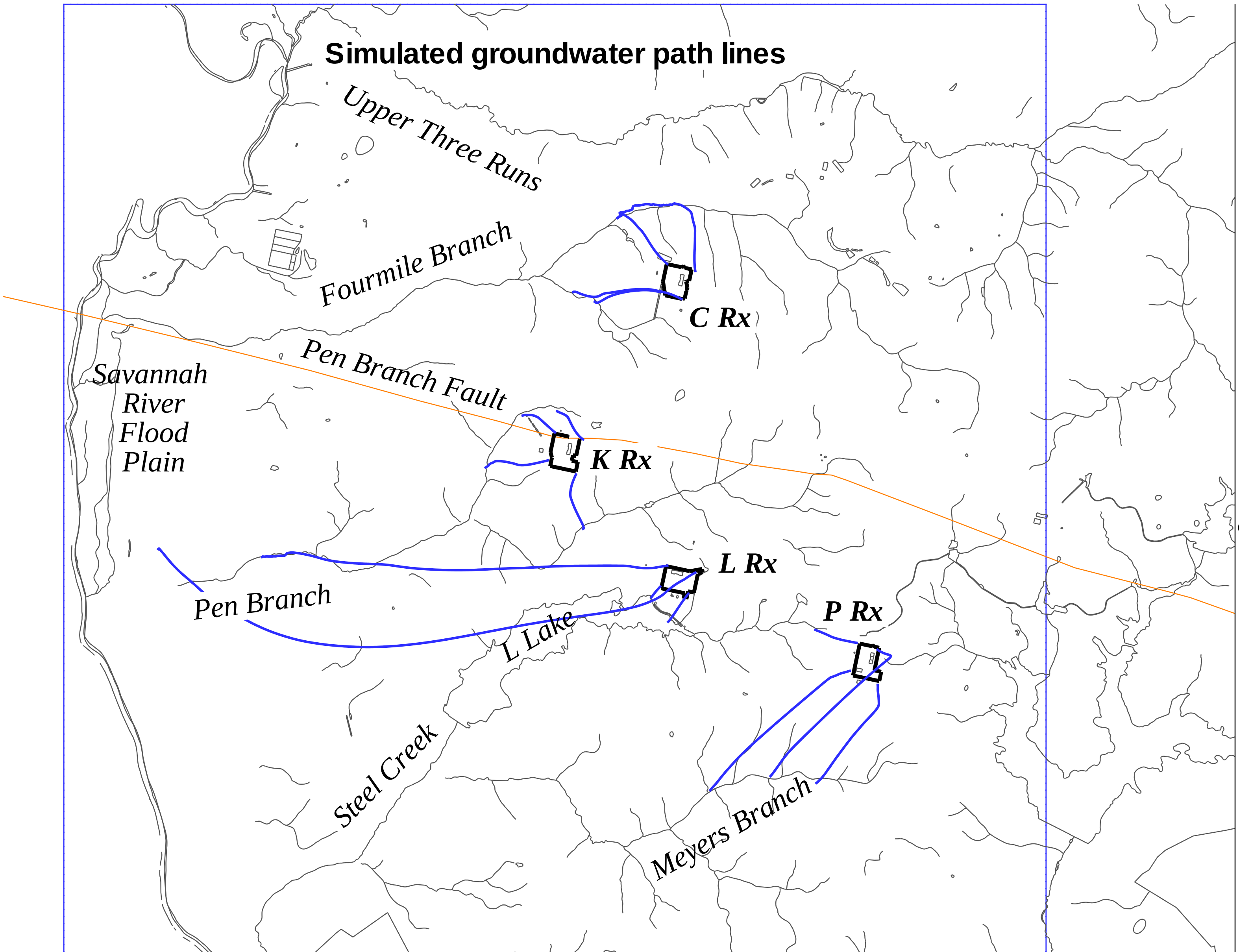

Figure H-2-21. (uncertainty case 2; compare to Figure 4-26)

Simulation results for uncertainty case 3

Uncertainty case 3 involves an increase in Gordon confining unit vertical conductivity by a factor of 5 to 5×10^{-4} ft/day (Table 4-4). Summary calibration results are provided in Table 4-5. This appendix presents detailed simulation results for uncertainty case 3 for comparison to the nominal results shown in figures in the main text. The correspondence between figures for the nominal and uncertainty case 3 is as follows:

Plot type	**Nominal case**	**Uncertainty case 3**
Head residual summary	Figure 4-1	Figure H-3-1
Head residuals in Gordon aquifer	Figure 4-2	Figure H-3-2
Head residuals in "lower" UTRA	Figure 4-3	Figure H-3-3
Head residuals in transmissive zone	Figure 4-4	Figure H-3-4
Head residuals in AA horizon	Figure 4-5	Figure H-3-5
Head residuals in A/uu horizons	Figure 4-6	Figure H-3-6
Kh in element layer 1	Figure 4-7	Figure H-3-7
Kv in element layer 2	Figure 4-8	Figure H-3-8
Kh in element layer 3	Figure 4-9	Figure H-3-9
Kh in element layer 4	Figure 4-10	Figure H-3-10
Kv in element layer 5	Figure 4-11	Figure H-3-11
Kh in element layer 6	Figure 4-12	Figure H-3-12
Kh in element layer 7	Figure 4-13	Figure H-3-13
Kh in element layer 8	Figure 4-14	Figure H-3-14
Gordon aquifer head	Figure 4-16	Figure H-3-15
"Lower" UTRA head	Figure 4-17	Figure H-3-16
"Upper" UTRA head	Figure 4-18	Figure H-3-17
Head in aquifer containing water table	Figure 4-19	Figure H-3-18
Water table	Figure 4-20	Figure H-3-19
Recharge/discharge	Figure 4-25	Figure H-3-20
Example particle tracing	Figure 4-26	Figure H-3-21

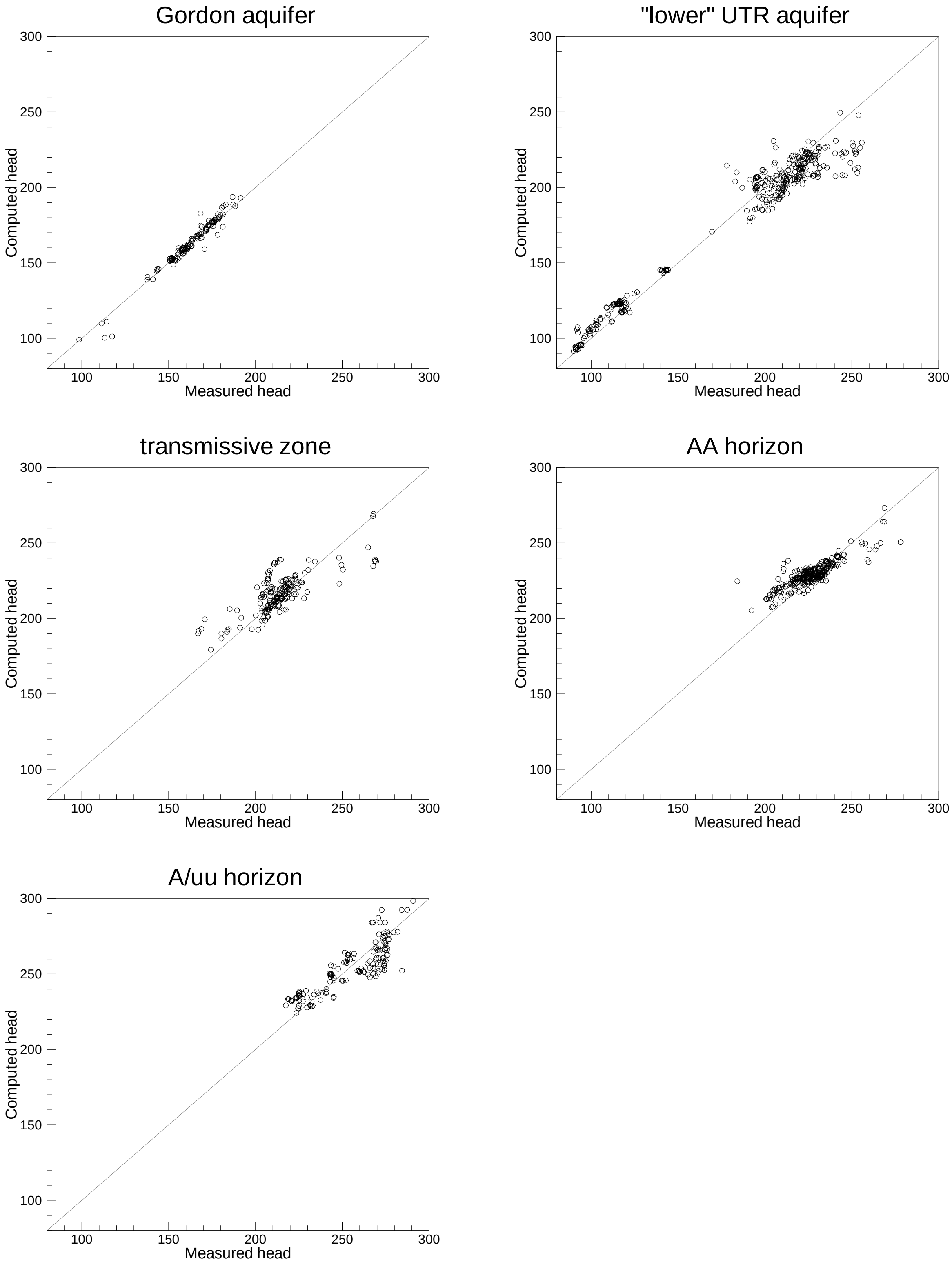

Figure H-3-1. (uncertainty case 3; compare to Figure 4-1)

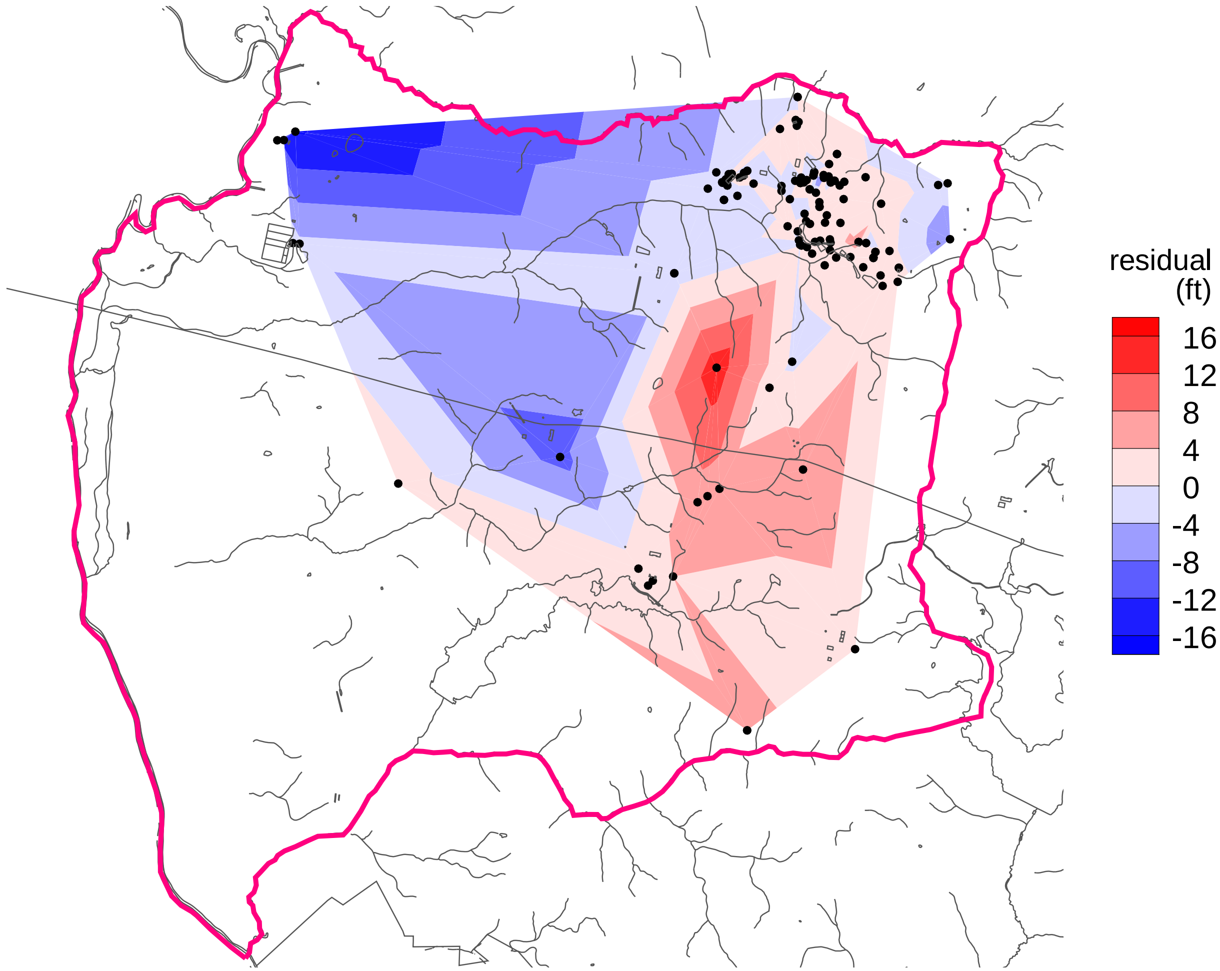

Figure H-3-2. (uncertainty case 3; compare to Figure 4-2)

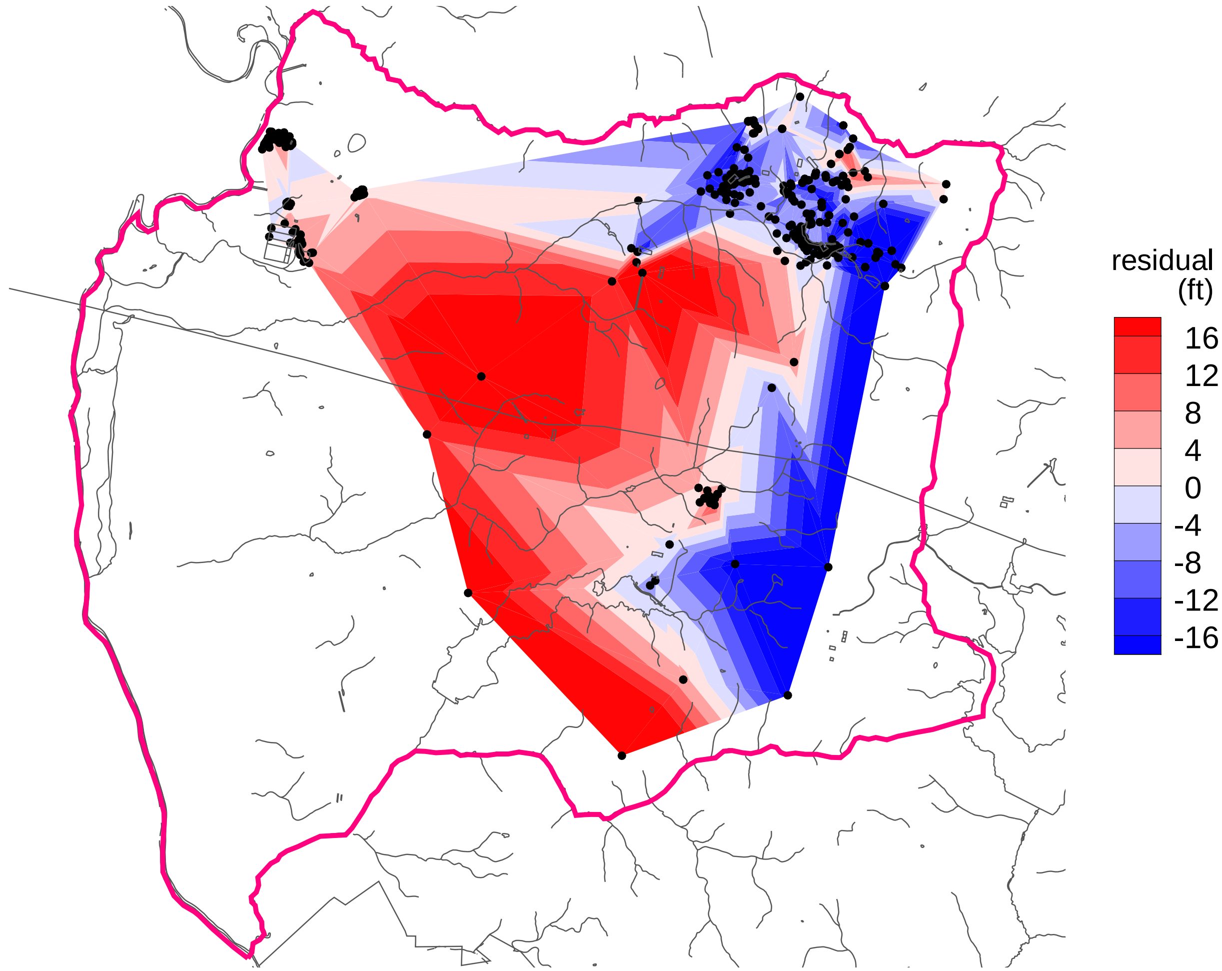

Figure H-3-3. (uncertainty case 3; compare to Figure 4-3)

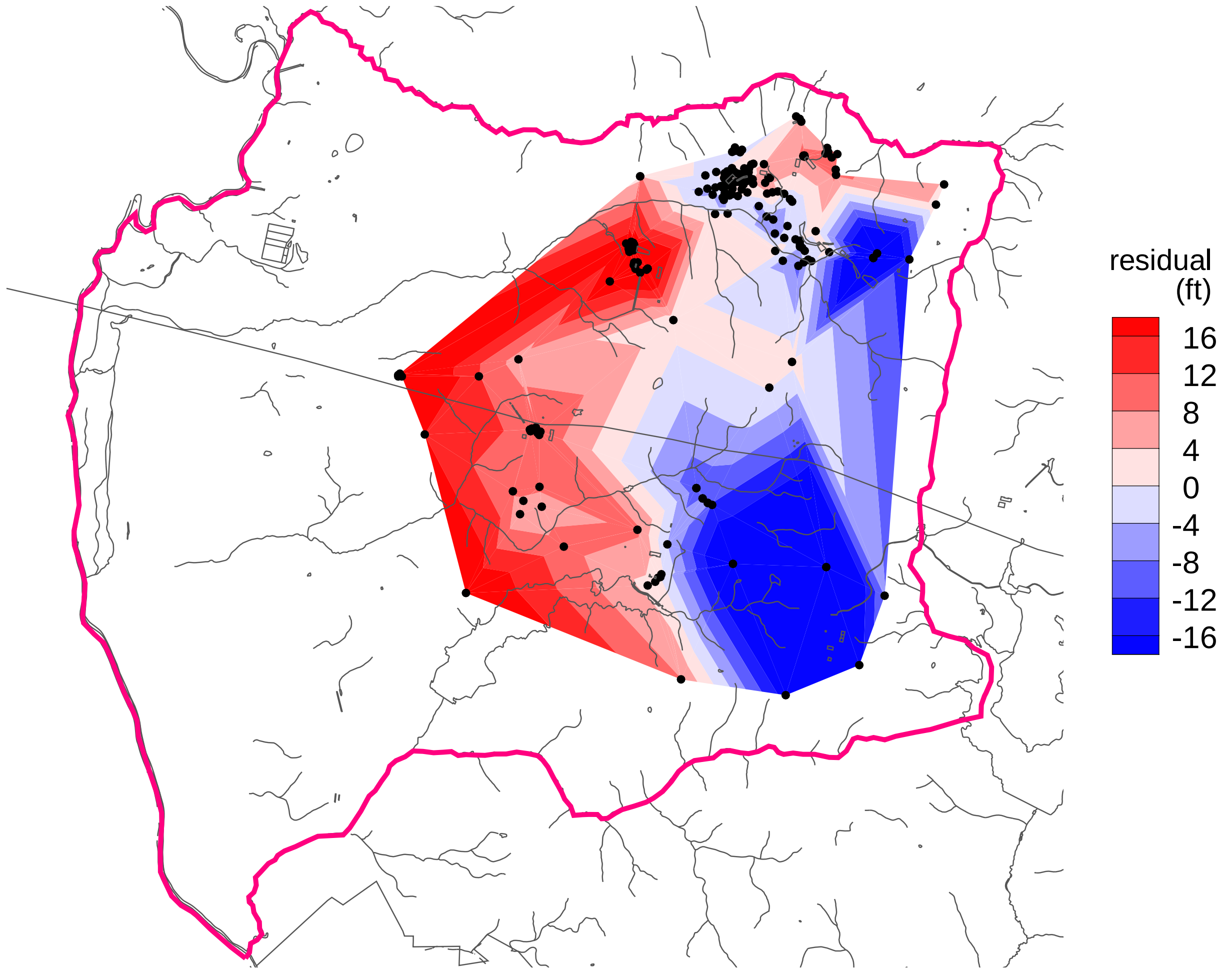

Figure H-3-4. (uncertainty case 3; compare to Figure 4-4)

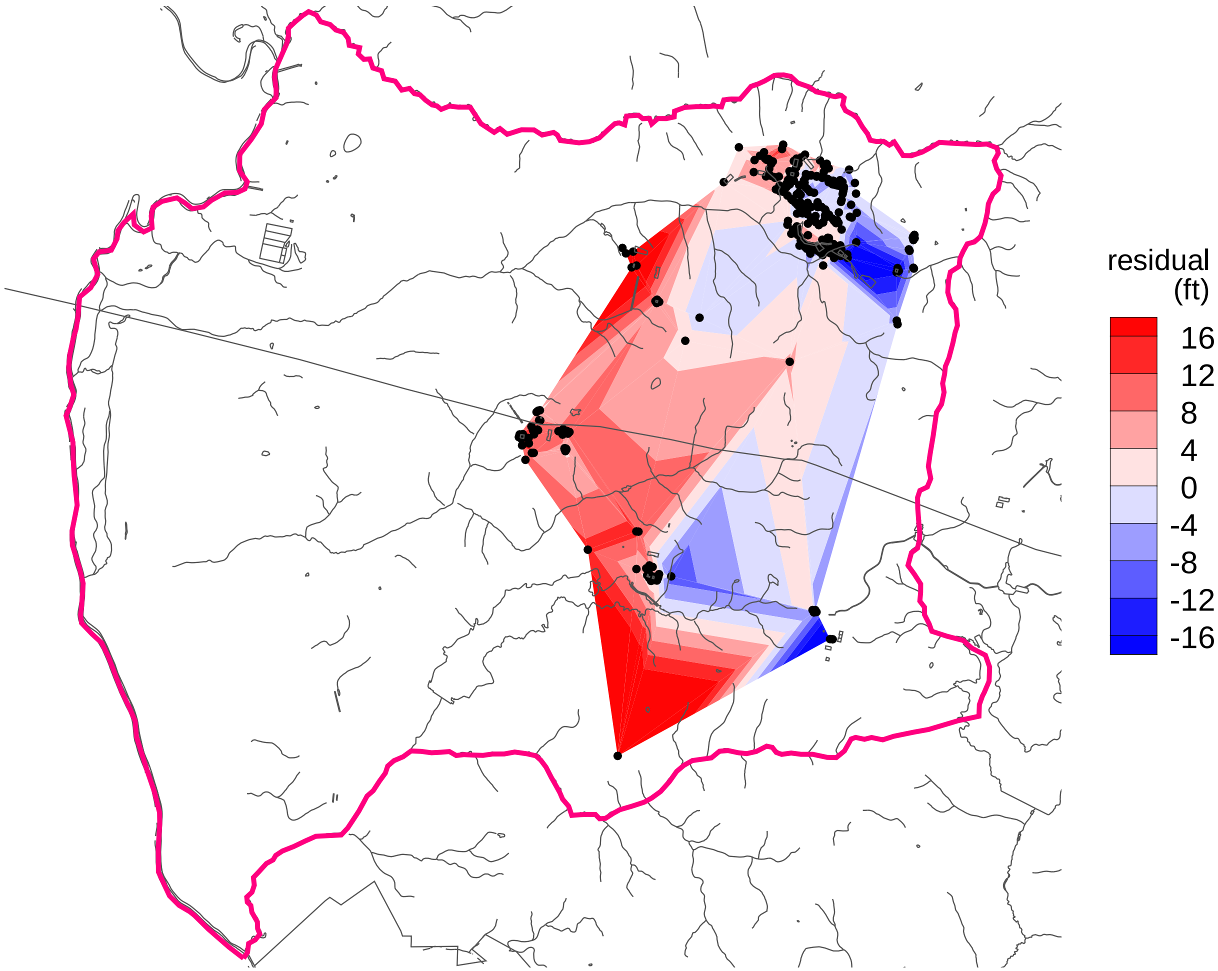

Figure H-3-5. (uncertainty case 3; compare to Figure 4-5)

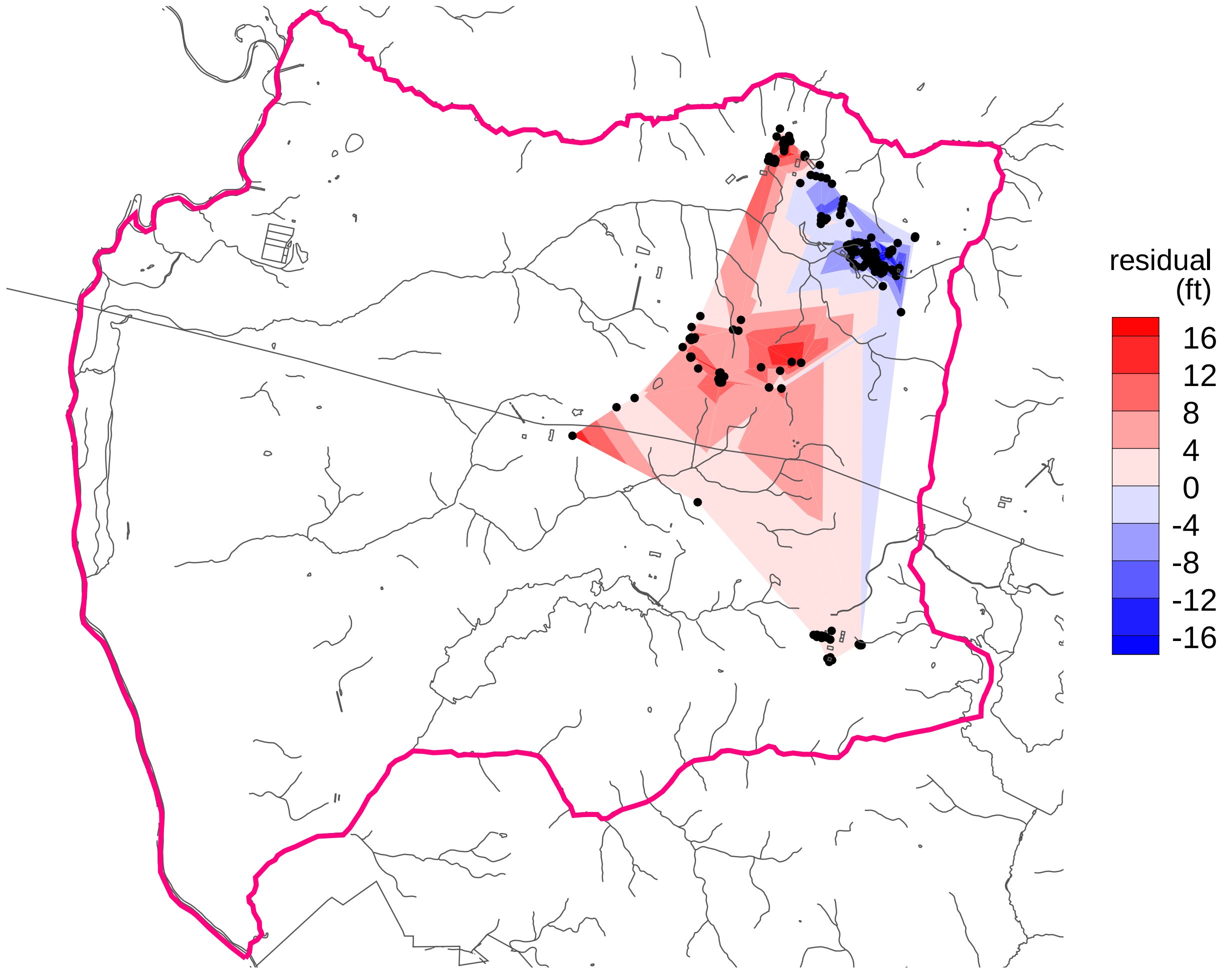

Figure H-3-6. (uncertainty case 3; compare to Figure 4-6)

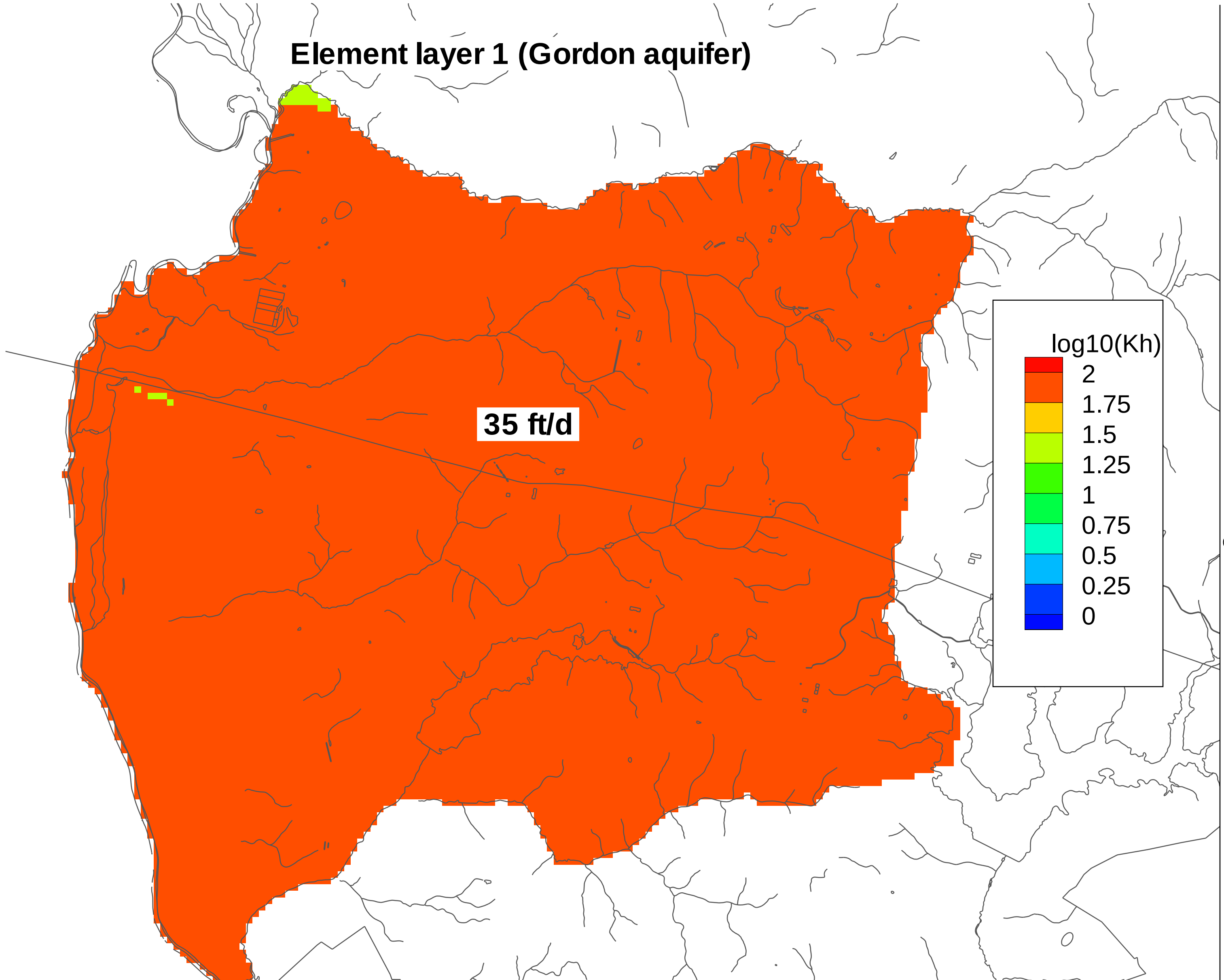

Figure H-3-7. (uncertainty case 3; compare to Figure 4-7)

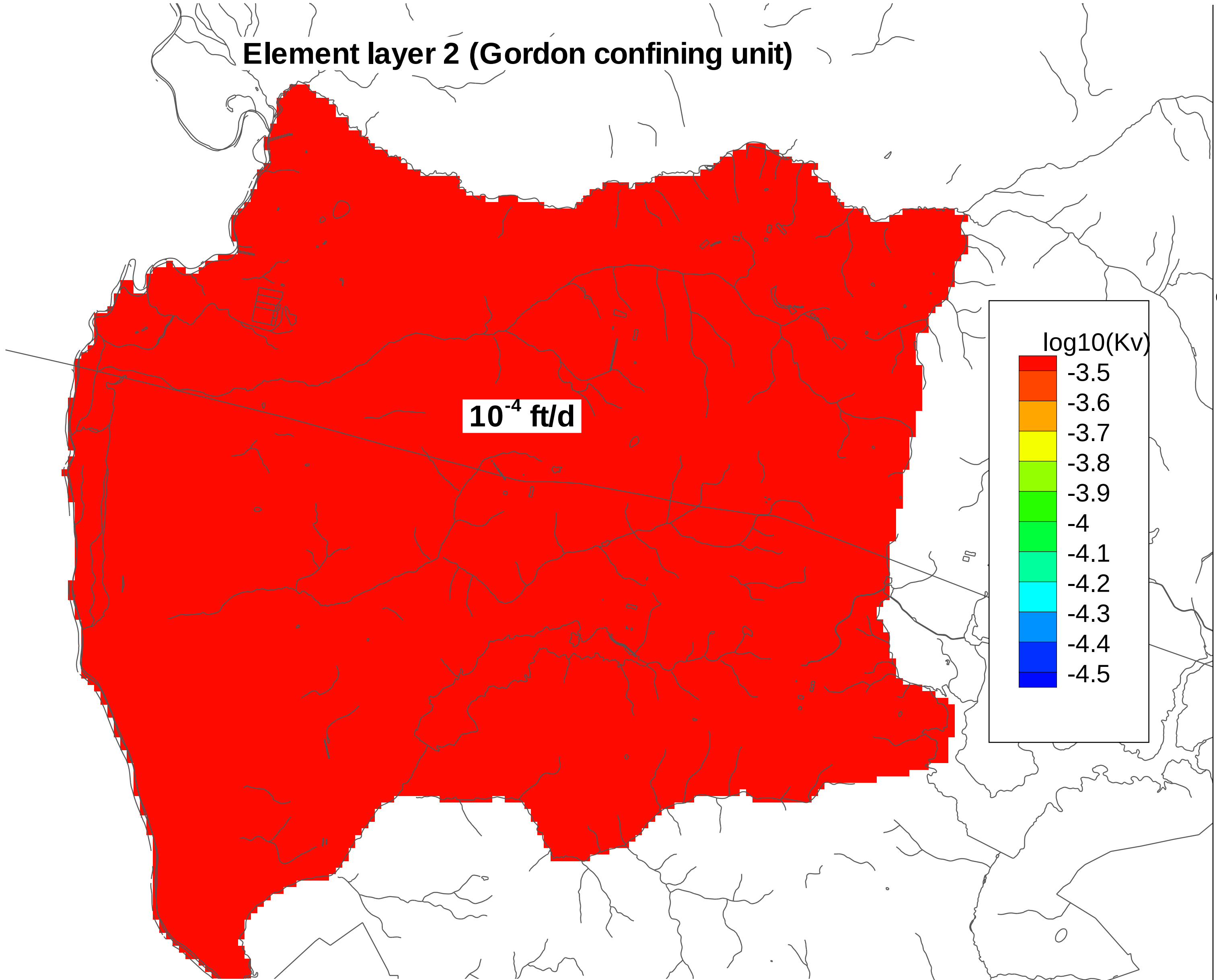

Figure H-3-8. (uncertainty case 3; compare to Figure 4-8)

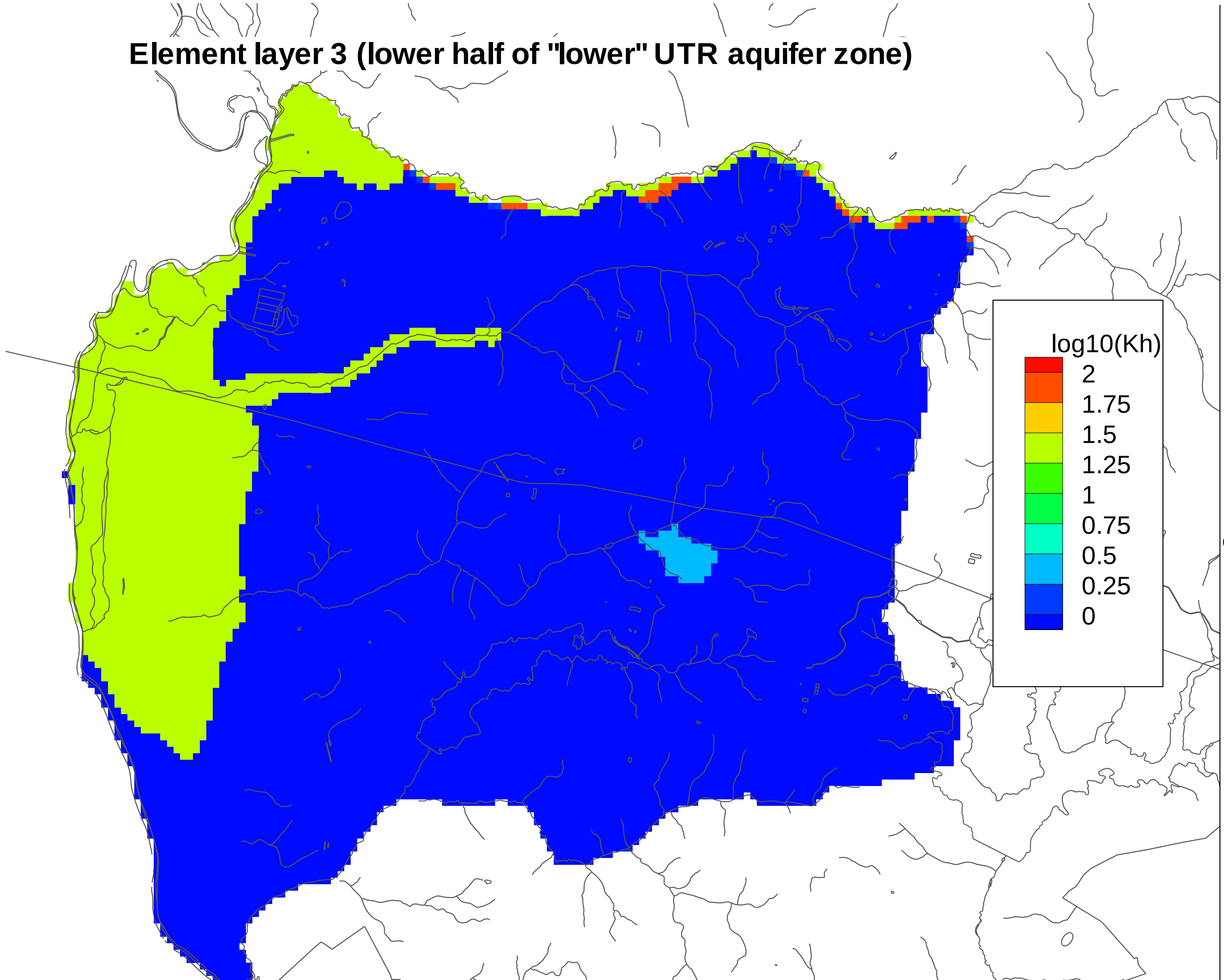

Figure H-3-9. (uncertainty case 3; compare to Figure 4-9)

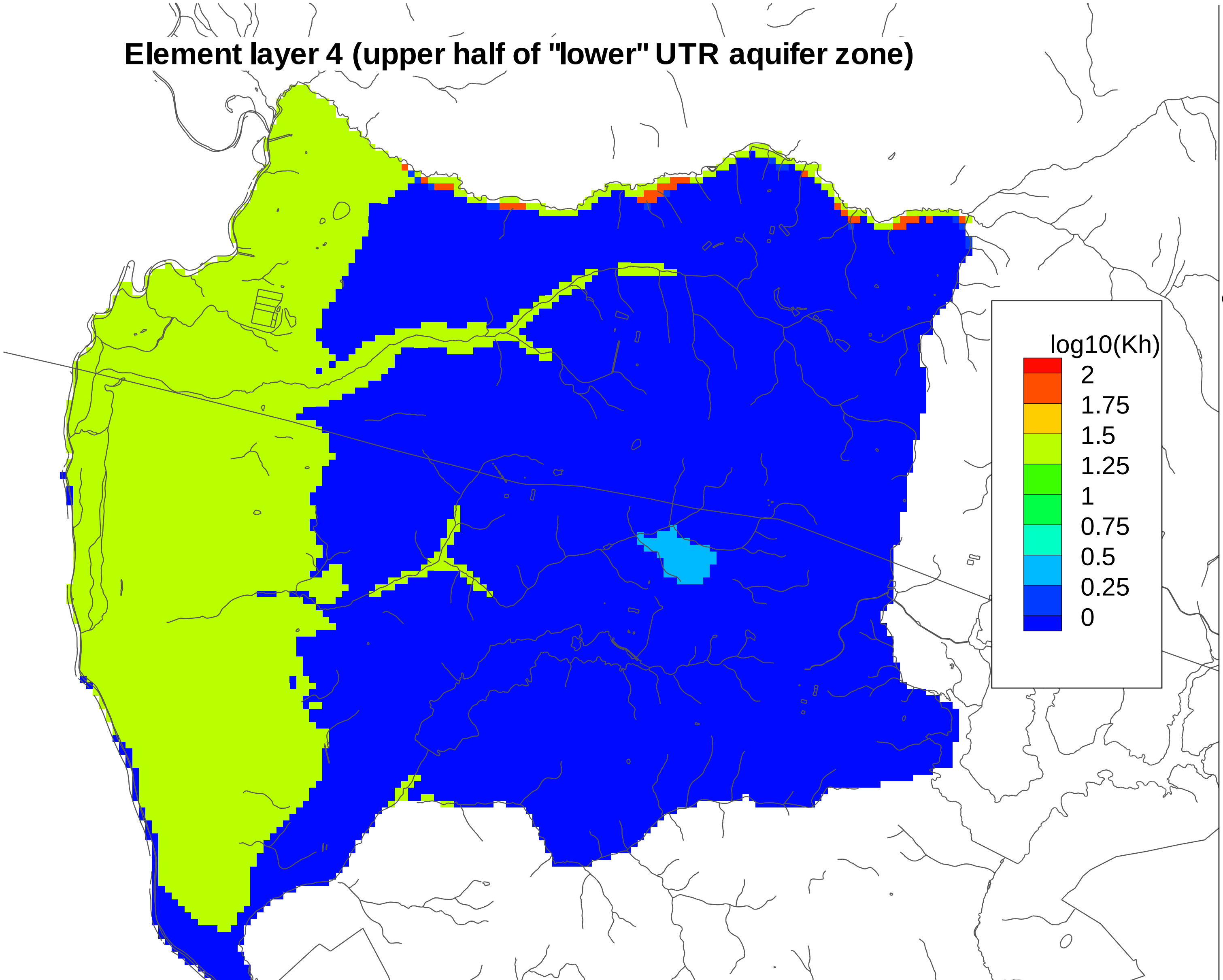

Figure H-3-10. (uncertainty case 3; compare to Figure 4-10)

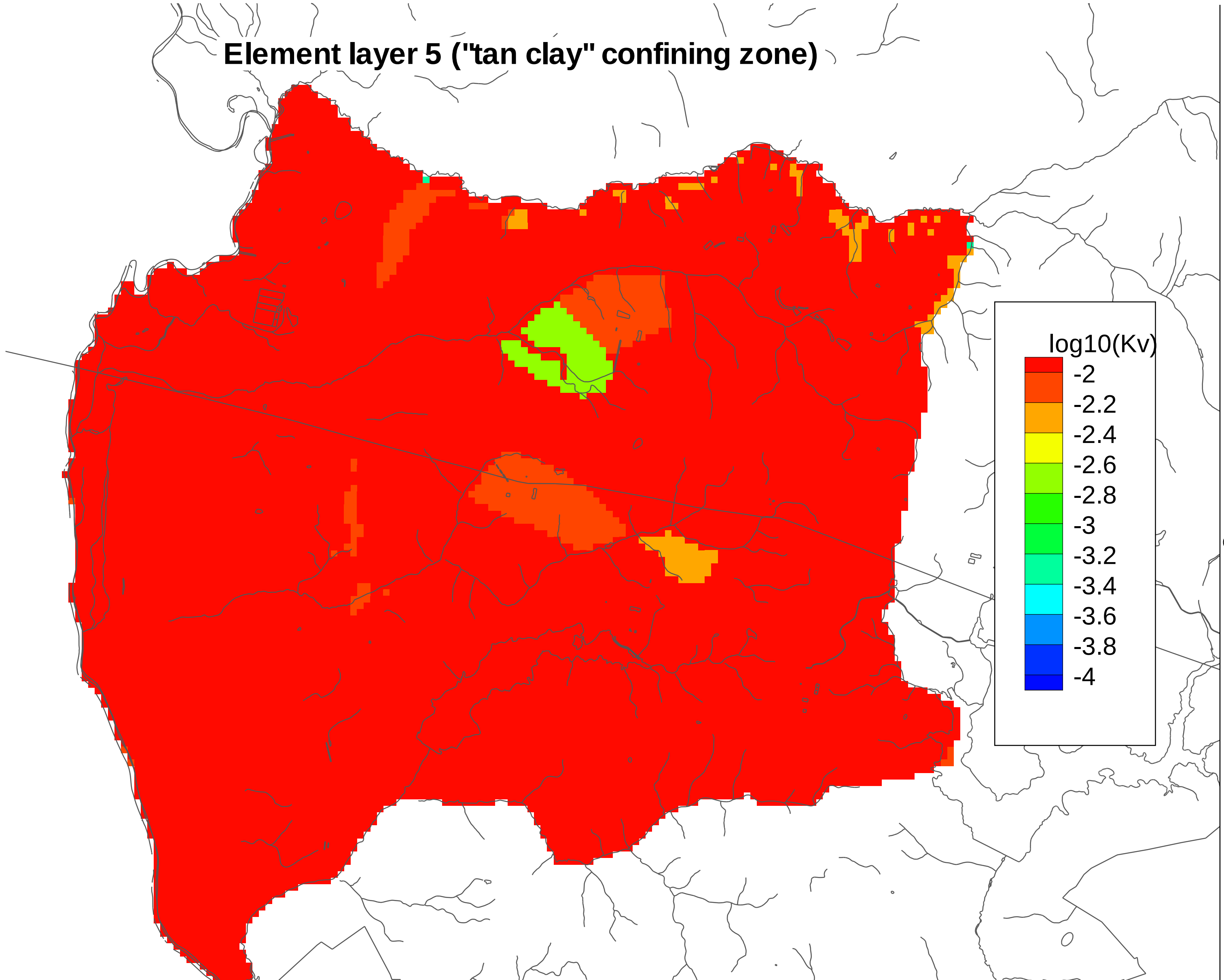

Figure H-3-11. (uncertainty case 3; compare to Figure 4-11)

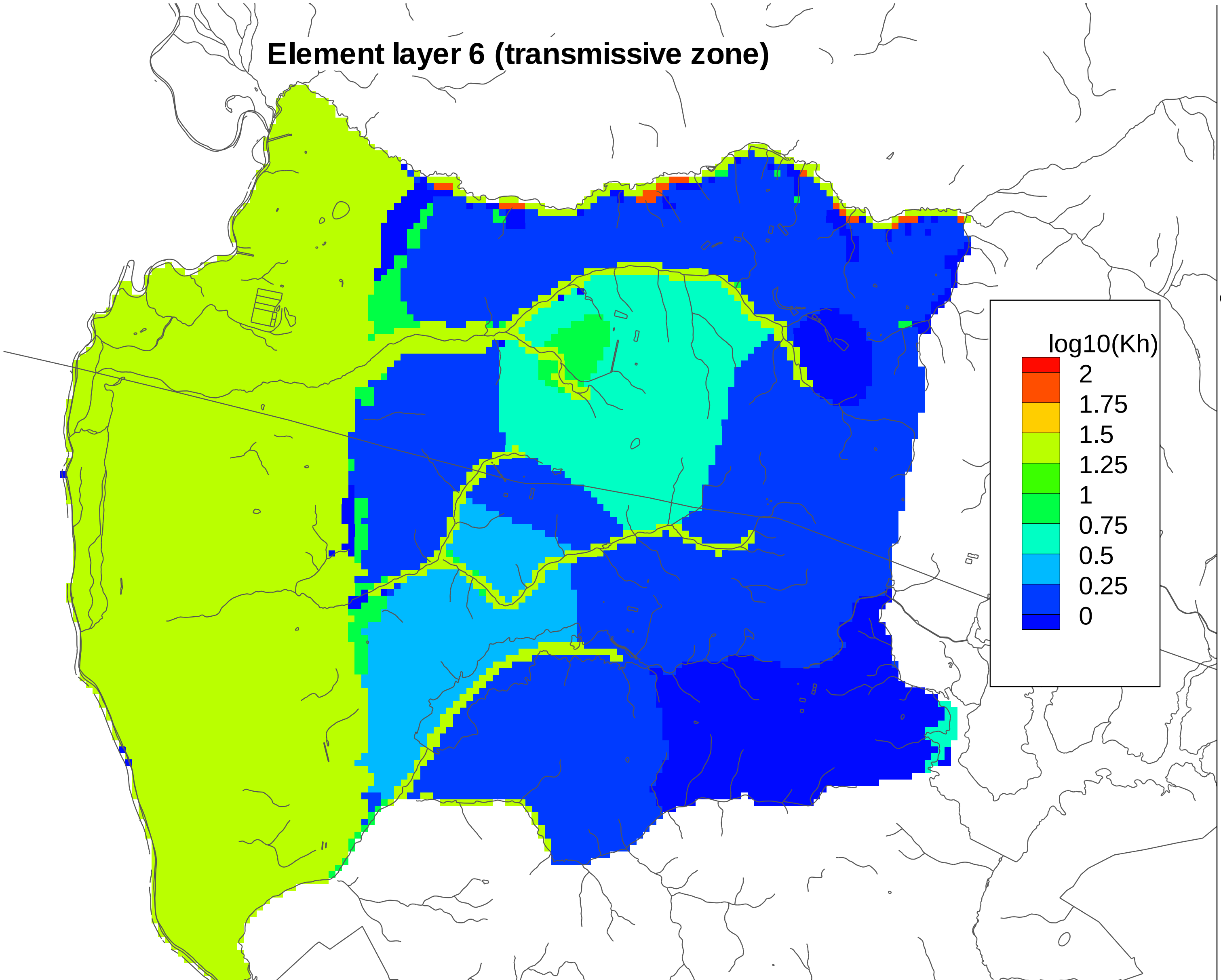

Figure H-3-12. (uncertainty case 3; compare to Figure 4-12)

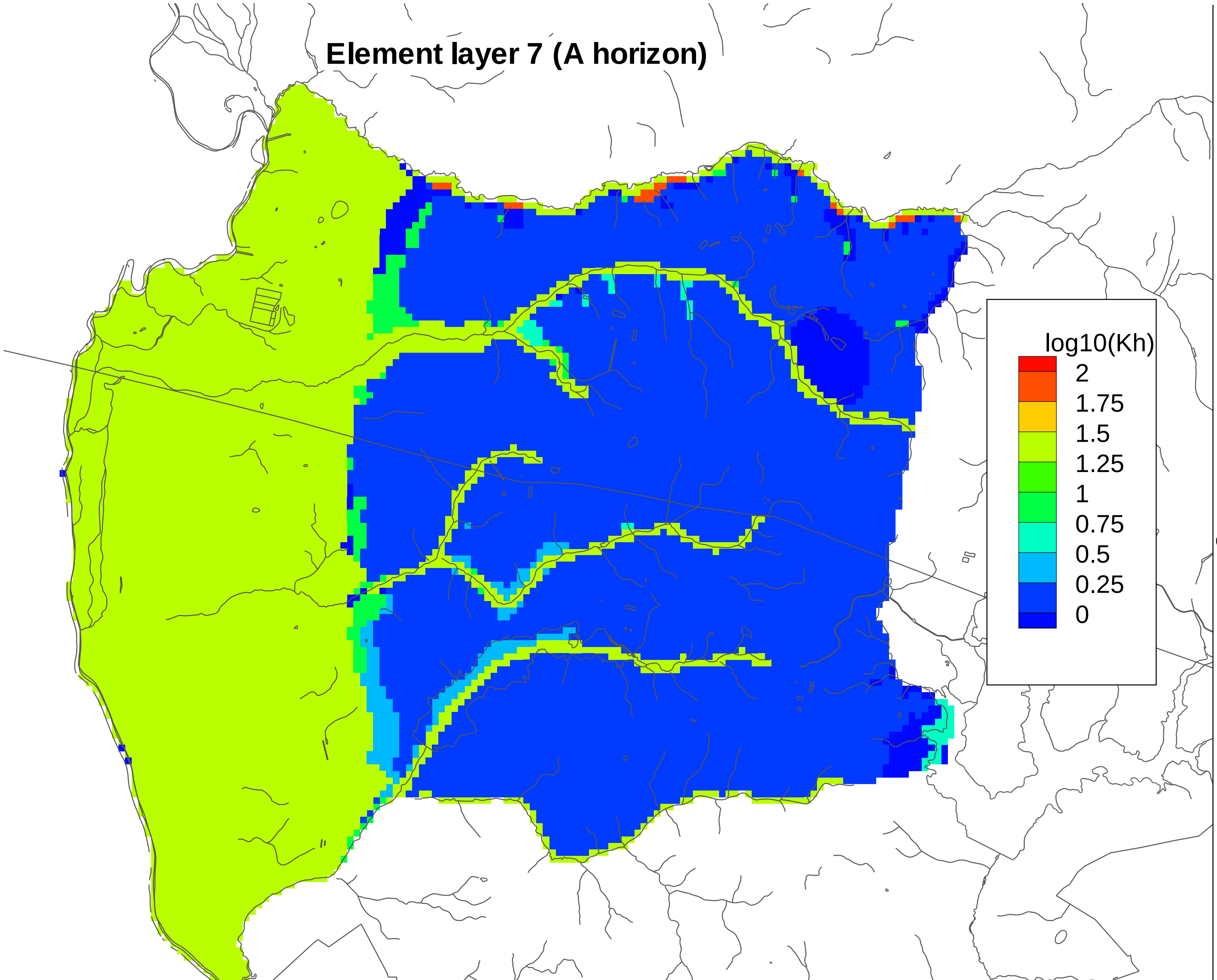

Figure H-3-13. (uncertainty case 3; compare to Figure 4-13)

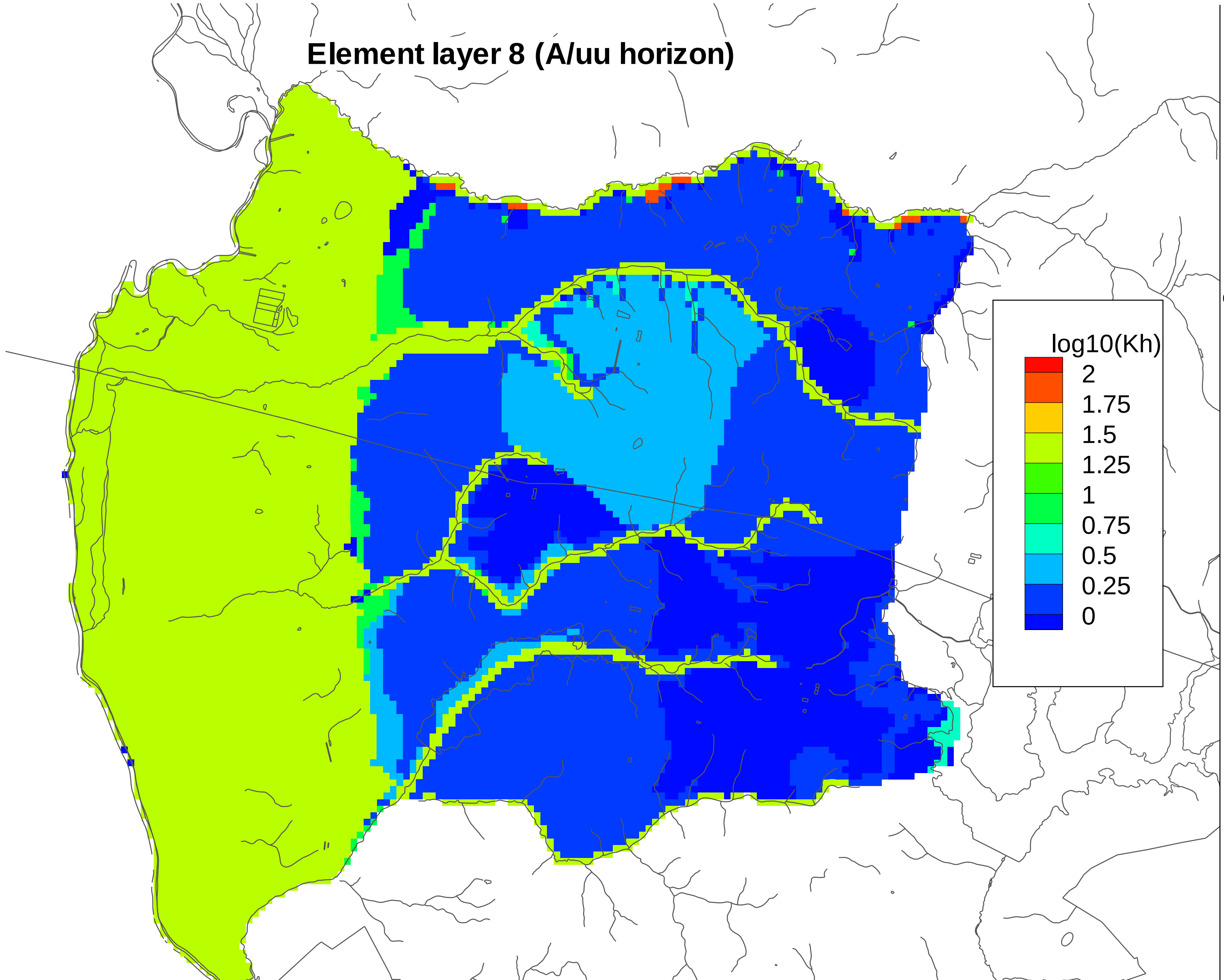

Figure H-3-14. (uncertainty case 3; compare to Figure 4-14)

Simulated hydraulic head in Gordon aquifer

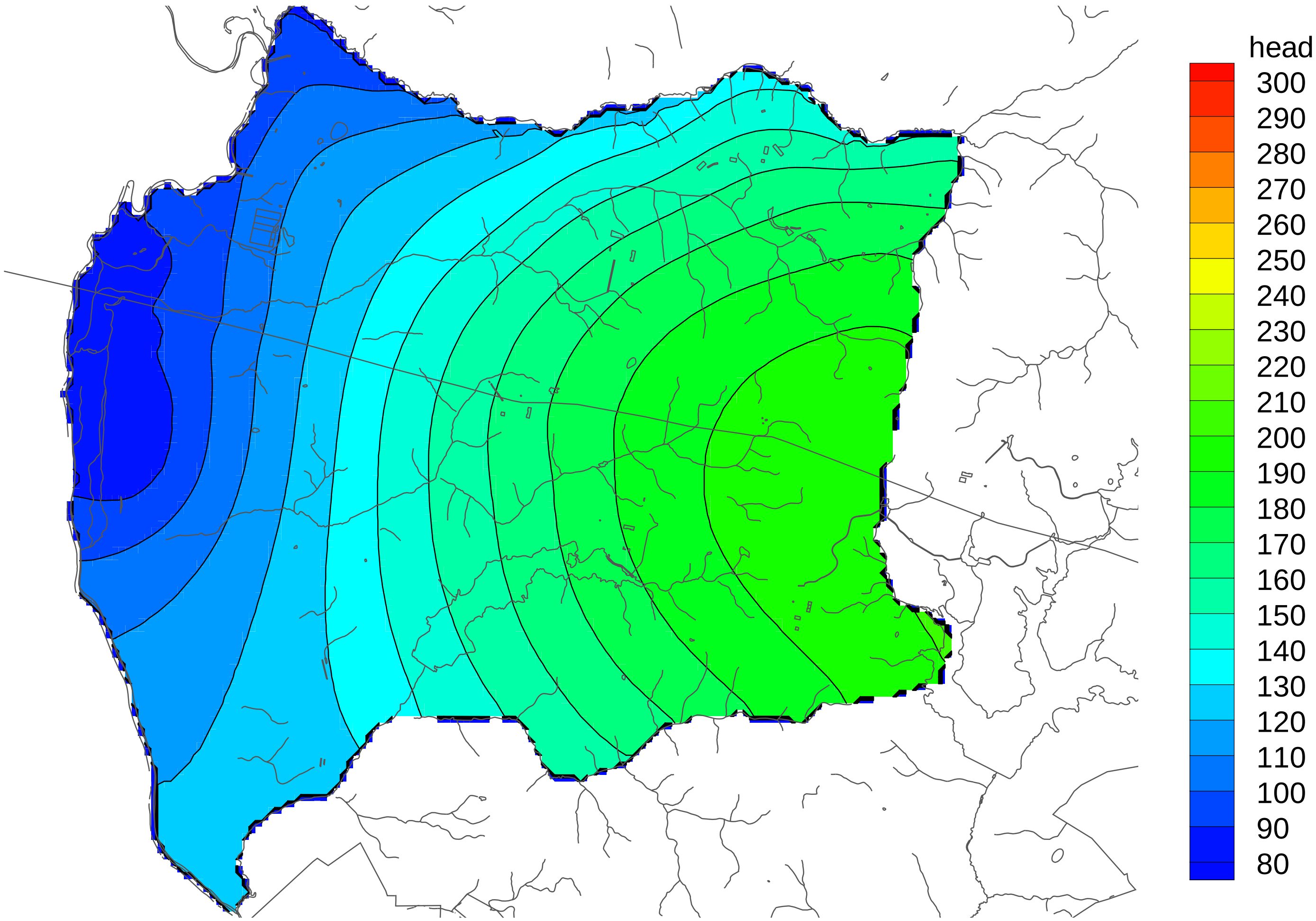

Figure H-3-15. (uncertainty case 3; compare to Figure 4-16)

Simulated hydraulic head in "lower" UTR aquifer zone

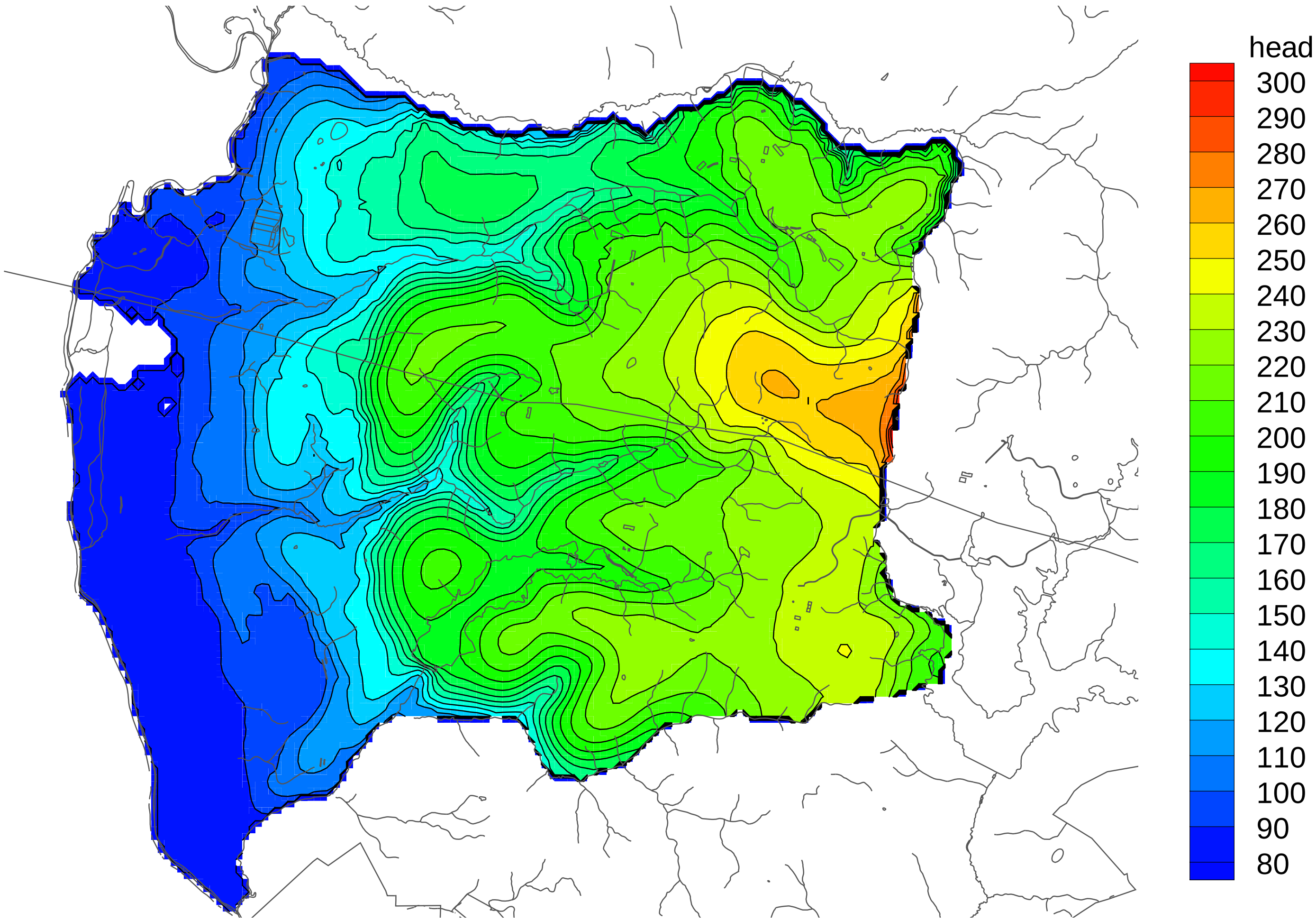

Figure H-3-16. (uncertainty case 3; compare to Figure 4-17)

Simulated hydraulic head in "upper" UTR aquifer zone

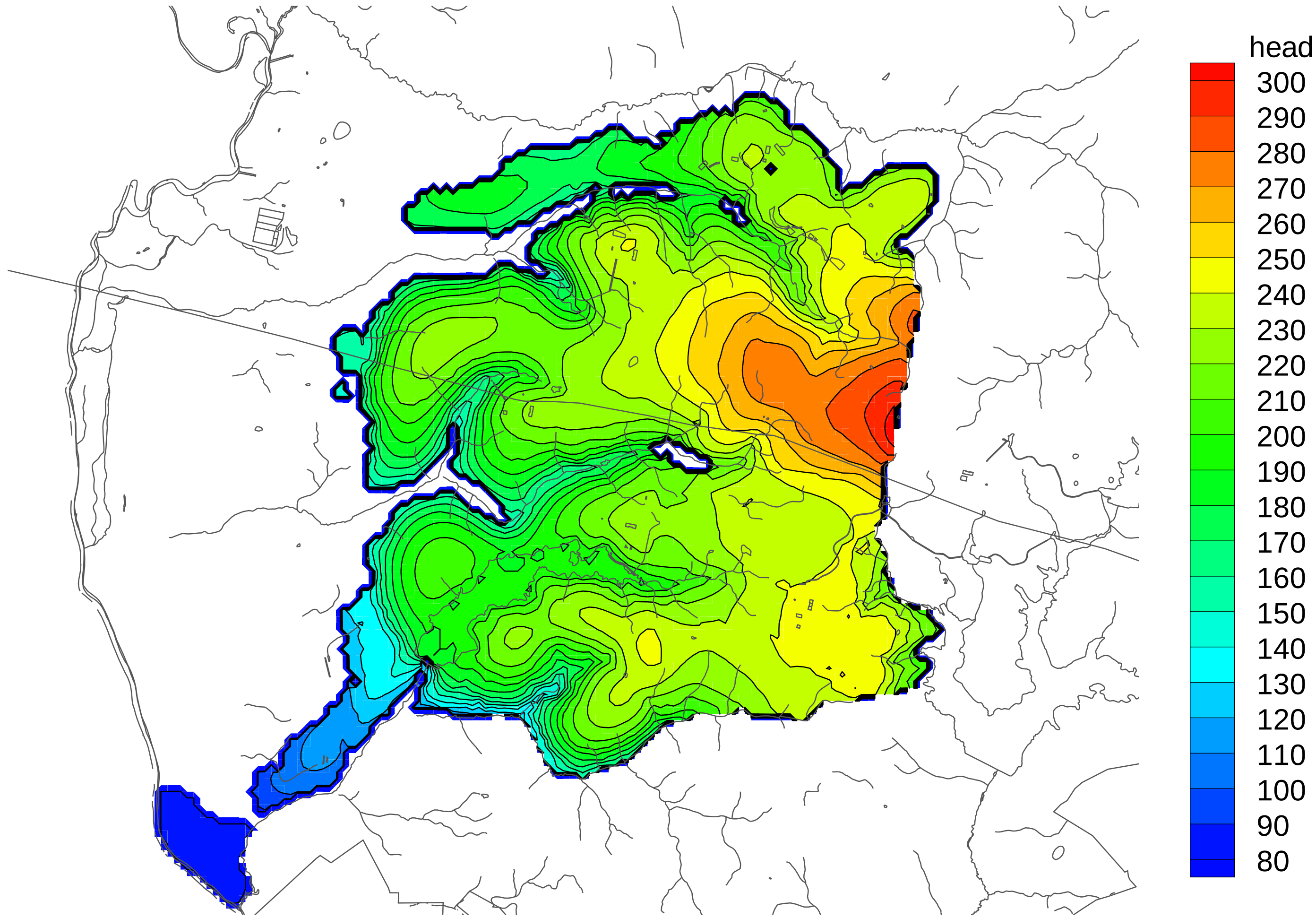

Figure H-3-17. (uncertainty case 3; compare to Figure 4-18)

Simulated hydraulic head in aquifer zone containing water table

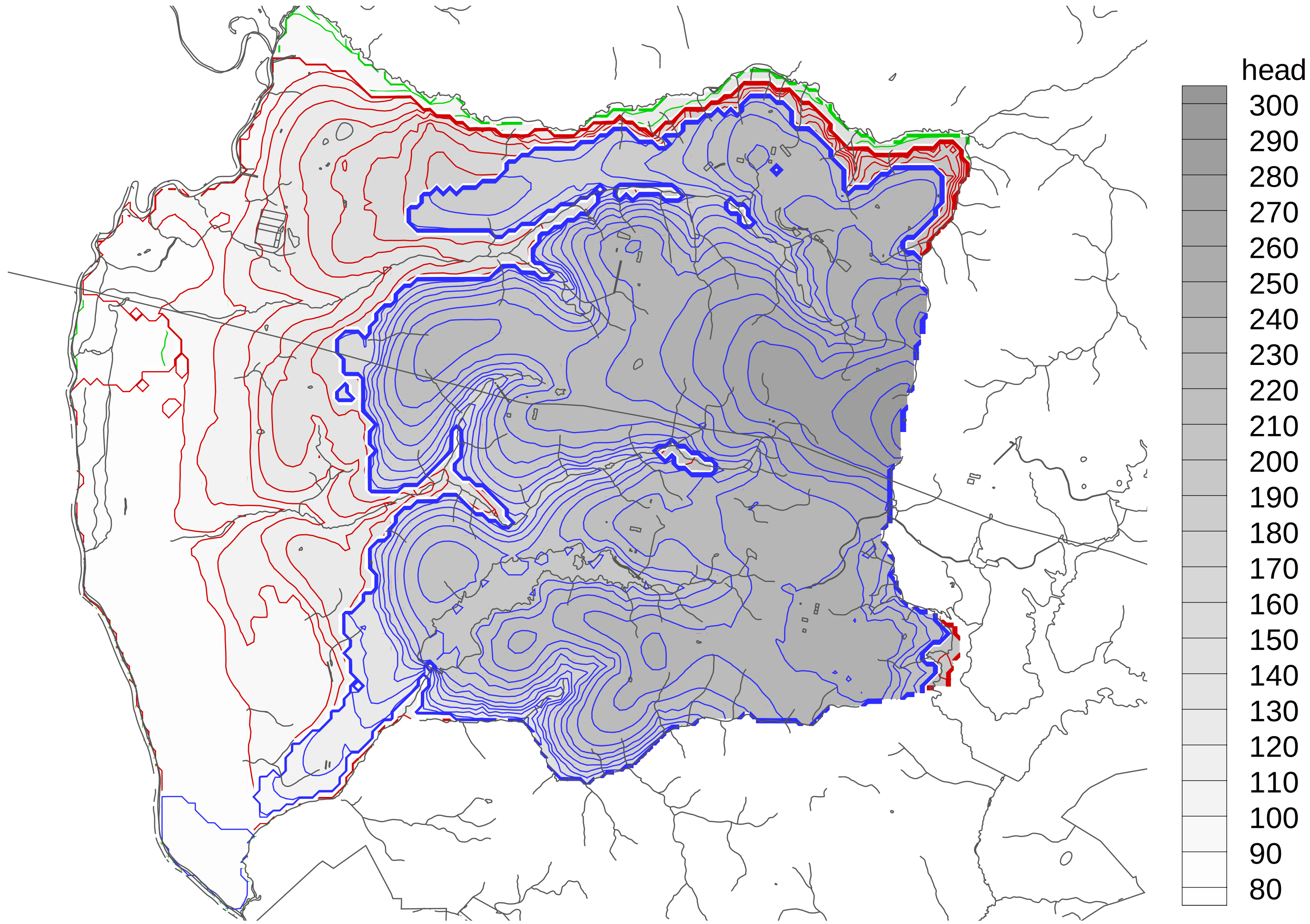

Figure H-3-18. (uncertainty case 3; compare to Figure 4-19)

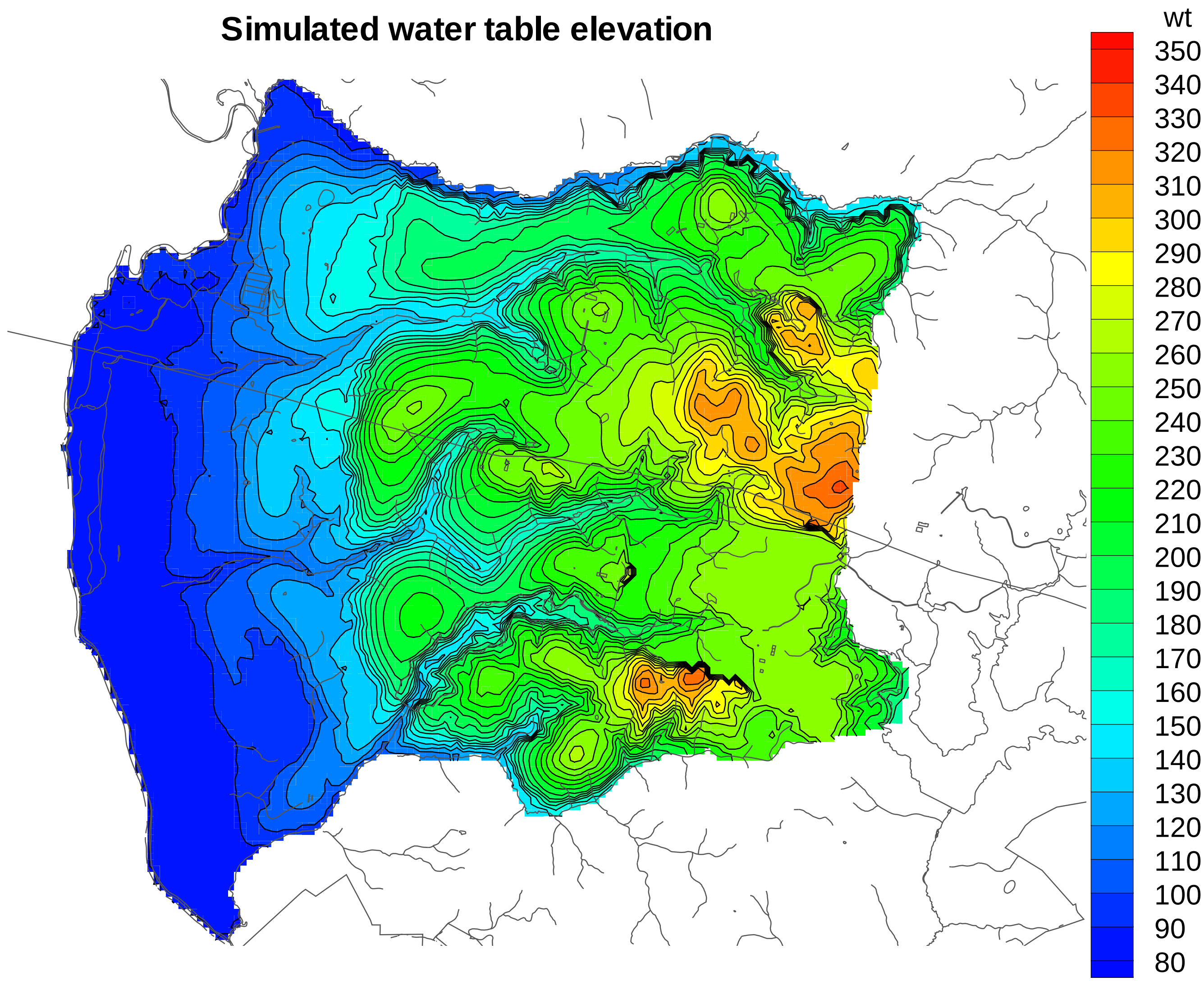

Figure H-3-19. (uncertainty case 3; compare to Figure 4-20)

Simulated groundwater recharge (discharge)

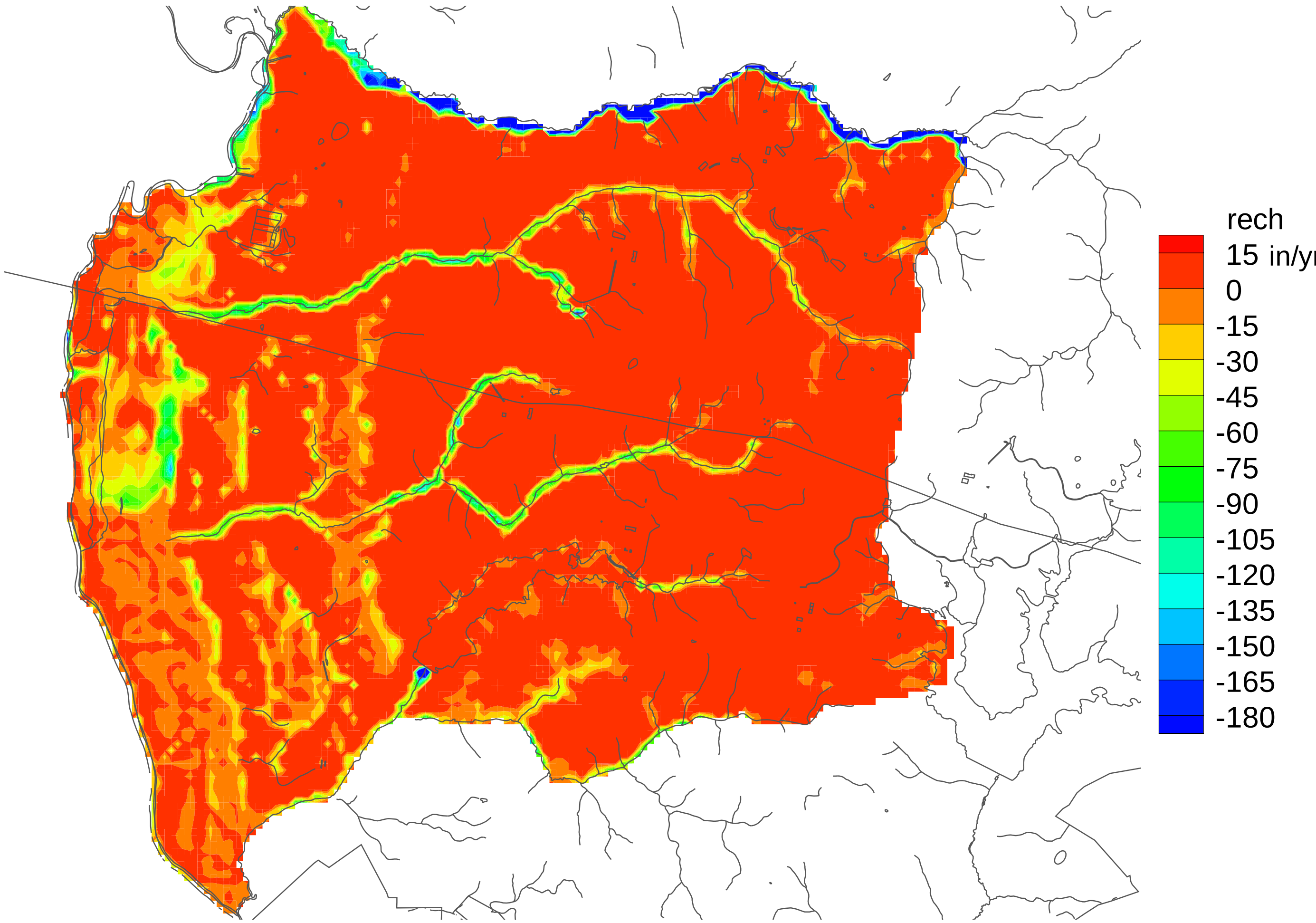

Figure H-3-20. (uncertainty case 3; compare to Figure 4-25)

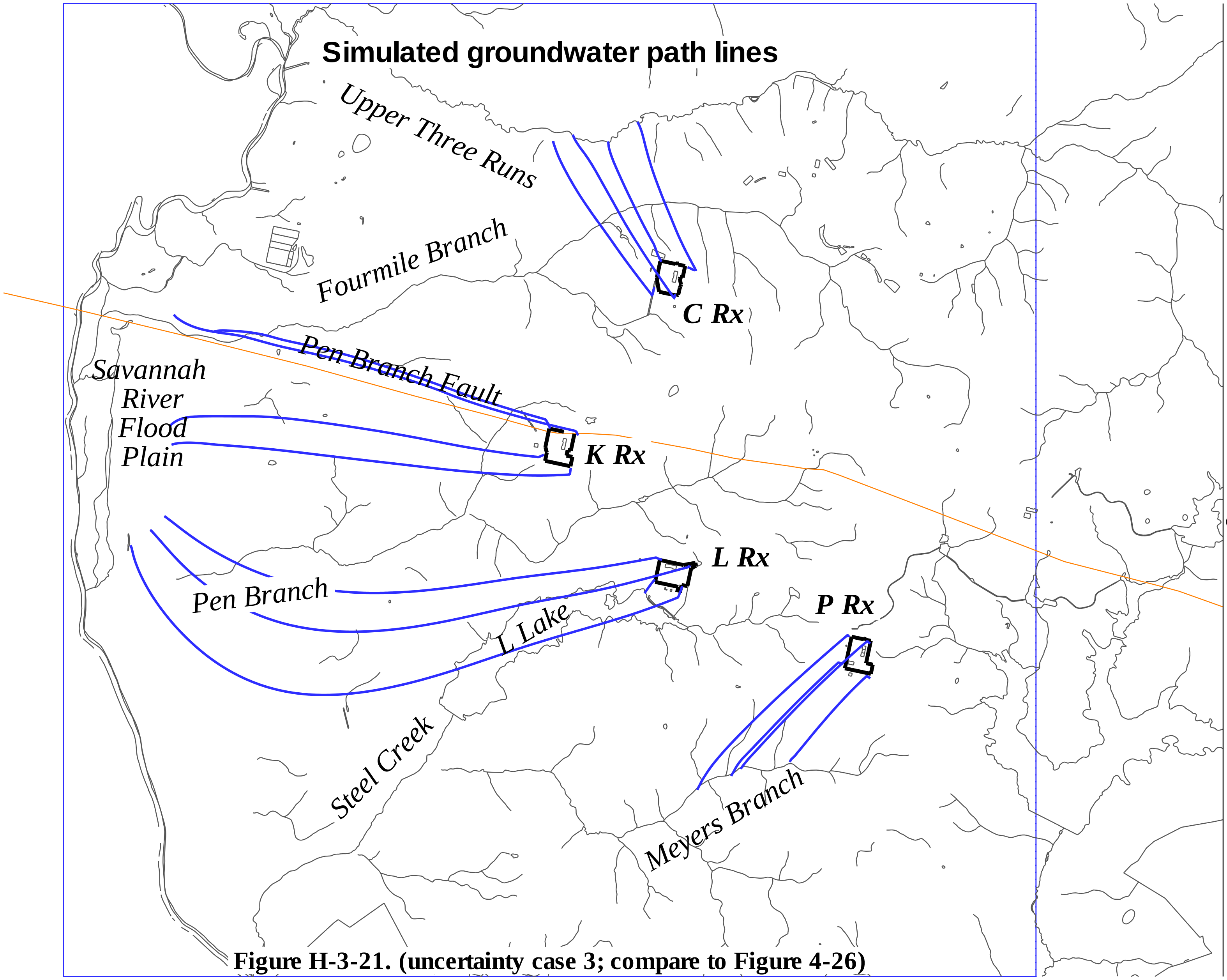

Figure H-3-21. (uncertainty case 3; compare to Figure 4-26)

Simulation results for uncertainty case 4

Uncertainty case 4 involves a decrease in Gordon confining unit vertical conductivity by a factor of 5 to 2×10^{-5} ft/day (Table 4-4). Summary calibration results are provided in Table 4-5. This appendix presents detailed simulation results for uncertainty case 4 for comparison to the nominal results shown in figures in the main text. The correspondence between figures for the nominal and uncertainty case 4 is as follows:

Plot type	**Nominal case**	**Uncertainty case 4**
Head residual summary	Figure 4-1	Figure H-4-1
Head residuals in Gordon aquifer	Figure 4-2	Figure H-4-2
Head residuals in "lower" UTRA	Figure 4-3	Figure H-4-3
Head residuals in transmissive zone	Figure 4-4	Figure H-4-4
Head residuals in AA horizon	Figure 4-5	Figure H-4-5
Head residuals in A/uu horizons	Figure 4-6	Figure H-4-6
Kh in element layer 1	Figure 4-7	Figure H-4-7
Kv in element layer 2	Figure 4-8	Figure H-4-8
Kh in element layer 3	Figure 4-9	Figure H-4-9
Kh in element layer 4	Figure 4-10	Figure H-4-10
Kv in element layer 5	Figure 4-11	Figure H-4-11
Kh in element layer 6	Figure 4-12	Figure H-4-12
Kh in element layer 7	Figure 4-13	Figure H-4-13
Kh in element layer 8	Figure 4-14	Figure H-4-14
Gordon aquifer head	Figure 4-16	Figure H-4-15
"Lower" UTRA head	Figure 4-17	Figure H-4-16
"Upper" UTRA head	Figure 4-18	Figure H-4-17
Head in aquifer containing water table	Figure 4-19	Figure H-4-18
Water table	Figure 4-20	Figure H-4-19
Recharge/discharge	Figure 4-25	Figure H-4-20
Example particle tracing	Figure 4-26	Figure H-4-21

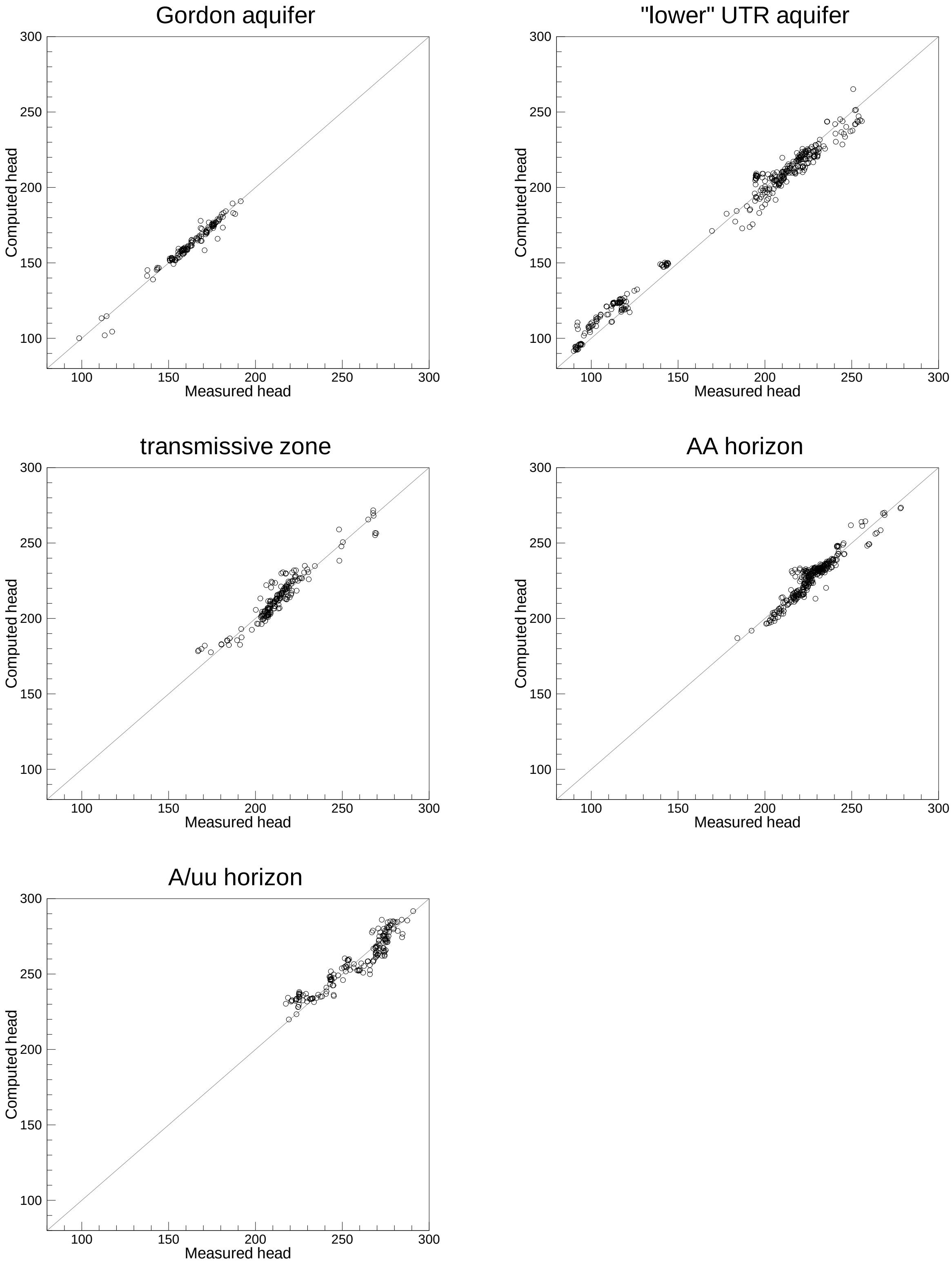

Figure H-4-1. (uncertainty case 4; compare to Figure 4-1)

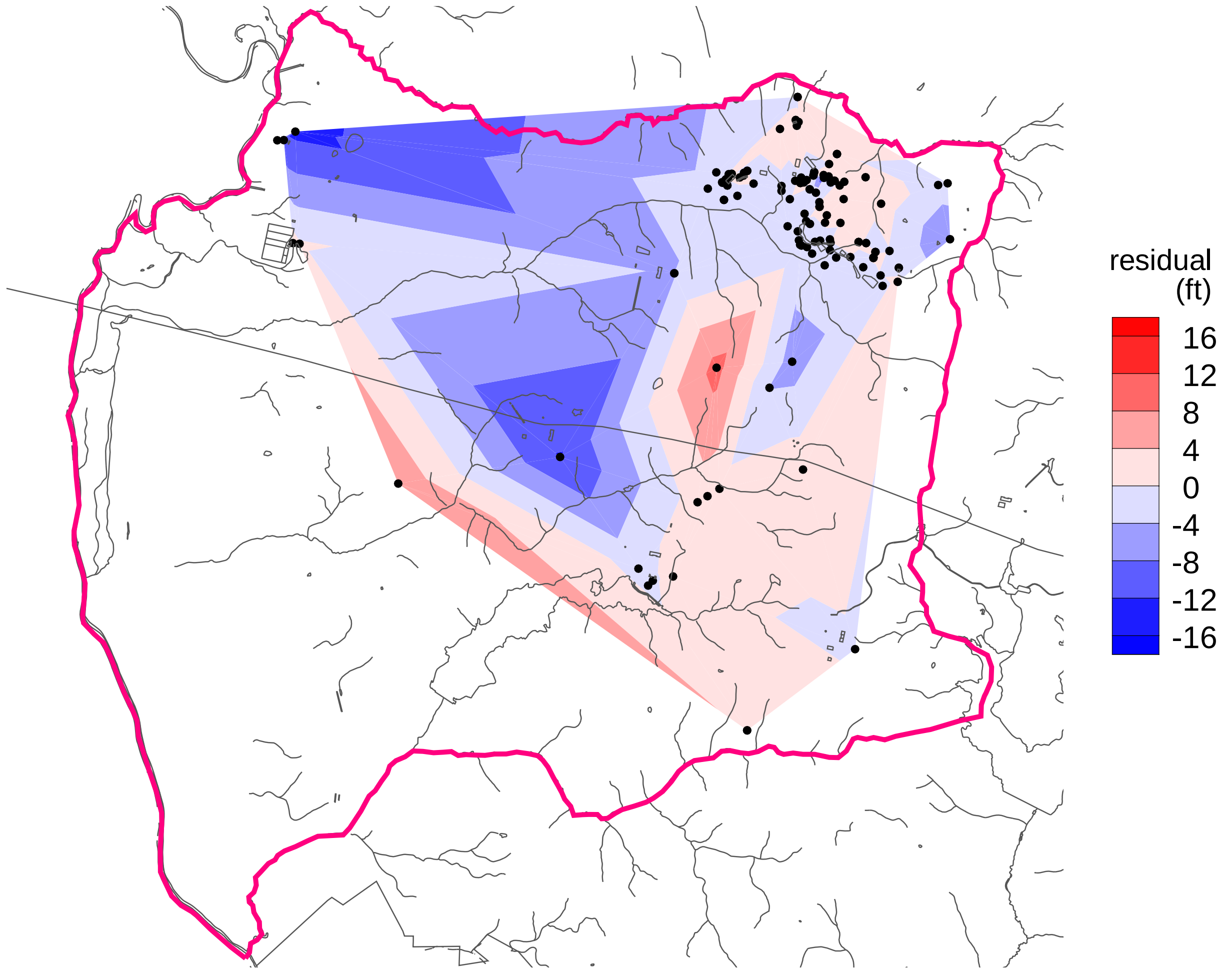

Figure H-4-2. (uncertainty case 4; compare to Figure 4-2)

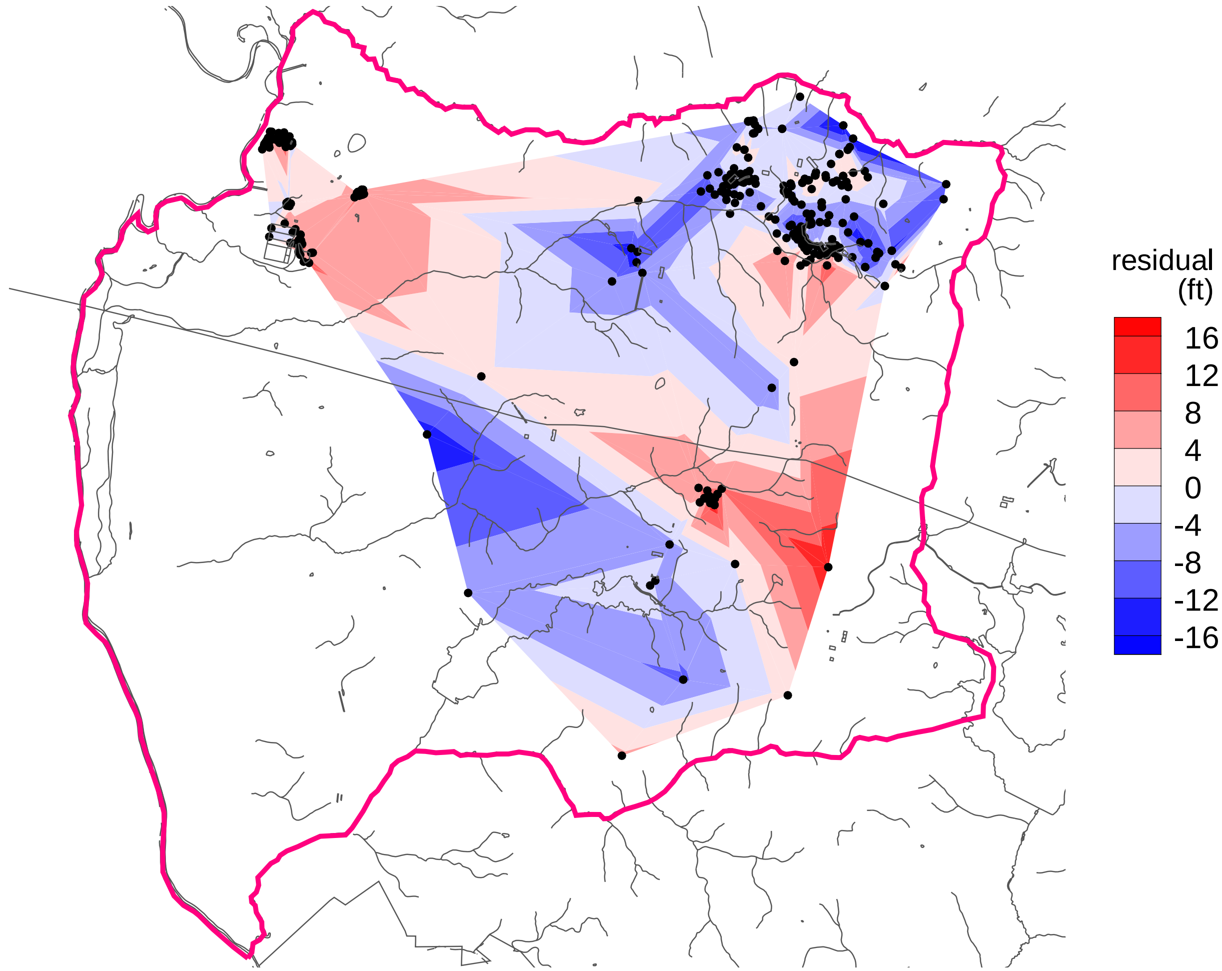

Figure H-4-3. (uncertainty case 4; compare to Figure 4-3)

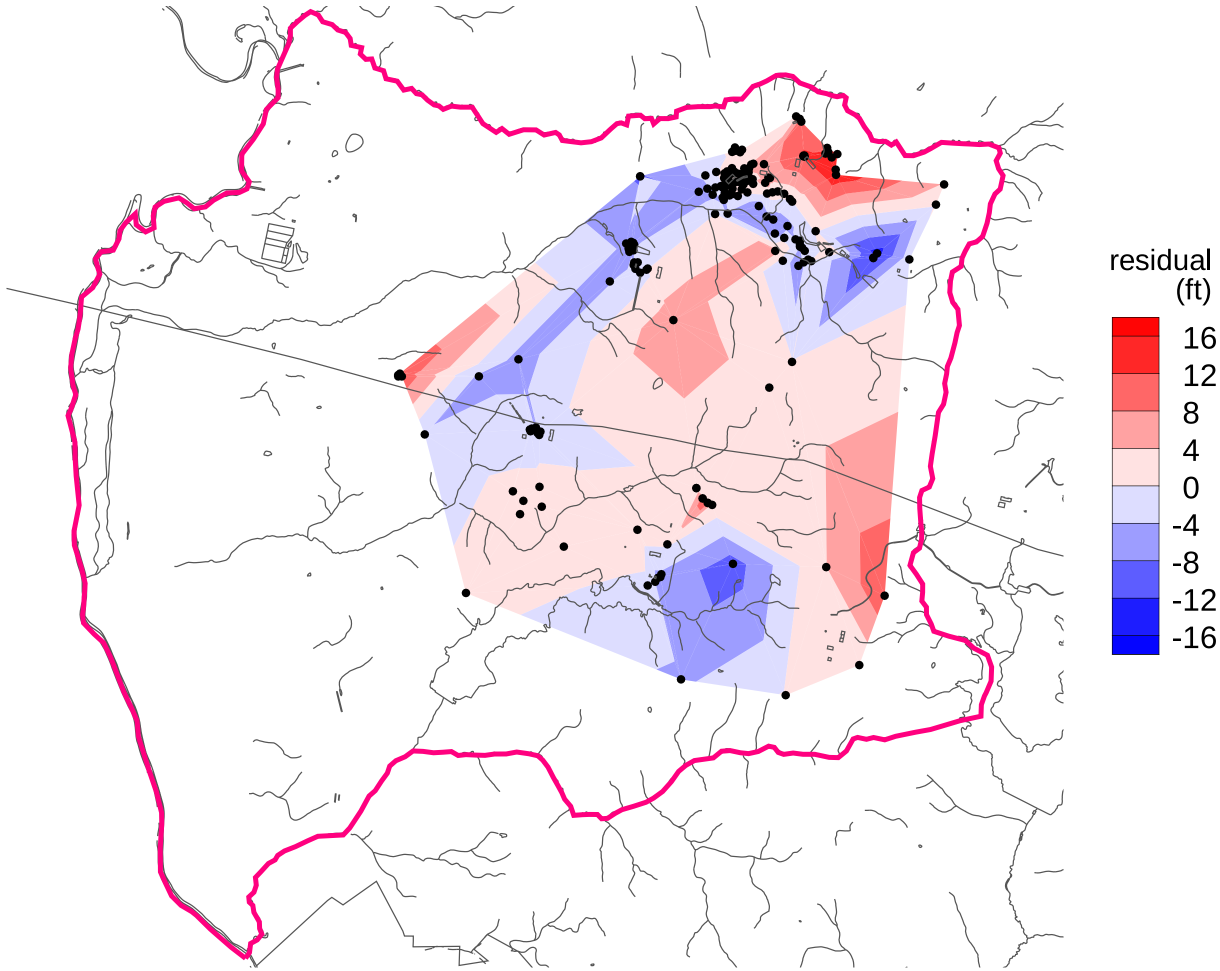

Figure H-4-4. (uncertainty case 4; compare to Figure 4-4)

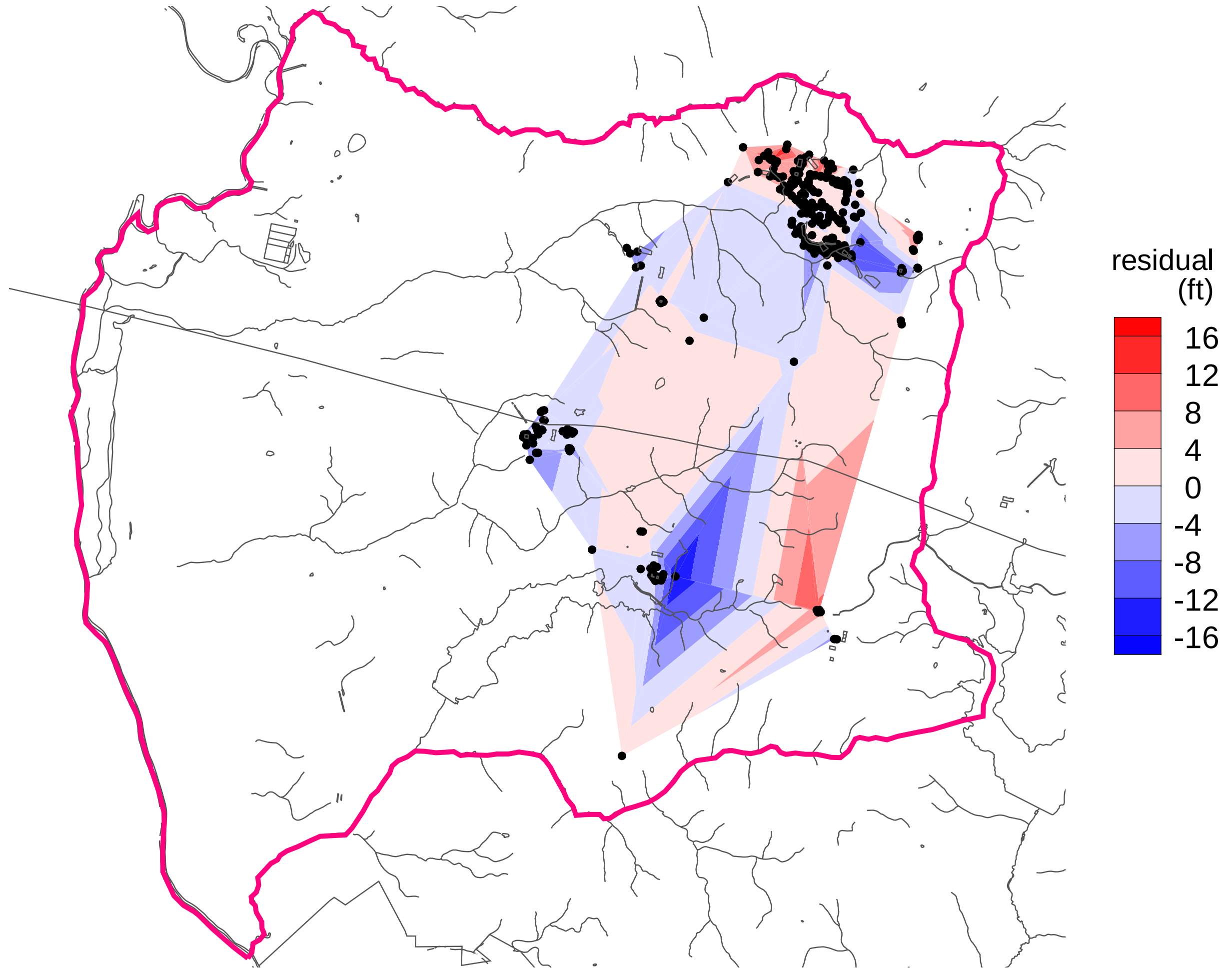

Figure H-4-5. (uncertainty case 4; compare to Figure 4-5)

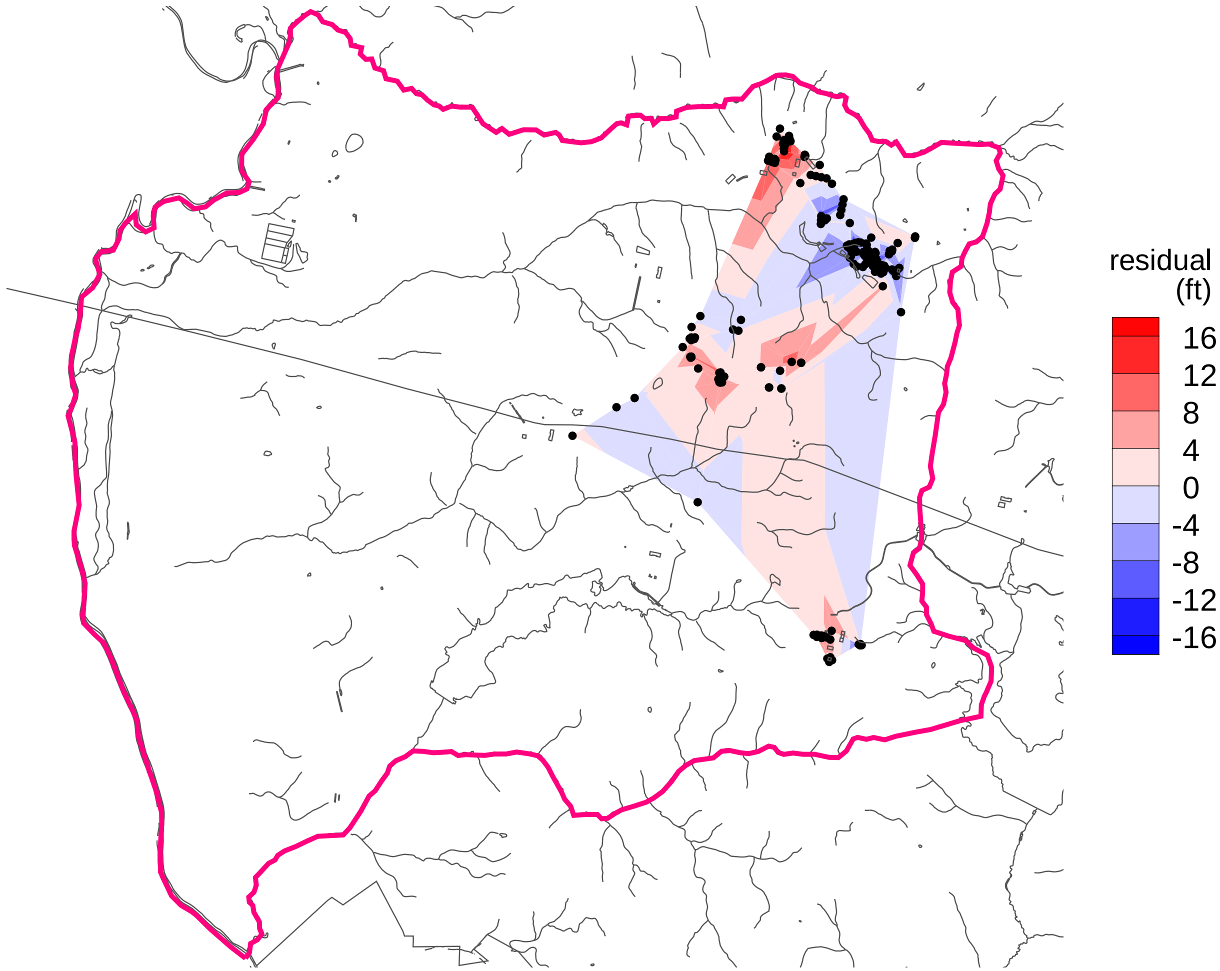

Figure H-4-6. (uncertainty case 4; compare to Figure 4-6)

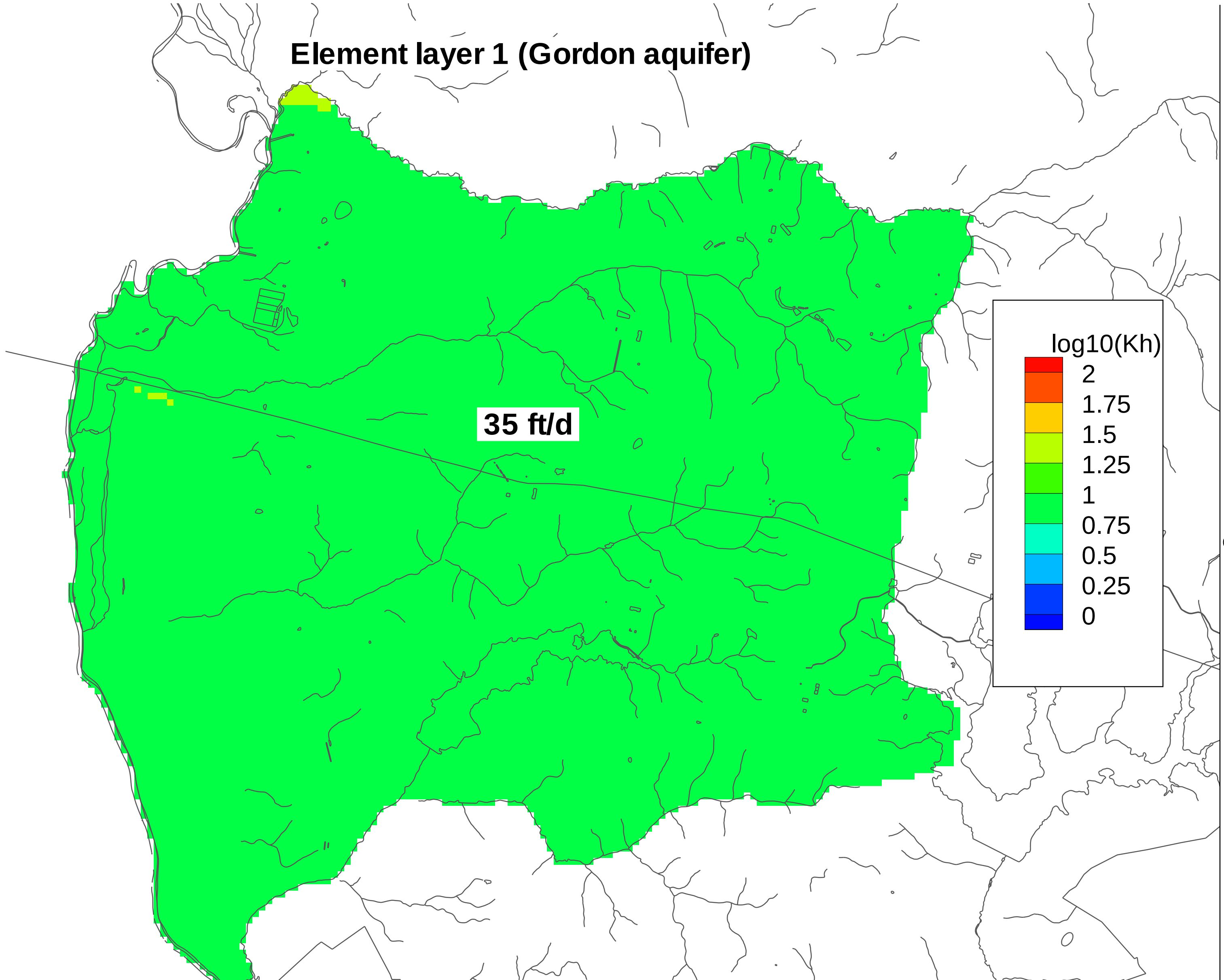

Figure H-4-7. (uncertainty case 4; compare to Figure 4-7)

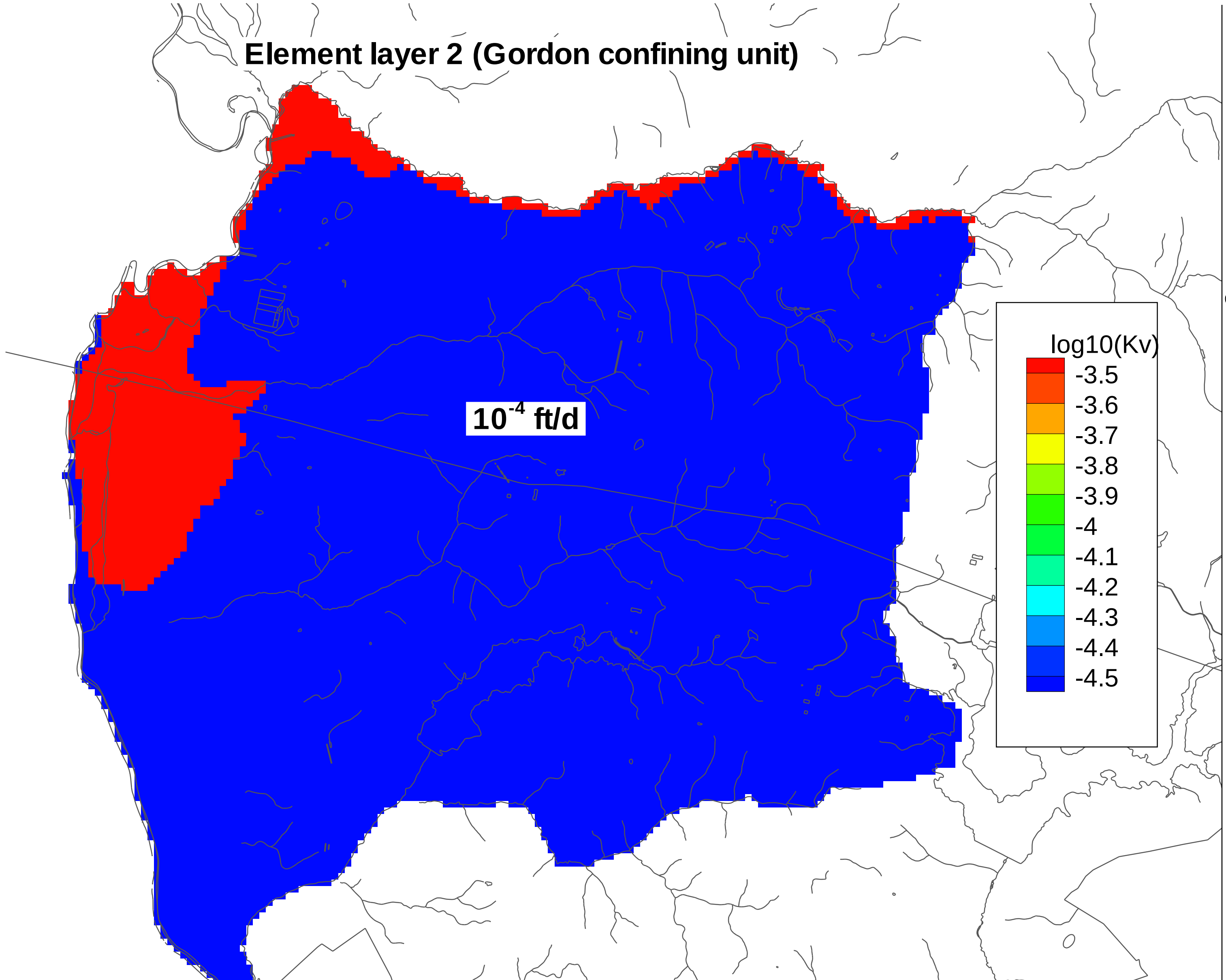

Figure H-4-8. (uncertainty case 4; compare to Figure 4-8)

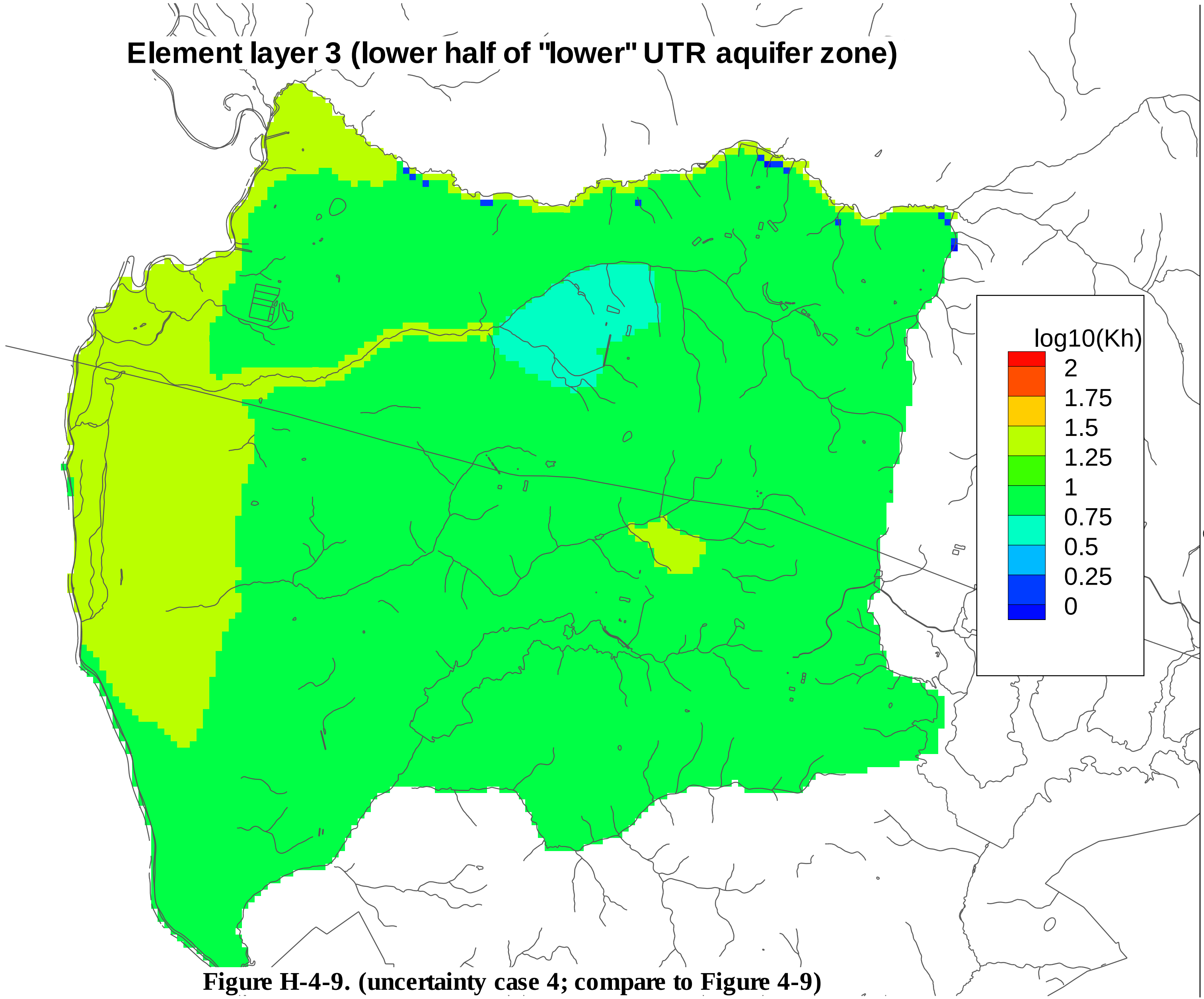

Figure H-4-9. (uncertainty case 4; compare to Figure 4-9)

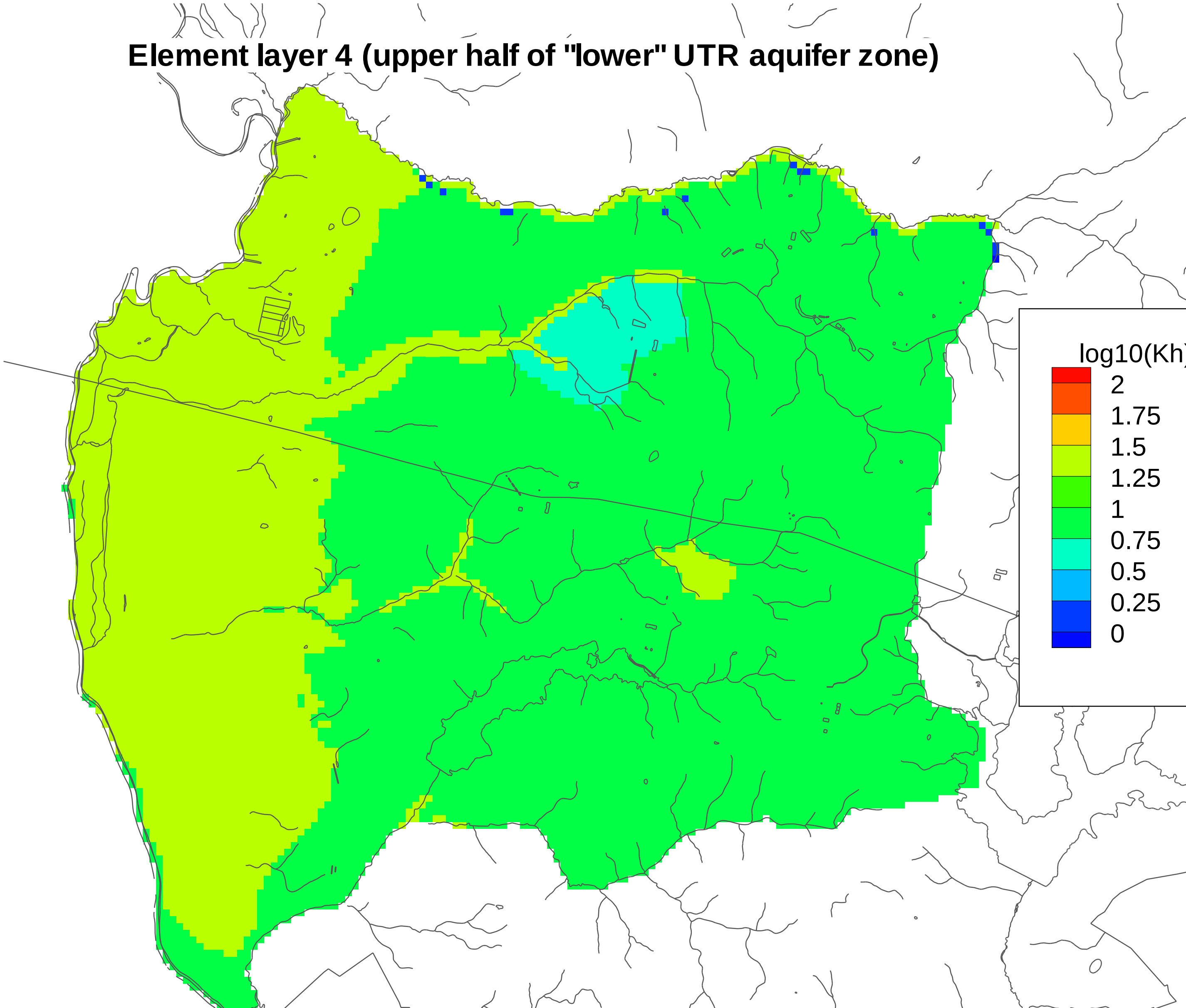

Figure H-4-10. (uncertainty case 4; compare to Figure 4-10)

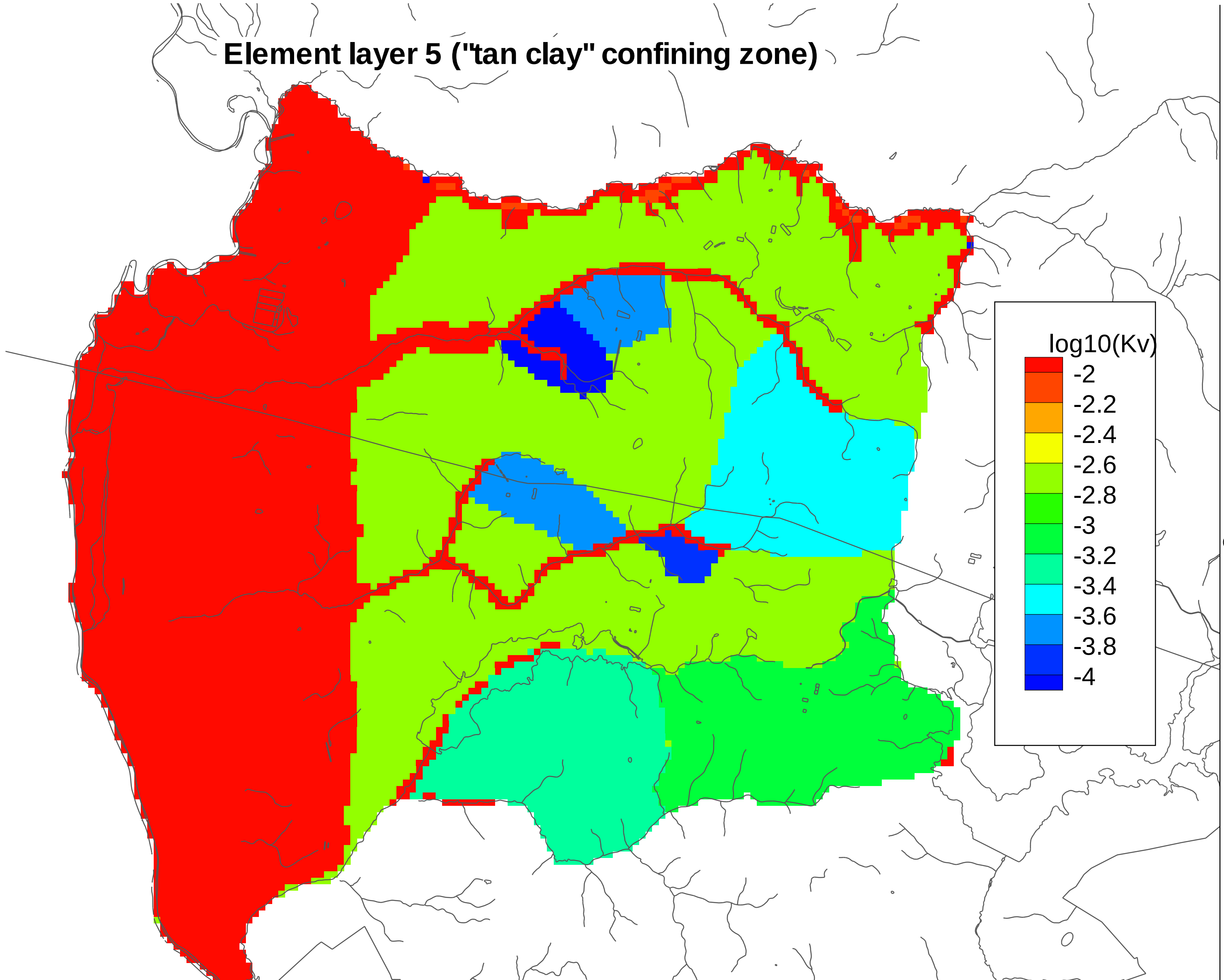

Figure H-4-11. (uncertainty case 4; compare to Figure 4-11)

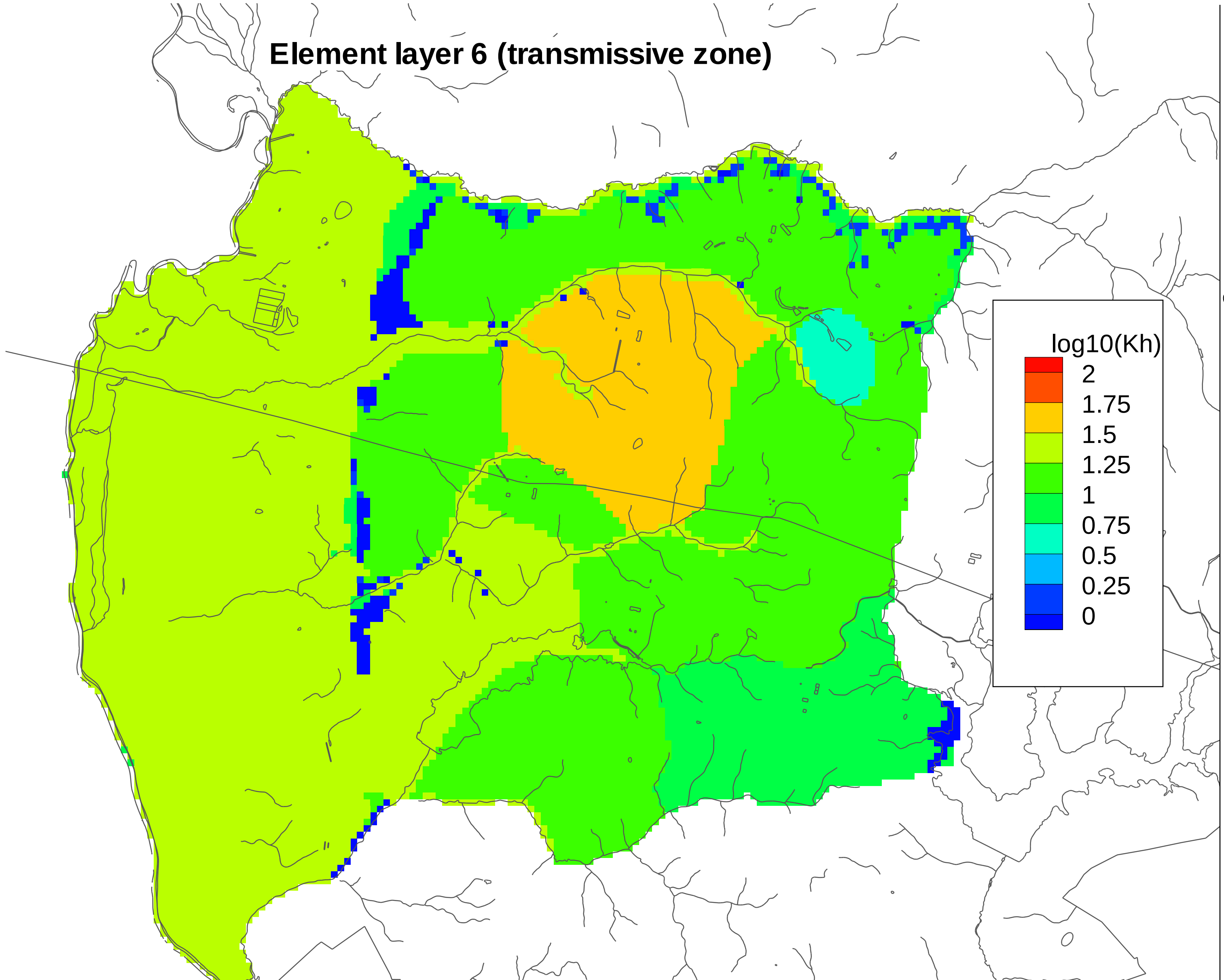

Figure H-4-12. (uncertainty case 4; compare to Figure 4-12)

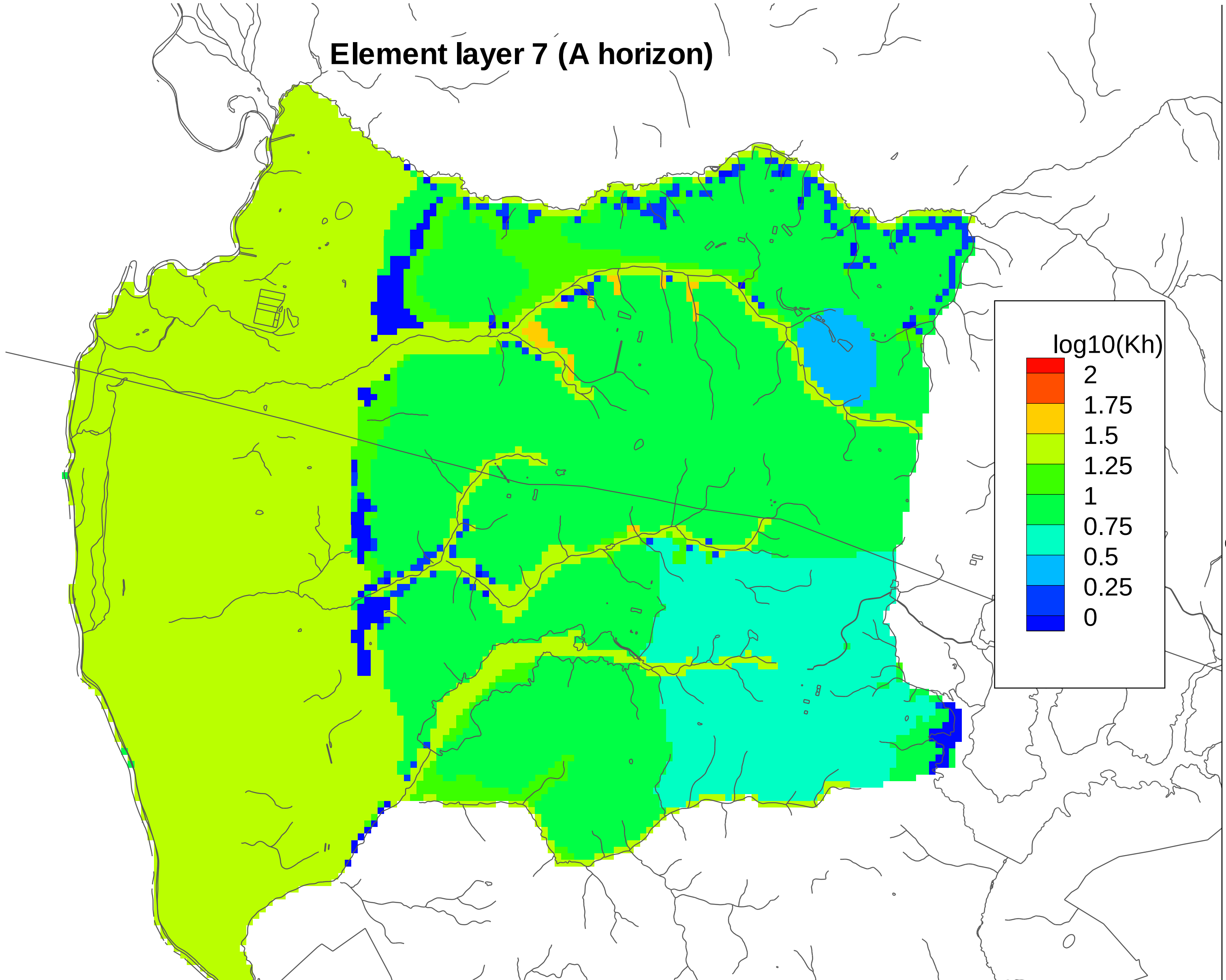

Figure H-4-13. (uncertainty case 4; compare to Figure 4-13)

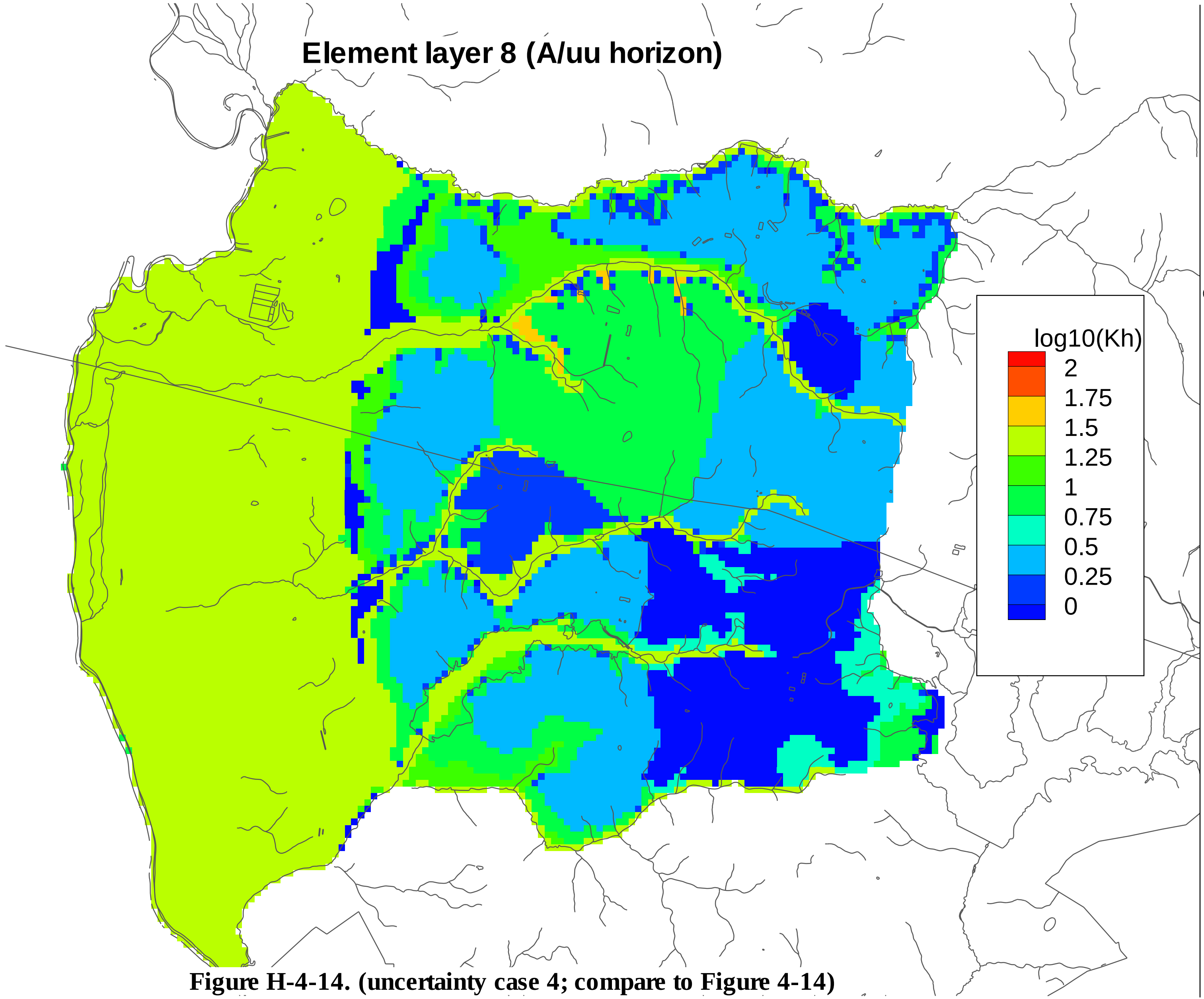

Figure H-4-14. (uncertainty case 4; compare to Figure 4-14)

Simulated hydraulic head in Gordon aquifer

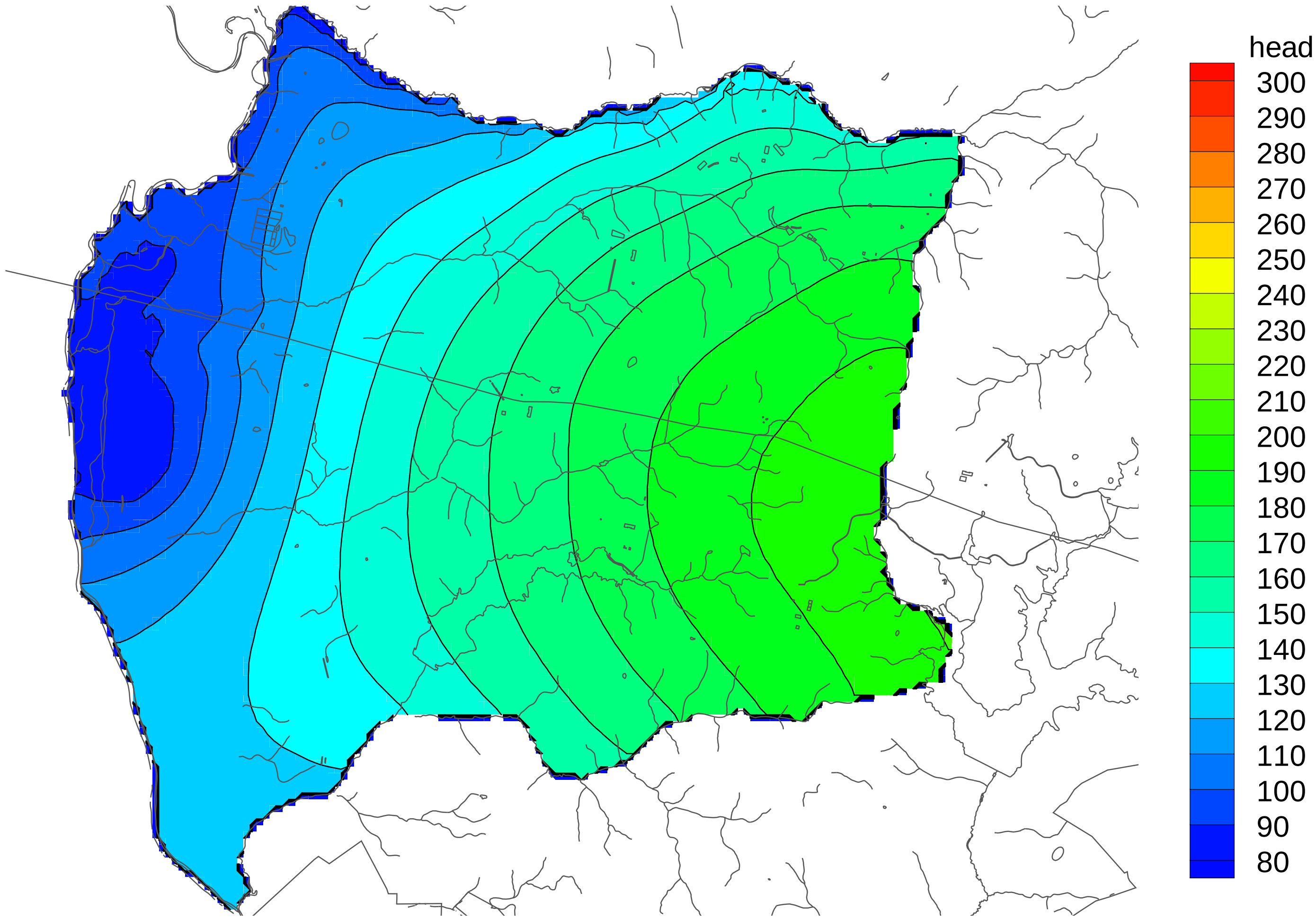

Figure H-4-15. (uncertainty case 4; compare to Figure 4-16)

Simulated hydraulic head in "lower" UTR aquifer zone

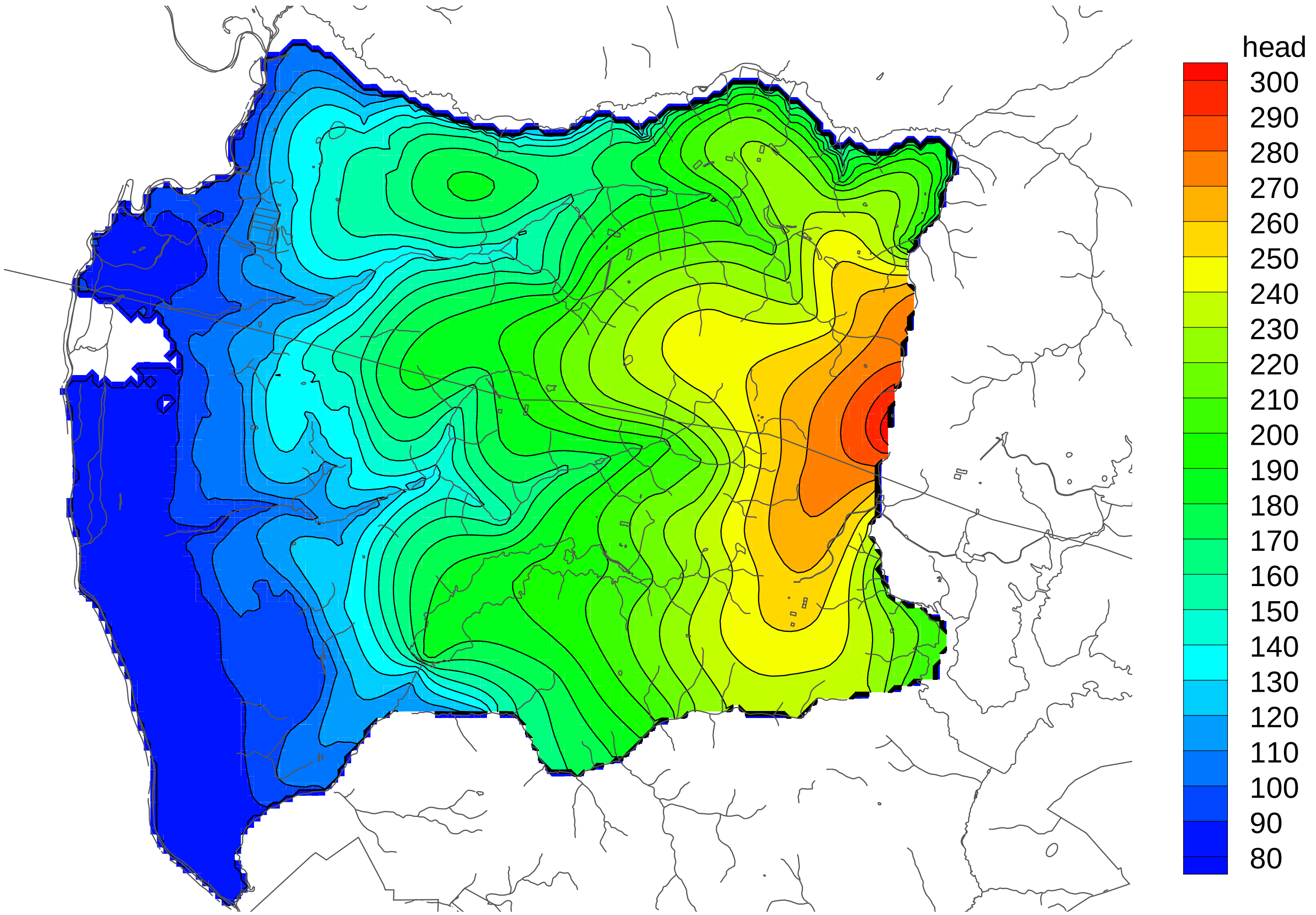

Figure H-4-16. (uncertainty case 4; compare to Figure 4-17)

Simulated hydraulic head in "upper" UTR aquifer zone

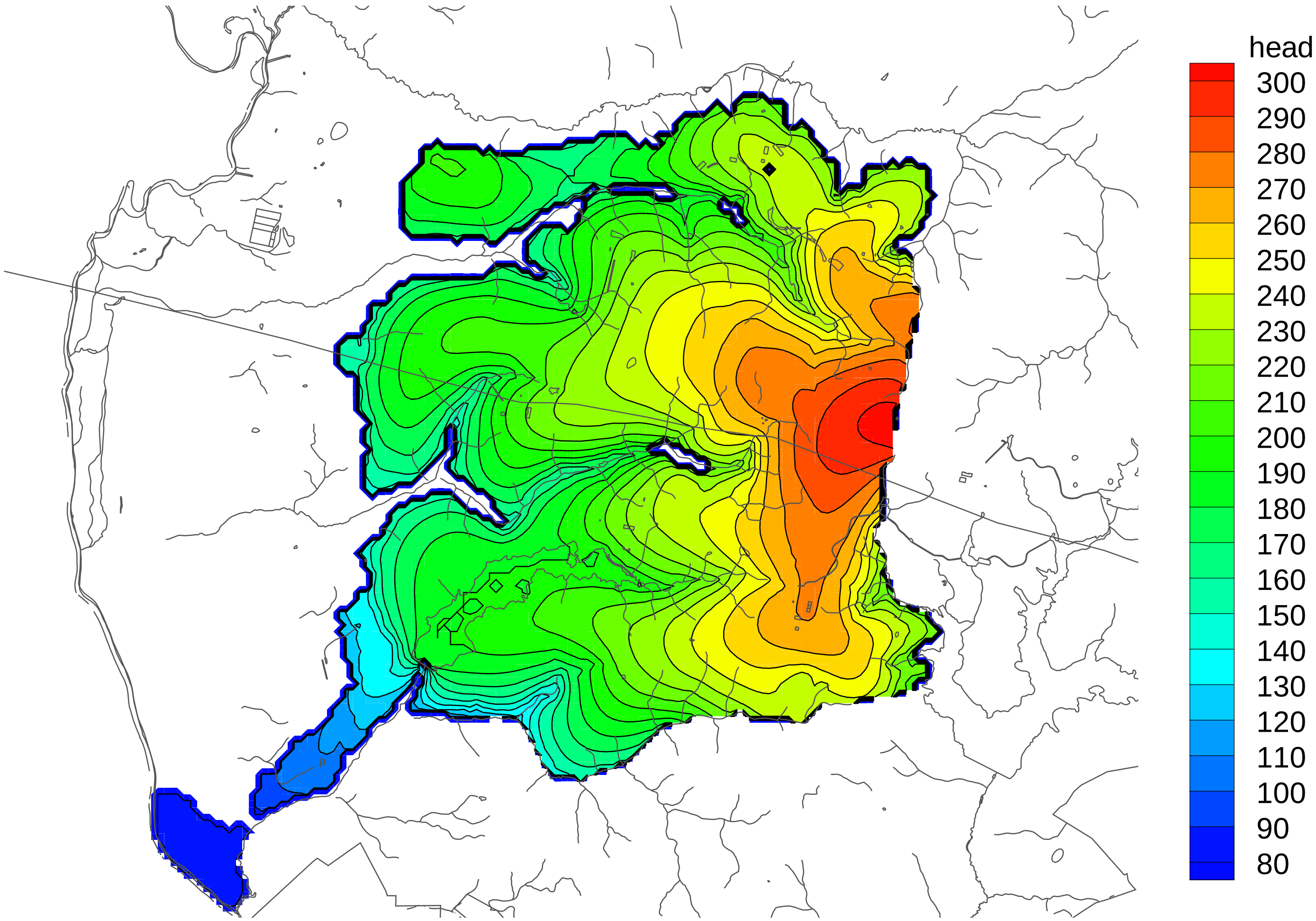

Figure H-4-17. (uncertainty case 4; compare to Figure 4-18)

Simulated hydraulic head in aquifer zone containing water table

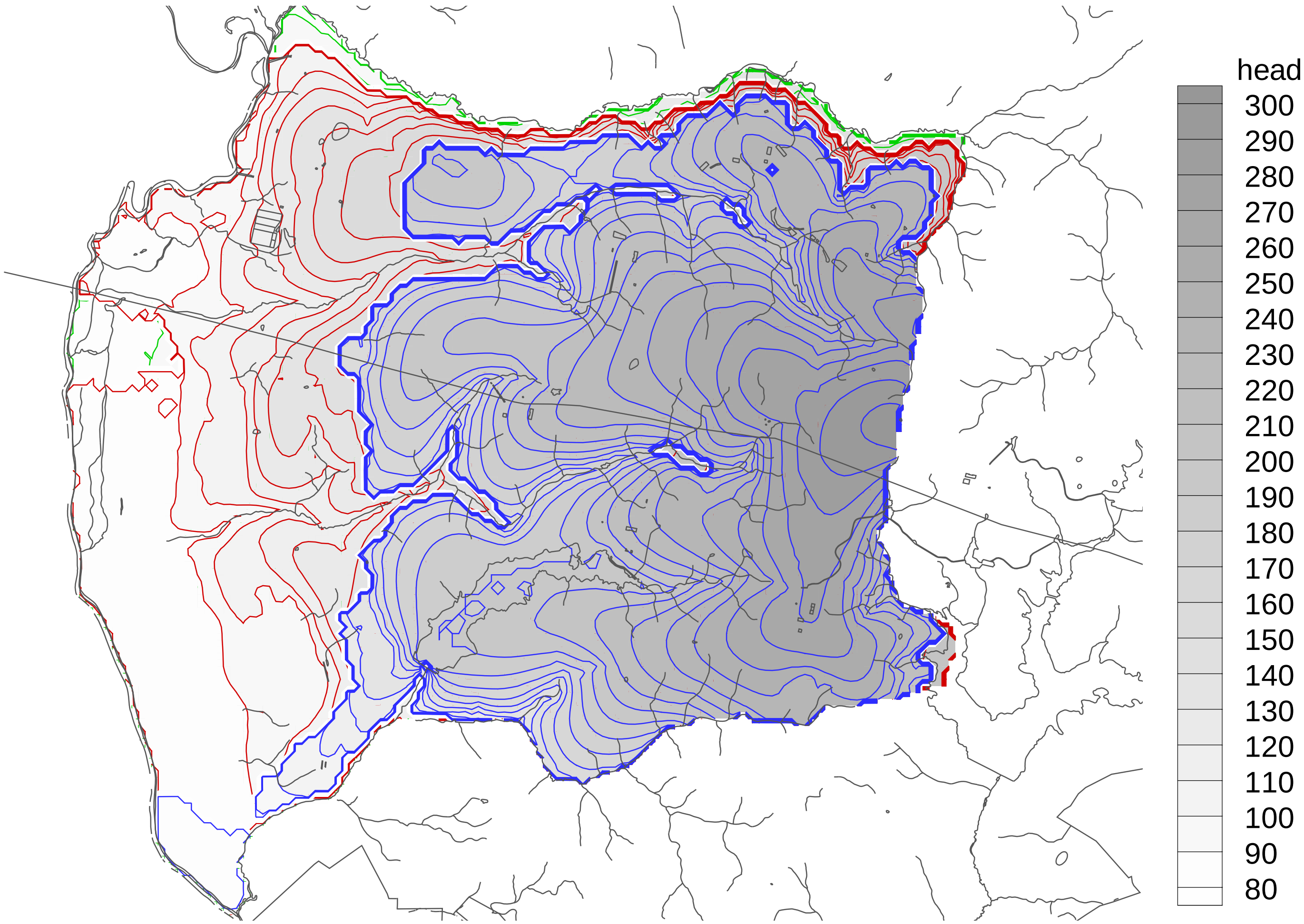

Figure H-4-18. (uncertainty case 4; compare to Figure 4-19)

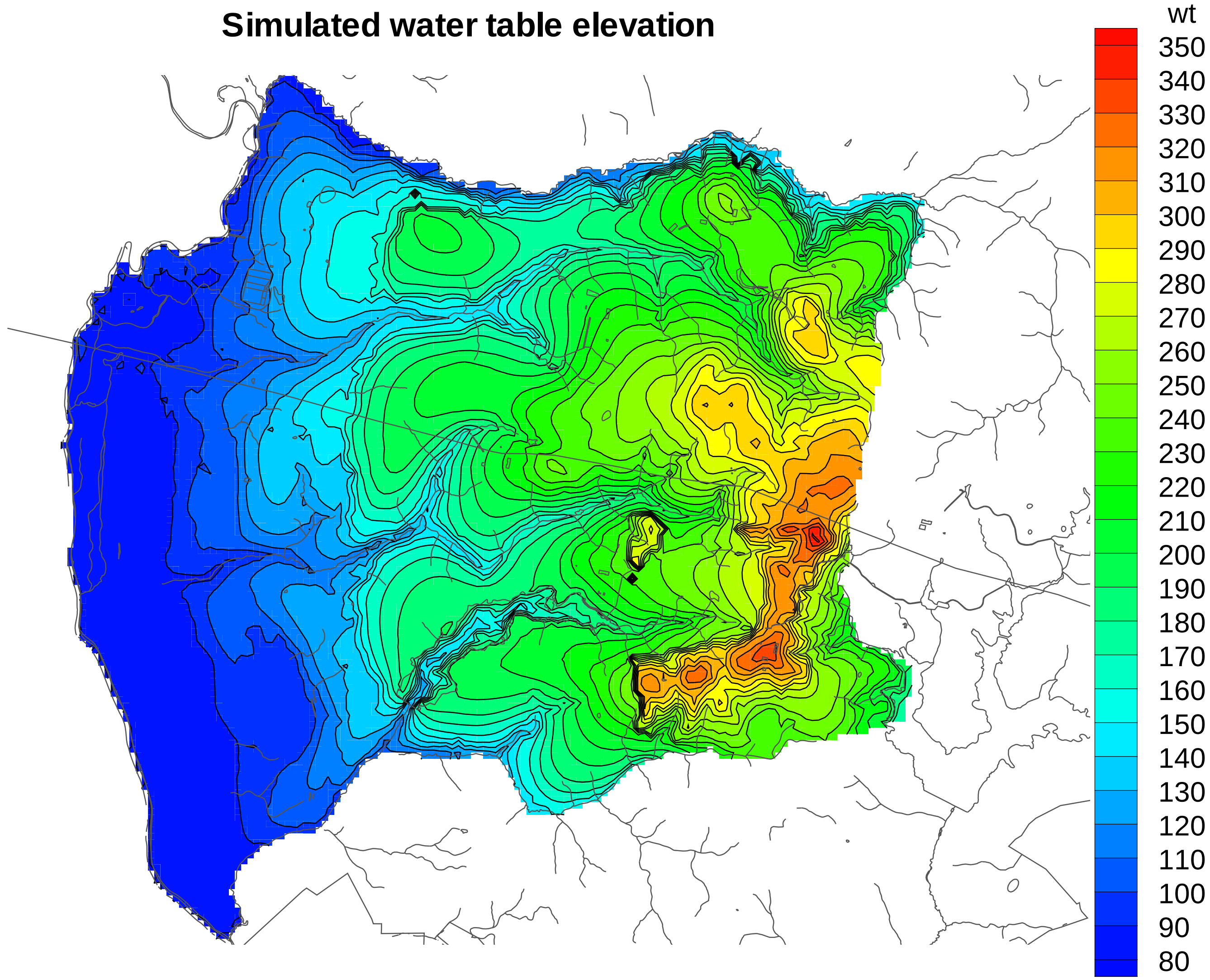

Figure H-4-19. (uncertainty case 4; compare to Figure 4-20)

Simulated groundwater recharge (discharge)

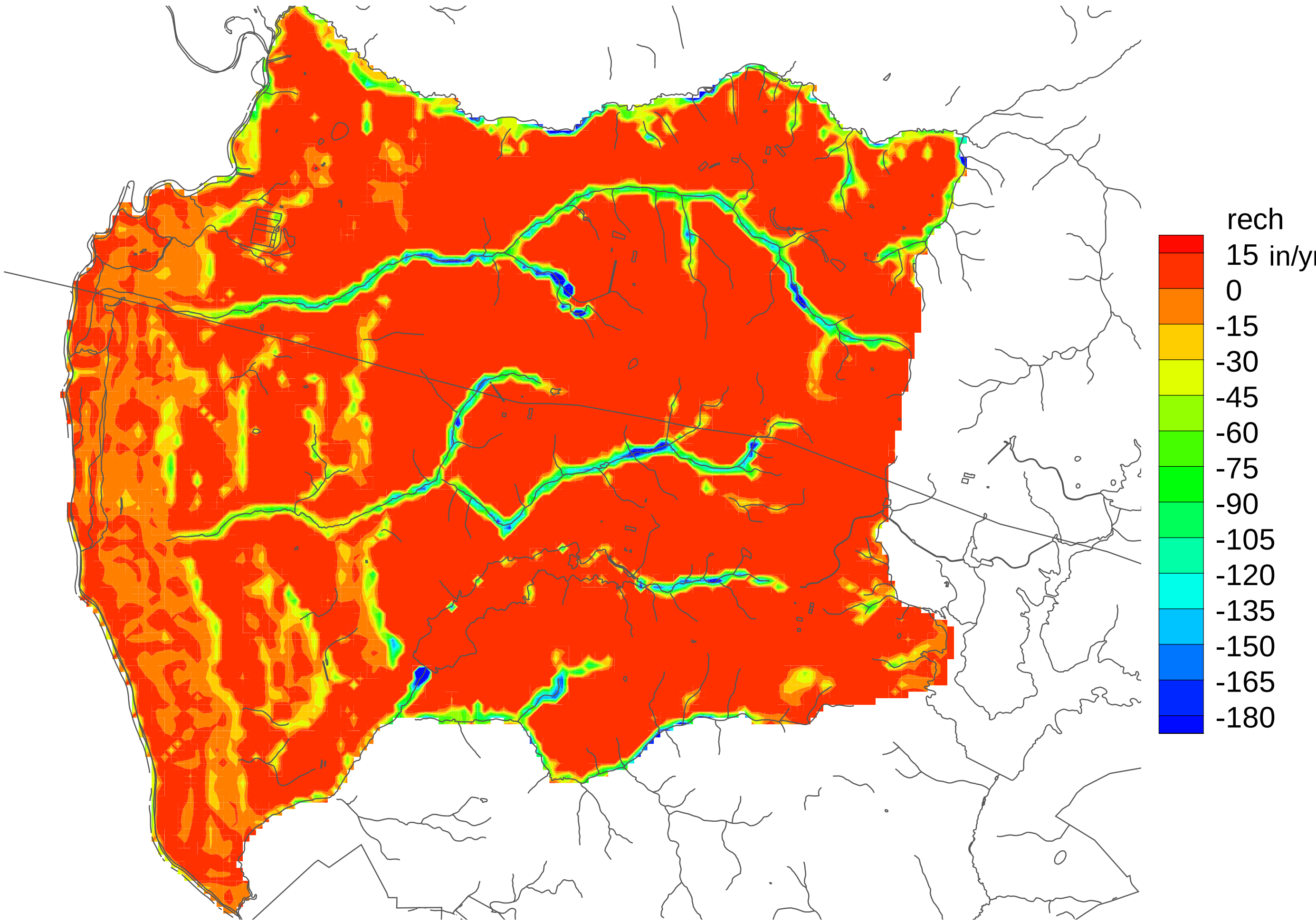

Figure H-4-20. (uncertainty case 4; compare to Figure 4-25)

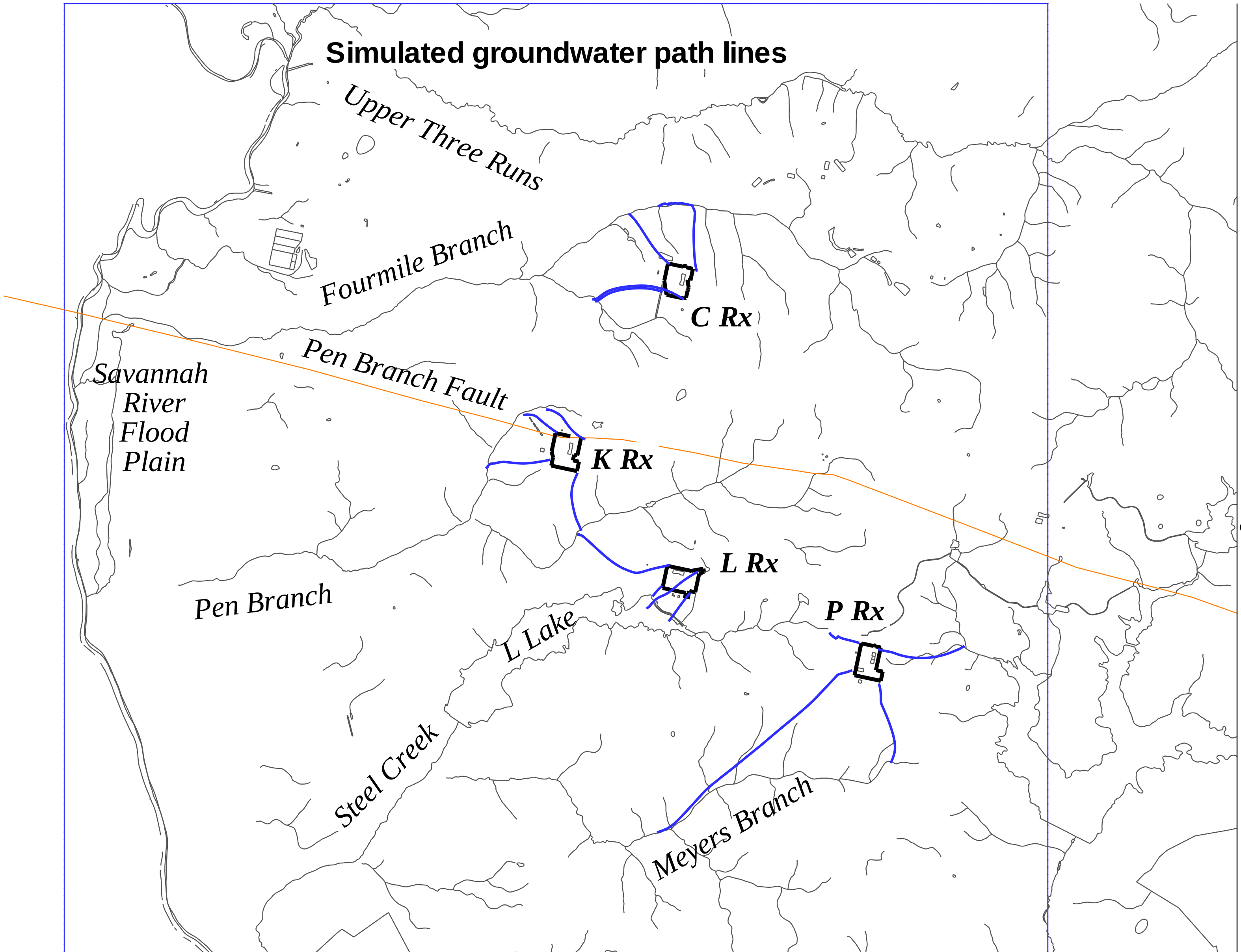

Figure H-4-21. (uncertainty case 4; compare to Figure 4-26)