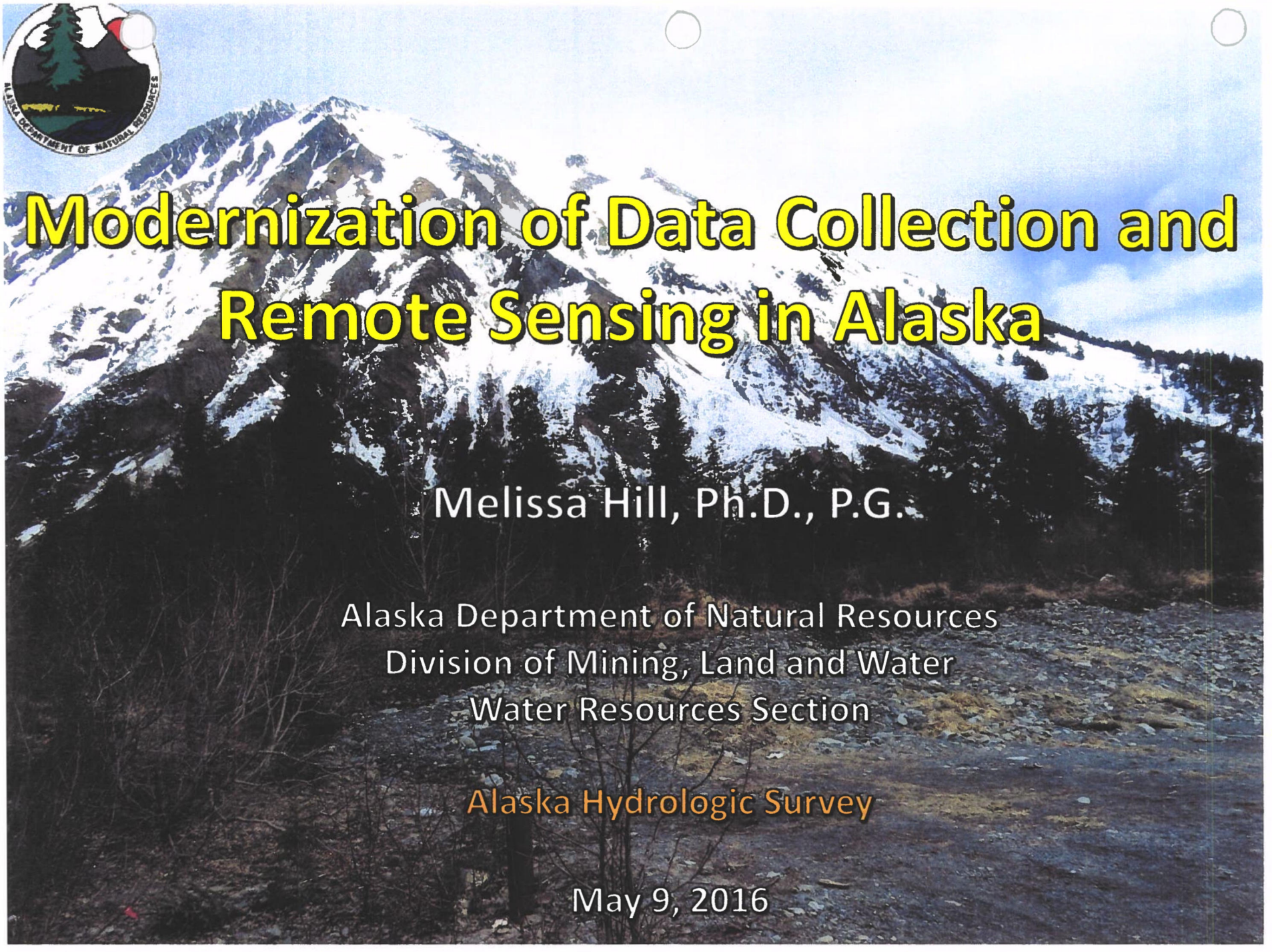

# Modernization of Data Collection and Remote Sensing in Alaska

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Alaska Hydrologic Survey

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# What is our history?

1867 - Alaska Purchase

1959 - Alaska becomes the 49th U.S. state

1966 - Passage of the Alaska Water Use Act

1977 - Amendment to Alaska Statute (AS) 41.08 which resulted in establishment of the Alaska Hydrologic Survey (AHS) *prior to this the U.S. Geological Survey (USGS) conducted hydrologic studies in Alaska*

# AHS Mandates

AS 41.08.017, AS 41.08.020, and Department Order 115, direct AHS to:

Provide data necessary to manage Alaska's waters as described in the Alaska Water Use Act, including the systematic collection, recording, evaluation and distribution of data on the quantity, location, and quality of water in the ground, surface, or along the coasts

Require filing of results and findings of surveys of water quantity, quality, and location, including water well logs, aquifer pump tests, water use, and water quality determination

Database management, publication, and release of these data to the public

Coordinate water data collection activities by state agencies and manage the Alaska Water Use Data System (AKWUDS)

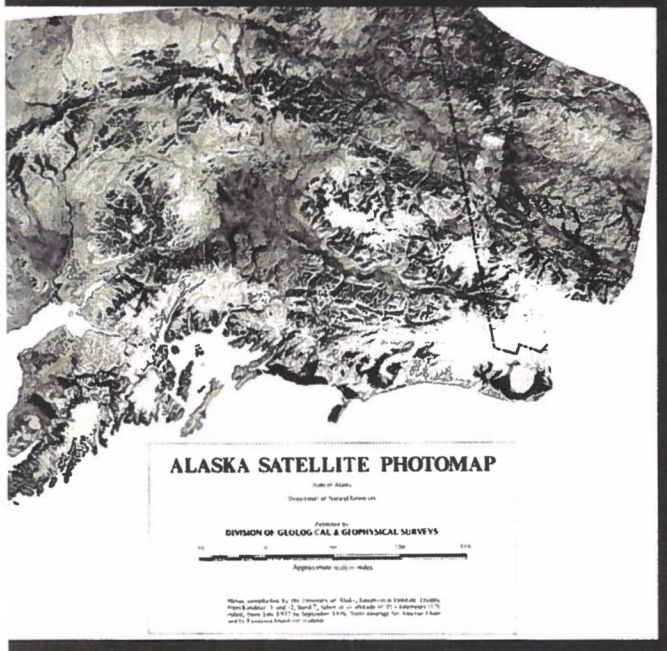
# Who are we?

AHS is comprised of 4 hydrologists:

2 based in Anchorage
1 based in Fairbanks
1 based in Juneau

1 groundwater/numerical modeler
1 hydrogeochemist
2 surface water hydrologists

# History of Remote Sensing in Alaska




1970 & 1974 (Supplement) – Interagency Technical Committee for Alaska – 10 year Comprehensive Plan for Climatologic & Hydrologic Data[1]

1978 – Division of Geological & Geophysical Surveys (DGGS) publishes the first satellite-image map of Alaska (black & white mosaic of images recorded by NASA's Landsat survey satellites)[2,3]

1979 – NASA funds a full-time positon at DGGS to coordinate efforts among multiple agencies for obtaining and implementing remote sensing programs (high-altitude aerial photography)[4]

[1] Alaska Ten Year Comprehensive Plan for Climatologic & Hydrologic Data, Interagency Technical Committee for Alaska, Sponsored by the Hydrology Committee, Water Resources Council, 1970 (3rd ed.) 1974 (Supplement) variously p.

[2] Mines & Geology Bulletin, 1978, State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys, vol. 27, no. 4, 18p.

[3] Alaska Satellite Photomap, 1978, State of Alaska, Department of Natural Resources, Alaska Division of Geological and Geophysical Surveys, Plate 4.

[4] Mines & Geology Bulletin, 1979, State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys, vol. 28, no. 4, 18p.

# 1970-1974 Ten-Year Comprehensive Plan

Surface Water Program – In 1973, USGS maintained 111 daily discharge stations, but envisioned and recommended an increase to 235 over a 10-year period. Estimated annual costs at the end of the 10-year period was $1,300,000 (1973 dollars)

Groundwater Program – In 1972, USGS maintained 80 observation wells (27 instrumented) and 1 spring. Recommendations included expansion in the number of observation wells over a 10-year period, development of a program to estimate water use, and water resource studies. Estimated annual costs at the end of the 10-year period was approximately $831, 000 (1973 dollars)

Snow/Ice Surveys and Glacier Hydrology Studies - multiple options were proposed at a cost of approximately $200,000 (1971-1973 dollars)

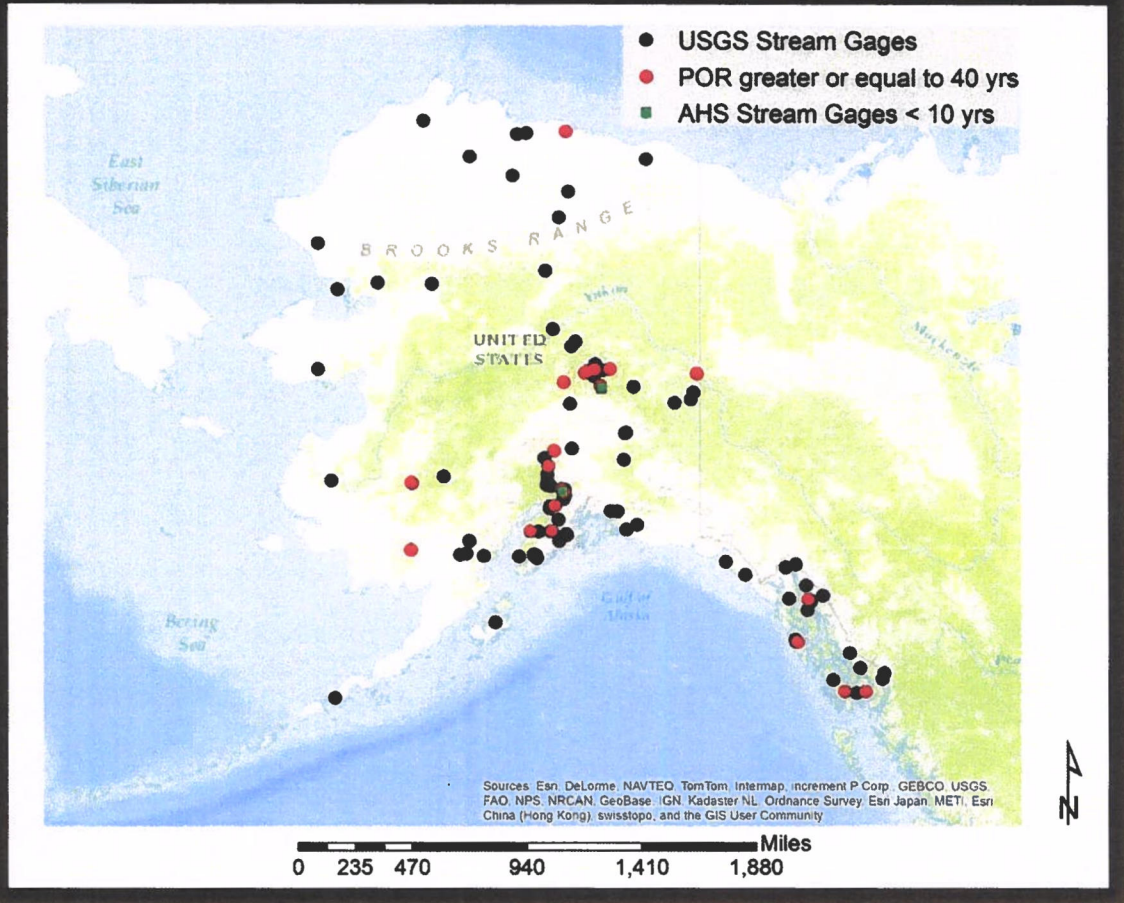
*Remote sensing – Acknowledged that satellite imagery would be particularly valuable*

42 years later, what is the status of hydrologic data collection and remote sensing efforts in Alaska?

Today USGS maintains approximately 100 stream gages in AK (we have lost gages since 1973)

Less than one-fourth (21) of the USGS stream gages have a POR ≥ 40 years

AHS maintains 3 stream gages (2 open-water season, 1 year-round with POR < 10 years)




Source USGS gage locations: http://waterwatch.usgs.gov/index.php?id=statusgage, accessed on April 21, 2016

# Examples of how Alaska compares with the rest of the US

# USGS National Streamflow Network Gap Analysis

*Alaska the 49th state to enter the US, had the shortest median years of record for the reference-quality stream gages*

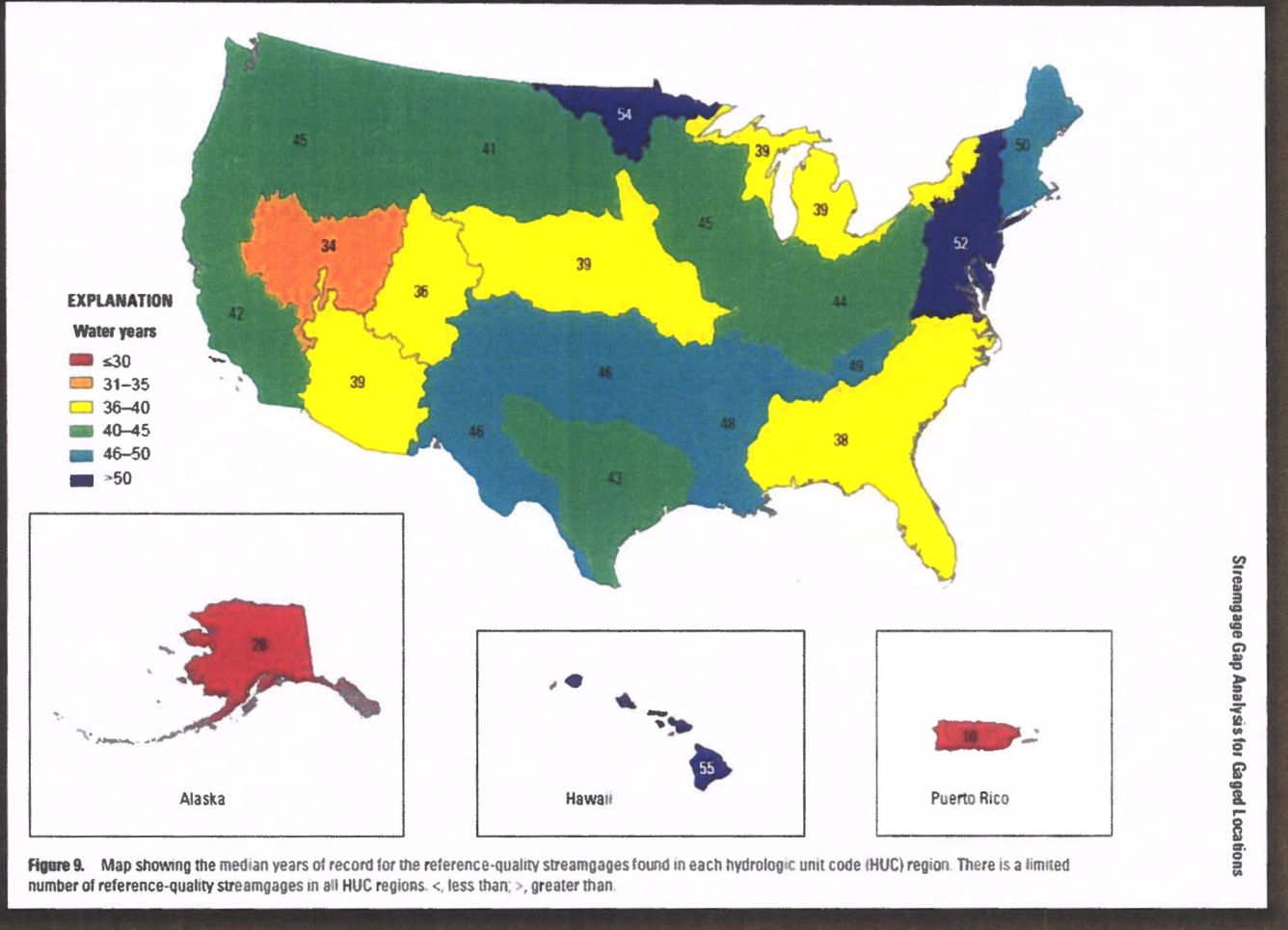



**Figure 9.** Map showing the median years of record for the reference-quality streamgages found in each hydrologic unit code (HUC) region. There is a limited number of reference-quality streamgages in all HUC regions. <, less than; >, greater than.

Source: Kiang, J.E., Stewart, D.W., Archfield, S.A., Osborne, E.B., and Eng, Ken, 2013, A national streamflow network gap analysis: U.S. Geological Survey Scientific Investigations Report 2013-5013, 79 p.

# USGS National Streamflow Network Gap Analysis con't

## *Drainage basins with* ≤ 2,000 mi² and 50-year POR between 1900 and 2009

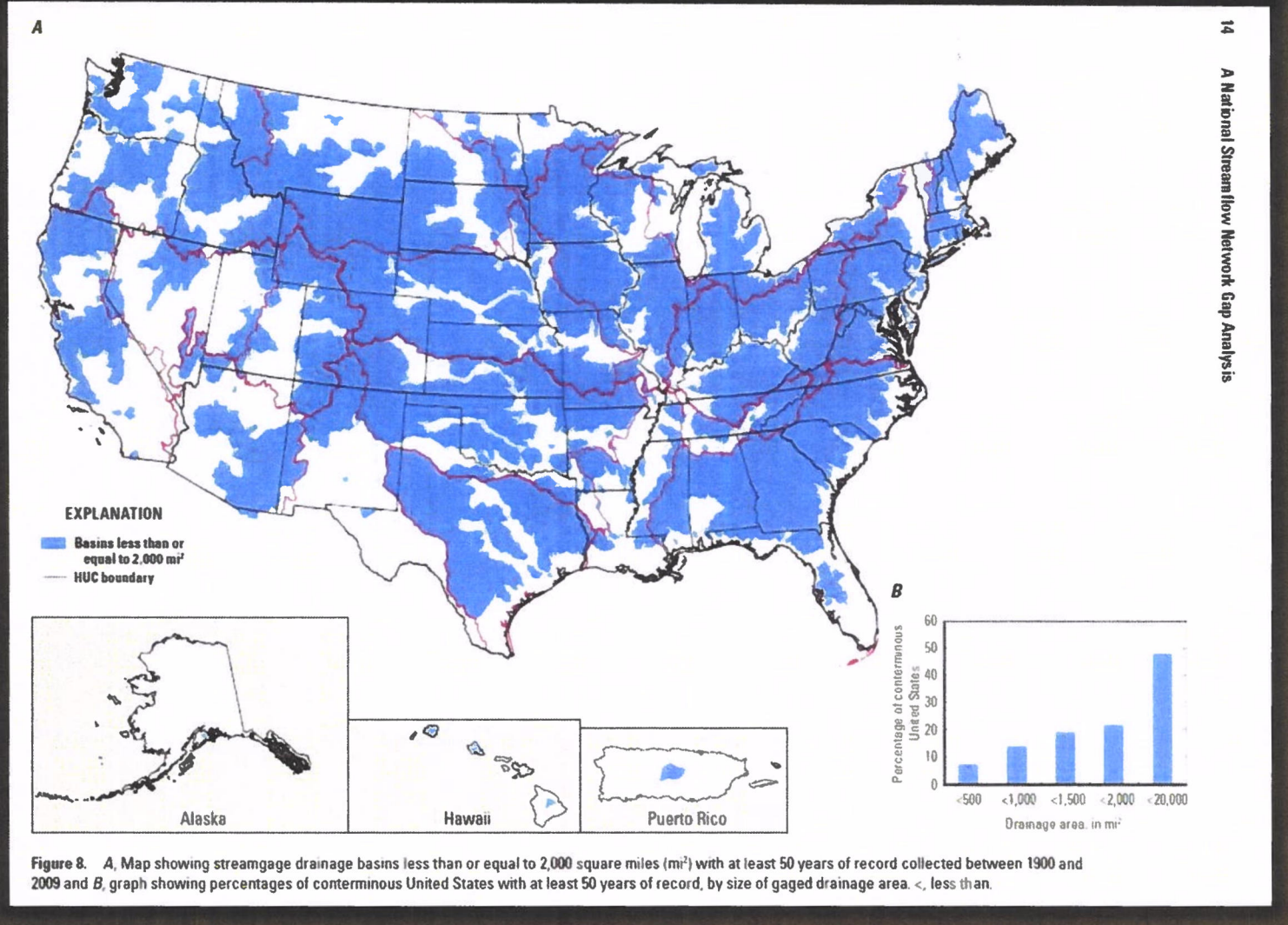



**Figure 8.** *A*, Map showing streamgage drainage basins less than or equal to 2,000 square miles (mi²) with at least 50 years of record collected between 1900 and 2009 and *B*, graph showing percentages of conterminous United States with at least 50 years of record, by size of gaged drainage area. <, less than.

Source: Kiang, J.E., Stewart, D.W., Archfield, S.A., Osborne, E.B., and Eng, Ken, 2013, A national streamflow network gap analysis: U.S. Geological Survey Scientific Investigations Report 2013-5013, 79 p.

# Remote sensing example – uses MODIS data

## Where is Alaska and Hawaii?

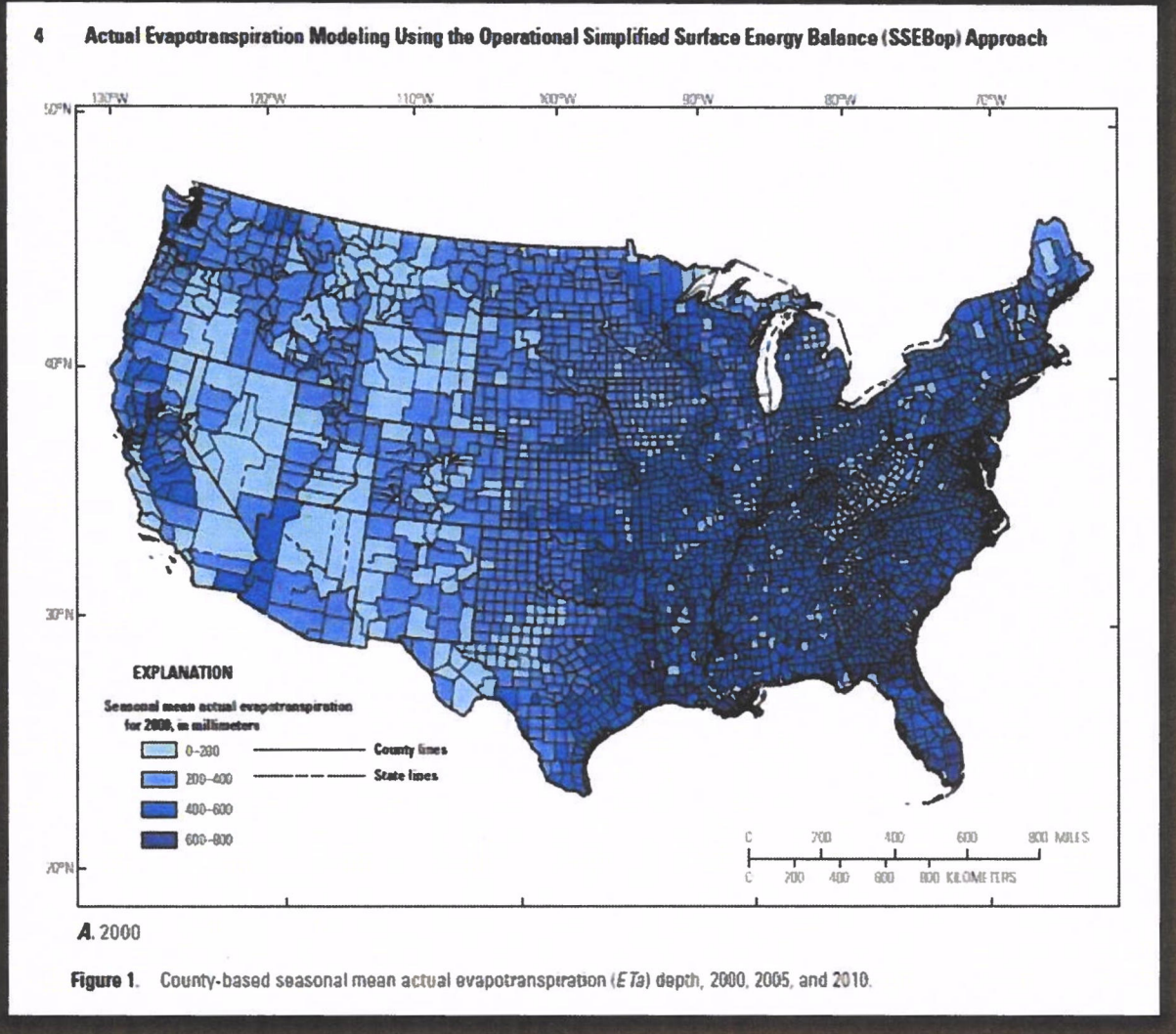



**Figure 1.** County-based seasonal mean actual evapotranspiration (*ETa*) depth, 2000, 2005, and 2010.

Source: Savoca, M.E., Senay, G.B., Maupin, M.A., Kenny, J.F., and Perry, C.A., 2013, Actual evapotranspiration modeling using the operational Simplified Surface Energy Balance (SSEBop) approach: U.S. Geological Survey Scientific Investigations Report 2013-5126, 16 p.

# Examples of how Alaska compares with its Canadian neighbors in British Columbia and Yukon

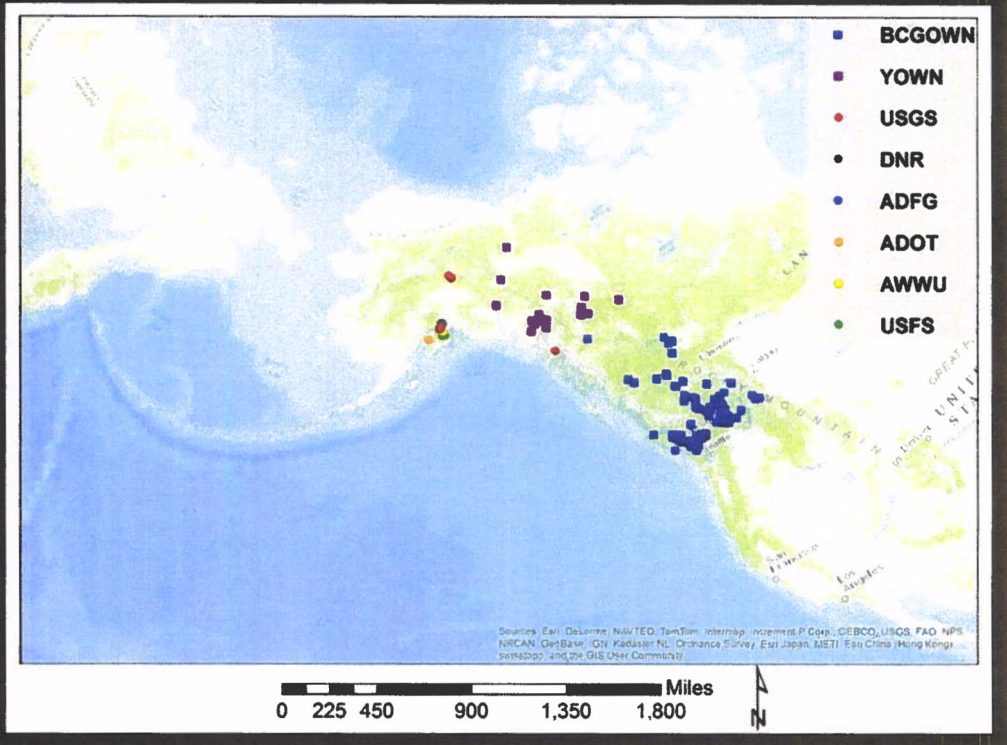
# Example – Groundwater Program

British Columbia (B.C.) – established a groundwater network in 1961 to observe long-term trends in over 180 wells, B.C.'s population as of June 1, 1961, 1.6 million[1] (population as of July 1, 2015, 4.7 million[1])

Yukon – established a groundwater network in 2001 & have been expanding it since that time. Yukon's population as of June 30, 2014 was 36,667[2] of which 27,962 resided in Whitehorse (in comparison Alaska's estimated population as of July 2015, 737,625[2])

Today, USGS maintains 5 groundwater stations in AK

AHS/DNR with its cooperators[3] maintains approximately 19 wells (1 well has a POR = 21 years)




[1]Source: http://www.bcstats.gov.bc.ca/StatisticsBySubject/Demography/PopulationEstimates.aspx, accessed on April 27, 2016

[2]Source: http://laborstats.alaska.gov/pop/popest.htm, accessed on April 27, 2016

[3]Cooperators ADFG (Alaska Department of Fish & Game) ADOT (Alaska Department of Transportation & Public Facilities) AWWU (Anchorage Water & Wastewater Utility) and U.S. Forest Service (USFS)

# AHS Water Use Program in Alaska

1994 – the last year an annual summary of reported water use was completed by AHS (Ireland and Mauer, 1995). At that time AKWUDS existed on a personal computer. Over the next 17 years, due to changes in staff, state resources, and priorities, the PC-version of AKWUDS was lost.

1995-2012 hiatus in the water use program, AHS continued to receive water use reports, but annual summaries of reported water use were not compiled. Hardcopy submittals were placed in file cabinets and electronic submittals were stored on a shared, backed-up network drive. During the hiatus, Alaska's population increased by approximately 132,000 (Alaska Department of Labor and Workforce Development, 2014)

2012-2013 pilot study conducted to electronically capture information from Alaska's Land Administration System (LAS) that stores water right/authorization information

2013 – AHS begins strategic site visits focusing on the relatively larger users (industrial cooling wells)

2015 – State allocates $30,000 to develop an online water use reporting system (AKWUDS Phase I)

# Example – Water Use Program (B.C.)

**Table1. Licensed stream lengths and water allocation restrictions on streams in British Columbia by decade (1860-2000).**

| Decade | Kilometres Licensed | Kilometres Restricted | Percentage Restricted |
|---|---|---|---|
| 1860 | 861 | 0 | 0 |
| 1870 | 2486 | 0 | 0 |
| 1880 | 4296 | 7 | 0 |
| 1890 | 7032 | 7 | 0 |
| 1900 | 10851 | 7 | 0 |
| 1910 | 12941 | 21 | 0 |
| 1920 | 16493 | 362 | 2 |
| 1930 | 18857 | 854 | 5 |
| 1940 | 22595 | 995 | 4 |
| 1950 | 28082 | 1712 | 6 |
| 1960 | 37664 | 3758 | 10 |
| 1970 | 47797 | 7672 | 16 |



**BRITISH COLUMBIA**
**MINISTRY OF WATER, LAND AND AIR PROTECTION - 2002**

| Decade | Kilometres Licensed | Kilometres Restricted | Percentage Restricted |
|---|---|---|---|
| 1980 | 55526 | 15118 | 27 |
| 1990 | 63201 | 17728 | 28 |
| 2000 | 63240 | 17735 | 28 |

Source: BC Ministry of Water. Land and Air Protection. Water Management Branch. Water Allocation Section. 2001.

Source: http://www.env.gov.bc.ca/soe/archive/reports/et02/technical_documents/Surface_Water_Quality_2002.pdf, accessed on May 3, 2016

# Example – Water Use Program (B.C.) con't.

One valley. One water. One stop reporting.

The choice is ours: continue using existing, inefficient water management processes, or move to online reporting and analysis which will lead to stable and reliable water supplies for the entire valley. Join the Okanagan Basin Water Board in bringing water management and data collection into the 21st century.

Check out the BC Water Use Reporting Centre today.

It's free. It's simple. It works.

BCWaterUseReporting.ca

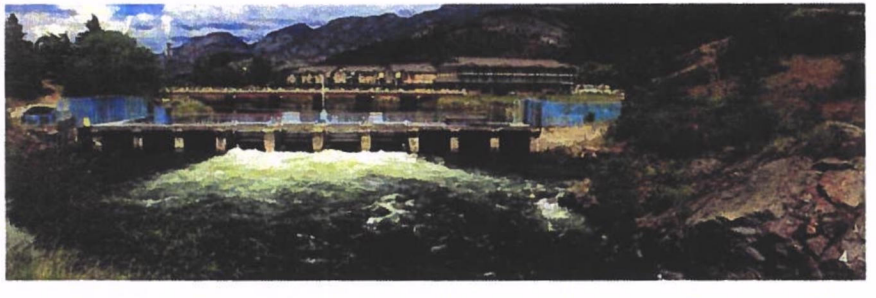
To learn more about, or participate in the BC Water Use Reporting Centre contact:
Okanagan Basin Water Board
obwb.ca/BCWaterUseReporting
Nelson Jatel
nelson.jatel@obwb.ca
(250) 469-6295

BC Water Use Reporting Centre

BRITISH COLUMBIA

Environment Canada / Environnement Canada

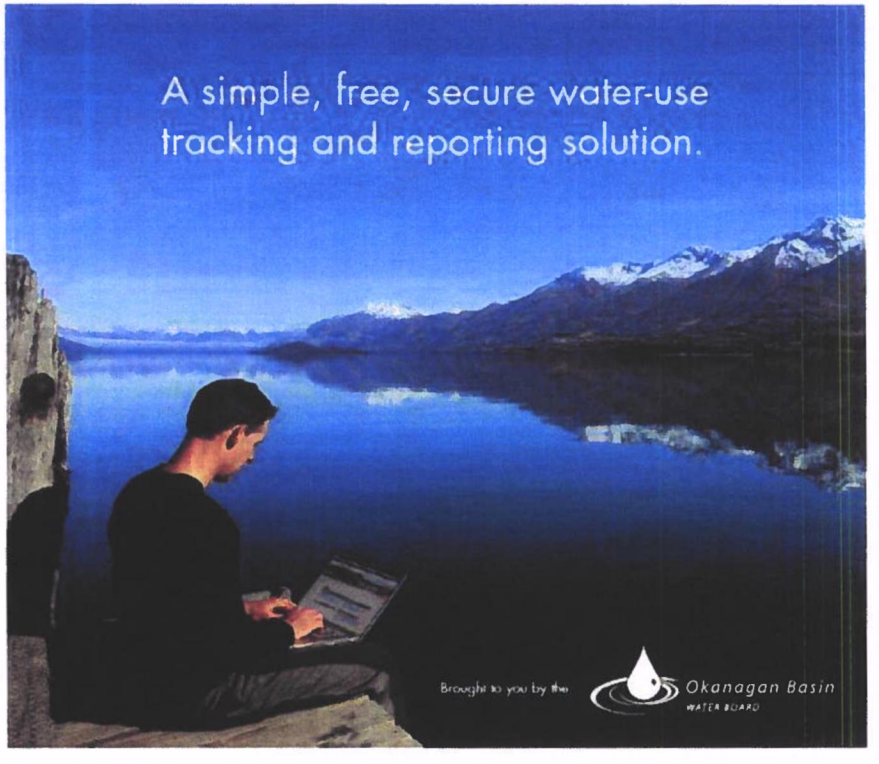
Okanagan Basin WATER BOARD



BC Water Use Reporting Centre

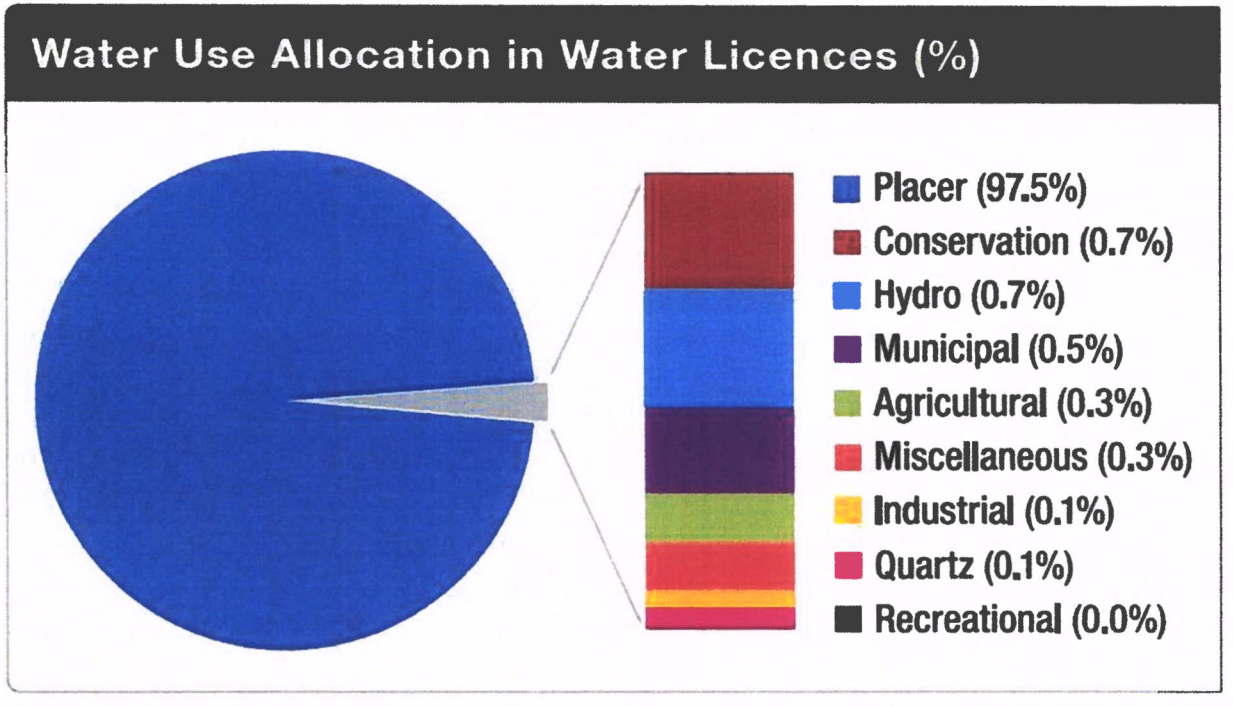
OKANAGAN PILOT

BCWaterUseReporting.ca




Source: http://www.obwb.ca/fileadmin/docs/brochure_bcwurc.pdf, accessed on May 3, 2016

# Example – Water Use Program (Yukon)

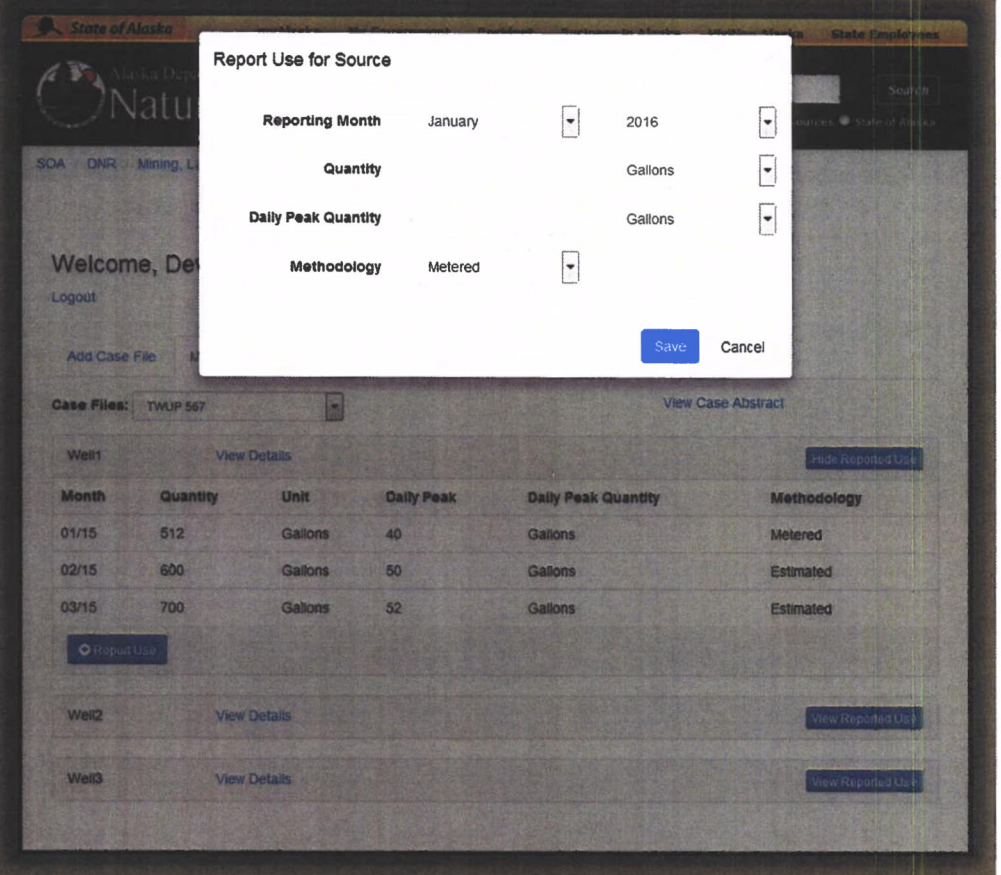



Please note the graph does not reflect percentages of actual water use by each category, but rather the allocated water use within water licences. Further, the graph does not delineate the various types of uses (consumptive vs. non-consumptive) that occur within the various activities.

Source: Water for Nature, Water for People, Yukon Water Fact Sheet, 2014, Department of Environment, Water Resources Branch, 4 p.

# Examples of recent successes with collecting hydrologic data in Alaska

- NGWMN (U.S. Geological Survey Cooperative Agreement Number G16AC00076)
- Alaska was the first state awarded funds for the Water Use Data & Research Program (U.S. Geological Survey Cooperative Agreement Number G15AC00414)
- Increased cooperation among agencies and with our Canadian neighbors
- Databases – Well Log Tracking System Phase II, groundwater database - NGWMN, AKWUDS Phase I scheduled for release by June 30, 2016



# The time to act is now:
# Why are these data critical over the next 50-year horizon?

1. Climate changes in the arctic and Alaska are occurring faster than mid-latitude regions[1]

2. Water availability is uncertain under changing climatic conditions

- *Snowpack and rainfall changes/decreases in recharge*
- *Permafrost degradation and its effects (subsidence, flooding, effects on infrastructure)*
- *Decreases in groundwater upwelling in streams/biological effects*
- *Rising sea levels, coastal erosion, melting glaciers*
- *Response time to natural disasters (wildfires, droughts, earthquakes, flooding, volcanic eruptions)*

3. Alaska's projected population ranges from a low of 782,551 to a high of 1,283,534 by 2042[2]

4. Alaska comprises about 1-percent of Earth's total land area[3] so ground-based stations are needed to calibrate emerging remote sensing technologies

Source: NASA Jet Propulsion Laboratory California Institute of Technology http://climate.nasa.gov/news/935/, accessed on April 26, 2016
Source: Alaska Department of Labor and Workforce Development, 2014
Source: NASA Jet Propulsion Laboratory California Institute of Technology http://www.jpl.nasa.gov/news/news.php?feature=4376, accessed on April 25, 2016

# How do we get there?

- Change in AHS' priorities
- Cooperative partnerships
- Communication/technical exchange with agencies processing remote sensing data
- Increasing efficiency and reducing staff workload with online reporting systems (Well Log Tracking System, AKWUDS)
- Focus on expanding the groundwater monitoring network and reestablishing the water use program
- USGS stream gages are needed for developing remote sensing technologies, AHS' existing surface water stations can be maintained for state purposes

# Consequences of Inaction

Where might Alaska be 50-years from now (2066) and what might that generation identify reflecting back to 2016 ?

# Questions?


Contact information

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