








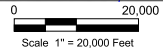


LEGEND

- | | | | |
|---|-----------------|---|--|
|  | Model Domain |  | Layer 1: Surficial Aquifer (Flood Sand & Gravel) |
|  | WRIA Boundaries |  | Layer 2: Tertiary Aquifer (Basalt and Latah) |
|  | Lakes |  | Dams of Interest |
|  | City Limits | | |
|  | Mike 11 Rivers | | |
|  | Roads | | |

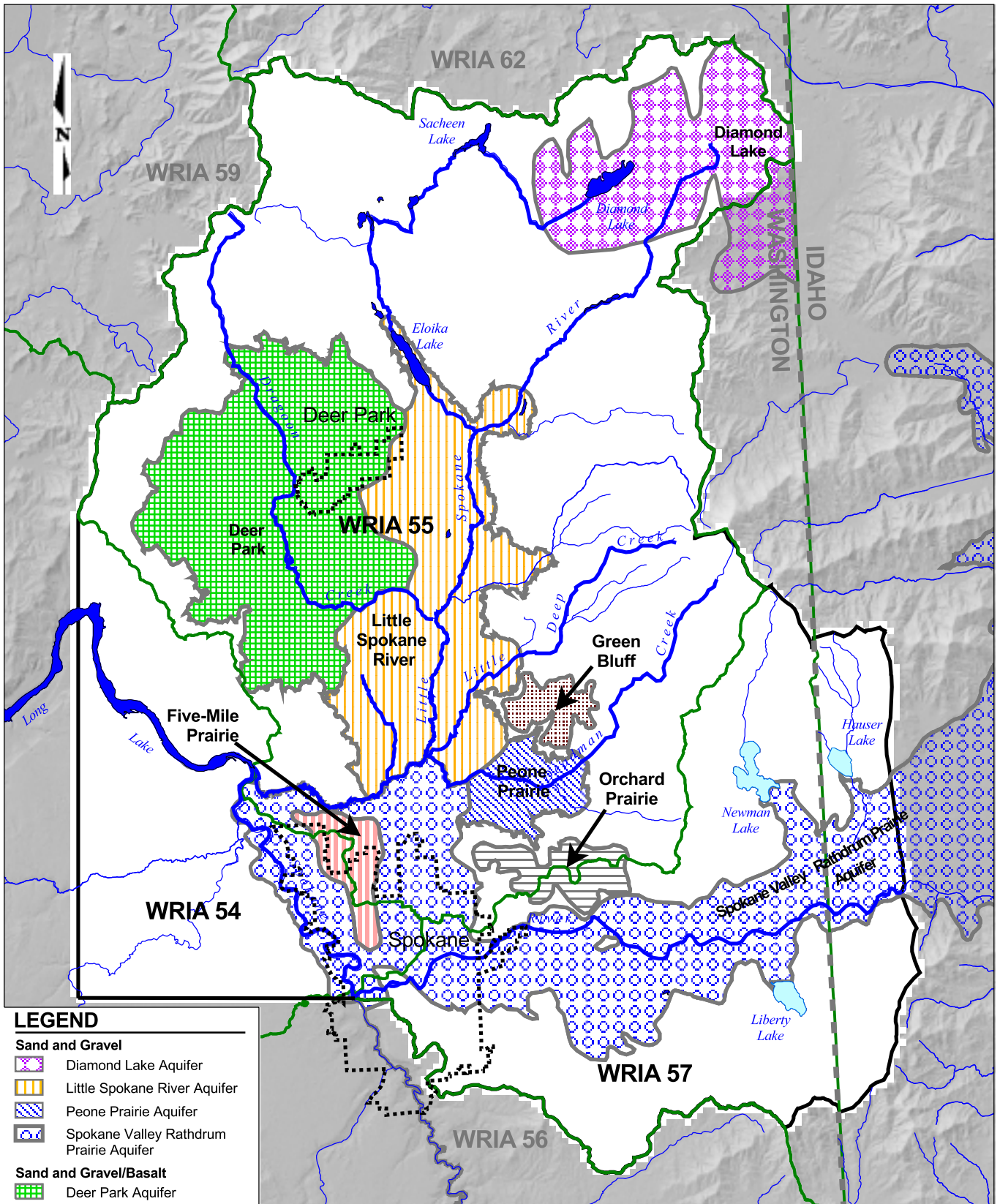


This figure was originally produced in color. Reproduction in black and white may result in loss of information.

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

Project Overview			
WRIA 55&57/WATERSHED PLANNING/WA			
Drawn: SAC	Revision: GKL	Date: May 13, 2003	Figure: 1.1



LEGEND

Sand and Gravel

- Diamond Lake Aquifer
- Little Spokane River Aquifer
- Peone Prairie Aquifer
- Spokane Valley Rathdrum Prairie Aquifer

Sand and Gravel/Basalt

- Deer Park Aquifer

Basalt

- Orchard Prairie Aquifer
- Green Bluff Aquifer
- 5 Mile Prairie Aquifer

Lakes

WRIA Boundaries

Mike11 Rivers

Model Domain

City Limits

0 30,000

Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

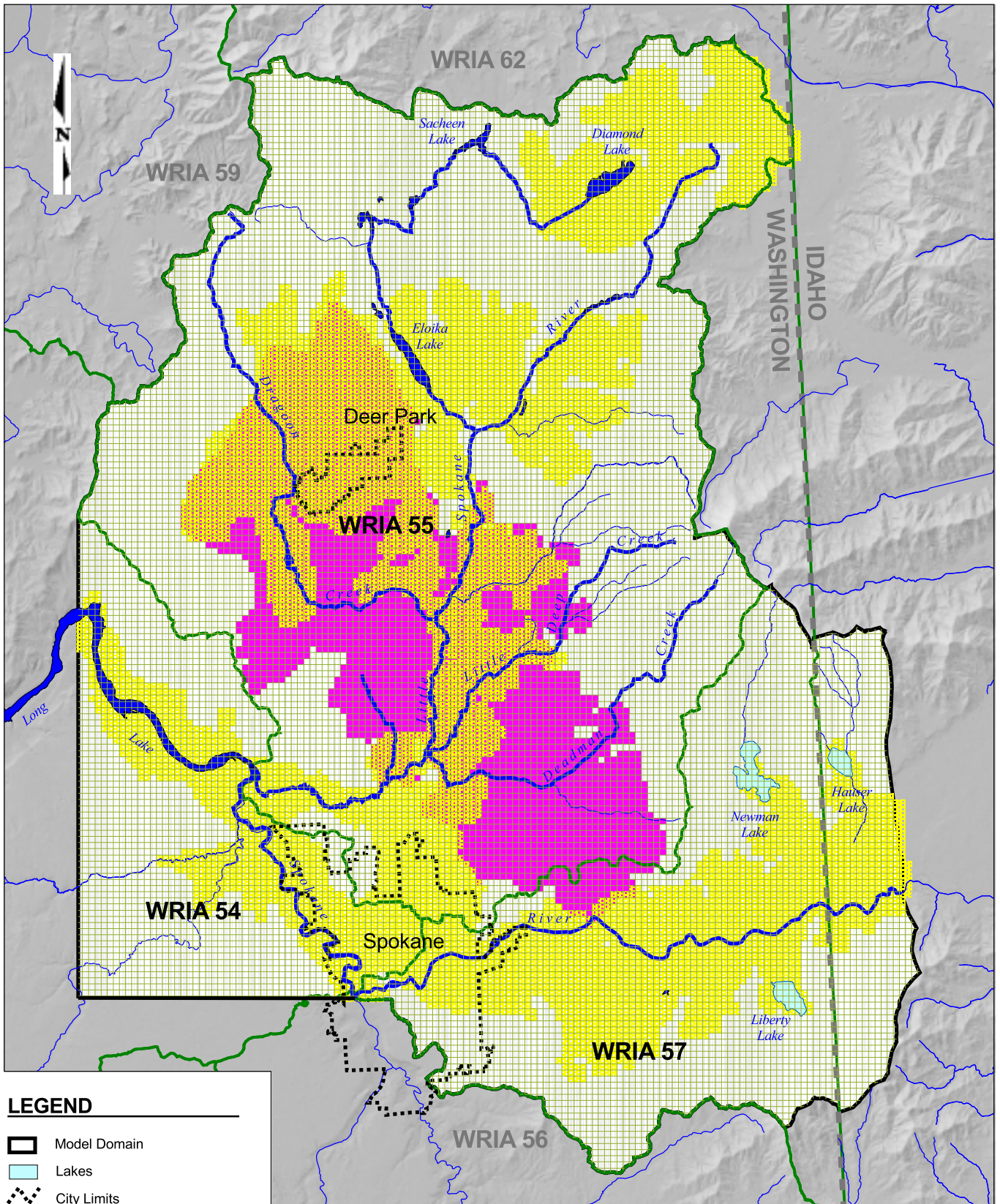
Source: USGS, WSDOE,
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Generalized Aquifer Delineations

WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC	Revision: BBA	Date: June 19, 2003	Figure: 3.1
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LEGEND

-  Model Domain
-  Lakes
-  City Limits
-  WRIA Boundaries
-  Mike11 Rivers
-  Model Grid (400 m²)
-  Layer 1: Surficial Aquifer (Flood Sand & Gravel)
-  Layer 2: Tertiary Aquifer (Basalt and Latah)

0 30,000



Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

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Model Domain

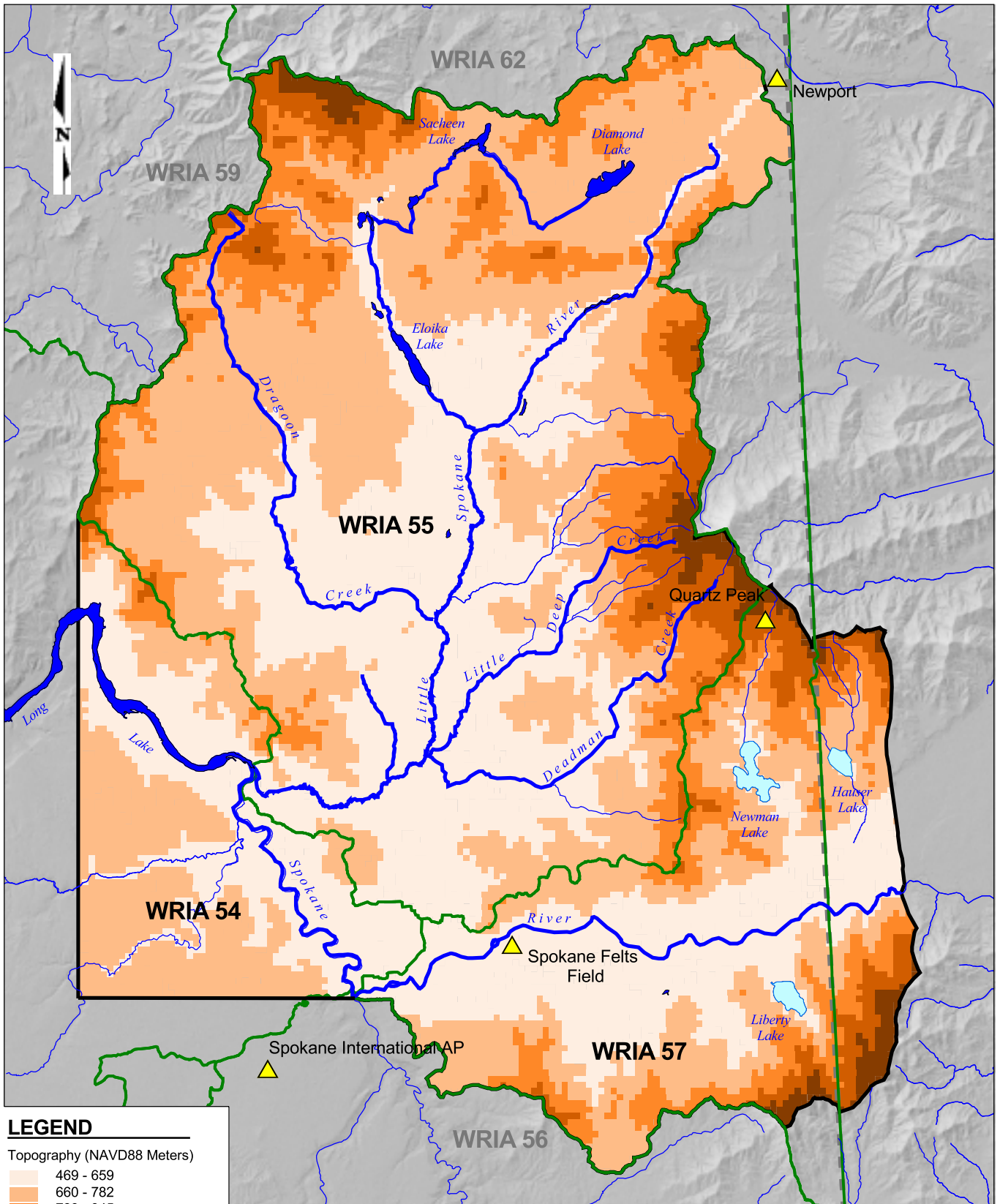
WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC

Revision: ATB

Date: May 13, 2003

Figure: **6.1**



LEGEND

Topography (NAVD88 Meters)

- 469 - 659
- 660 - 782
- 783 - 945
- 946 - 1181
- 1182 - 1730

- Weather Stations
- Lakes
- WRIA Boundaries
- Mike11 Rivers
- Model Domain

0 30,000

Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

This figure was originally produced in color.
Reproduction in black and white may result
in loss of information.

Topography and Weather Stations

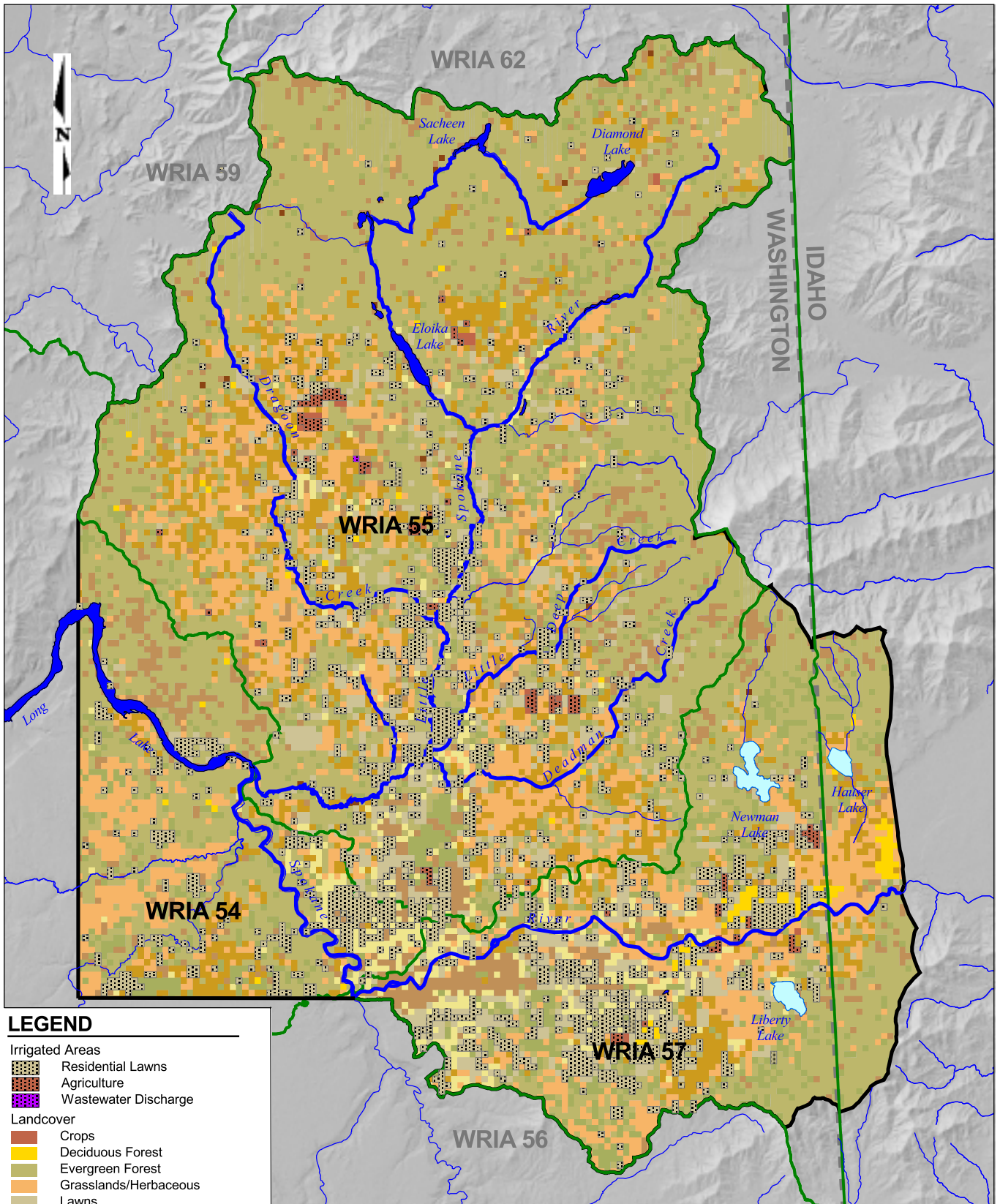
WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC

Revision: ATB

Date: May 15, 2003

Figure: **6.2**



LEGEND

- Irrigated Areas**
- Residential Lawns
 - Agriculture
 - Wastewater Discharge
- Landcover**
- Crops
 - Deciduous Forest
 - Evergreen Forest
 - Grasslands/Herbaceous
 - Lawns
 - Pasture/Hay/Turf
 - Residential
 - Shrubland
 - Wetlands
 - Unvegetated
 - Lakes
- WRIA Boundaries
- Mike11 Rivers
- Model Domain

0 30,000

Scale 1" = 30,000 Feet

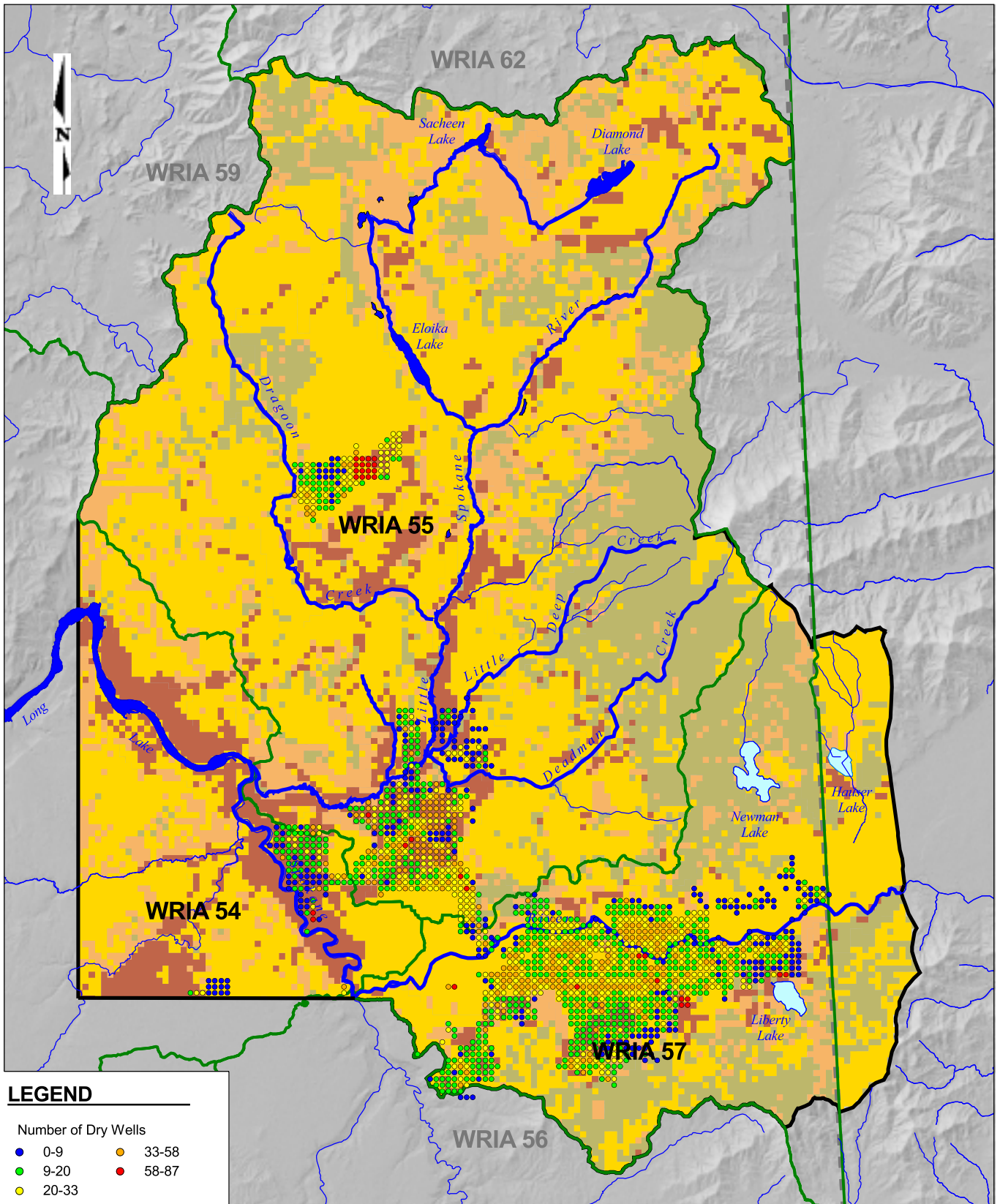
Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

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in loss of information.

Landcover and Irrigated Areas
WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC	Revision: ATB	Date: May 13, 2003	Figure: 6.3
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LEGEND

- Number of Dry Wells
- 0-9
 - 9-20
 - 20-33
 - 33-58
 - 58-87

- Soil Hydrologic Group
- A
 - B
 - C
 - D

- Lakes
- WRIA Boundaries
- Mike11 Rivers
- Model Domain



Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

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Distribution of Soils & Dry Wells

WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC

Revision: ATB

Date: May 13, 2003

Figure: **6.4**

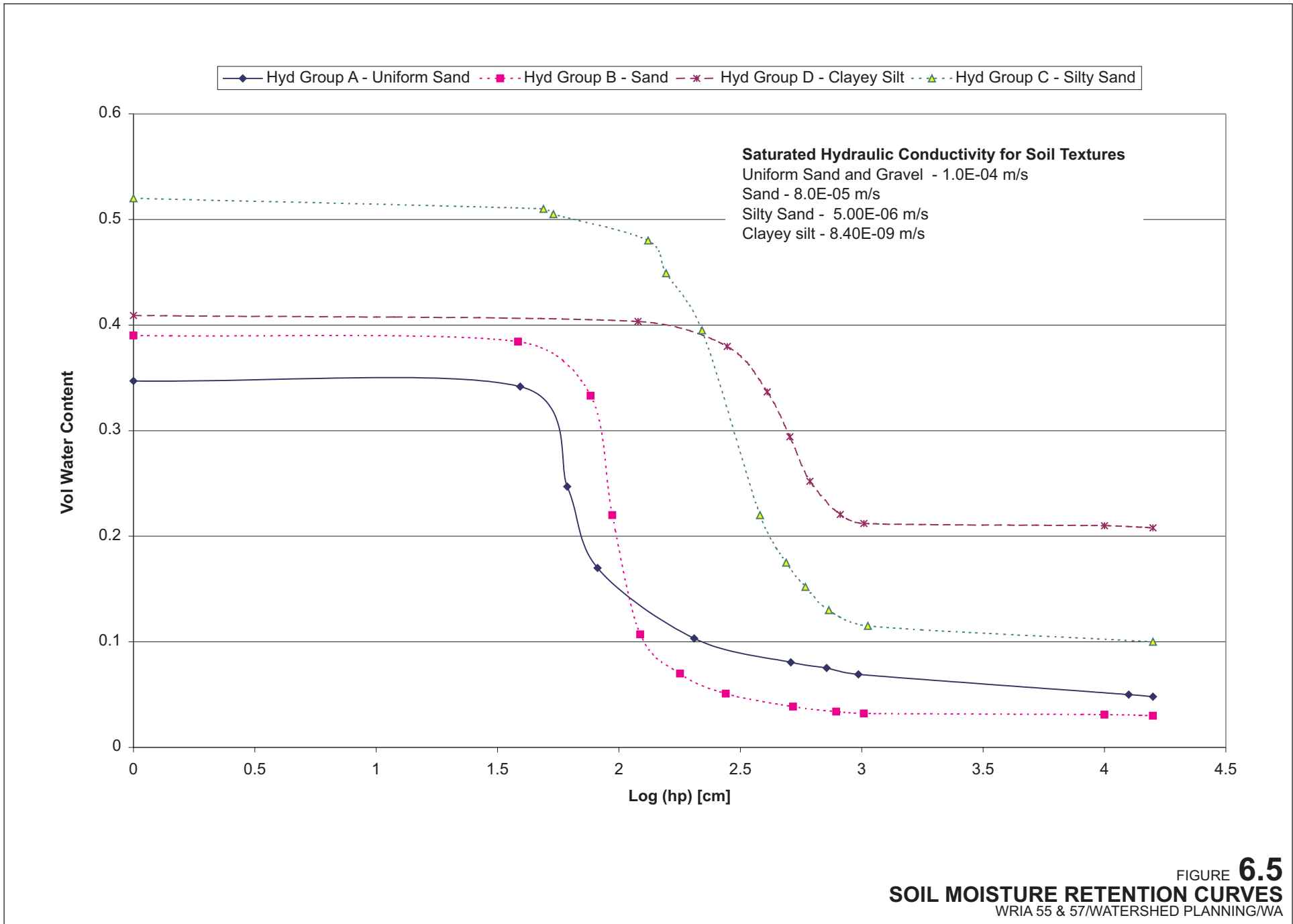
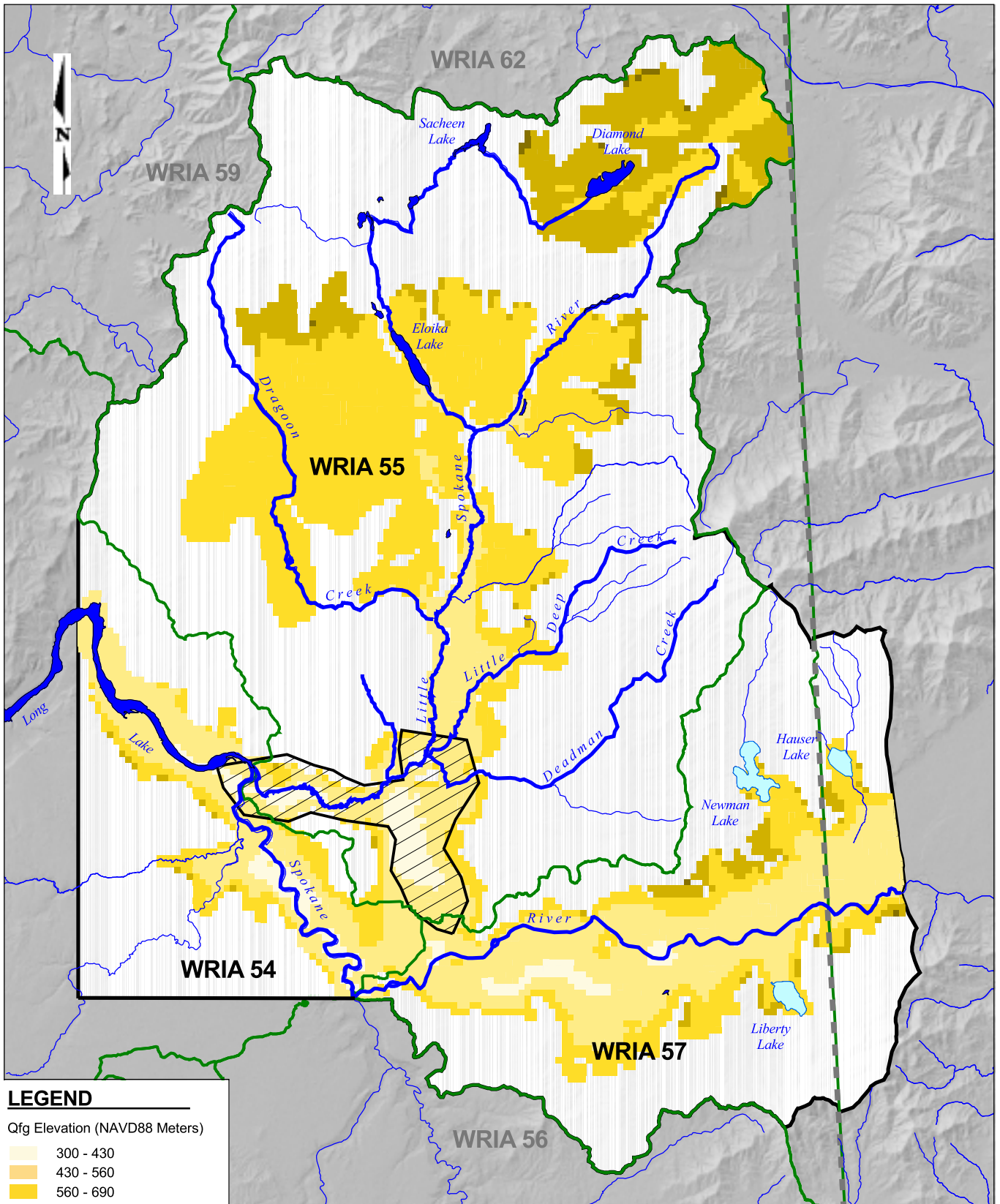


FIGURE **6.5**
SOIL MOISTURE RETENTION CURVES
 WRIA 55 & 57/WATERSHED PLANNING/WA



LEGEND

Qfg Elevation (NAVD88 Meters)

- 300 - 430
- 430 - 560
- 560 - 690
- 690 - 820
- 820 - 950

- Lakes
- WRIA Boundaries
- Mike11 Rivers
- Model Domain
- Clay Lens

0 30,000

Scale 1" = 30,000 Feet

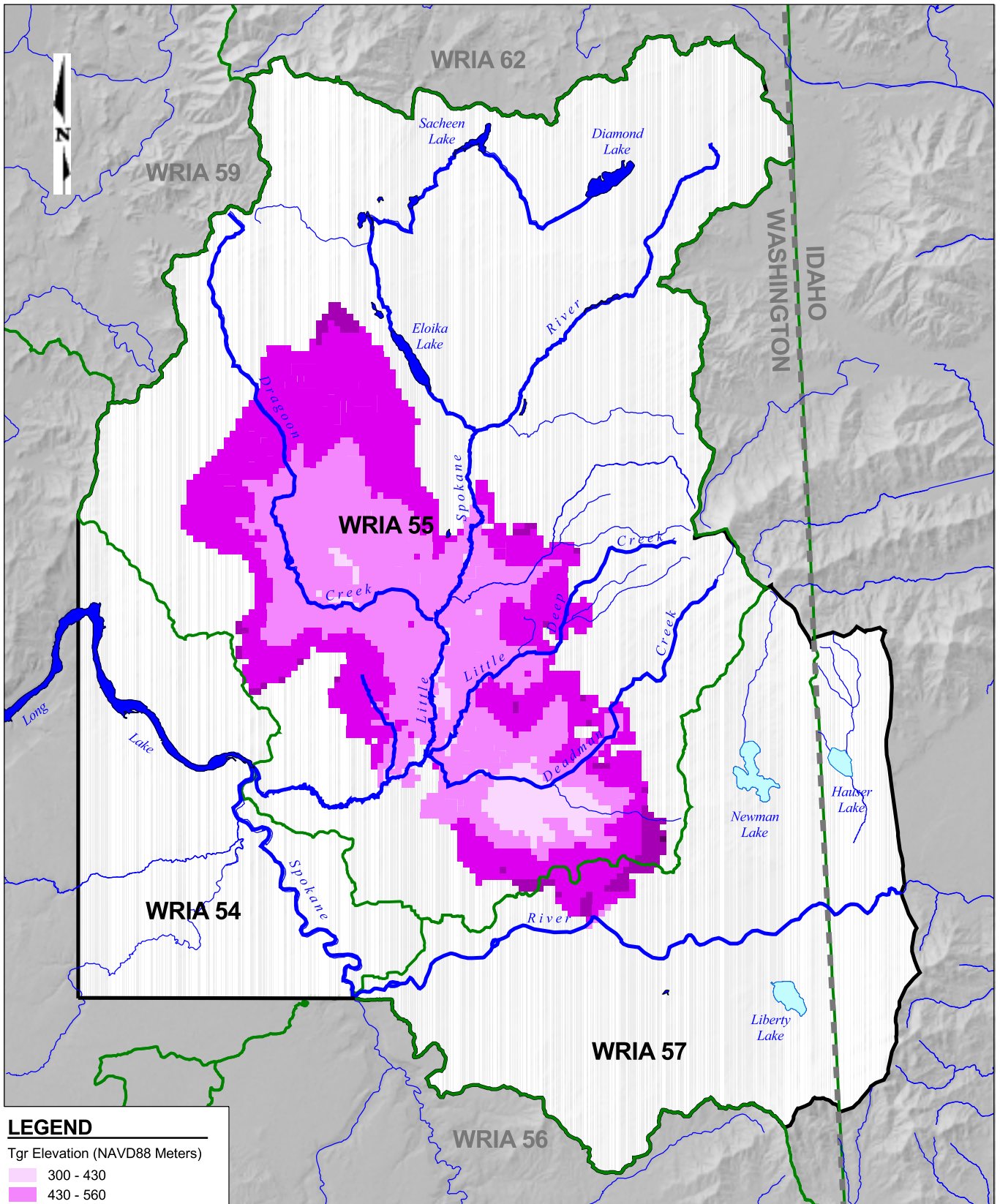
Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

This figure was originally produced in color.
Reproduction in black and white may result
in loss of information.

**Bottom Elevation of Model Layer 1 -
Surficial Aquifer Flood Sands and Gravels**
WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC	Revision: ATB	Date: May 13, 2003	Figure: 6.6
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LEGEND

Tgr Elevation (NAVD88 Meters)

- 300 - 430
- 430 - 560
- 560 - 690
- 690 - 820
- 820 - 950

- Lakes
- WRIA Boundaries
- Mike11 Rivers
- Model Domain

0 30,000

Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

This figure was originally produced in color.
Reproduction in black and white may result
in loss of information.

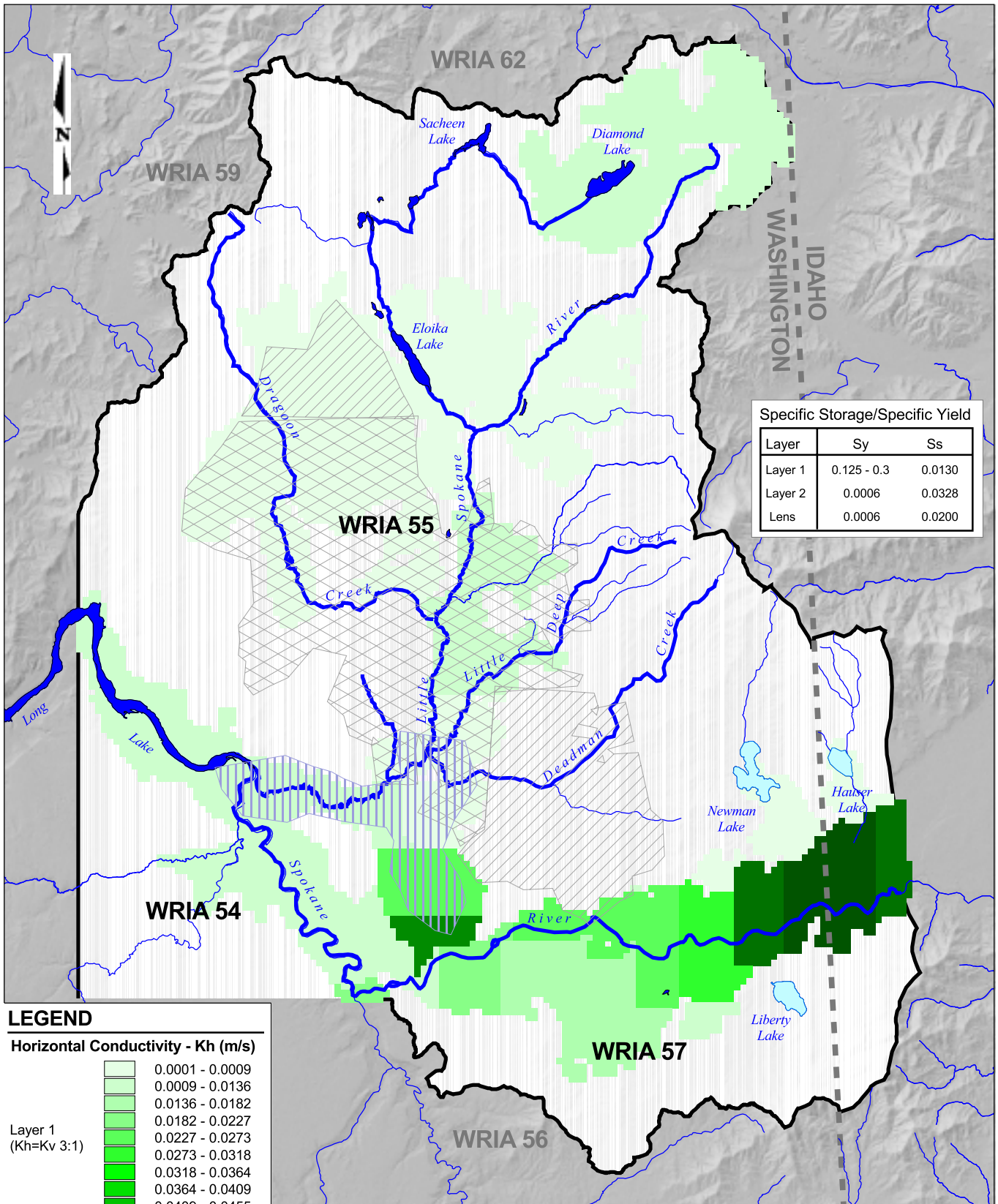
**Bottom Elevation of Model Layer 2 -
Tertiary Aquifer (Basalt and Latah)**
WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC

Revision: ATB

Date: May 13, 2003

Figure: **6.7**



Specific Storage/Specific Yield

Layer	Sy	Ss
Layer 1	0.125 - 0.3	0.0130
Layer 2	0.0006	0.0328
Lens	0.0006	0.0200

LEGEND

Horizontal Conductivity - Kh (m/s)

- 0.0001 - 0.0009
 - 0.0009 - 0.0136
 - 0.0136 - 0.0182
 - 0.0182 - 0.0227
 - 0.0227 - 0.0273
 - 0.0273 - 0.0318
 - 0.0318 - 0.0364
 - 0.0364 - 0.0409
 - 0.0409 - 0.0455
 - 0.0455 - 0.0800
 - 0.0800 - 0.1200
 - 0.1200 - 0.2000
- Layer 1 (Kh=Kv 3:1)
- 5.6 x 10⁻⁵
 - 9.6 x 10⁻⁶
- Layer 2 (Kh=Kv 3:1)
- 1 x 10⁻⁸
- Lens (Kh=Kv)

- Model Domain
- WRIA Boundaries
- Mike11 Rivers
- Lakes

0 30,000
Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

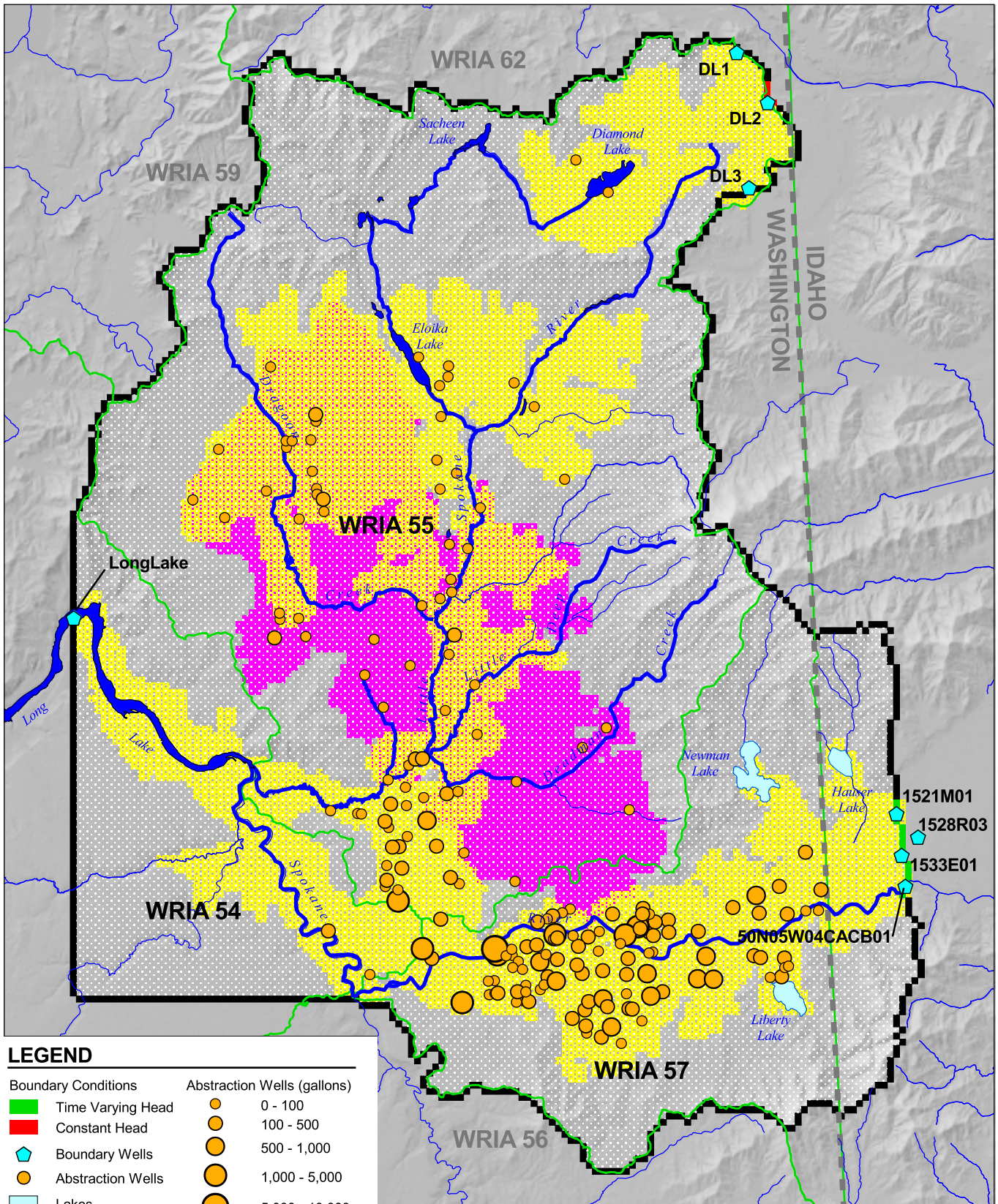
Source: USGS, WSDOE,
Golder Associates Inc.

This figure was originally produced in color.
Reproduction in black and white may result
in loss of information.

Aquifer Properties

WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC Revision: ATB Date: May 13, 2003 Figure: **6.8**



LEGEND

- | | |
|--|------------------------------------|
| Boundary Conditions | Abstraction Wells (gallons) |
| Time Varying Head | 0 - 100 |
| Constant Head | 100 - 500 |
| Boundary Wells | 500 - 1,000 |
| Abstraction Wells | 1,000 - 5,000 |
| Lakes | 5,000 - 10,000 |
| WRIA Boundaries | |
| Mike11 Rivers | |
| Model Domain | |
| Layer 1: Surficial Aquifer (Flood Sand & Gravel) | |
| Layer 2: Tertiary Aquifer (Basalt and Latah) | |

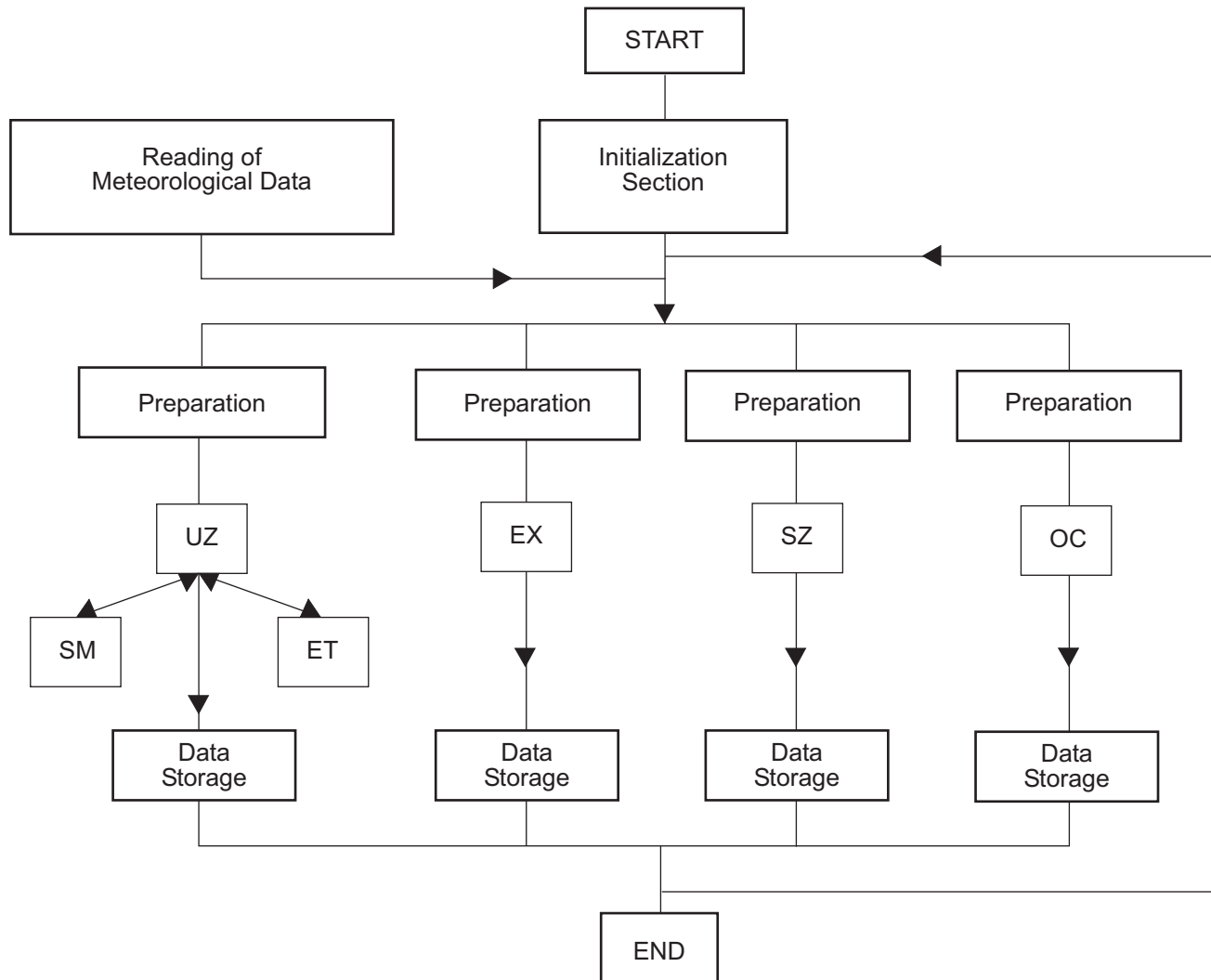
0 30,000
 Scale 1" = 30,000 Feet

Map Projection:
 Washington State Plane, NAD83,
 North Zone, Feet
 Source: USGS, WSDOE,
 Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in loss of information.

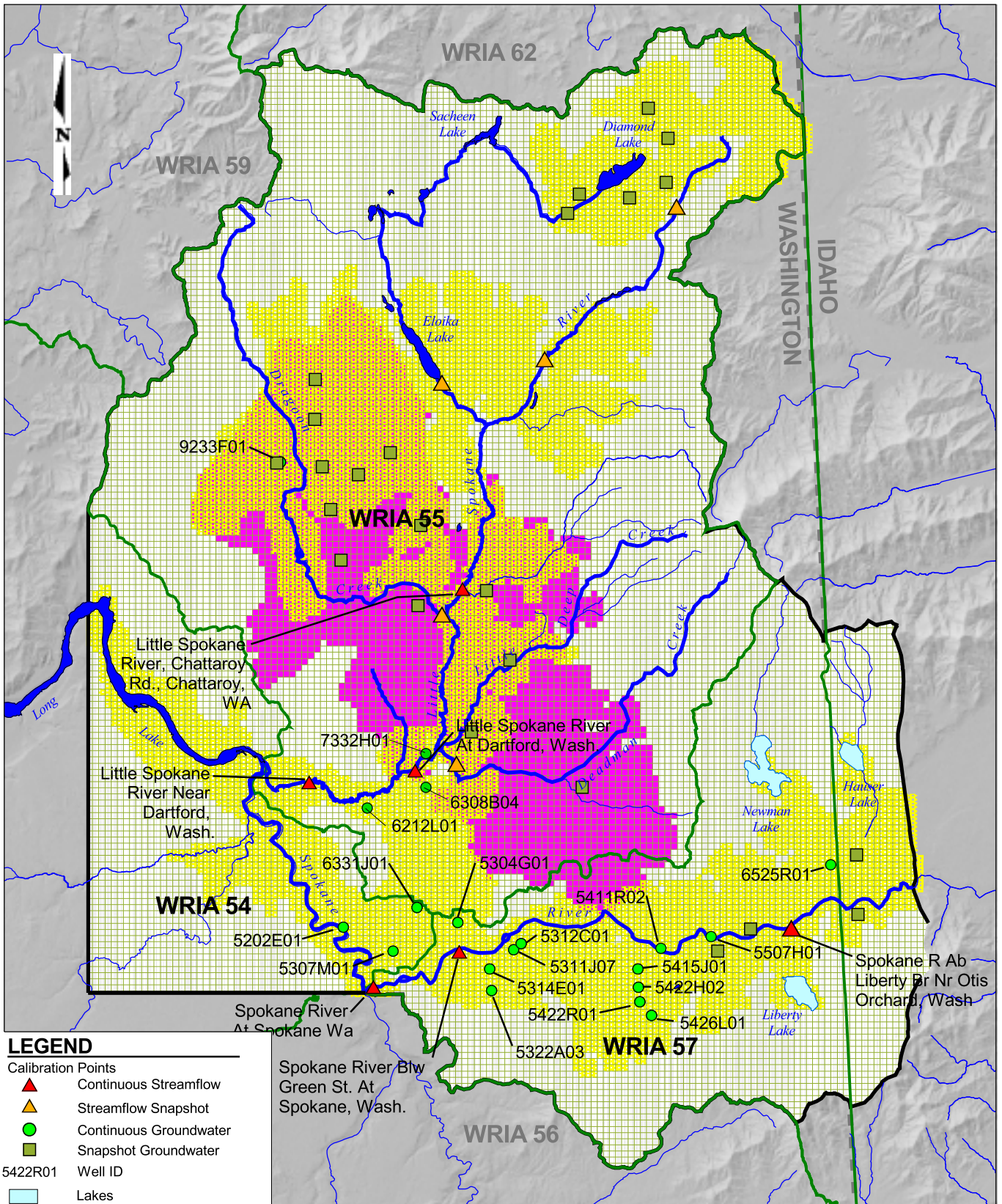
Boundary Conditions With Abstraction Wells			
WRIA 55&57/WATERSHED PLANNING/WA			
Drawn: SAC	Revision: ATB	Date: May. 13, 2003	Figure: 6.9

Modeling Process (Mechanics)



Note: Graphic copied from MikeSHE Manual (v2001b)

FIGURE 7.1
MODEL EXECUTION SEQUENCE
 WRIA 55 & 57/WATERSHED PLANNING/WA



LEGEND

- Calibration Points
- ▲ Continuous Streamflow
 - ▲ Streamflow Snapshot
 - Continuous Groundwater
 - Snapshot Groundwater
- 5422R01 Well ID
- Lakes
 - ▭ WRIA Boundaries
 - ▬ Mike11 Rivers
 - ▭ Model Domain
 - ▭ Model Grid (400 m²)
 - ▭ Layer 1: Surficial Aquifer (Flood Sand & Gravel)
 - ▭ Layer 2: Tertiary Aquifer (Basalt and Latah)

0 30,000

Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

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Groundwater and Surface Water Calibration Points			
WRIA 55&57/WATERSHED PLANNING/WA			
Drawn: SAC	Revision: BBA	Date: July 9, 2003	Figure: 8.1

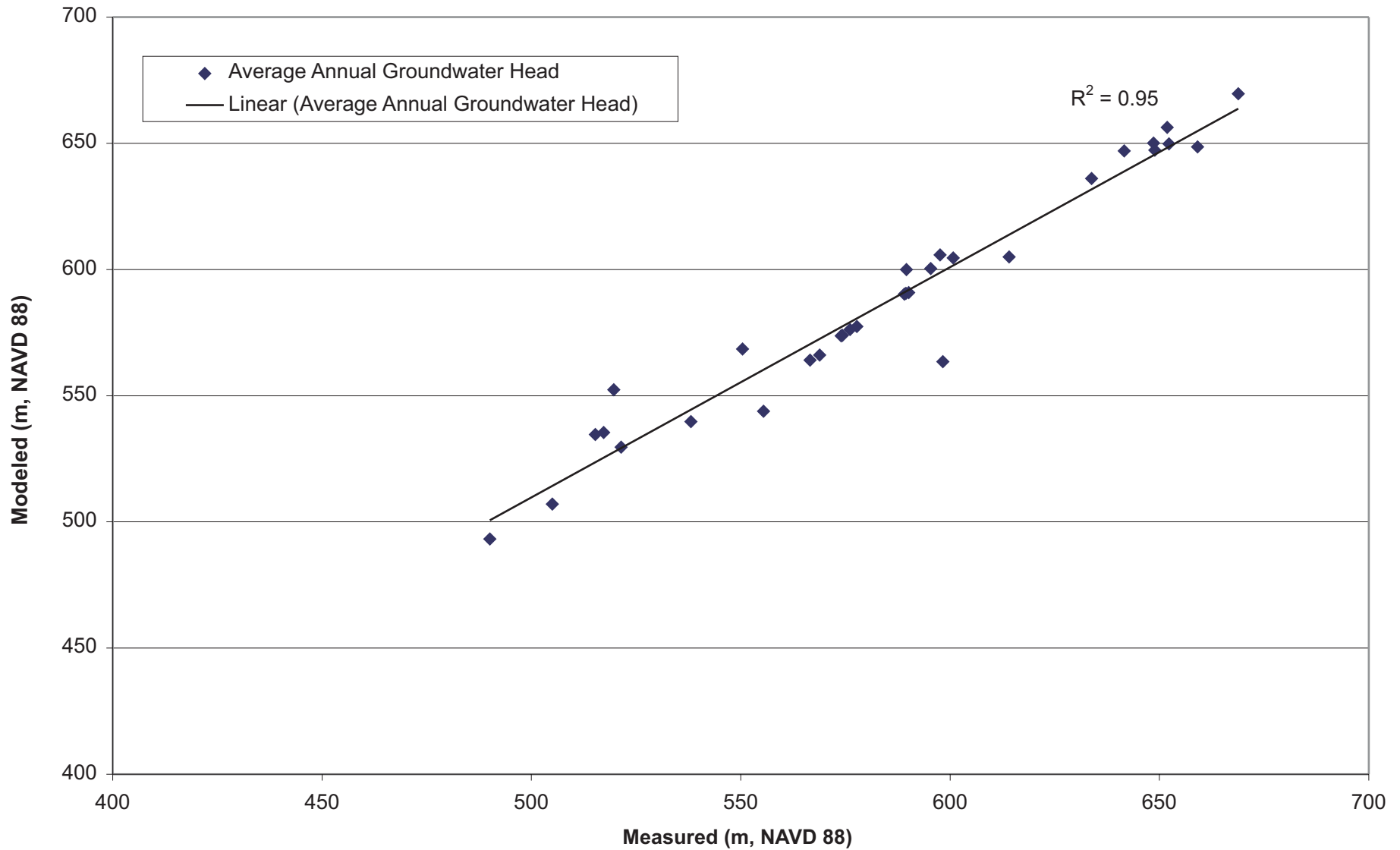
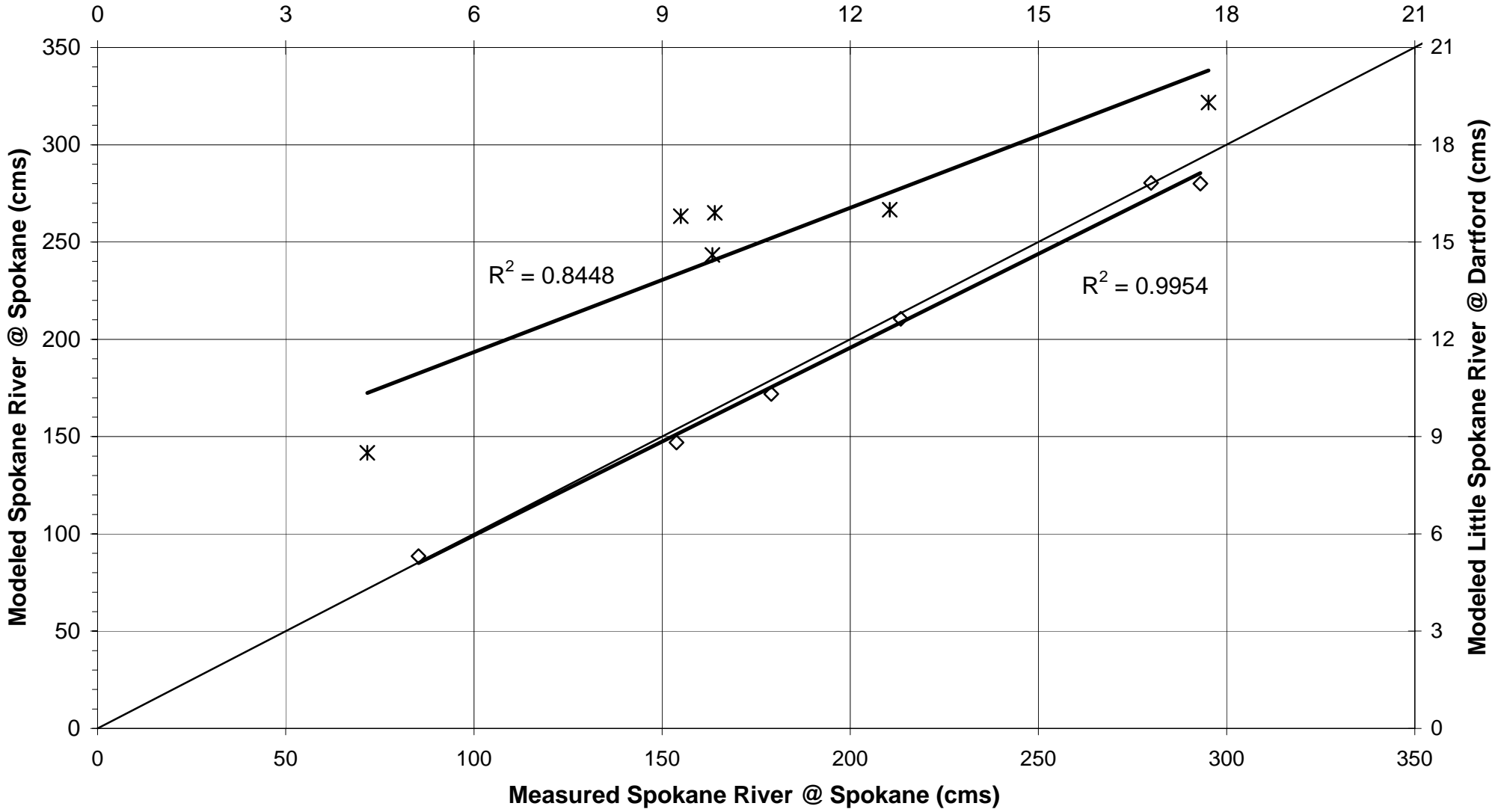


FIGURE 8.2
**ANNUAL MODELED VS MEASURED
 1997 GROUNDWATER ELEVATION**
 WRIA 55 & 57/WATERSHED PLANNING/WA

Measured Little Spokane River @ Dartford (cms)



WRIA 15
Watershed Planning

◇ Spokane River @ Spokane

* Little Spokane River @ Dartford

Measured Versus Modeled Streamflows

DRAWN	CVP	DATE	May-03	JOB NO.	013-1372.2300
CHECKED	SM	SCALE	na	DWG. NO.	na
REVIEWED	CVP	FILE NO.	Figure 8-3.xls	FIGURE NO.	8.3

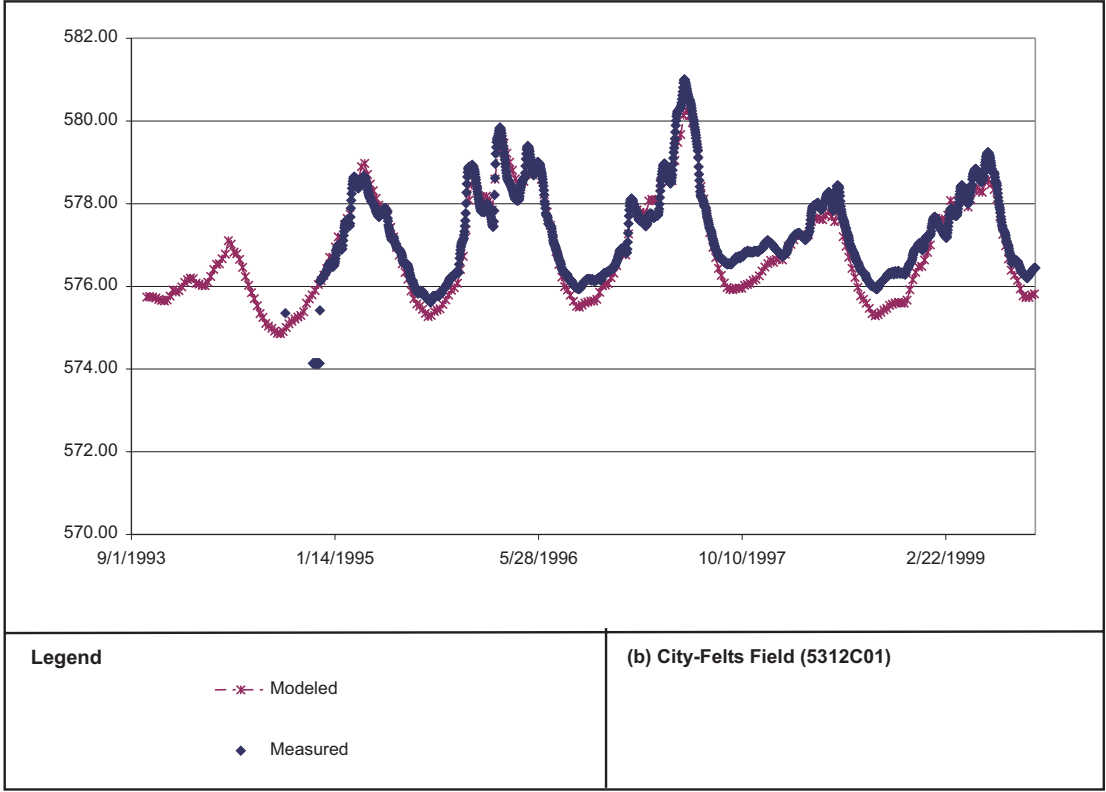
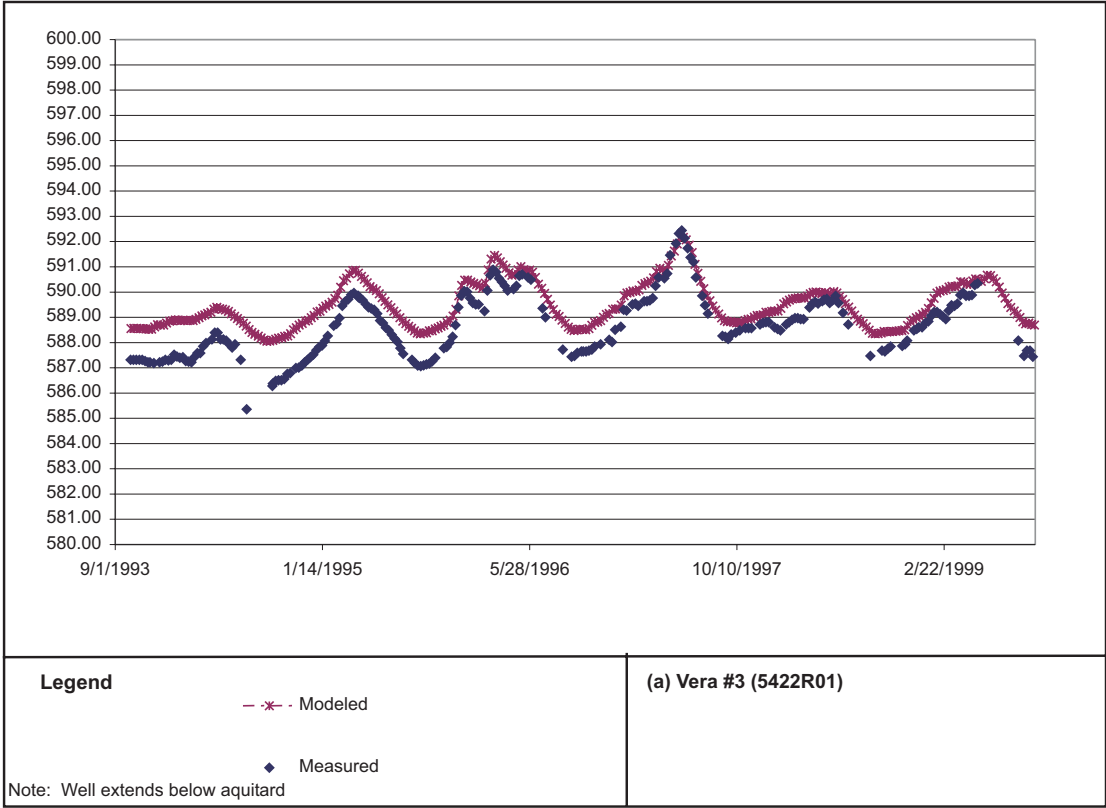


FIGURE 8.4
WEEKLY GROUNDWATER CALIBRATION
 – VERA #3, FELTS FIELD
 WRIA 55 & 57/WATERSHED PLANNING/WA

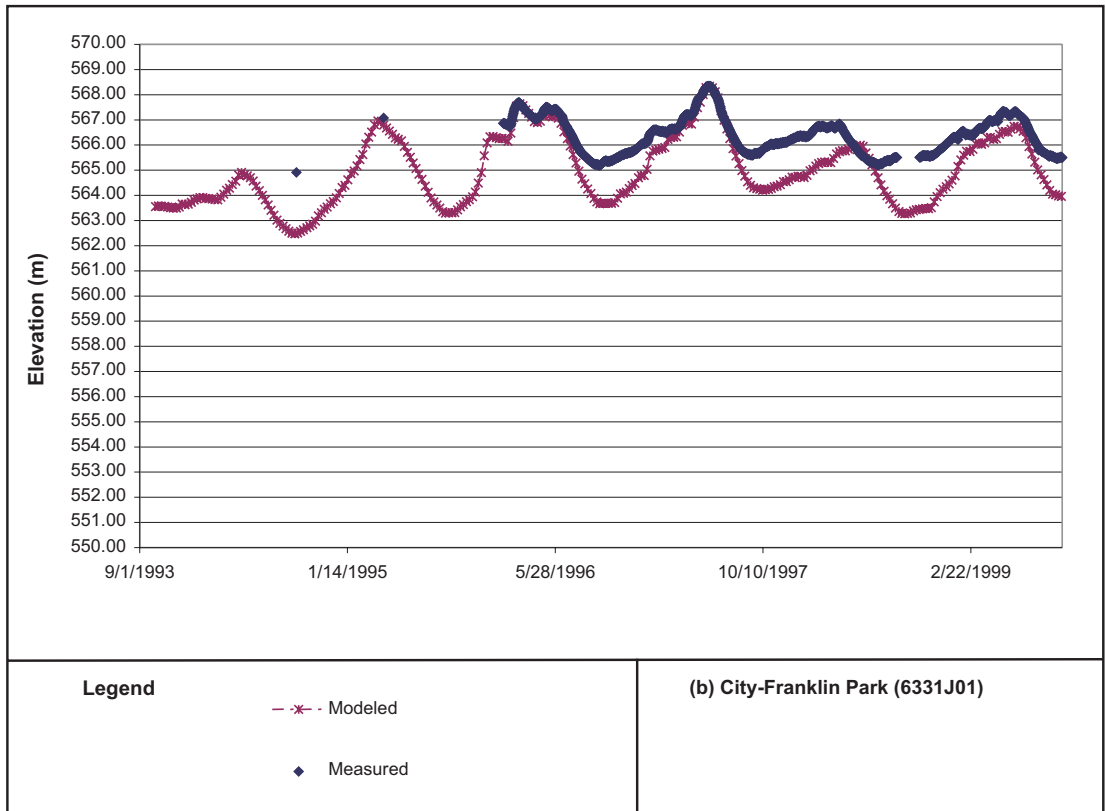
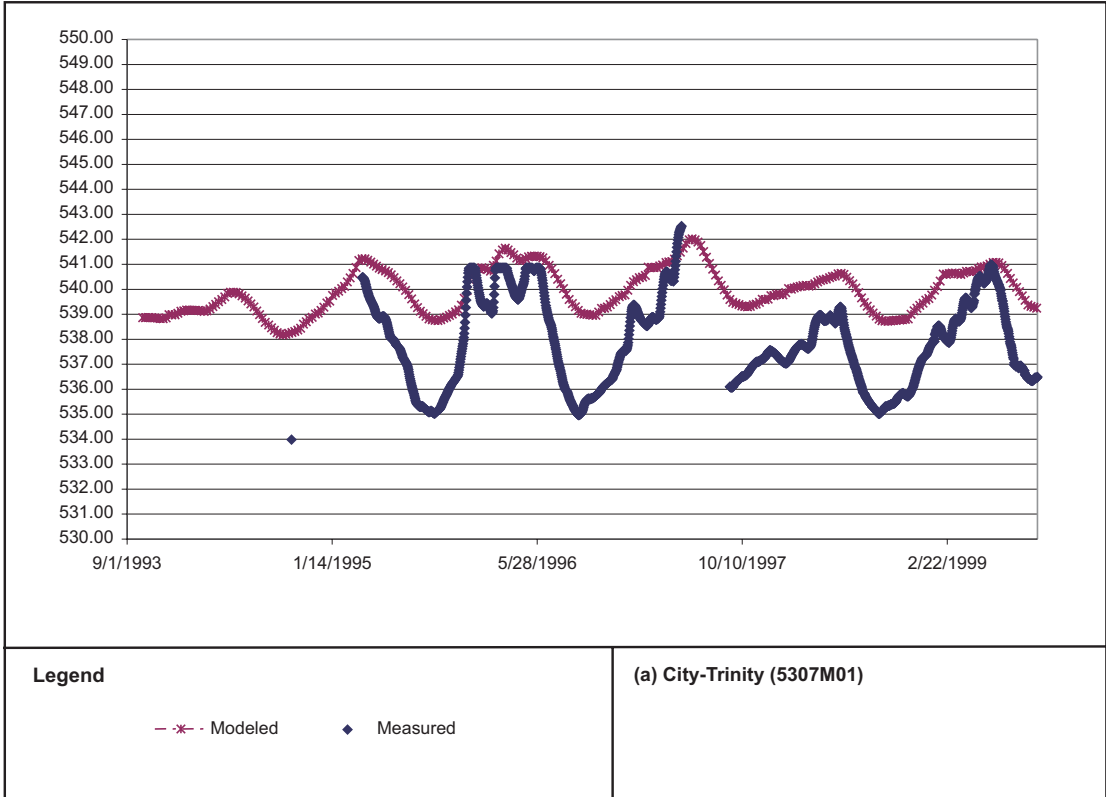


FIGURE 8.5
WEEKLY GROUNDWATER CALIBRATION
 – TRINITY, FRANKLIN PARK
 WRIA 55 & 57/WATERSHED PLANNING/WA

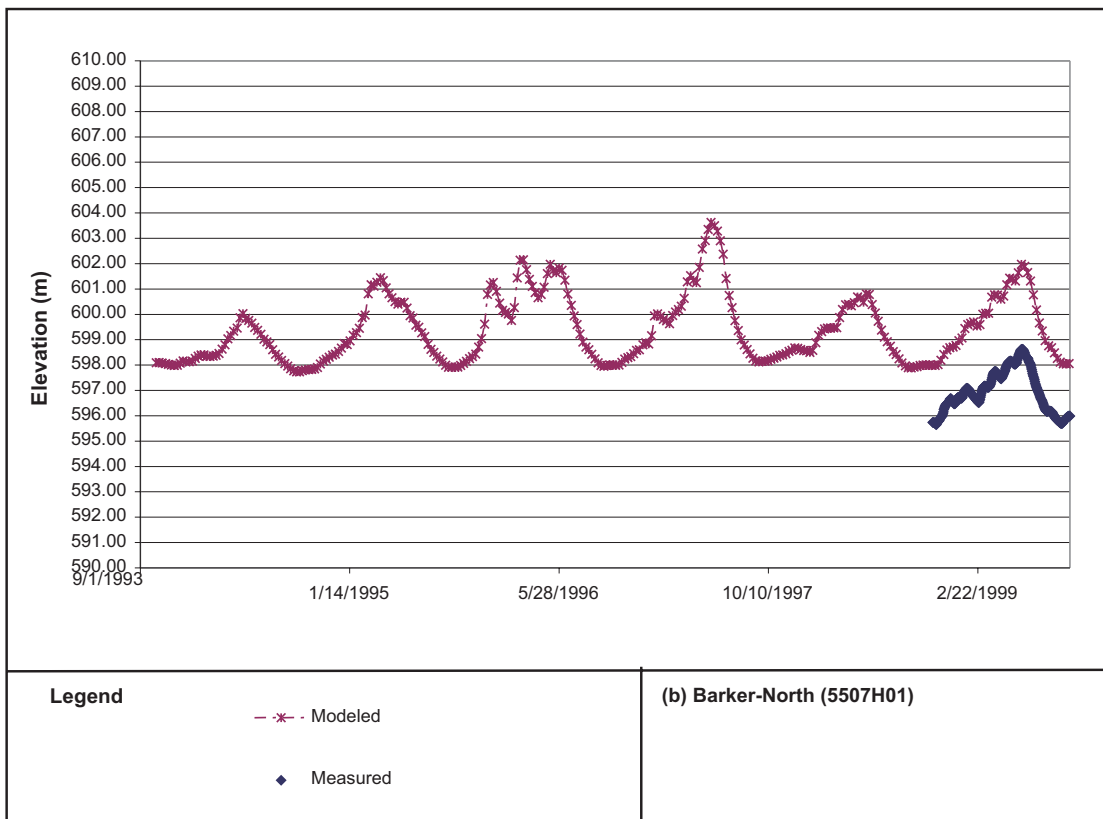
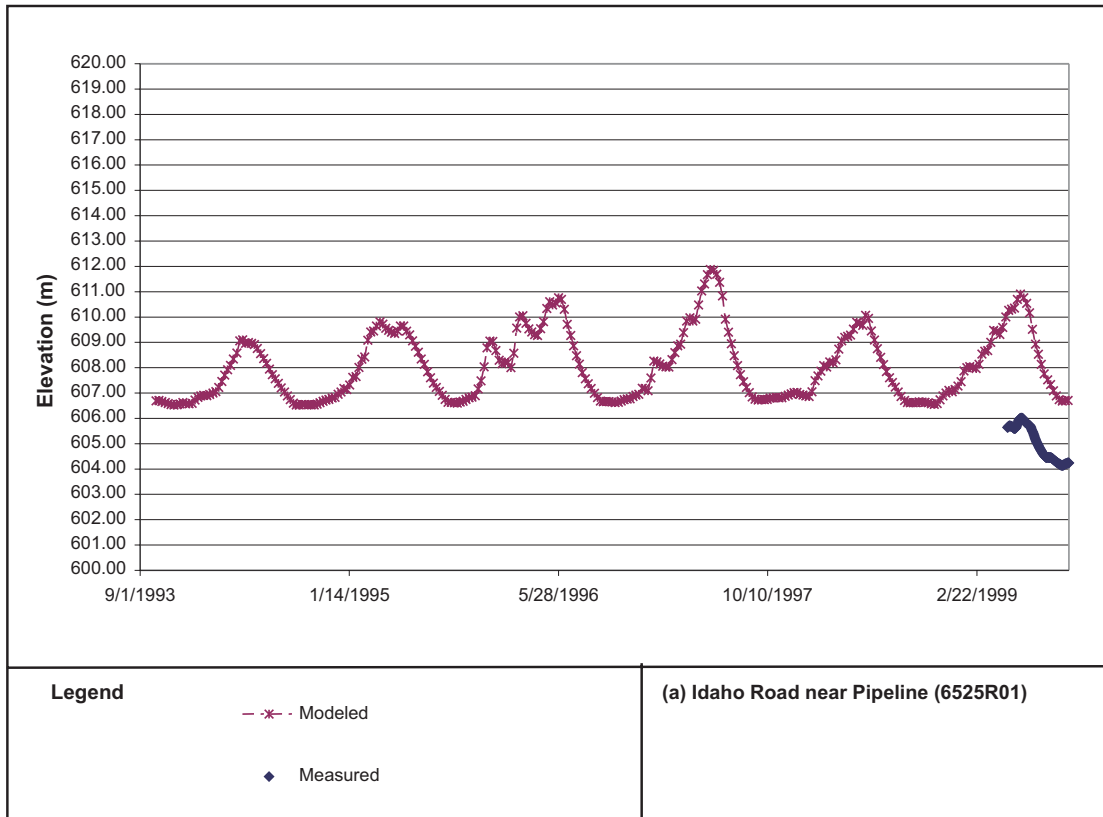


FIGURE 8.6
**WEEKLY GROUNDWATER CALIBRATION,
 IDAHO ROAD, BARKER-NORTH**
 WRIA 55 & 57 WATERSHED PLANNING/WA

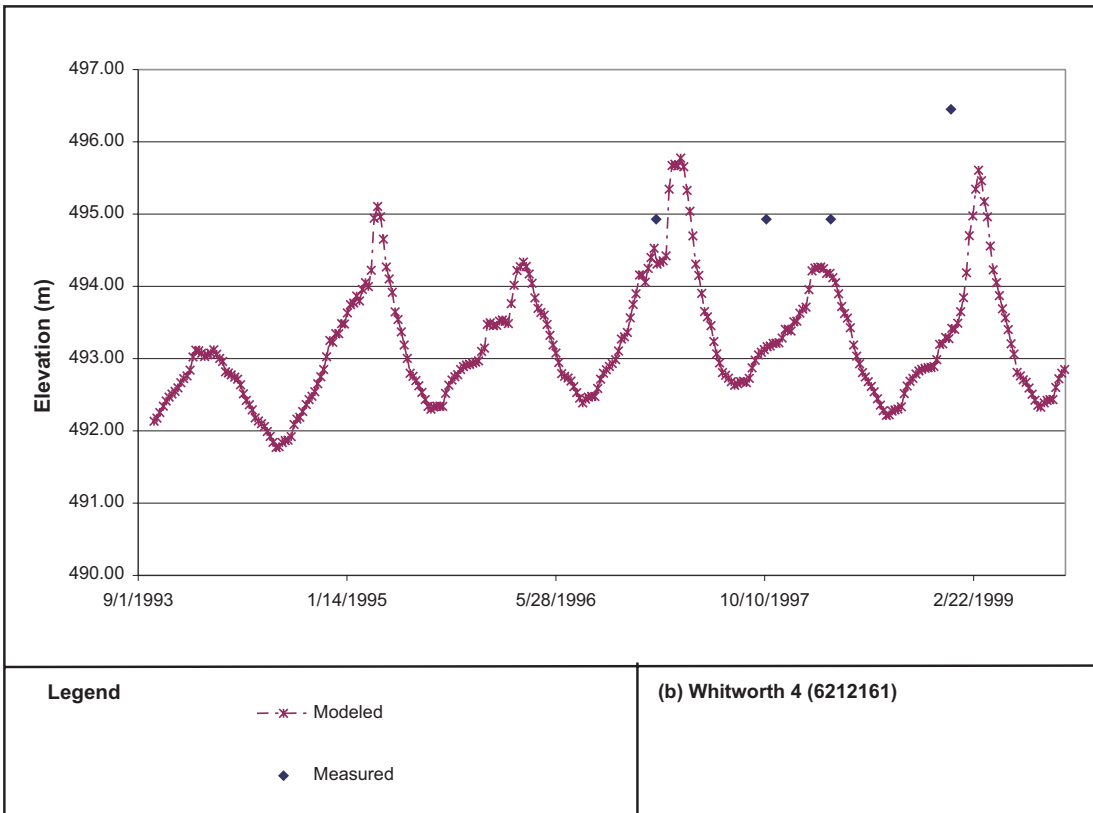
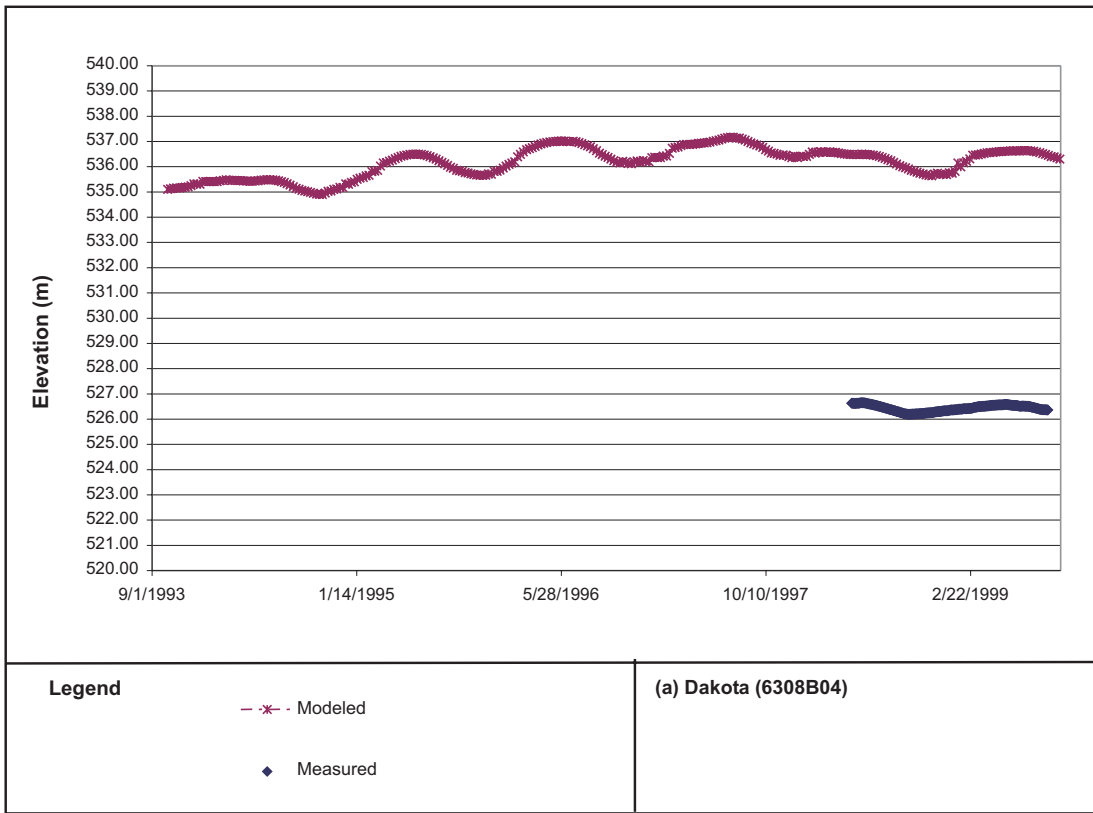
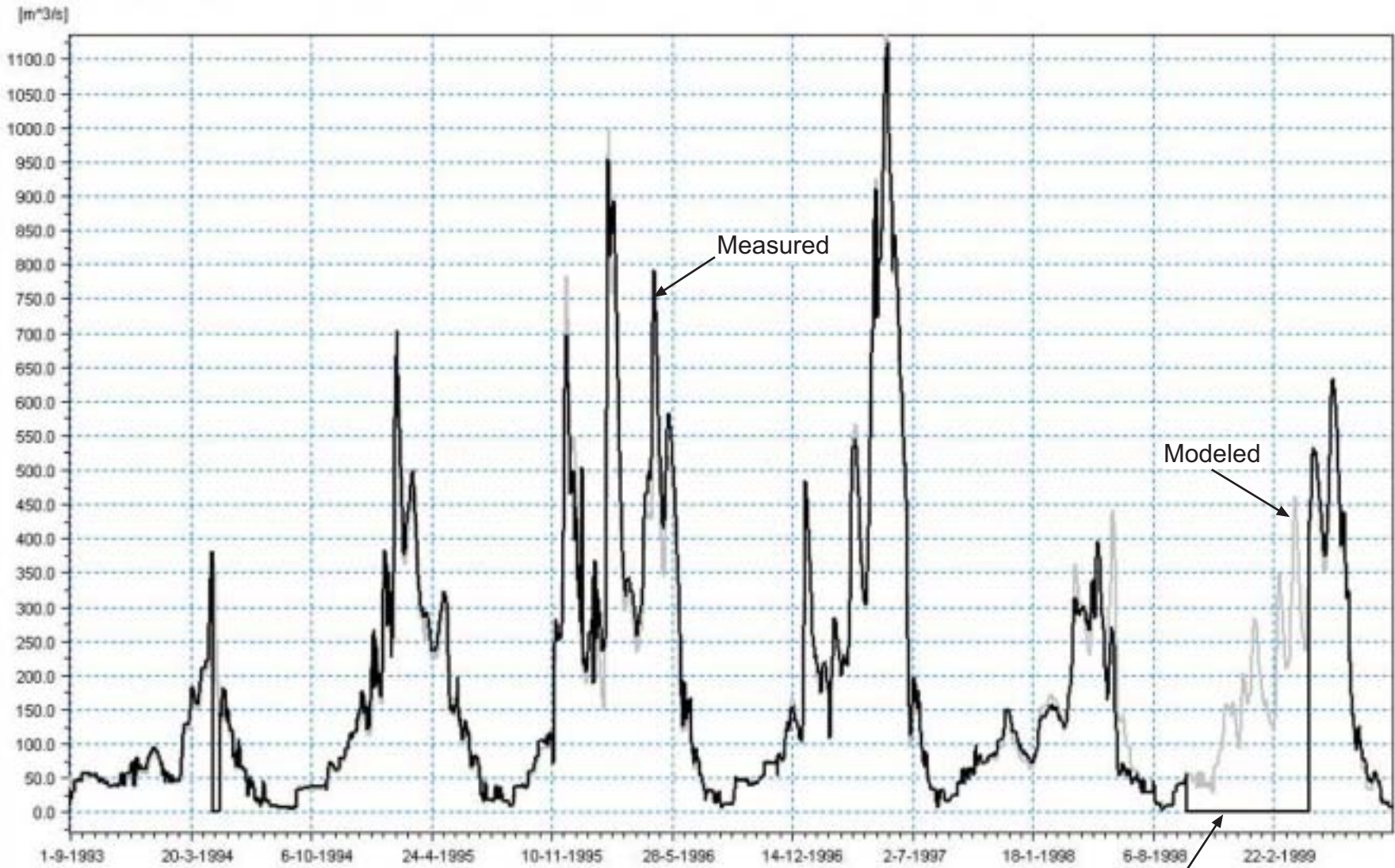
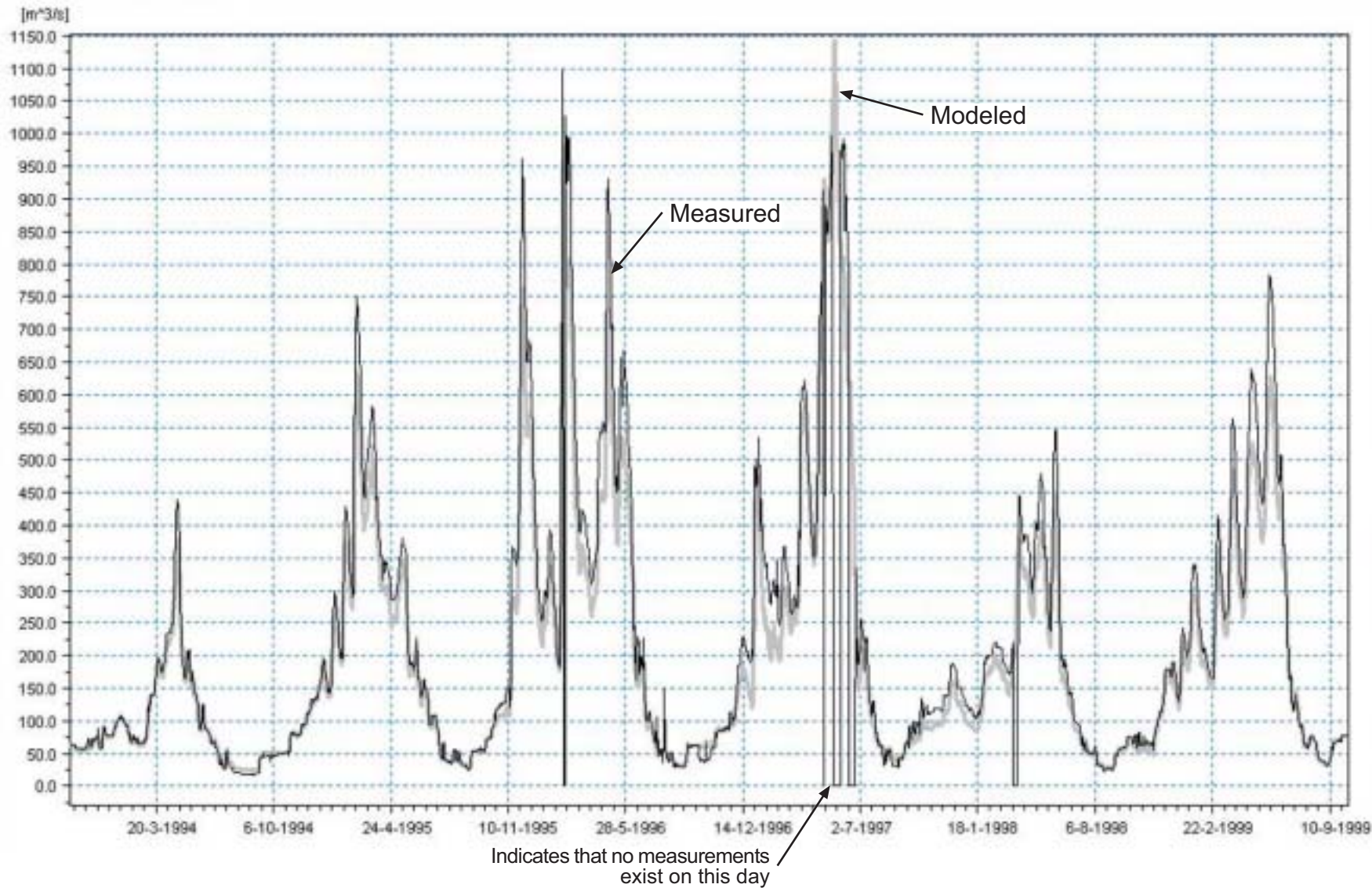


FIGURE 8.7
WEEKLY GROUNDWATER CALIBRATION
– DAKOTA, WHITWORTH 4
 WRIA 55 & 57/WATERSHED PLANNING/WA



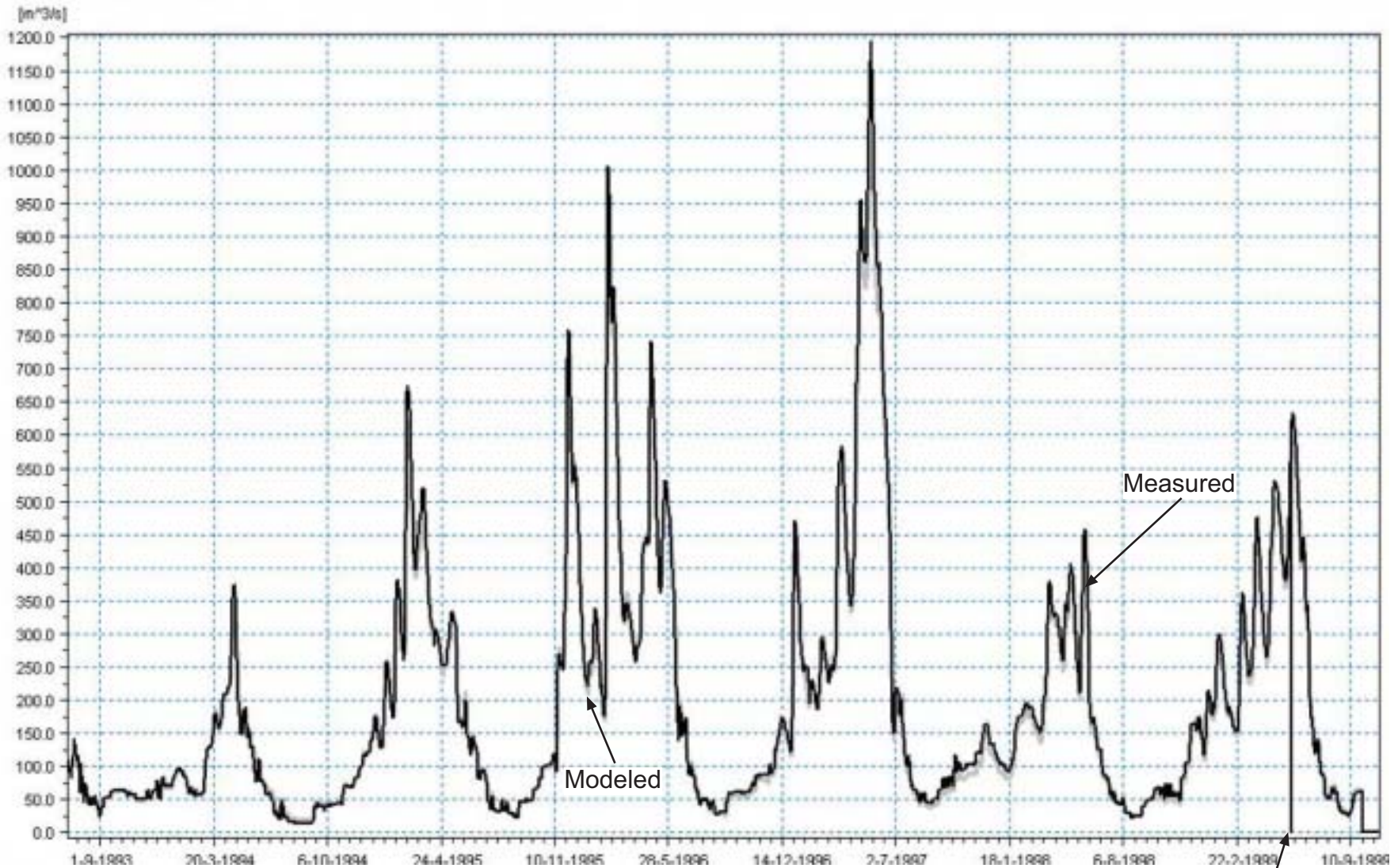
Run #1227

FIGURE 8.8
**SPOKANE RIVER NEAR
 OTIS ORCHARDS (CHAINAGE 31,901)**
 WRIA 55 & 57/WATERSHED PLANNING/WA



Run #1227

FIGURE 8.9
**SPOKANE RIVER AT
 GREENE STREET (CHAINAGE 53,716)**
 WRIA 55 & 57/WATERSHED PLANNING/WA



Run #1227

FIGURE 8.10
SPOKANE RIVER AT SPOKANE (CHAINAGE 61,417)
 WRIA 55 & 57/WATERSHED PLANNING/WA

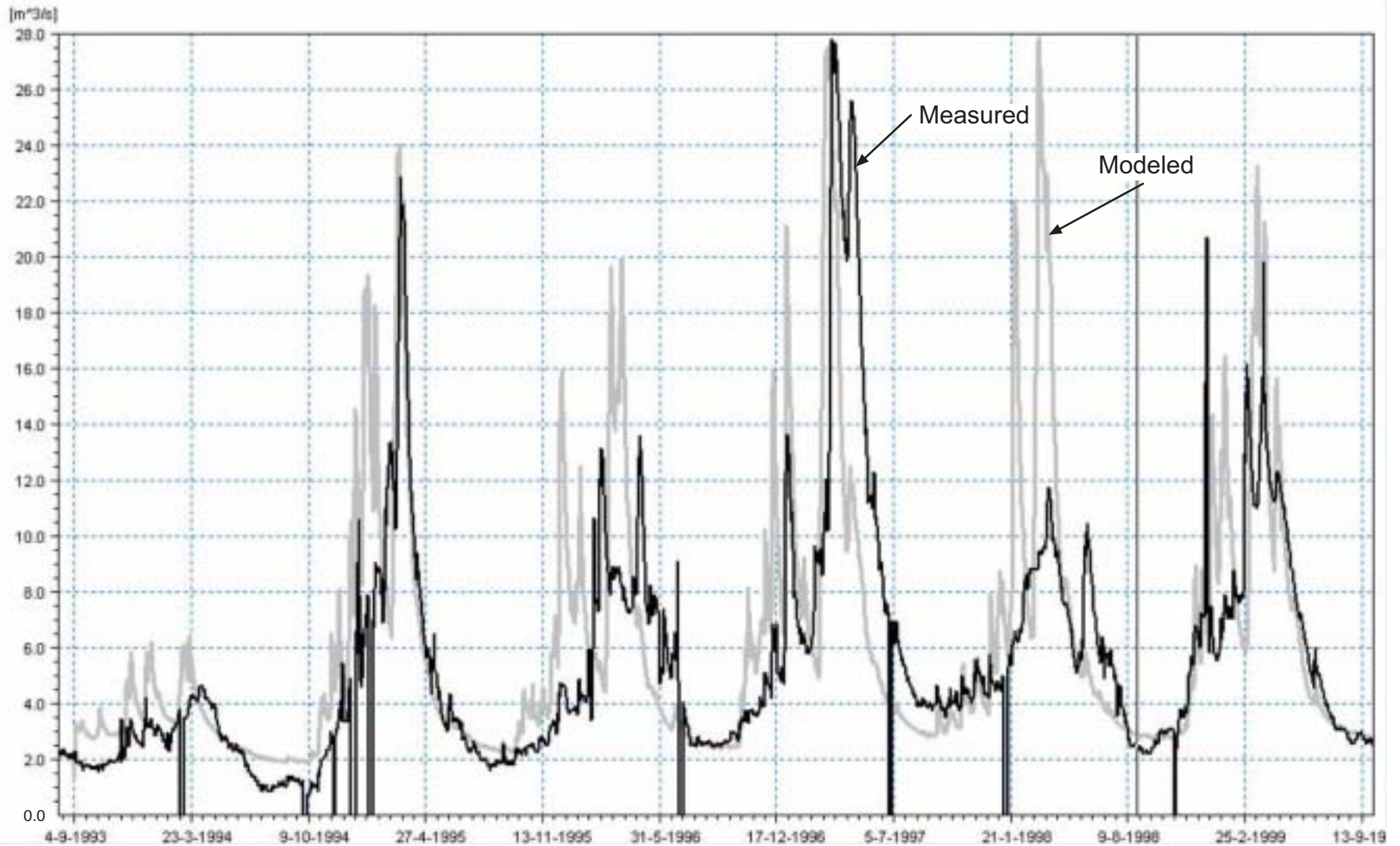


FIGURE 8.11
 LITTLE SPOKANE RIVER AT
 CHATTAROY ROAD CHATTAROY (CHAINAGE 46,855)
 WRIA 55 & 57/WATERSHED PLANNING/WA

Run #1227

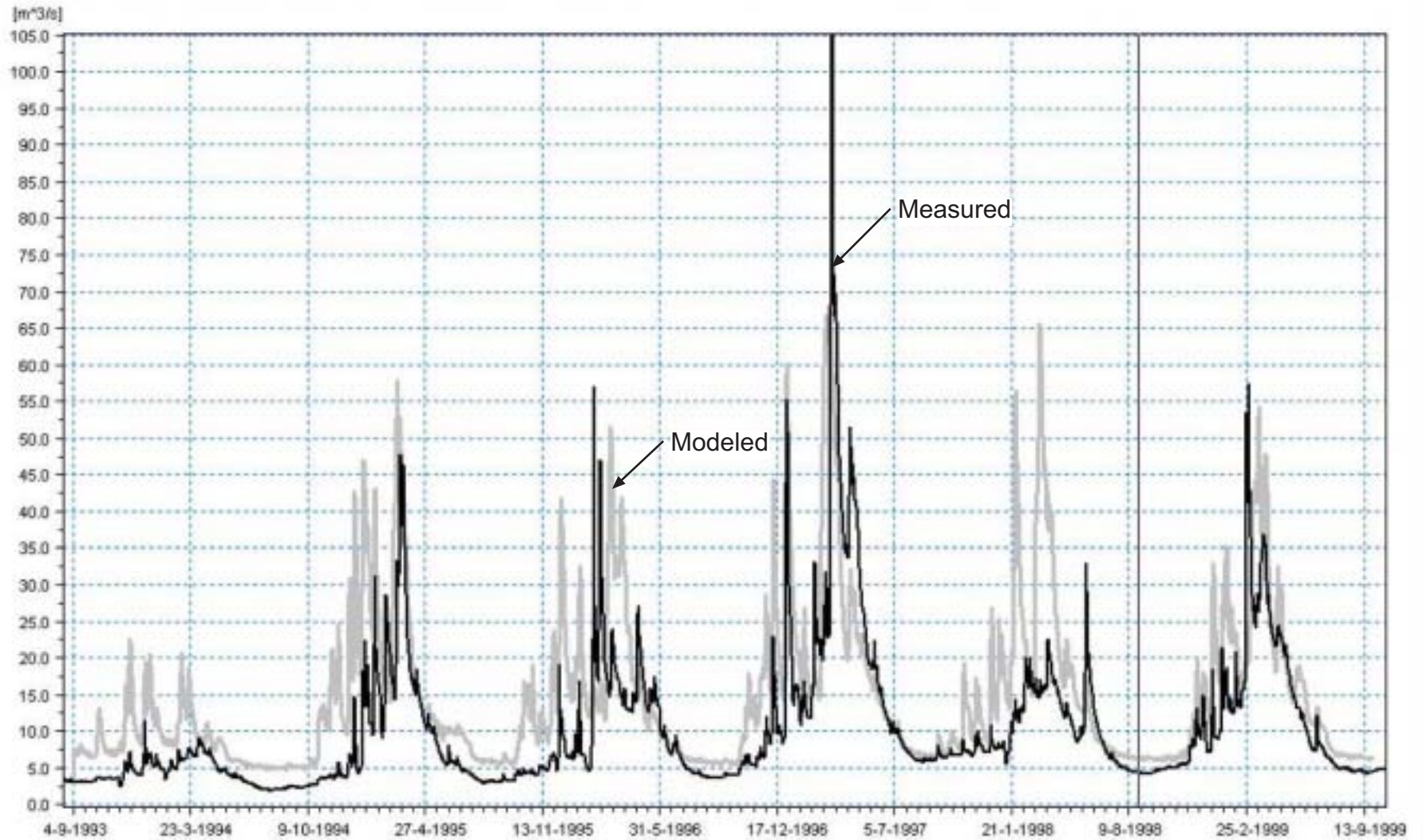


FIGURE 8.12
 LITTLE SPOKANE RIVER AT DARTFORD
 (CHAINAGE 62,731)
 WRIA 55 & 57/WATERSHED PLANNING/WA

Run #1227

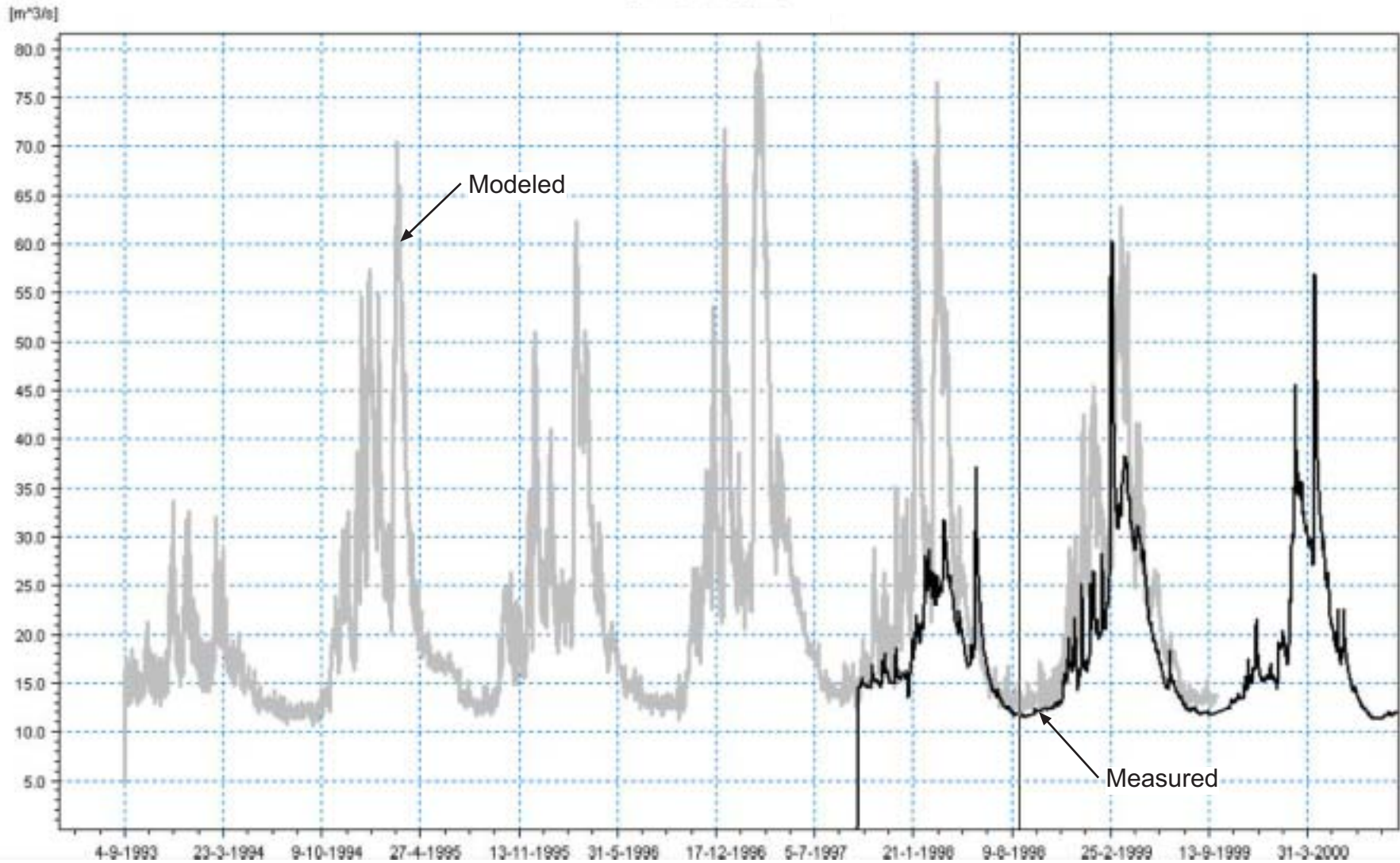


FIGURE 8.13
 LITTLE SPOKANE RIVER NEAR DARTFORD
 (CHAINAGE 70,625)

WRIA 55 & 57/WATERSHED PLANNING/WA

Run #1227

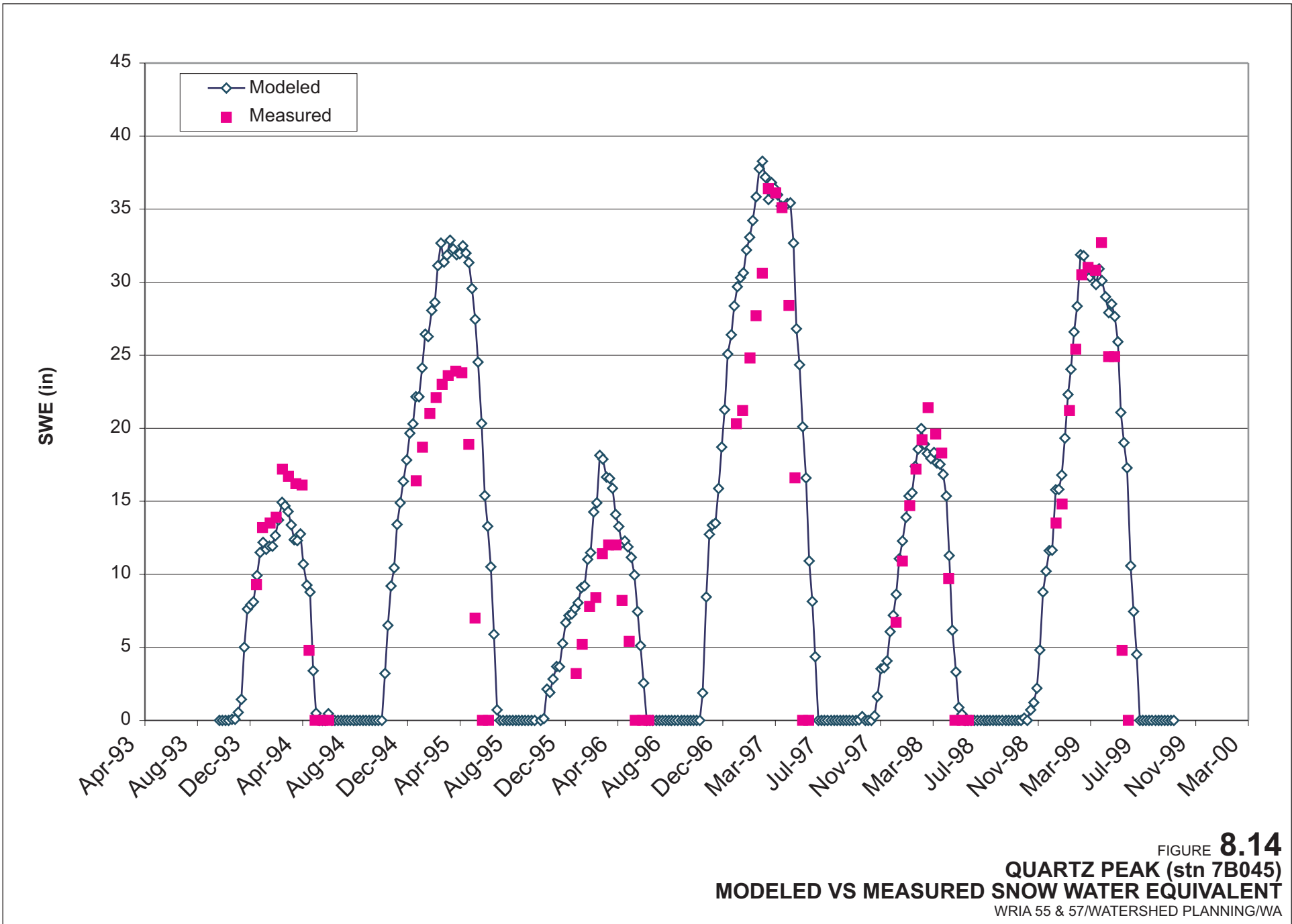
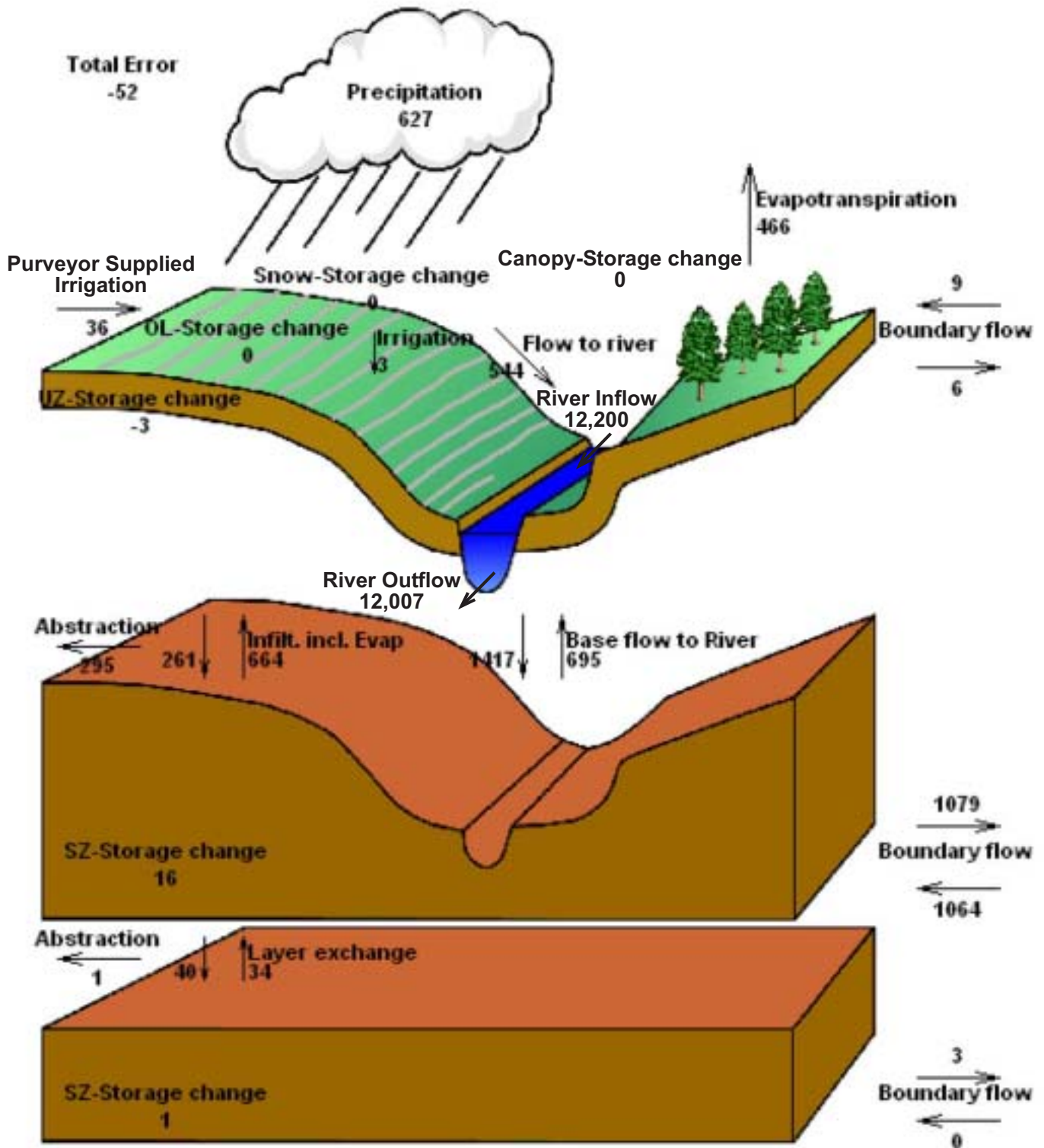
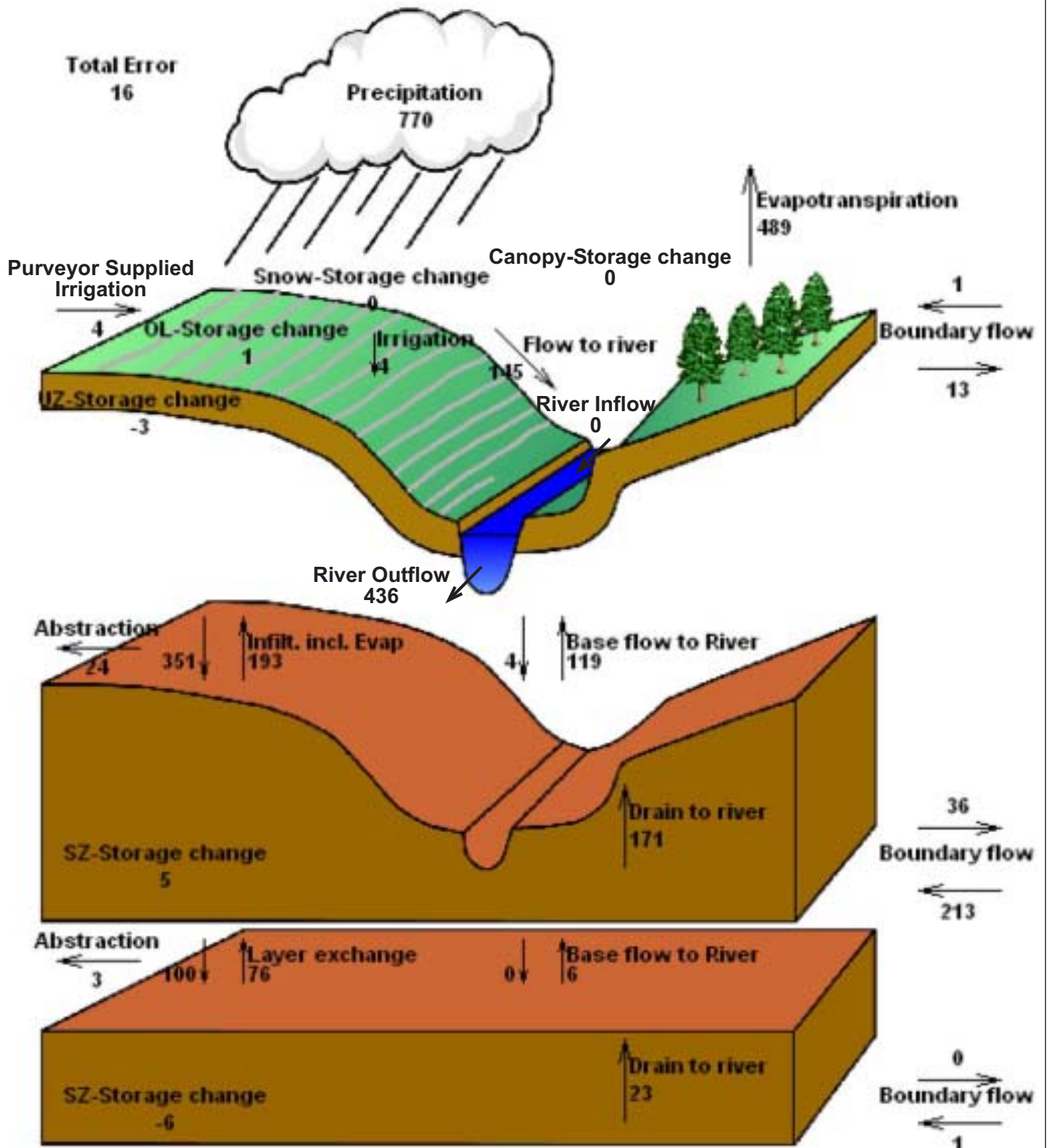


FIGURE 8.14
QUARTZ PEAK (stn 7B045)
MODELED VS MEASURED SNOW WATER EQUIVALENT
 WRIA 55 & 57/WATERSHED PLANNING/WA



Units in millimeters.

FIGURE 9.1
WRIA 57 ANNUAL WATER BALANCE (1999)
 WRIA 55 & 57/WATERSHED PLANNING/WA



Units in millimeters.

FIGURE 9.2
WRIA 55 ANNUAL WATER BALANCE (1999)
 WRIA 55 & 57 WATERSHED PLANNING/WA

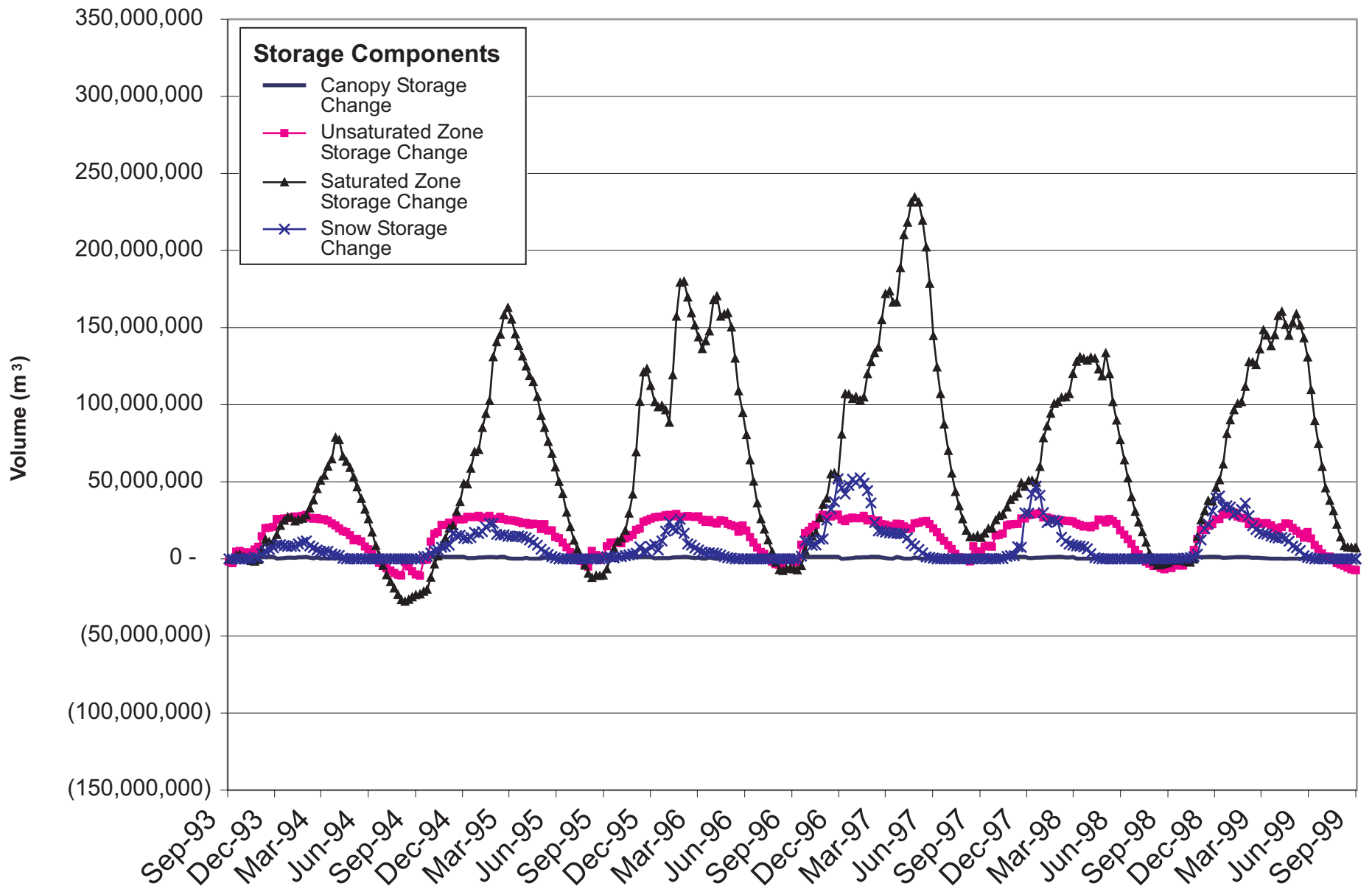


FIGURE 9.3
WRIA 57 STORAGE COMPONENTS
 WRIA 55 & 57/WATERSHED PLANNING/WA

Run #1227

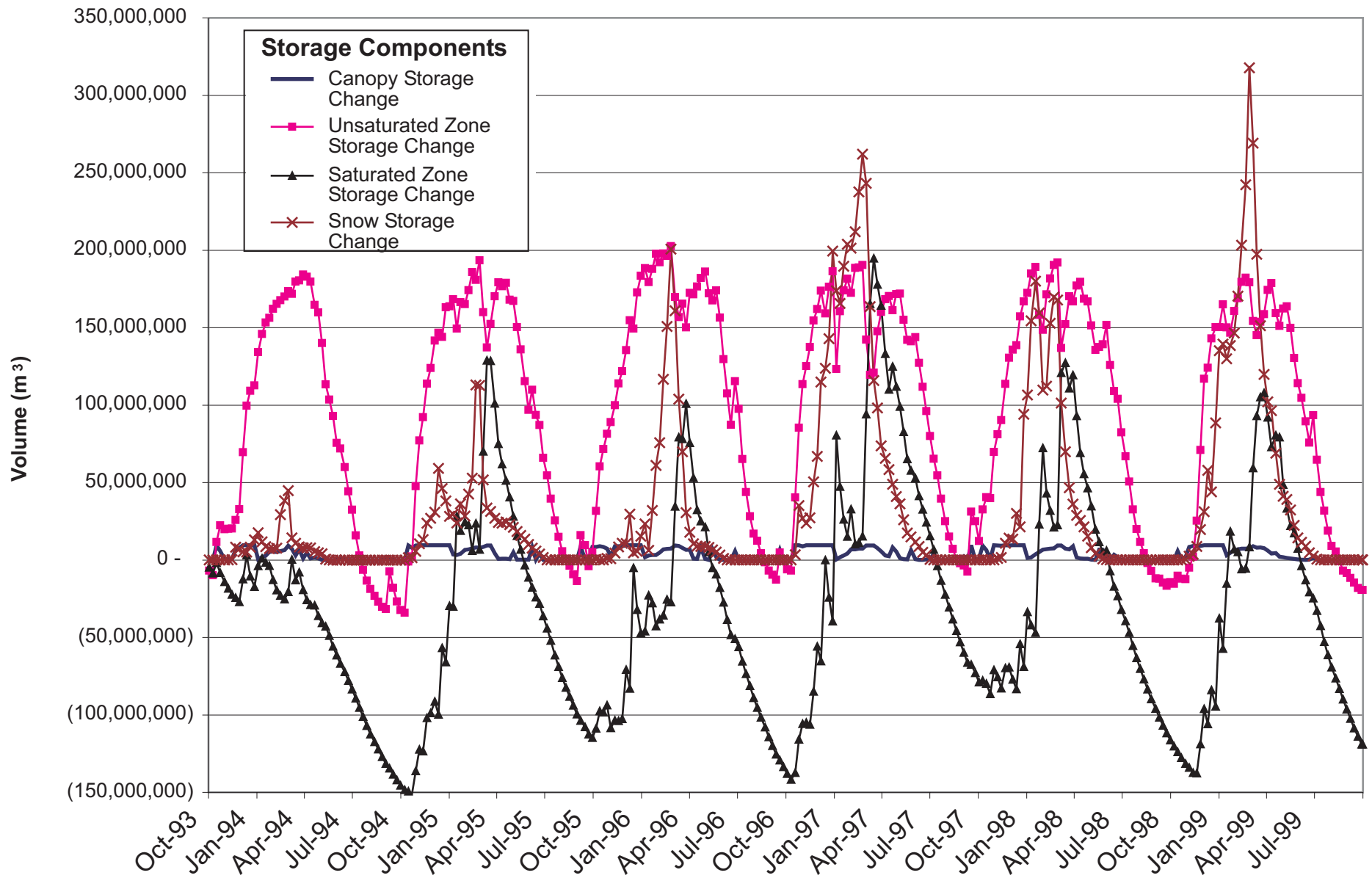
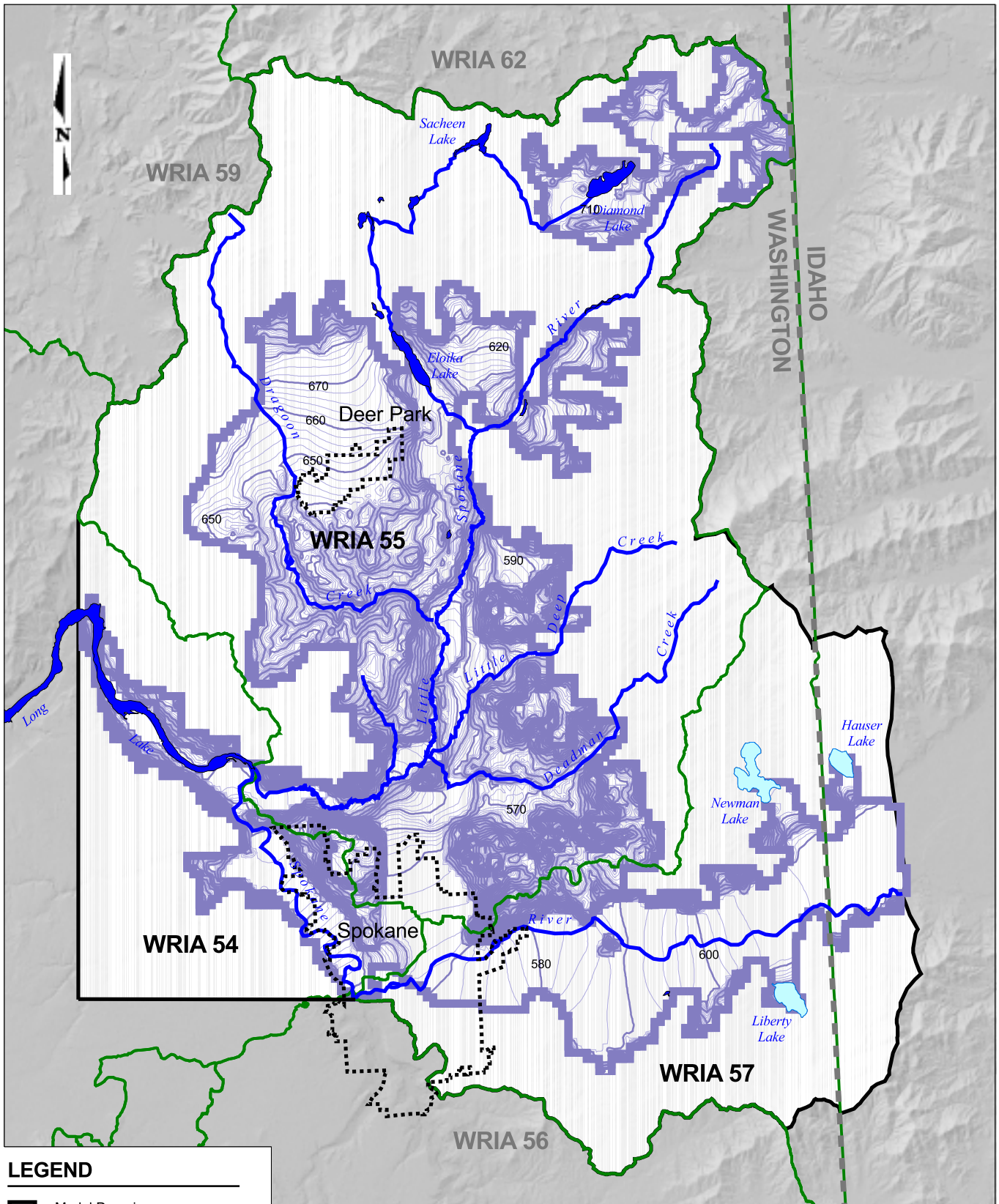


FIGURE 9.4
WRIA 55 STORAGE COMPONENTS
 WRIA 55 & 57/WATERSHED PLANNING/WA








Run #1227

DRAWING NO. 01313722300fg25.fh11 DATE 02/13/04 DRAWN BY EL

Golder Associates



LEGEND

-  Model Domain
-  Lakes
-  City Limits
-  WRIA Boundaries
-  Mike11 Rivers
-  2 Meter Contour Intervals
-  10 Meter Contour Intervals

0 30,000



Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

Source: USGS, WSDOE,
Golder Associates Inc.

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Mean Annual Saturated Zone Head - Layer 1

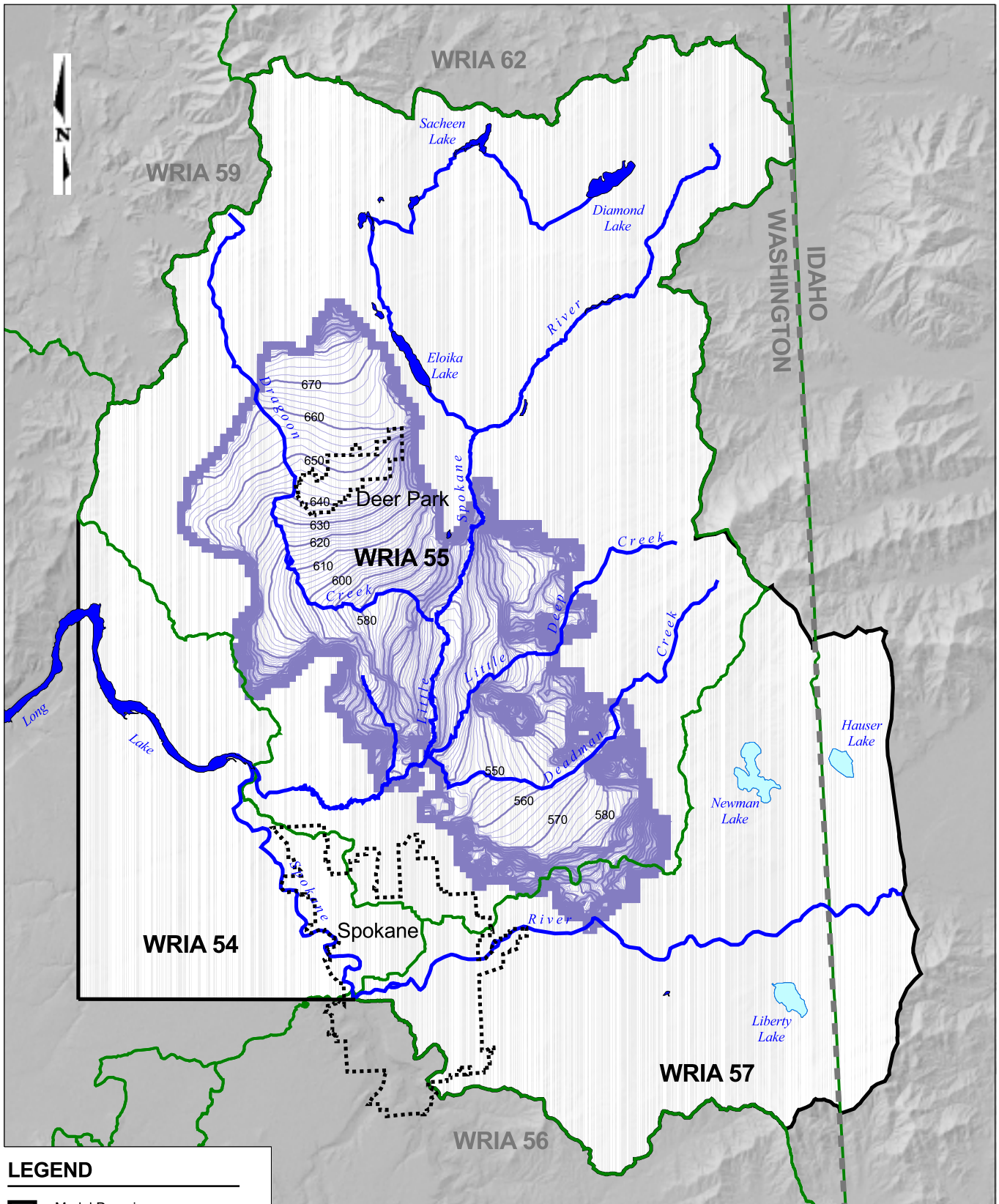
WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC

Revision: GKL

Date: May 13, 2003

Figure: **9.5**



LEGEND

- Model Domain
- Lakes
- City Limits
- WRIA Boundaries
- Mike11 Rivers
- 2 Meter Contour Intervals
- 10 Meter Contour Intervals

0 30,000

Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

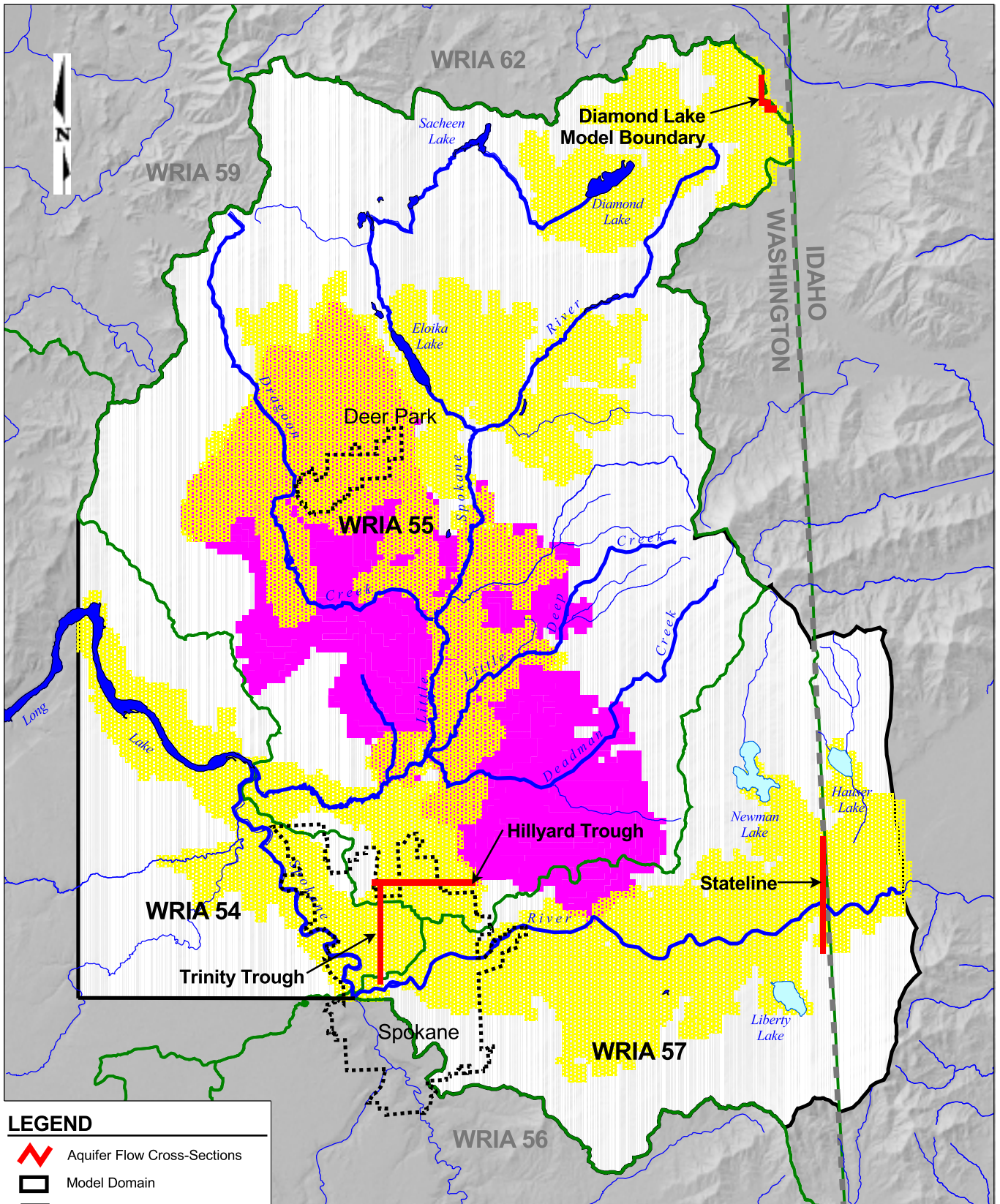
Source: USGS, WSDOE,
Golder Associates Inc.

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in loss of information.

Mean Annual Saturated Zone Head - Layer 2

WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC	Revision: GKL	Date: May 13, 2003	Figure: 9.6
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Aquifer Flow Cross Section Locations

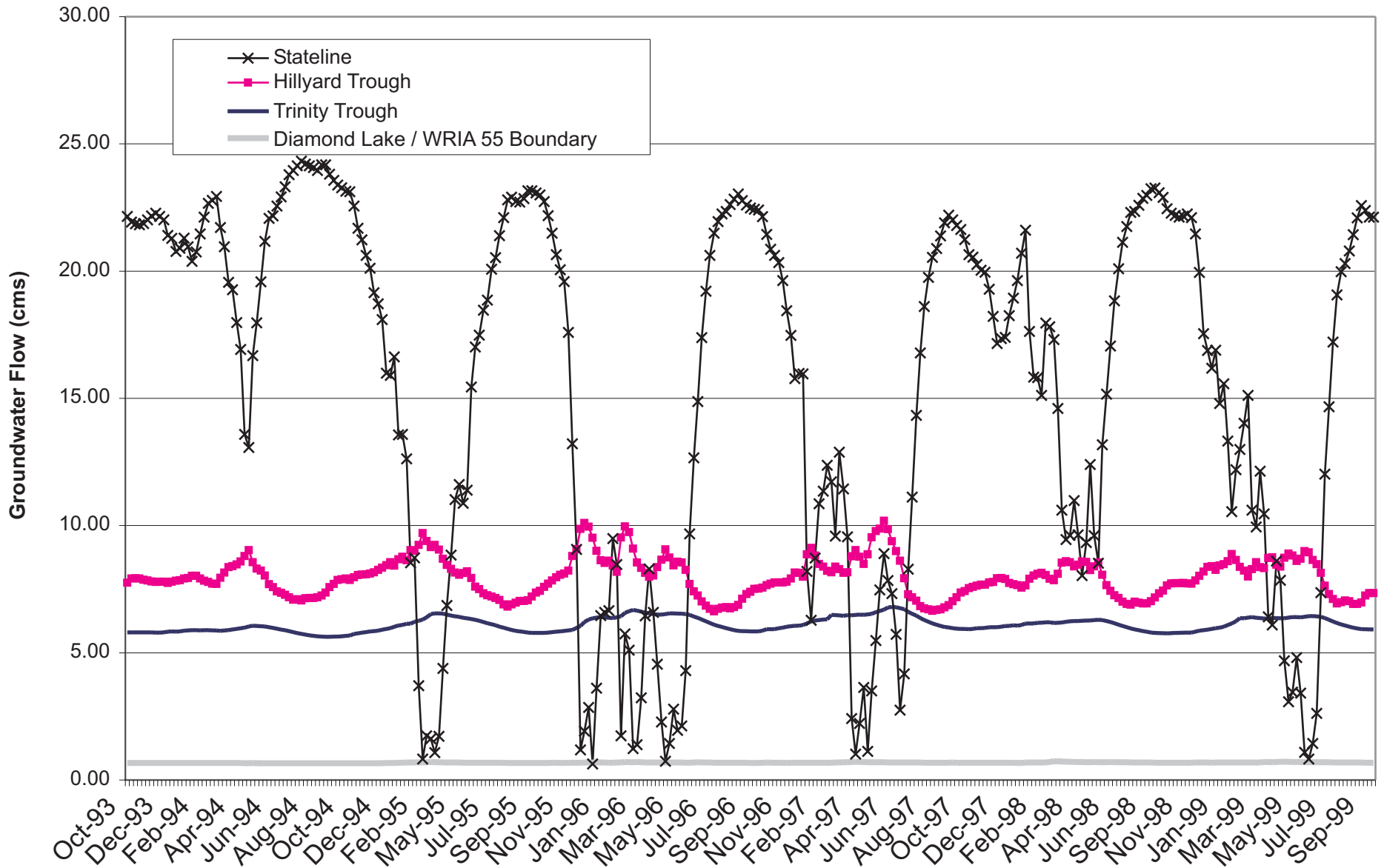
WRIA 55&57/WATERSHED PLANNING/WA

Drawn: SAC

Revision: GKL

Date: May 13, 2003

Figure: **9.7**

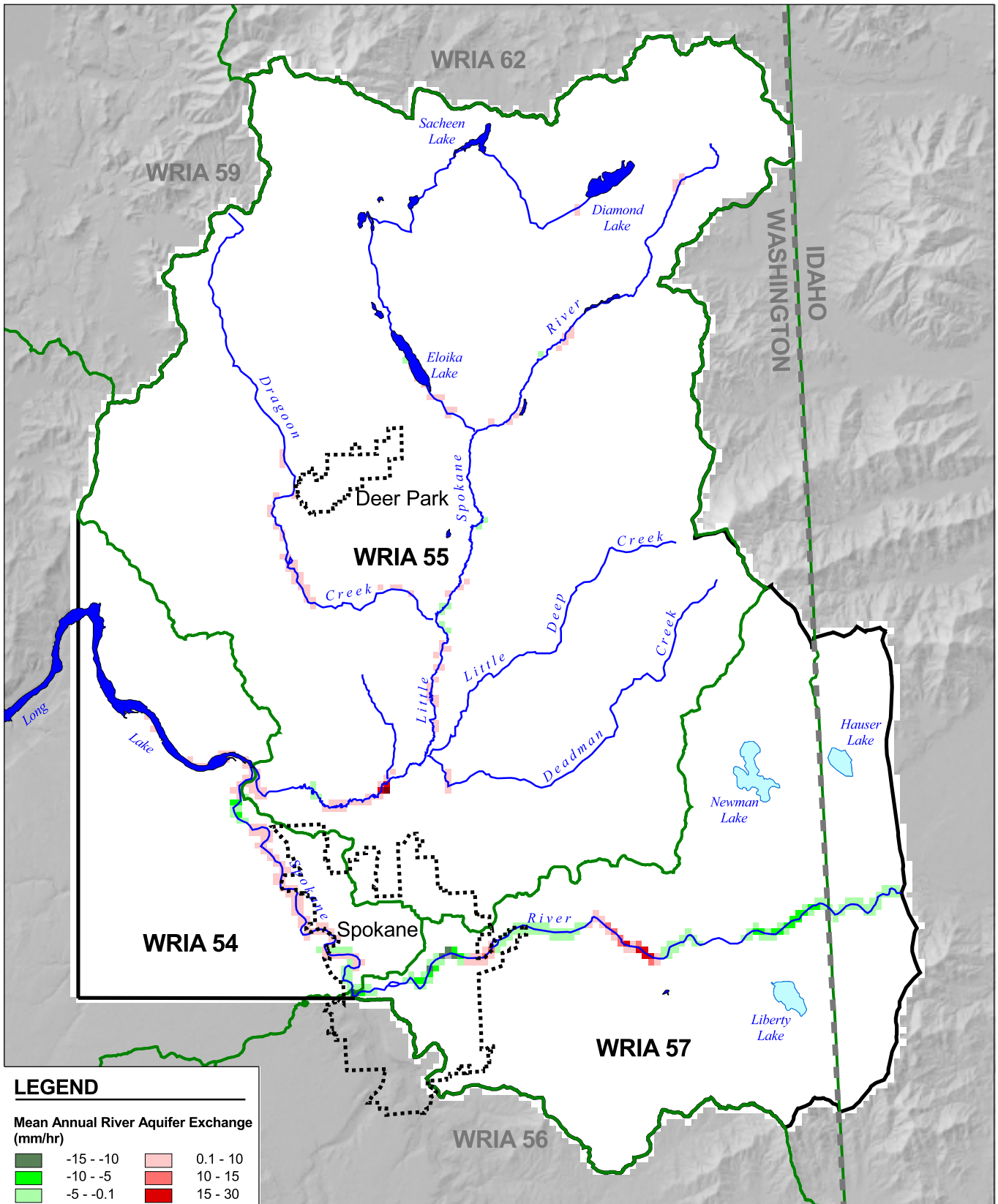


Run #1227

DRAWING NO. 01313722300fg26.fh9 DATE 05/14/03 DRAWN BY EFS

FIGURE 9.8
AQUIFER FLOW HYDROGRAPH
 WRIA 55 & 57/WATERSHED PLANNING/WA

Golder Associates



LEGEND

Mean Annual River Aquifer Exchange (mm/hr)

	-15 - -10		0.1 - 10
	-10 - -5		10 - 15
	-5 - -0.1		15 - 30
	-0.1 - 0.1		30 - 45

- Model Domain
- Lakes
- City Limits
- WRIA Boundaries
- Mike 11 Rivers

0 30,000

Scale 1" = 30,000 Feet

Map Projection:
Washington State Plane, NAD83,
North Zone, Feet

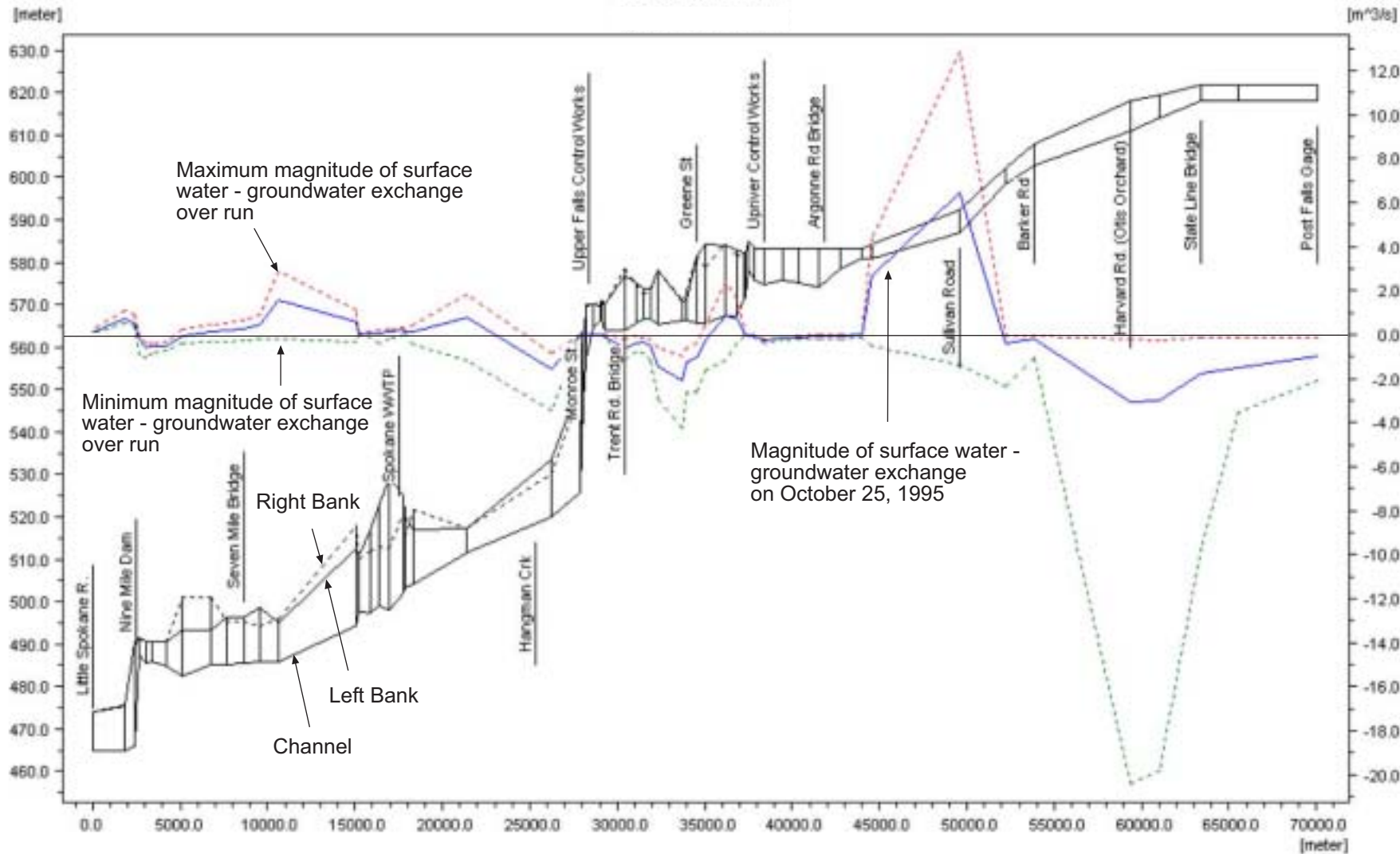
Source: USGS, WSDOE,
Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in loss of information.

Mean Annual River Aquifer Exchange			
WRIA 55&57/WATERSHED PLANNING/WA			
Drawn: SAC	Revision: GKL	Date: May 13, 2003	Figure: 9.9

Elevation

Flow

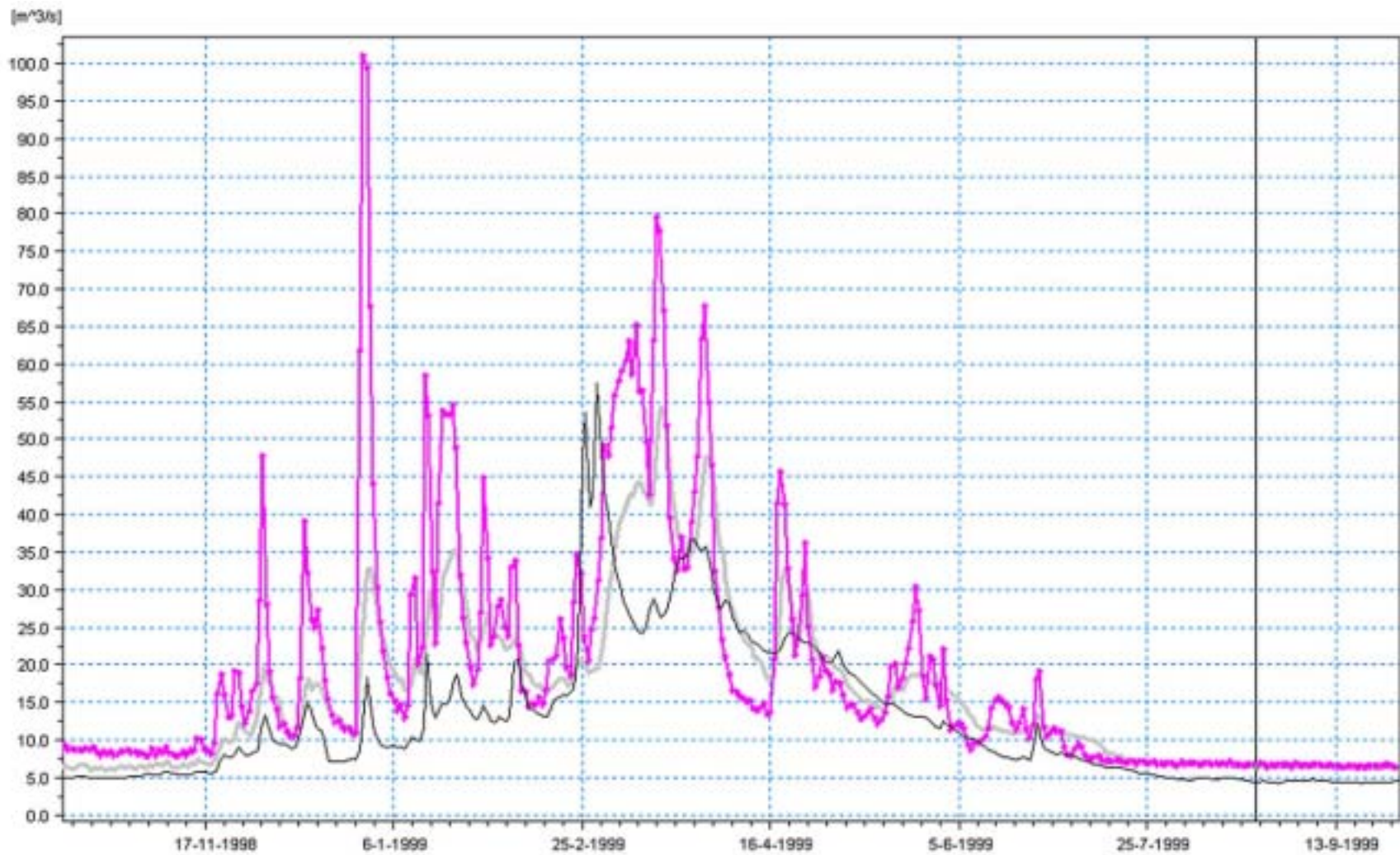


Colored lines indicate the range of surface water – aquifer interactions simulated as baseflow during a typical run.
 A line that is below 0.0 m³/s (right side y-axis) indicates that river water is infiltrating and recharging the aquifer (losing river reach).
 Lines above 0.0 m³/s indicate that groundwater is discharging to surface water (gaining river reach).

Note: Results shown are from run for WY 1995-1997

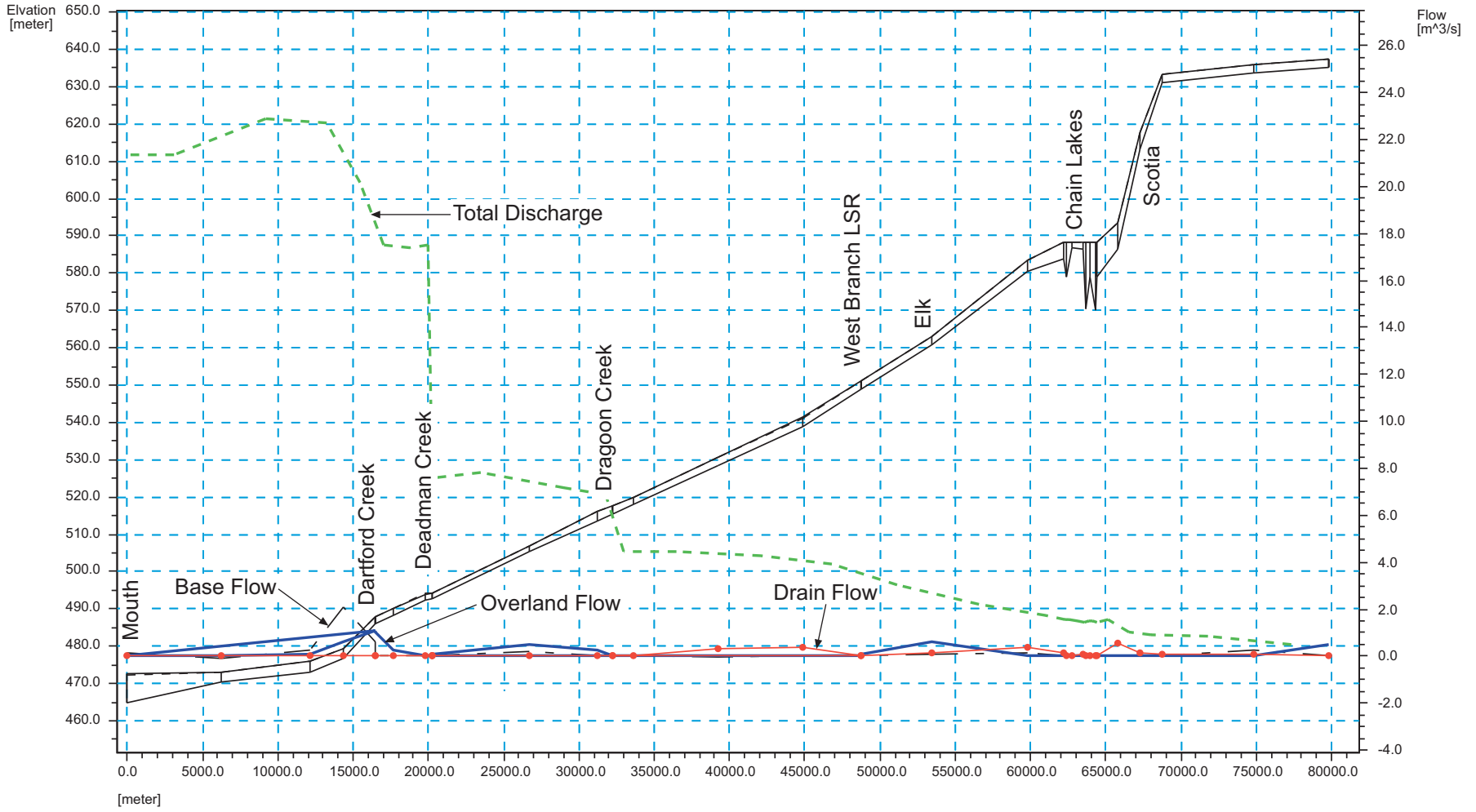
FIGURE **9.10**
SIMULATED SPOKANE RIVER BASE FLOWS
 WRIA 55 & 57/WATERSHED PLANNING/WA

Run #1227



- Drainage Time Constant = 0.00001 /s
- Drainage Time Constant = 0.000001 /s
- Measure Discharge

FIGURE **9.11**
SENSITIVITY OF RIVER DISCHARGE TO CHANGES IN THE DRAINAGE TIME CONSTANT - LITTLE SPOKANE RIVER AT DARTFORD
 WRIA 55 & 57/WATERSHED PLANNING/WA



Note: Each line indicates the flow contribution of the individual component at the time shown (10/26/1995 at 2:41 am)

FIGURE 9.12
LITTLE SPOKANE RIVER FLOW CONTRIBUTIONS
 WRIA 55 & 57/WATERSHED PLANNING/WA