TECHNICAL MEMORANDUM

Date:	May 28, 2020
To:	Lindsey Ozbolt, Planning Official Dan Carlson, Director of Kittitas County Community Development Services
From:	Al Wald, Senior Hydrogeologist Nathan Boroughs, GIS Analyst Mike Thai, Environmental Scientist
Project Name:	Kittitas CAO Update
Project Number:	181229

Subject: Critical Aquifer Recharge Area Remapping

The purpose of this memorandum is to update the 2014 Critical Aquifer Recharge Areas (CARA) delineation for Group B public drinking water supply systems (Group B systems) in Kittitas County, WA. The report includes review of a previous delineation, additional analysis of aquifer characteristics, and subsequent recommendations for map changes. Title 17A of Kittitas County Code, Critical Areas Ordinance (CAO), contains the CARA regulations.

Location

Kittitas County is located east of the Cascade crest in central Washington state, between Chelan County to the north and Yakima County to the south. Much of the study area lies along the Yakima River and its tributaries which drain from the crest of the Cascade Mountains to the Yakima River canyon below Ellensburg (Figure 1).

Kittitas County is on the western margin of the Columbia Plateau Geographic Province and includes geologic elements of the Yakima Fold Belt Subprovince. It includes areas of three major watersheds: WRIA 38 (Naches), WRIA 39 (Upper Yakima), and WRIA 40 (Alkali-Squilchuck). The county is 2,333 square miles in area with a 2018 population of 47,364 residents (https://www.co.kittitas.wa.us/).

Geology

The geology of Kittitas County is characterized by metamorphic and volcanic bedrock in the foothills of the Cascade Mountains, the Columbia River Basalt Group along the Columbia River to the southeast, and valley-fill deposits in the Kittitas Valley along the Yakima River (Figure 2).

The Kittitas and Roslyn Basins are synclinal valleys between prominent anticlinal ridges (USGS, 1963; USGS, 2009). They are separated by the Lookout Mountain bedrock feature. The Kittitas Basin (KB) area is about 270 square miles with a maximum thickness of 700 ft. The Roslyn Basin (RB) area is about 70 square miles with a maximum thickness of 2,010 ft. Each structural basin is a topographic basin and a groundwater subbasin (USGS, 1963).

Valley-fill deposits are typically unconsolidated to weakly consolidated glacial, glacio-fluvial, lacustrine, and alluvial sediments interspersed with landslide deposits, talus, loess, and ash layers (USGS, 2014). Valley-fill stratigraphy is typically Ellensburg Formation (confined), with overlying Thorp Gravel and Fan deposits (unconfined), with overlying surficial alluvium or glaciofluvial materials (unconfined) (USBR, 2011).

A geologic profile shows the relative thickness and composition of the strata in cross-section (Figure 3).

Hydrogeology

Groundwater occurs in fracture zones in the bedrock and basalt units, semi-consolidated sand and gravels in the Ellensburg Formation, and unconsolidated valley-fill deposits (WDOE, 1985). Consolidated bedrock in the Cascade Range is basically devoid of water (ibid). Specific capacity (a measure of potential well yields) for wells in the bedrock is generally less than 0.001 gpm/ft of depth. Specific capacity for wells in the basalt and valley-fill deposits are generally 0.9 and 2.8 gpm/ft, respectively (USGS, 2009).

The water table gradient, or horizontal direction of groundwater movement is from upslope recharge to discharge in the Yakima River and its tributaries. Water table gradients downslope generally follow the steeper topographic gradients (USBR, 2011). Groundwater contours and depth-to-water records for wells in the Kittitas Reclamation District suggest the valley-fill deposits are recharged from east Kittitas Valley (USBR, 2013). Ambient vertical hydraulic gradients in the upslope areas show increasing depth to water with increasing well depth (decreasing hydraulic head with depth) typical of groundwater recharge (USBR, 2011). Much of the recharge from deep percolation of runoff, snowmelt, and canal leakage drains to local streams and the Yakima River. Regional groundwater recharge to deeper units is generally on long flow paths, on the order of 5 to 50 miles, with travel times of 10's to 100's of years (USGS, 2009).

Increasing water levels with depth (increasing vertical hydraulic gradients) in wells in the lower valley result from geostatic pressure of overlying strata and hydrostatic pressure from uplifted

strata in the anticlines. The Kittitas Basin around the City of Ellensburg has one of highest concentrations of flowing artesian wells in the Columbia Plateau Province (WDOE, 1961). The depth of flowing artesian wells ranges from 50 to 400 feet with specific capacities of 5.4 to 9.5 gpm/ft of drawdown. Wells in the Thorp gravels and Ellensburg Formation may have contributing artesian conditions due to water-bearing zones of sands and gravels with high primary porosity confined beneath layers of lacustrine silts, ash deposits, and glacial till. The units have low susceptibility to contamination from surface sources due to increasing hydraulic heads with depth and semi-consolidated clay-shale or ash layers which limit deep percolation and vertical conductivity.

Well Logs

See the well logs (Figures 6 – 8) for a description of the general lithology of bedrock, basalt, and valley-fill strata.
https://appswr.ecology.wa.gov/wellconstruction/map/WCLSWebMap/default.aspx

CARA Criteria

Much of Kittitas County does not meet the criteria for classification of critical aquifer recharge areas. National Forests, Wilderness Areas, and the Yakima Firing Range are in federal jurisdiction. State parks and wildlife areas are in state jurisdiction. Incorporated cities and towns are in local jurisdiction and usually have their own CAO programs. WRIA 38 (Naches) has little development, one Group B system of very low susceptibility, and does not meet the criteria for classification of critical aquifer recharge areas. WRIA 40 (Alkali-Squilchuck) has very little development, only a few Group B systems along the Columbia River, and does not meet the criteria for classification of critical aquifer recharge areas. There are no identified Sole-Source Aquifers in Kittitas County (EPA, 2020). Aquifers in bedrock units with low vertical hydraulic conductivity (on the order of 0.0005 ft/day) and limited fracture permeability do not meet susceptibility criteria for critical aquifer recharge areas. Aquifers in basalt units with low vertical hydraulic conductivity (on the order of .01 ft/day) and massive basalt flows with semi-consolidated, low permeability interbeds do not meet susceptibility criteria for critical aquifer recharge areas.

Group A public drinking water supply systems (Group A systems), municipal water utilities, and incorporated water districts are regulated under Chapter 246-290 WAC by Washington State Department of Health (DOH). DOH source water protection programs for Group A systems require regular monitoring and reporting to assure water quality meets state standards. Proposed well locations are reviewed for time of travel calculations, delineation of wellhead

protection areas, and other siting criteria (WAC 246-100). Single-family domestic wells are exempt from water right permitting requirements but are regulated by Washington Department of Ecology driller licensing and well construction standards. Exempt wells are typically dispersed locations with relatively low withdrawal rates. Group A systems and exempt wells do not typically meet vulnerability criteria for critical aquifer recharge areas.

Groups B public drinking water supply systems (Group B systems) are regulated under Chapter 245-291 WAC by DOH. Group B system wells require a minimum sanitary control area of 100 ft and sanitary seals for well casings to prevent surface contamination from reaching local sources. Group B systems with 10 to 14 service connections are regulated by DOH, Office of Drinking Water Programs. Group B systems with less than 10 service connections are regulated under county health programs. There are about 373 Group B systems in Kittitas County.

New developments in critical aquifer recharge areas are reviewed by the county and subject to CARA requirements where a spill incident, waste water infiltration, or significant groundwater withdrawal could result in contamination of public drinking water supplies. CARA reviews typically include hydrogeologic assessment of aquifer susceptibility (based on stratigraphy and hydrogeologic factors) and vulnerability (based on structural controls, geologic controls, and risk of contamination). Potential sources of contamination of wells in critical aquifer recharge areas include septic systems, landfills, stormwater infiltration basins, leaking underground storage tanks, and injection wells used for waste disposal.

CARA Recommendations for Kittitas County

Based on this study, a proposed update to the Critical Aquifer Recharge Areas delineation for Kittitas County includes local recharge areas for unconsolidated aquifers in valley-fill deposits of the Roslyn and Kittitas Basins, as shown in Figure 5.

Wells in these aquifers have low to medium susceptibility to groundwater quality impacts, depending on local hydraulic gradients, relative conductivity of water-bearing zones, and distance from contamination sources. Review and approval of developments with potential water quality impacts to Group B systems in these areas should require hydrogeologic assessment of siting criteria and potential sources of contamination according to critical areas regulations.

Figures

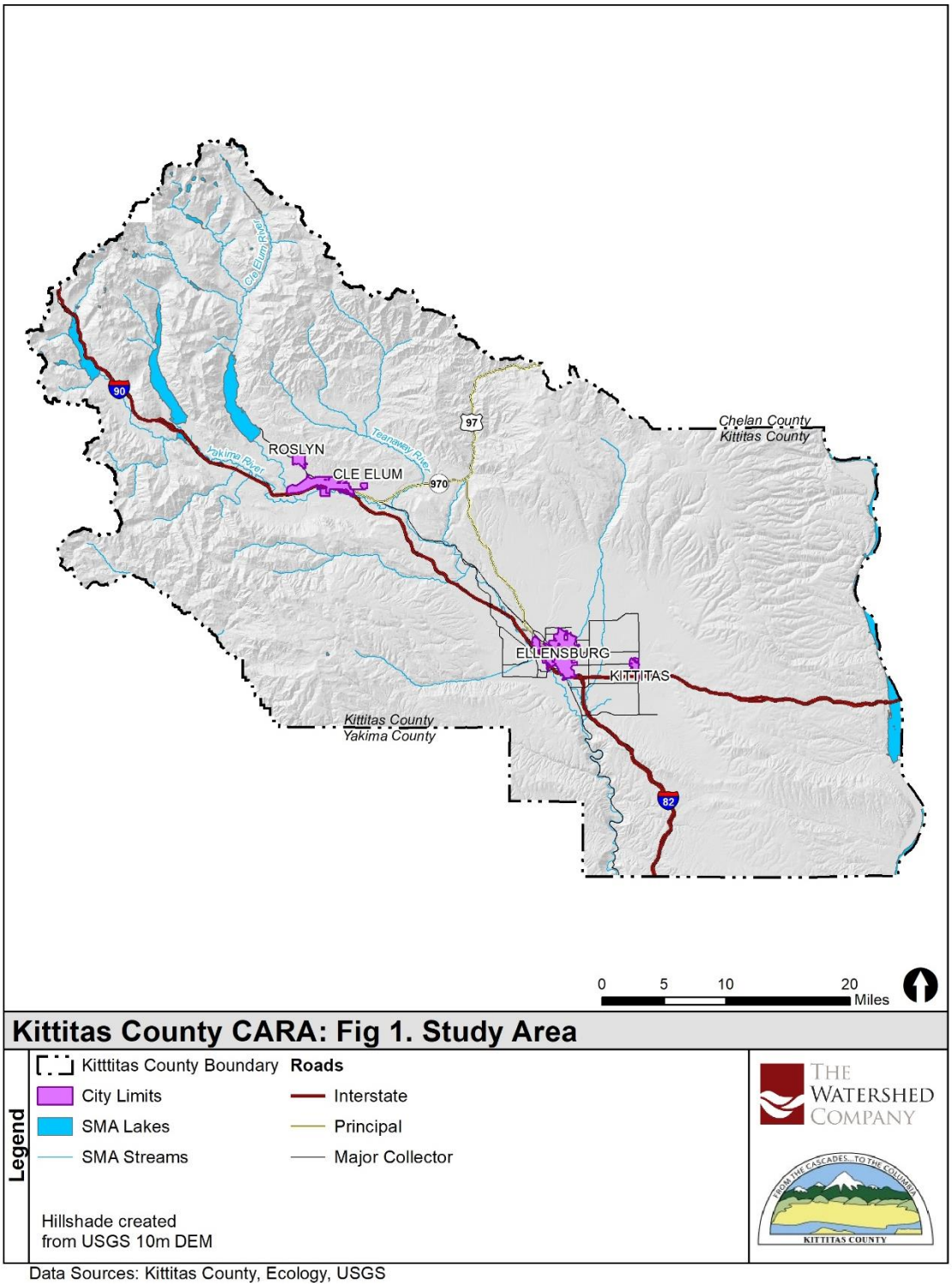


Figure 1. Study area. General location and simplified geology along the upper Yakima River.

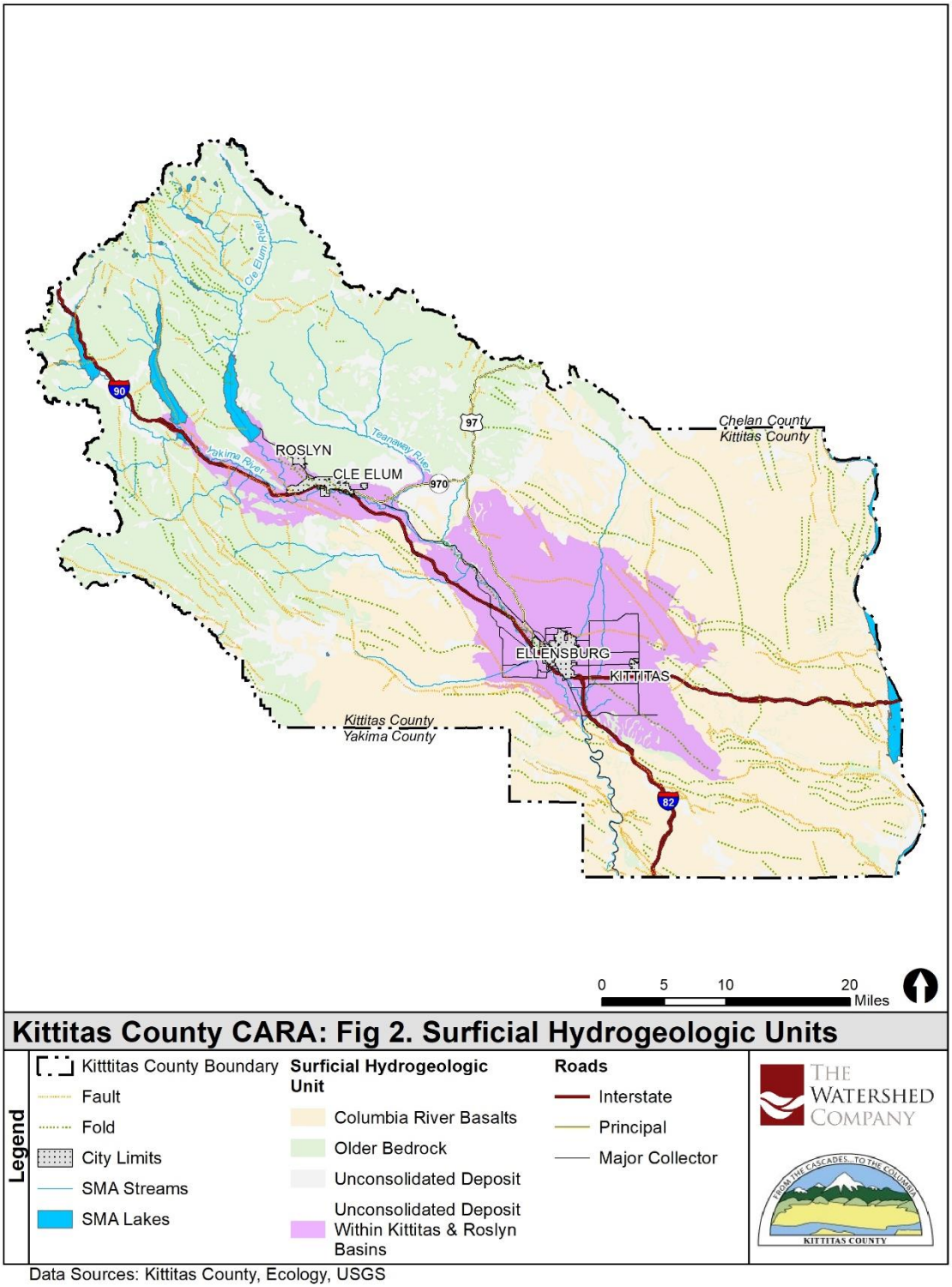


Figure 2. Surficial hydrogeologic units showing unconsolidated valley-fill deposits of the Kittitas and Roslyn Basins.

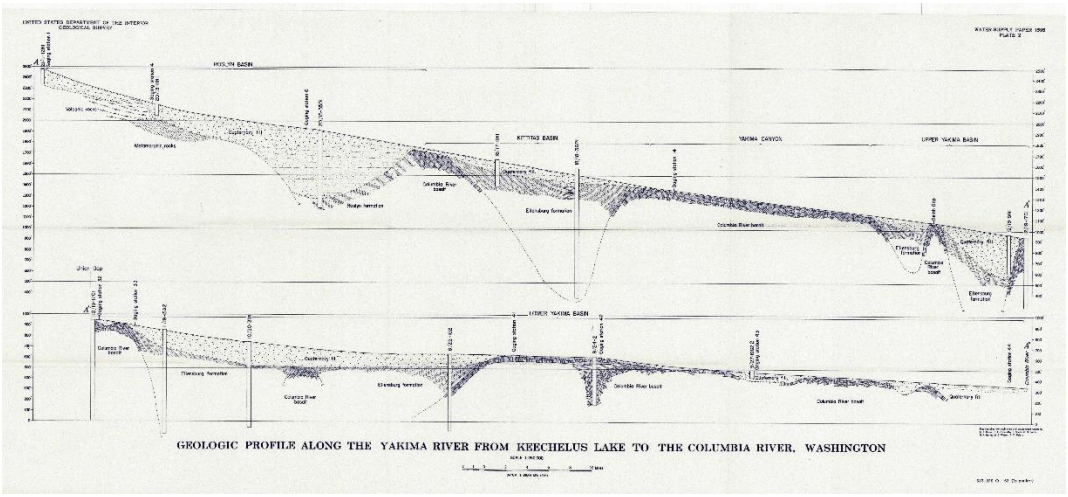


Figure 3. Cross-sections showing relative depth of Quaternary fill and associated strata in the Kittitas and Roslyn Basins (USGS,1963)

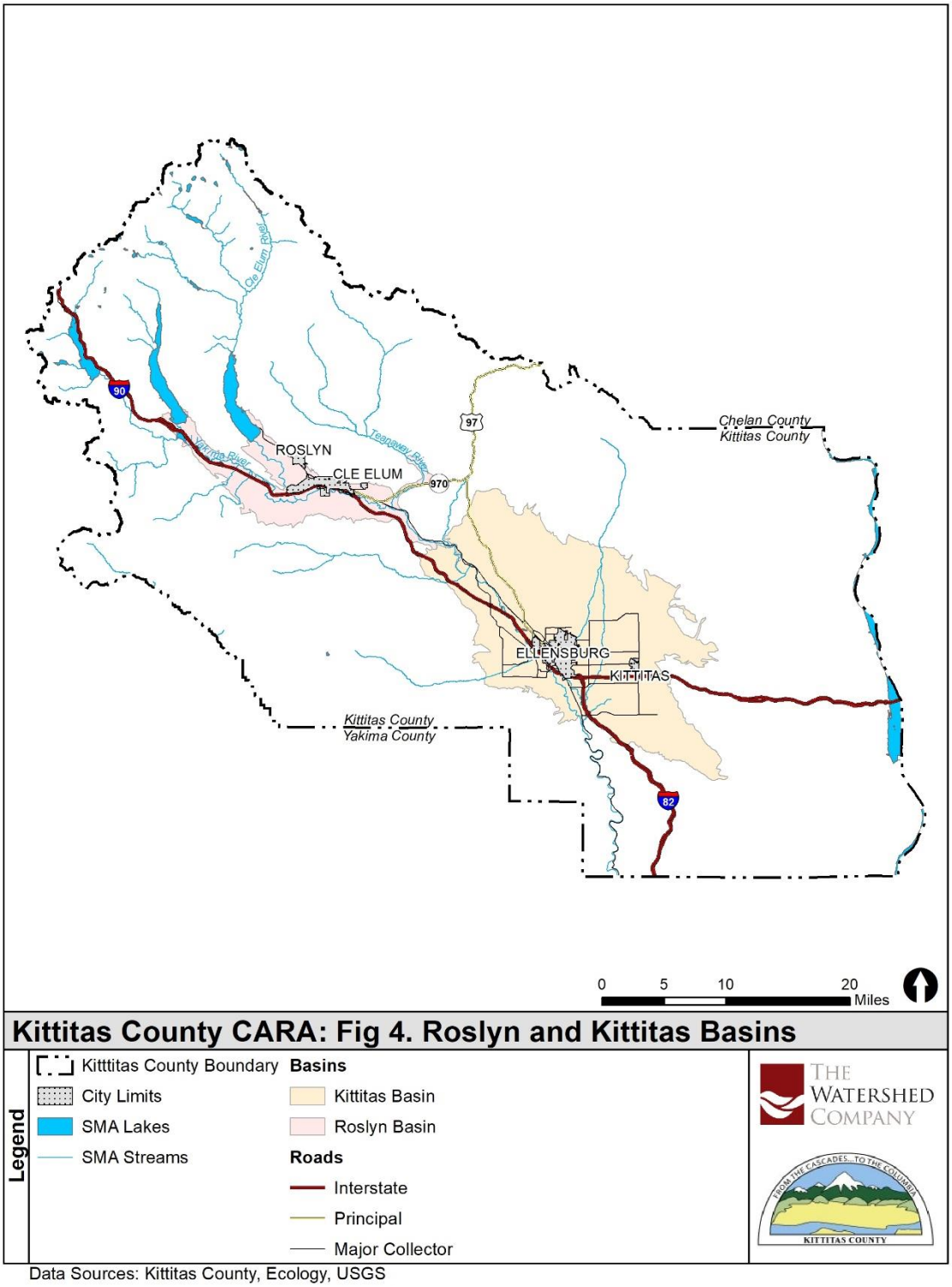


Figure 4. Showing the Roslyn and Kittitas Basins separately.

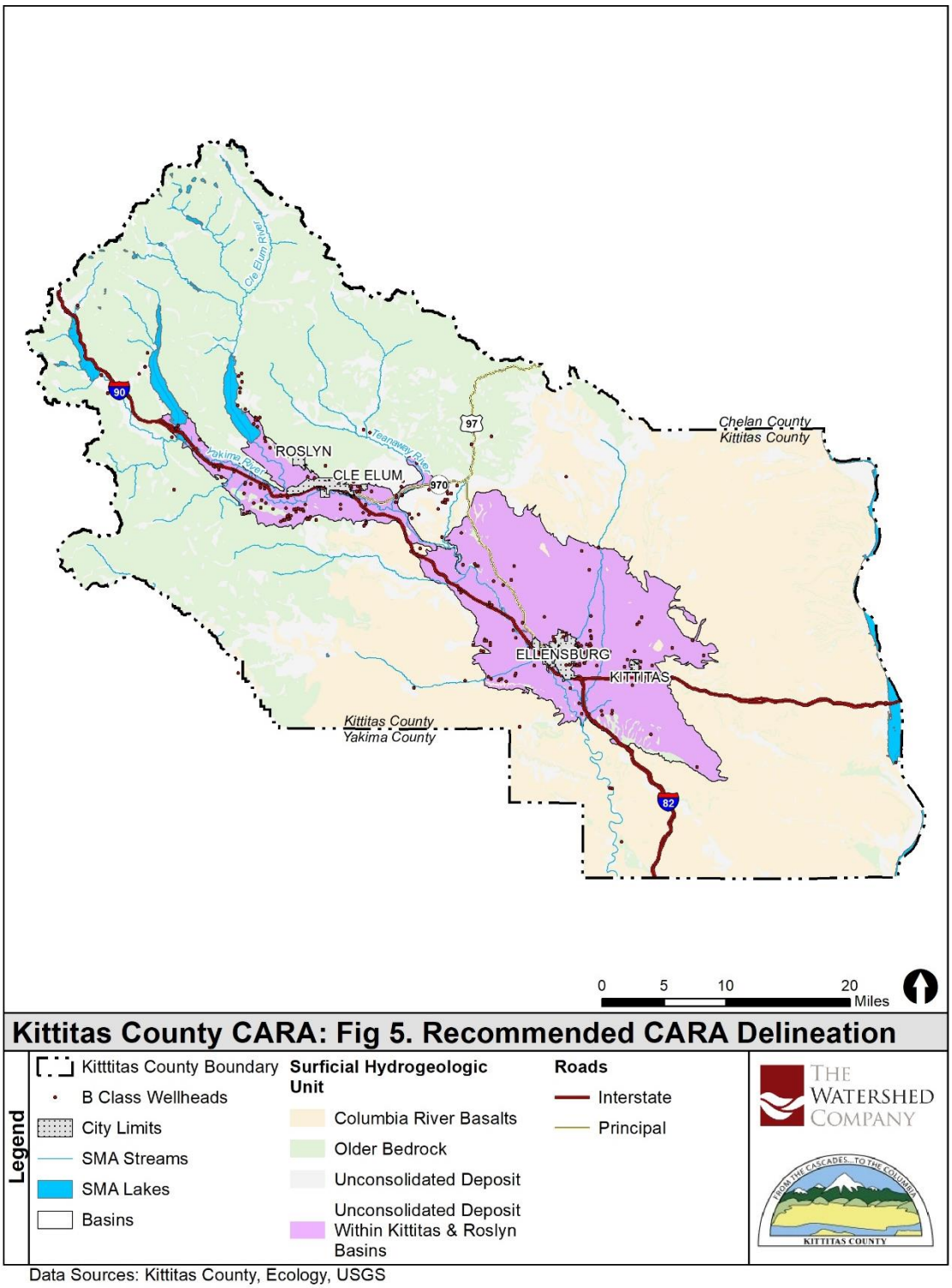
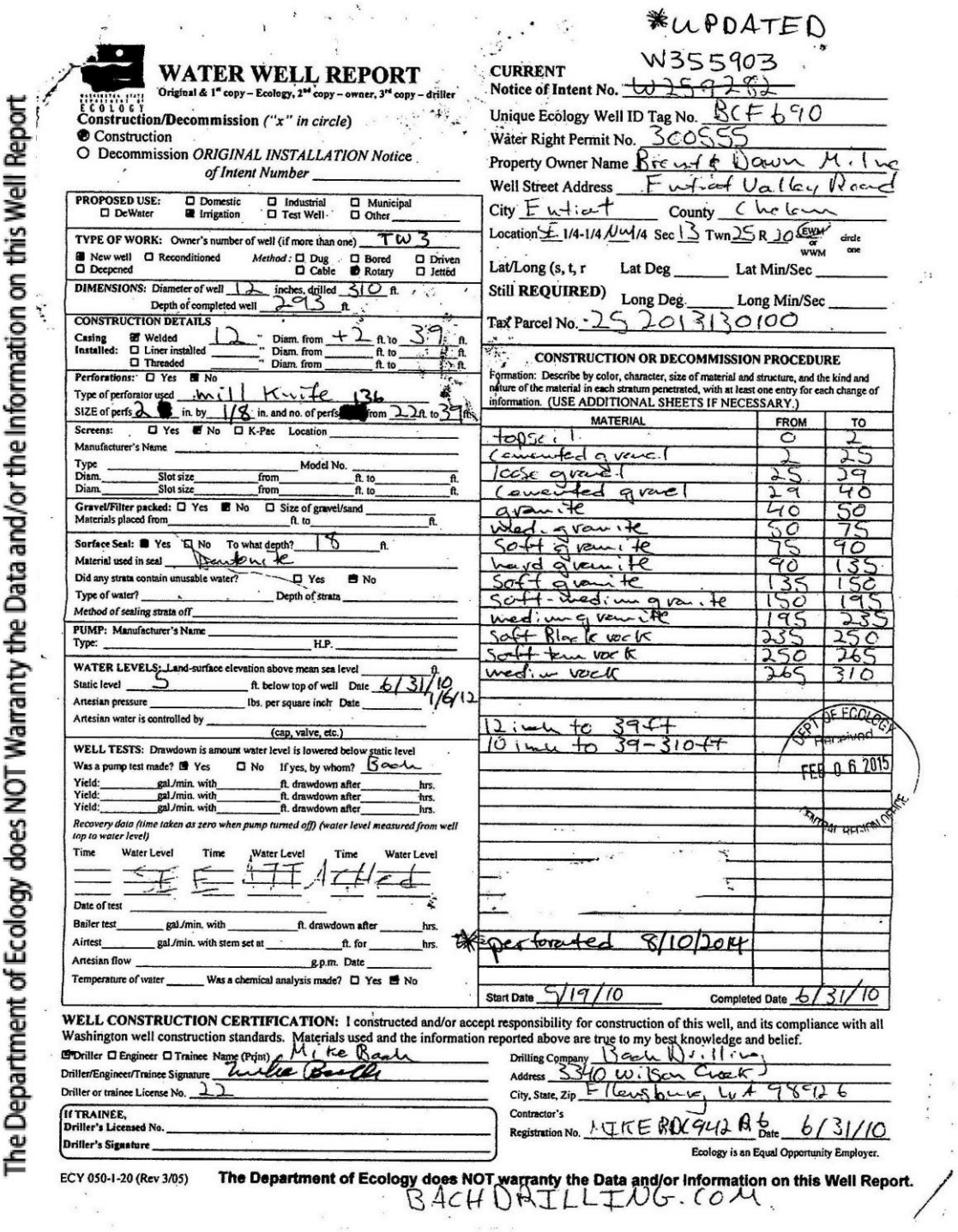


Figure 5. Recommended CARA delineation, Kittitas County, WA.



*UPDATED

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

CURRENT W355903
Notice of Intent No. W259282

Unique Ecology Well ID Tag No. BCF690
Water Right Permit No. 300555
Property Owner Name Brent & Dawn Miller
Well Street Address Entiat Valley Road
City Entiat County Chelan
Location SE 1/4-1/4 NW 1/4 Sec 13 Twn 25 R 20 (EWM or WWM) circle one
Lat/Long (s, t, r Still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg. _____ Long Min/Sec _____
Tax Parcel No. 252013130100

Construction/Decommission ("x" in circle)
● Construction
○ Decommission ORIGINAL INSTALLATION Notice of Intent Number _____

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ■ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) TW3
■ New well ☐ Reconditioned Method: ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ● Rotary ☐ Jetted

DIMENSIONS: Diameter of well 12 inches, drilled 310 ft. Depth of completed well 293 ft.

CONSTRUCTION DETAILS
Casing Installed: ■ Welded 12" Diam. from +2 ft. to 39 ft. ☐ Liner installed _____" Diam. from _____ ft. to _____ ft. ☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ■ No
Type of perforator used mill Knife 136
SIZE of perfs 2 [redacted] in. by 1/8 in. and no. of perfs [redacted] from 222 ft. to 39 ft.

Screens: ☐ Yes ■ No ☐ K-Pac Location _____
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ■ No ☐ Size of gravel/sand _____
Materials placed from _____ ft. to _____ ft.

Surface Seal: ■ Yes ☐ No To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? ☐ Yes ■ No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

PUMP: Manufacturer's Name _____
Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 5 ft. below top of well Date 6/31/10 1/6/12
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ■ Yes ☐ No If yes, by whom? Bach
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? ☐ Yes ■ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
topsoil	0	2
Cemented gravel	2	25
loose gravel	25	29
Cemented gravel	29	40
granite	40	50
Med. granite	50	75
Soft granite	75	90
hard granite	90	135
Soft granite	135	150
Soft-med. granite	150	195
med. granite	195	235
Soft Black rock	235	250
Soft tan rock	250	265
med. rock	265	310
12 inch to 39 ft		
10 inch to 39-310 ft		
perforated 8/10/2014		

Start Date 5/19/10 Completed Date 6/31/10

DEPT OF ECOLOGY Received FEB 06 2015 Central Regional Office

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

■ Driller ☐ Engineer ☐ Trainee Name (Print) Mike Bach
Driller/Engineer/Trainee Signature Mike Bach
Driller or trainee License No. 22

Drilling Company Bach Drilling
Address 3340 Wilson Creek
City, State, Zip Ellensburg, WA 98926
Contractor's Registration No. MIKEBDC942AB Date 6/31/10

If TRAINEE, Driller's Licensed No. _____ Driller's Signature _____

ECY 050-1-20 (Rev 3/05) The Department of Ecology does NOT warranty the Data and/or Information on this Well Report.

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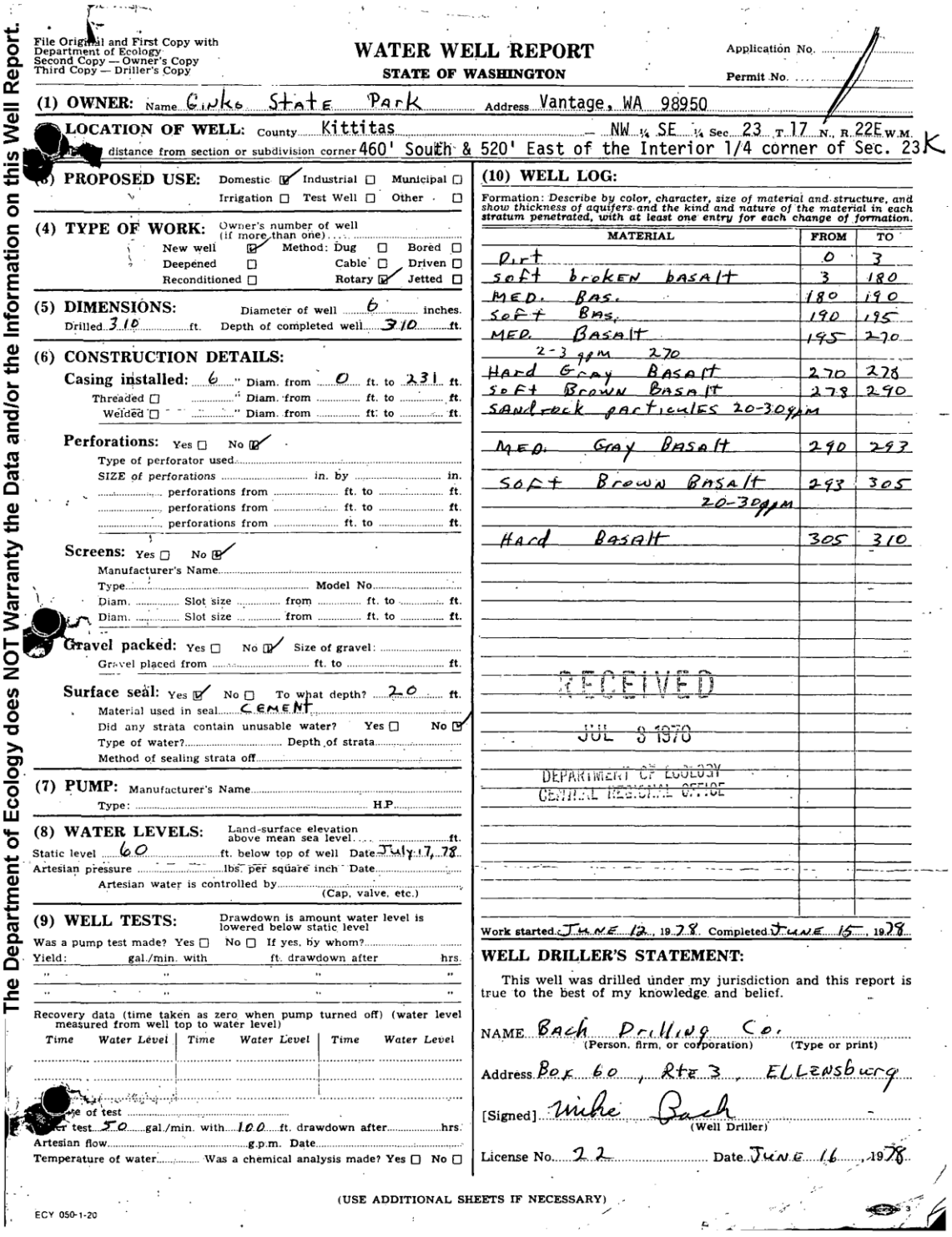
Figure 6. Well log for bedrock strata (note changes in lithology at 29 and 150 ft).



The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. .....
Permit No. .....

(1) OWNER: Name Ginko State Park Address Vantage, WA 98950

LOCATION OF WELL: County Kittitas — NW ¼ SE ¼ Sec. 23 T. 17 N., R. 22E W.M.
distance from section or subdivision corner 460' South & 520' East of the Interior 1/4 corner of Sec. 23

(8) PROPOSED USE: Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 310 ft. Depth of completed well 310 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0 ft. to 231 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☐ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☑
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☑
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☑ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☑ No ☐ To what depth? 20 ft.
Material used in seal CEMENT
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 60 ft. below top of well Date July 7, 78
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

e of test
er test 50 gal./min. with 100 ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Dirt	0	3
soft broken BASALT	3	180
MED. BAS.	180	190
Soft Bas.	190	195
MED. BASALT	195	270
2-3 gpm 270		
Hard Gray BASALT	270	278
Soft Brown BASALT	278	290
SANDrock particles 20-30gpm		
MED. Gray BASALT	290	293
Soft Brown BASALT 20-30gpm	293	305
Hard BASALT	305	310

RECEIVED
JUL 3 1978
DEPARTMENT OF ECOLOGY
CENTRAL REGIONAL OFFICE

Work started JUNE 12, 1978 Completed JUNE 15, 1978

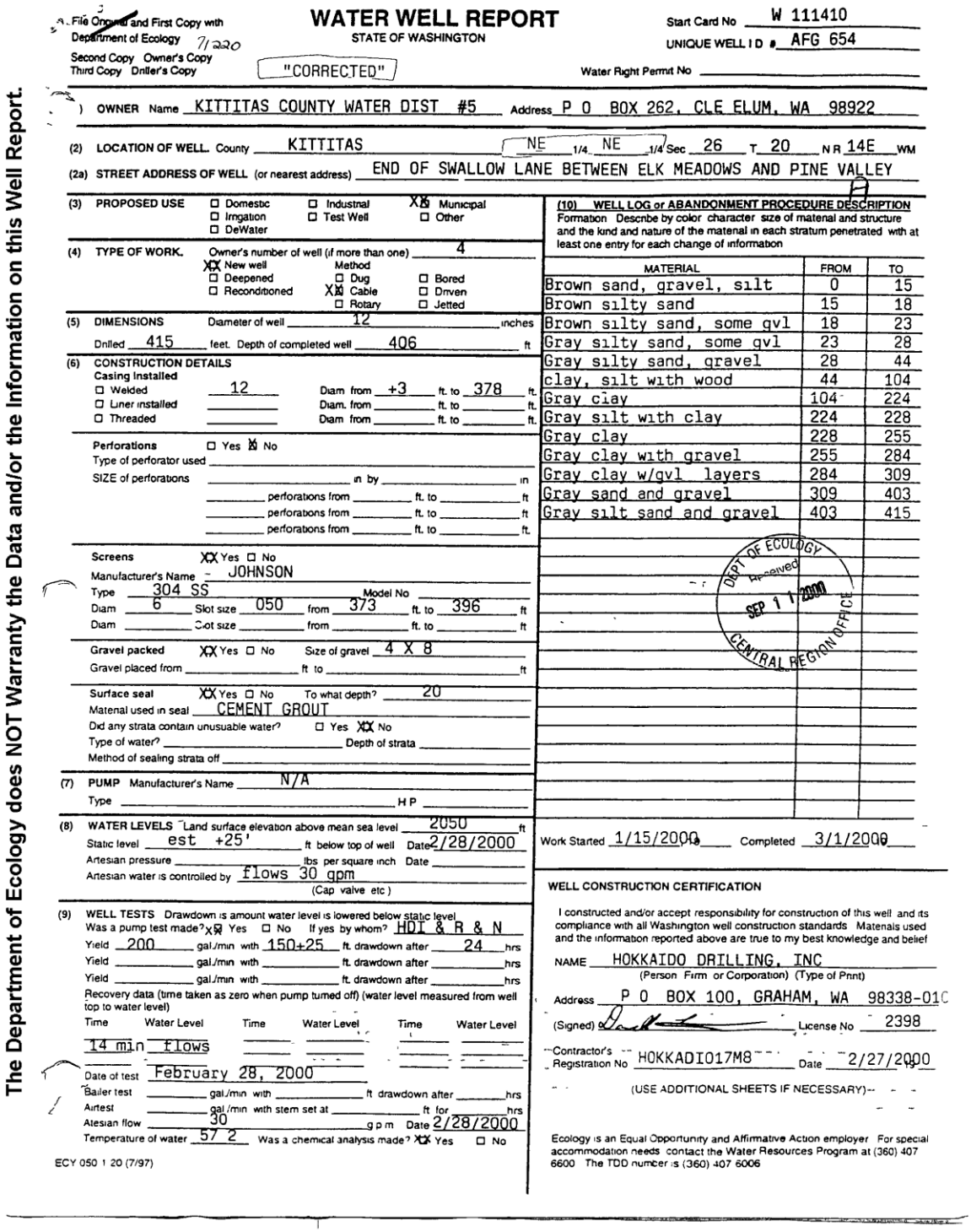
WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Bach Drilling Co.
(Person, firm, or corporation) (Type or print)
Address Box 60, Rte 3, ELLENSburg
[Signed] Mike Bach
(Well Driller)
License No. 22 Date JUNE 16, 1978

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

Figure 7. Well log for basalt strata (note change in lithology at 290 ft).



WATER WELL REPORT
STATE OF WASHINGTON

File Original and First Copy with Department of Ecology 7/220
Second Copy Owner's Copy
Third Copy Driller's Copy
"CORRECTED"

Start Card No W 111410
UNIQUE WELL I D # AFG 654
Water Right Permit No

(1) OWNER Name KITTITAS COUNTY WATER DIST #5 Address P O BOX 262, CLE ELUM, WA 98922

(2) LOCATION OF WELL. County KITTITAS NE 1/4 NE 1/4 Sec 26 T 20 N R 14E WM

(2a) STREET ADDRESS OF WELL (or nearest address) END OF SWALLOW LANE BETWEEN ELK MEADOWS AND PINE VALLEY

(3) PROPOSED USE ☐ Domestic ☐ Industrial ☒ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) TYPE OF WORK. Owner's number of well (if more than one) 4
☒ New well ☐ Deepened ☐ Reconditioned
Method ☐ Dug ☐ Bored ☒ Cable ☐ Driven ☐ Rotary ☐ Jetted

(5) DIMENSIONS Diameter of well 12 inches
Drilled 415 feet. Depth of completed well 406 ft

(6) CONSTRUCTION DETAILS
Casing Installed
☐ Welded 12 Diam from +3 ft. to 378 ft.
☐ Liner installed Diam. from ft. to ft.
☐ Threaded Diam from ft. to ft.

Perforations ☐ Yes ☒ No
Type of perforator used
SIZE of perforations in by in
perforations from ft. to ft
perforations from ft. to ft
perforations from ft. to ft

Screens ☒ Yes ☐ No
Manufacturer's Name JOHNSON
Type 304 SS Model No
Diam 6 Slot size 050 from 373 ft. to 396 ft
Diam Slot size from ft. to ft

Gravel packed ☒ Yes ☐ No Size of gravel 4 X 8
Gravel placed from ft to ft

Surface seal ☒ Yes ☐ No To what depth? 20
Material used in seal CEMENT GROUT
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP Manufacturer's Name N/A
Type H P

(8) WATER LEVELS Land surface elevation above mean sea level 2050 ft
Static level est +25' ft below top of well Date 2/28/2000
Artesian pressure lbs per square inch Date
Artesian water is controlled by flows 30 gpm (Cap valve etc)

(9) WELL TESTS Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes by whom? HDI & R & N
Yield 200 gal./min with 150+25 ft. drawdown after 24 hrs
Yield gal./min with ft. drawdown after hrs
Yield gal./min with ft. drawdown after hrs
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
14 min	flows				

Date of test February 28, 2000
Bailer test gal./min with ft drawdown after hrs
Airtest gal./min with stem set at ft for hrs
Artesian flow 30 g p m Date 2/28/2000
Temperature of water 57 2 Was a chemical analysis made? ☒ Yes ☐ No

ECY 050 1 20 (7/97)

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION
Formation Describe by color character size of material and structure and the kind and nature of the material in each stratum penetrated with at least one entry for each change of information

MATERIAL	FROM	TO
Brown sand, gravel, silt	0	15
Brown silty sand	15	18
Brown silty sand, some gvl	18	23
Gray silty sand, some gvl	23	28
Gray silty sand, gravel	28	44
clay, silt with wood	44	104
Gray clay	104	224
Gray silt with clay	224	228
Gray clay	228	255
Gray clay with gravel	255	284
Gray clay w/gvl layers	284	309
Gray sand and gravel	309	403
Gray silt sand and gravel	403	415

DEPT OF ECOLOGY Received SEP 11 2000 CENTRAL REGION OFFICE

Work Started 1/15/2000 Completed 3/1/2000

WELL CONSTRUCTION CERTIFICATION
I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards Materials used and the information reported above are true to my best knowledge and belief
NAME HOKKAIDO DRILLING, INC (Person Firm or Corporation) (Type of Print)
Address P O BOX 100, GRAHAM, WA 98338-010
(Signed) License No 2398
Contractor's Registration No HOKKADI017M8 Date 2/27/2000
(USE ADDITIONAL SHEETS IF NECESSARY)

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The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Figure 8. Well log for valley-fill strata (note changse in lithology at 44 and 228 ft).

References

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