Water Data Management in ESRD

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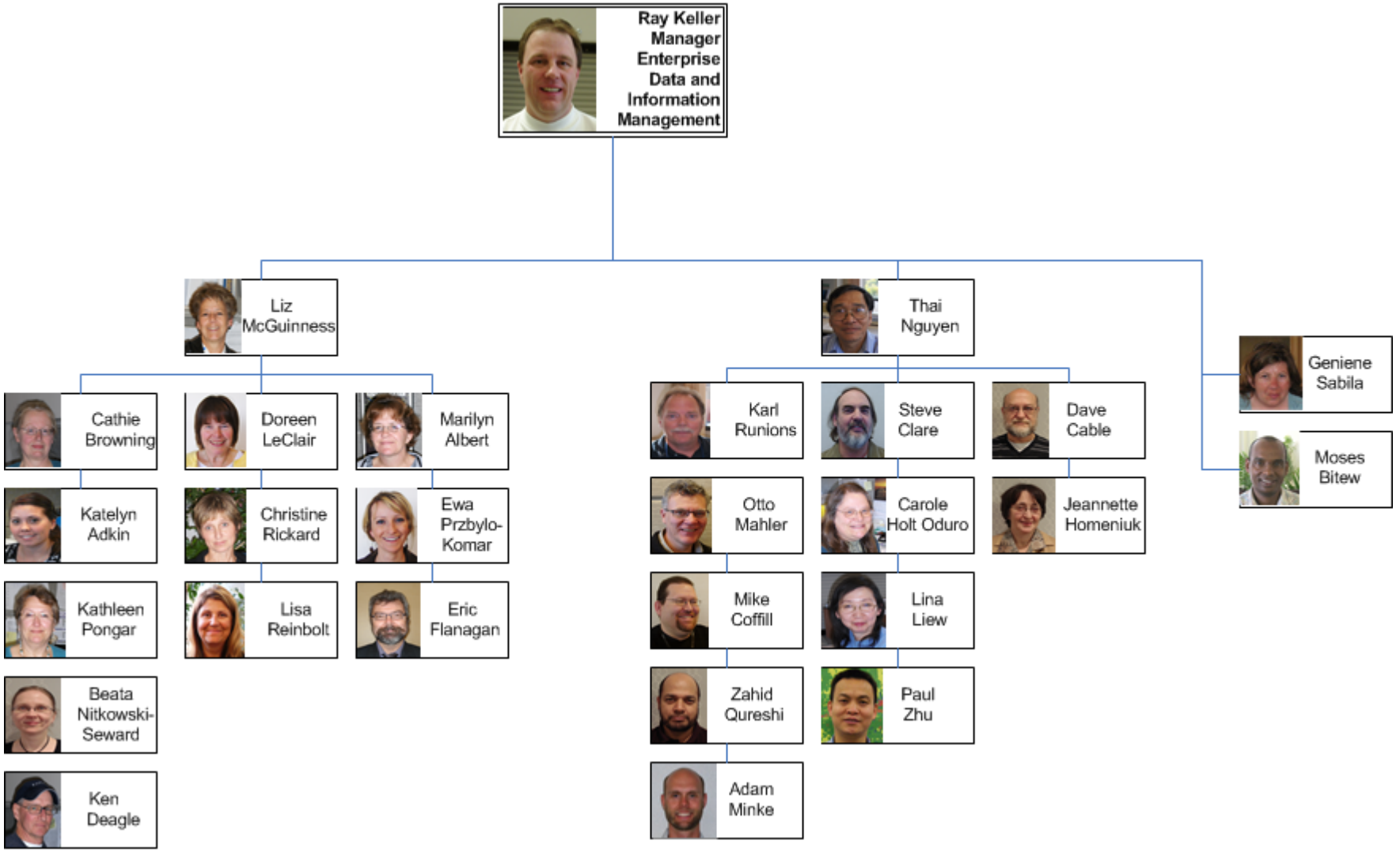
Enterprise Data & Information Management

Alberta Environment and Sustainable Resource Development

August 2013

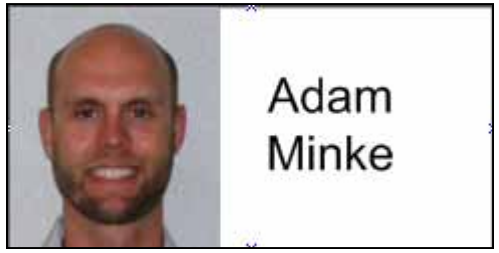
Enterprise Data & Information Management Staff



Water Data Group
Near-Real-Time/Historical

Senior Technologist & Supervisor

Real-Time Data Technologists:



Water Data Group Responsibilities

- Manage the Real-Time Data Collection Systems
- Provide data support for Field Staff
- Provide 24x7 Data Support
- Provide access to Hydro/Met Data
- Archive Historical ESRD Data

Contribution to Goals

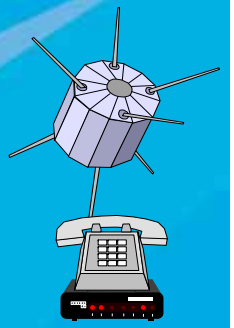
- Support River Forecasting
- Support Dam Operation
- Support Irrigation Operation
- Support Agriculture’s Drought-Net Program

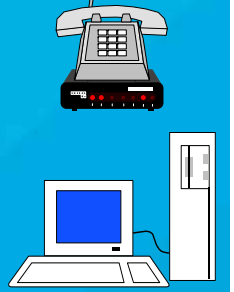
- Support risk management of floods and drought
- Support monitoring of health of rivers and lakes
- Support inter-provincial and international apportionment agreement

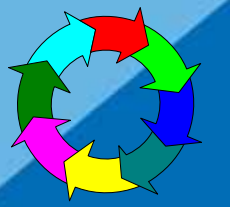
Data Collection: Working Together

- Monitoring = Field Activity
  - Field measurements
  - Equipment installation
- Data Management = Office
  - Telemetry decoding
  - Formatting and loading into database
  - Dissemination and archiving
- Water Operations = Results
  - Forecasting of flood events
  - Water Management

Realtime Data Communications







Satellite DCPs (450)

Phone Loggers (190)

SCADA Data Transfer (20)

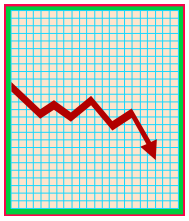
FTP (15)

Webpage Data Mining (36)

Internal Database Transfer (250)

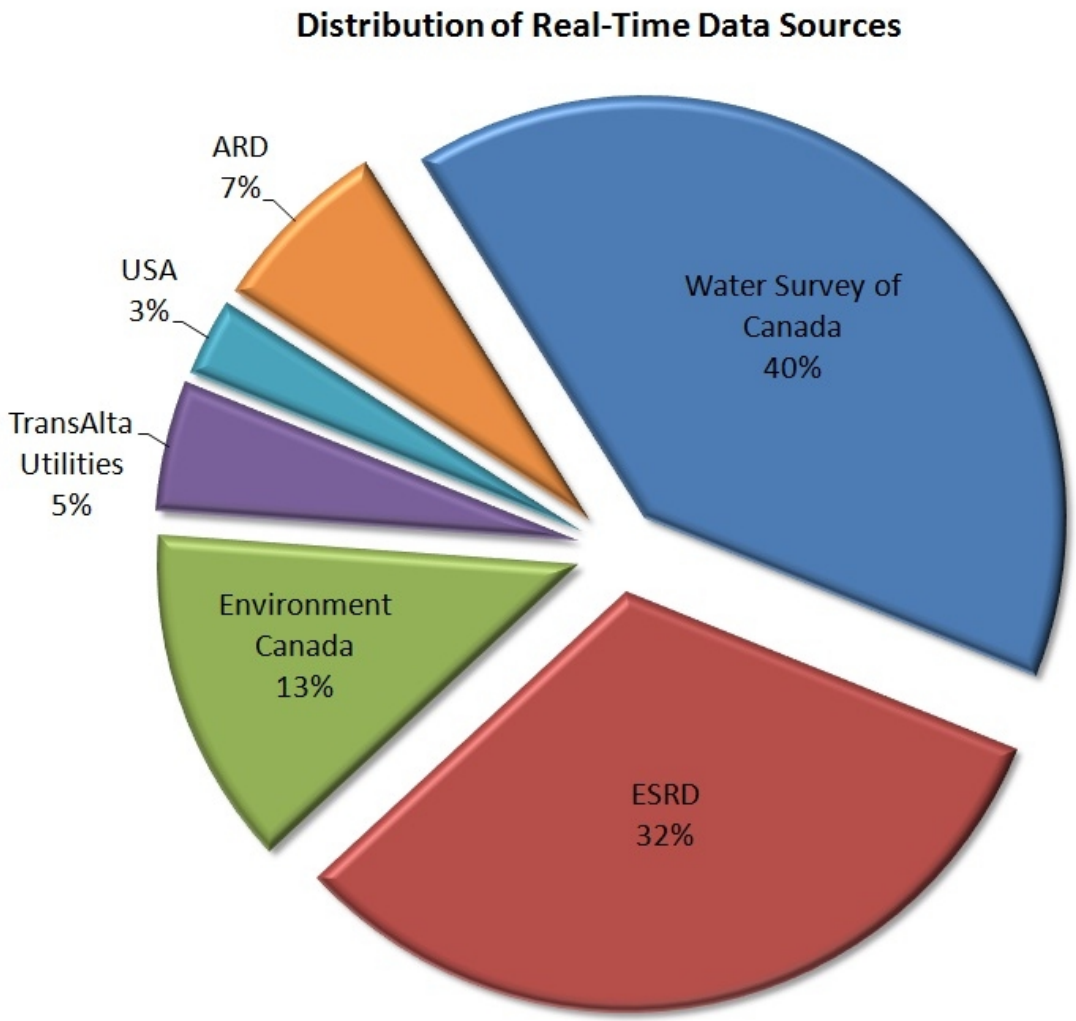
Radio/ CDMA (40)

WISKI



Bulk Historical Data Products

Data Sources

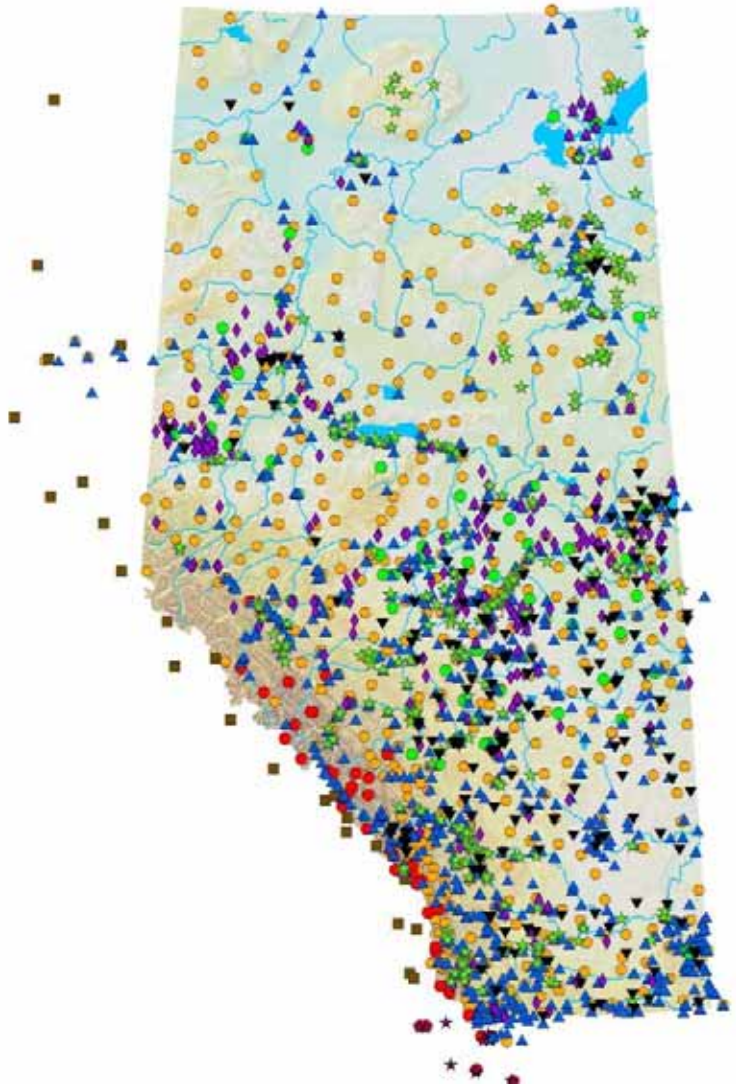


Access to Other Historical Data Sources

- MSLL (Miscellaneous Streams and Lake Levels)
- Manual Snow Courses Data
- GOWN-Groundwater database
- Water Quality Information
- WSC Historical
- MSC Historical
- Others

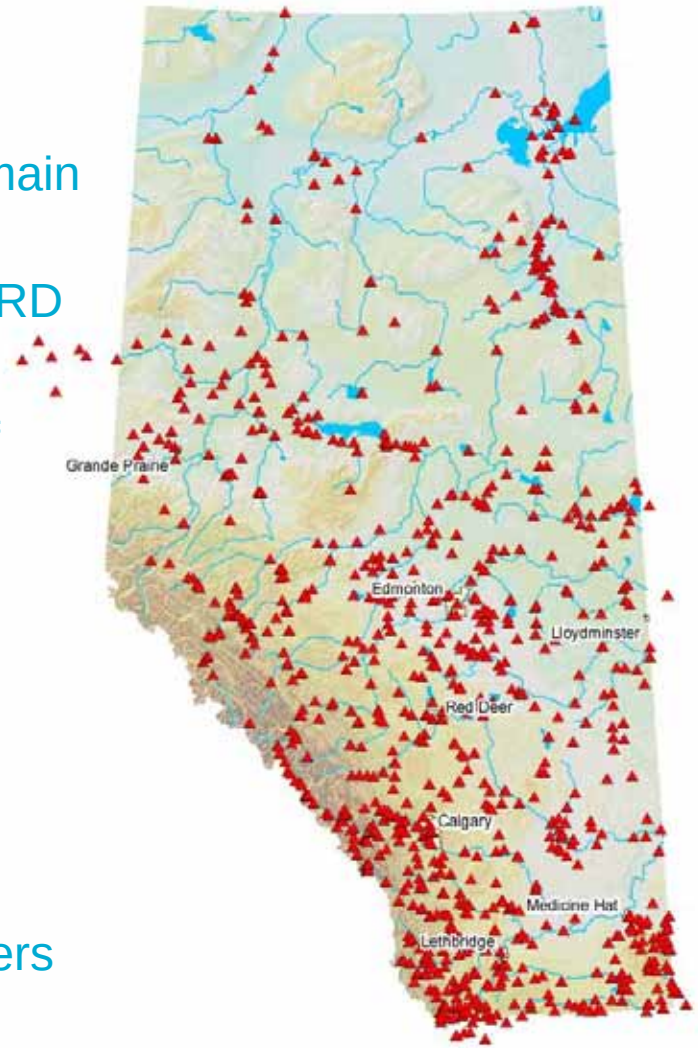
Monitoring Locations

- Hydrometric
- Lakes
- Meteorological
- Snow
- Water Quality
- Ground Water



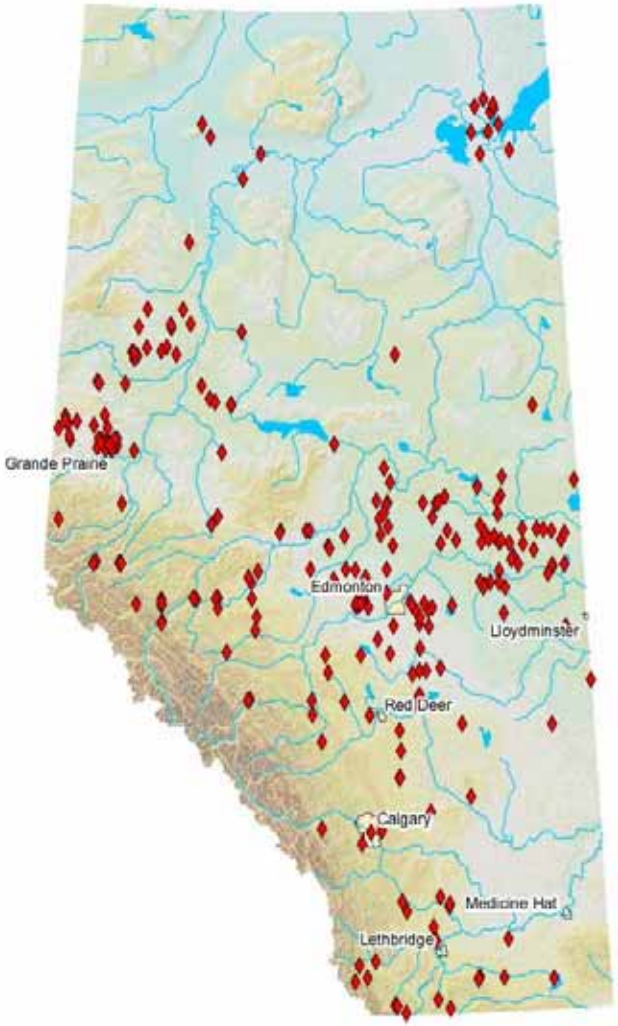
Hydrometric: Federal / Provincial

- Hydrometric Agreement
  - ~450 stations
  - Water Survey of Canada is main operator
  - ~45 stations operated by ESRD
  - 400+ with telemetry
  - recorders, data loggers, staff gauges
- Parameters:
  - River Stage
    - Flow / Discharge
  - Reservoir & Lake Level
  - Reservoir Gate Settings
  - Some WQ physical parameters



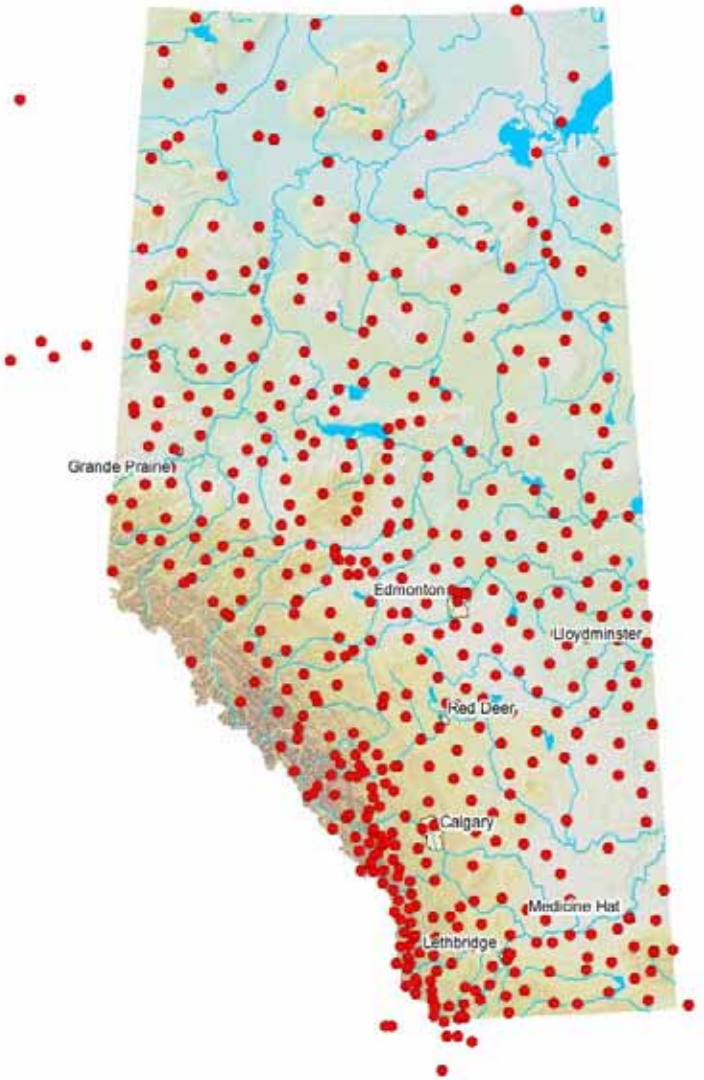
Lake Monitoring

- ~ 250 lakes
- Routinely visited by ESRD monitoring staff
  - Some have staff gauges
  - A few have recorders
- Many collected for 30+ years
- Readings also submitted by trained local observers



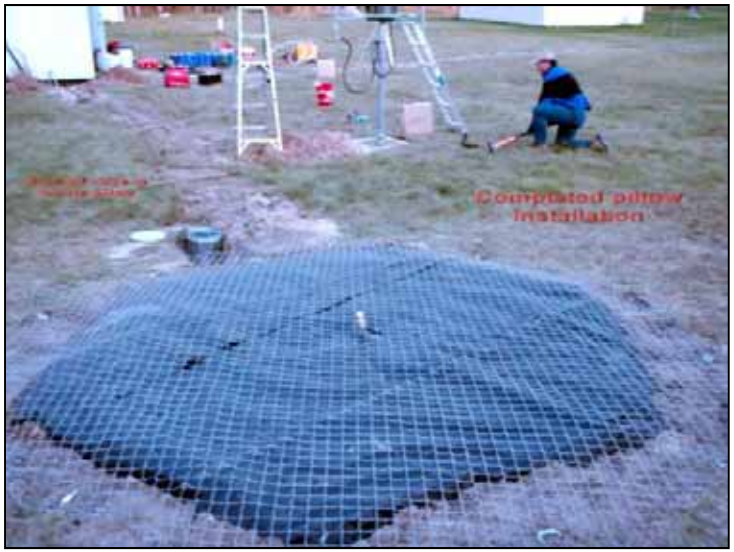
Meteorological

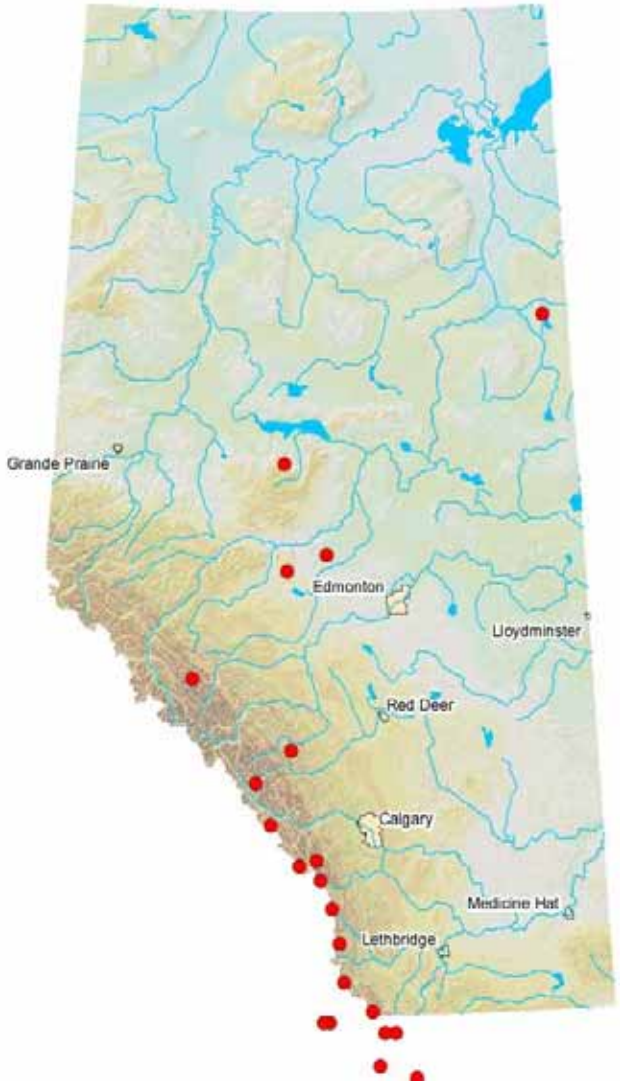
- ~ 500 Stations
- ESRD
- Alberta Agriculture & Rural Development
- MSC
- Parameters:
  - Precipitation
  - Air Temperature
  - Snow Depth & Water
  - Humidity
  - Wind speed & direction
  - etc.



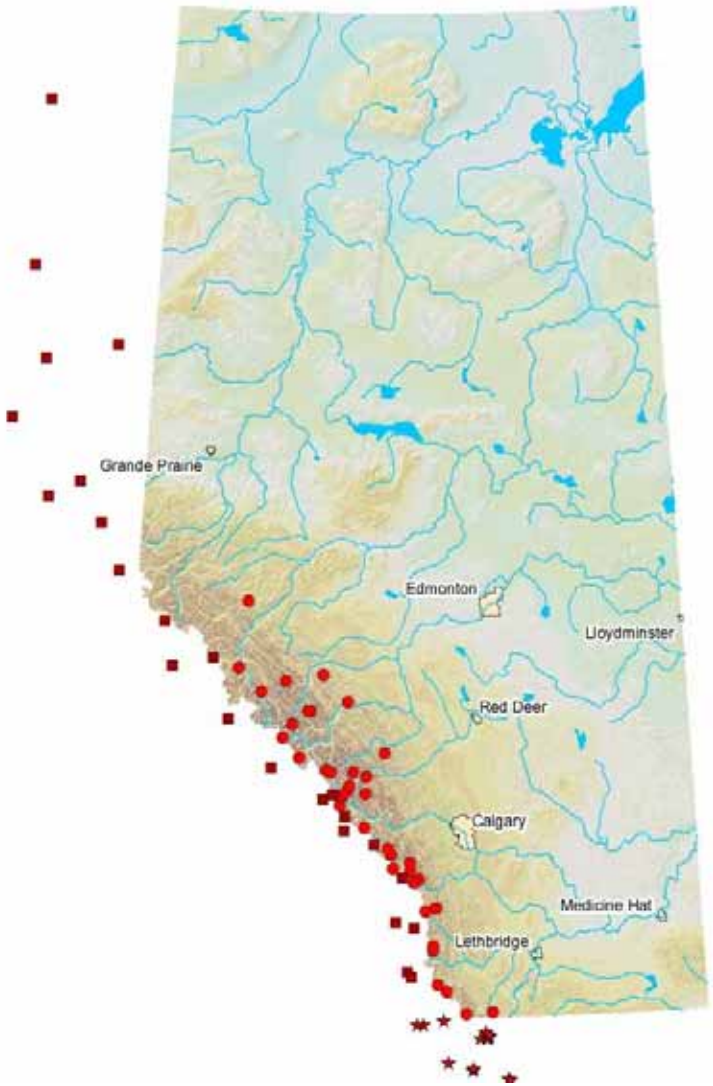
Snow Pillow Sites: Near-Real-Time

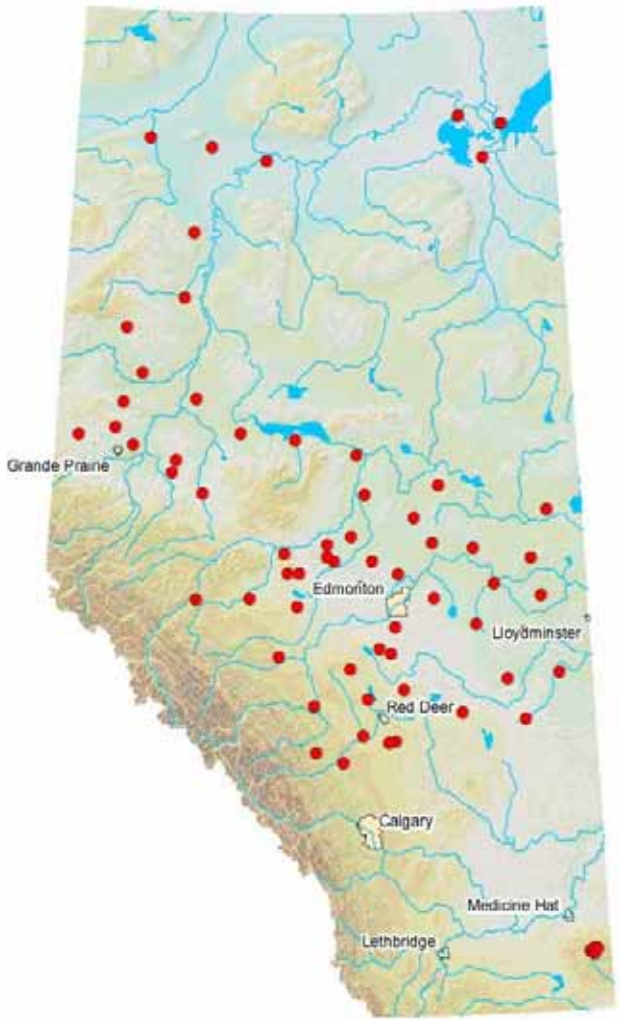
- 17 Mountain Sites
  - 6 Operated by US SnoTel Program
- 4 Plains Area Sites





Snow Course Sites: Mountains & Plains





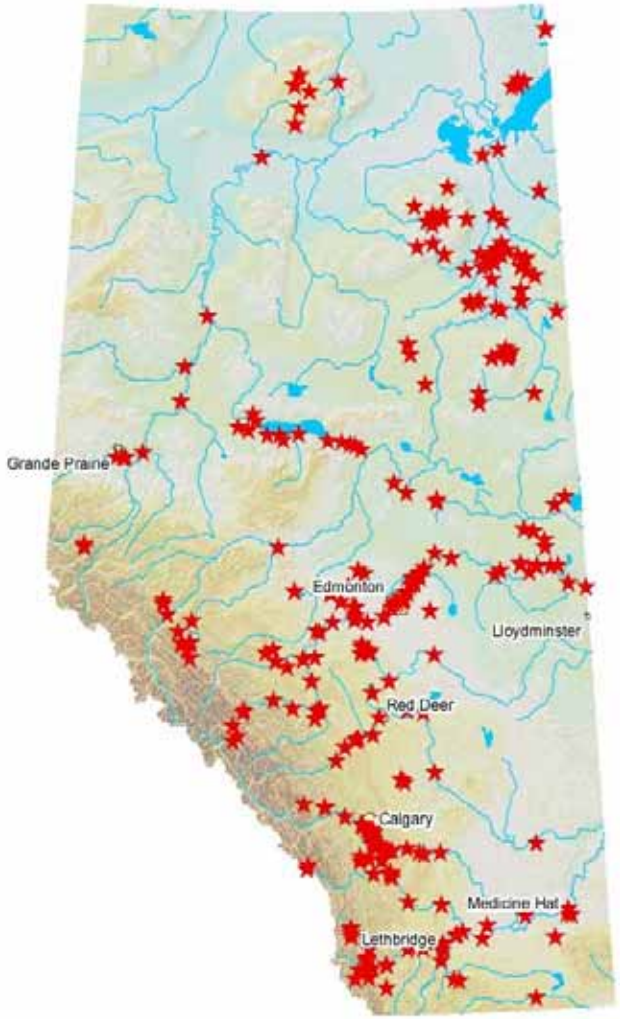
Water Quality Monitoring

Near-Real-Time

- 5 to 10 stations with telemetry, depending on time of year
  - DATASONDE

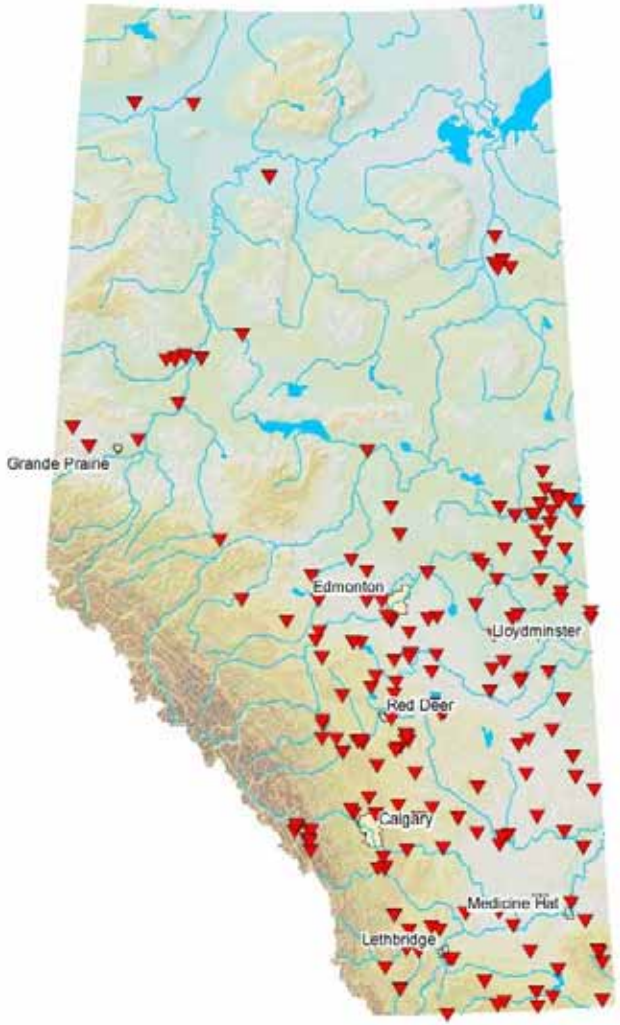
Overall Program

- ~400 WQ sites every year
- Mostly short or medium term only, depending on project
- Long Term River Network
  - 28 monitored



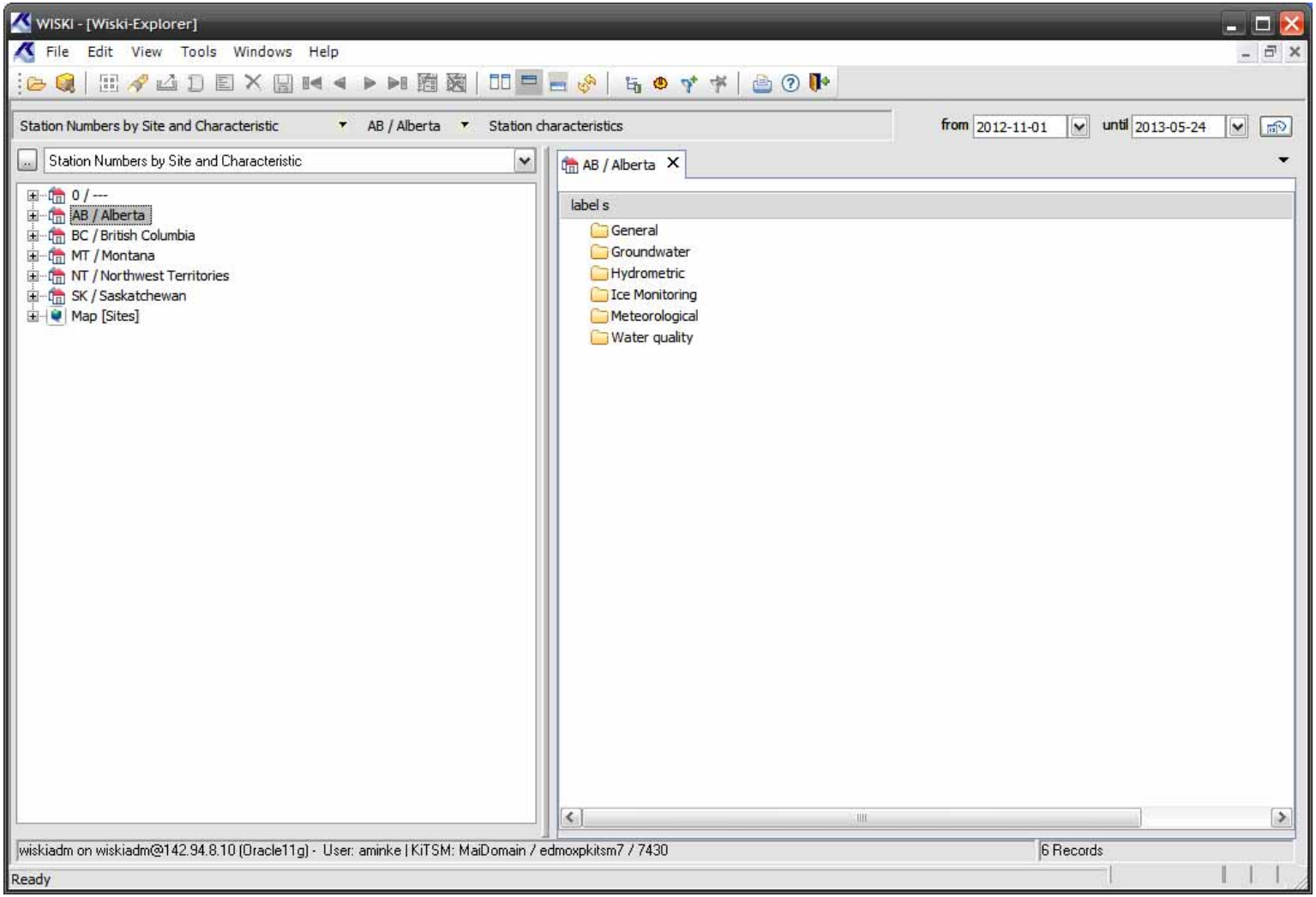
GOWN: Groundwater Observation Well Network

- ~150 water wells with continuous recorders
- 25 water wells with frequent manual observations
- Currently ~40 wells with GOES telemetry, with more scheduled in the future

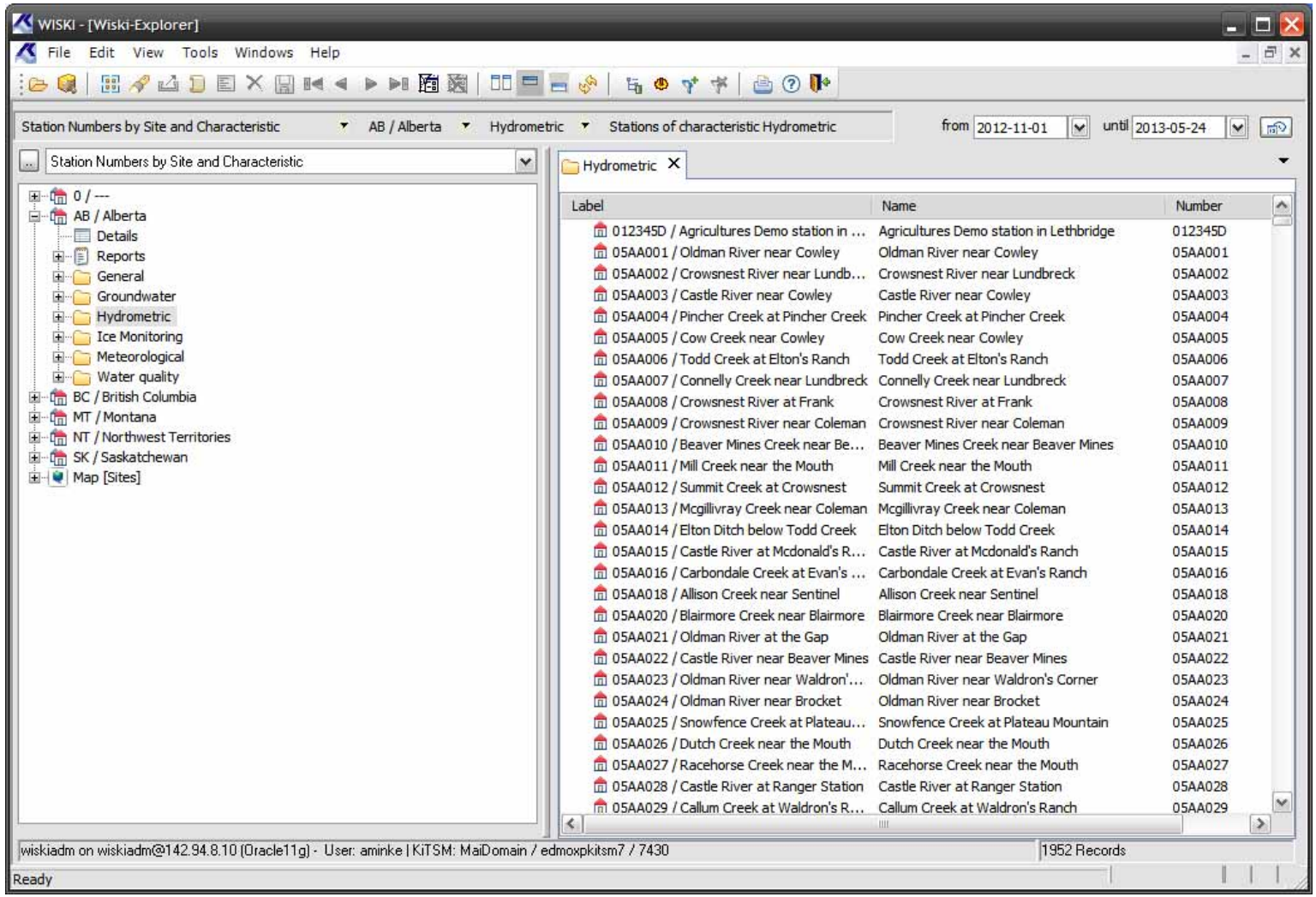


WISKI:
Managing Water Data

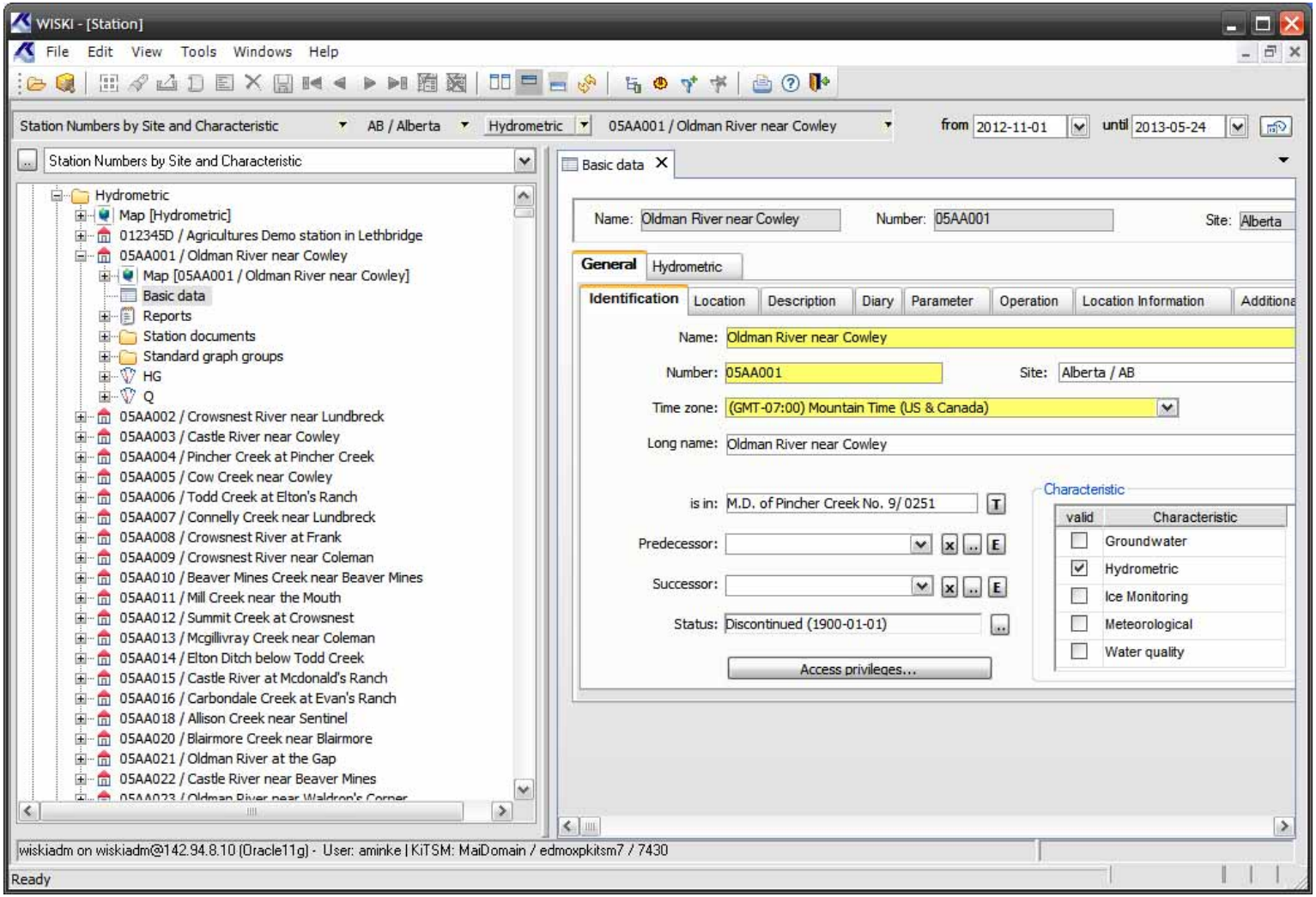
WISKI Explorer



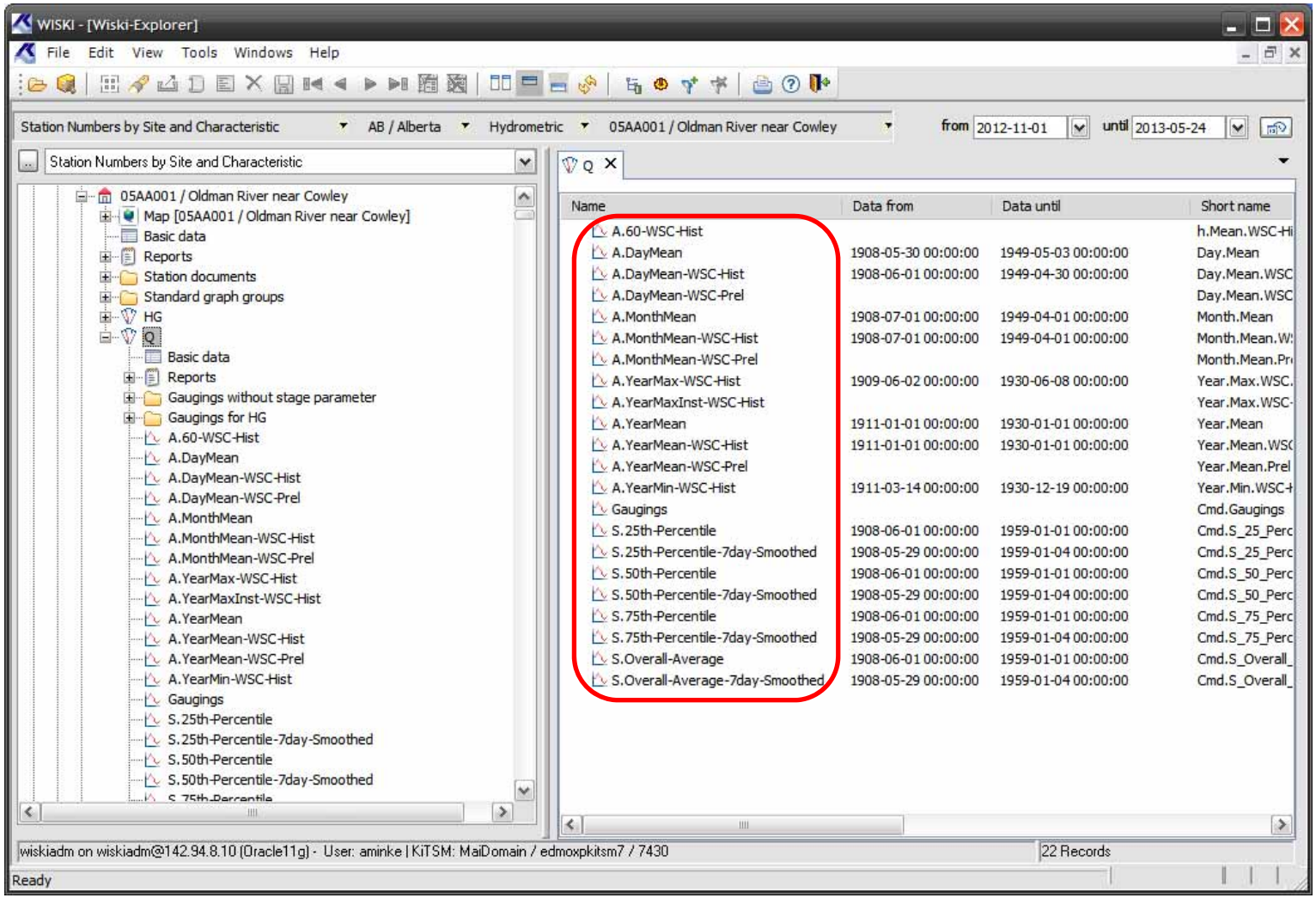
WISKI Explorer



WISKI Explorer



WISKI Explorer

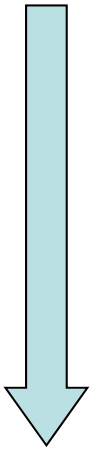


Database Structure: Timeseries

- WISKI stores data in separate timerseries
- Unique timeseries for each layer of data
- Each layer is transparent & allows edits to be visible

Timeseries Prefixes & Naming:

- O. Original
- V. Validated
- P. Production
- C. Calculated
- A. Aggregated
- S. Statistical



Examples:

- O.NRT
- O.Readings-Gauge
- O.Corrections-Datum

Data Availability

Data Availability

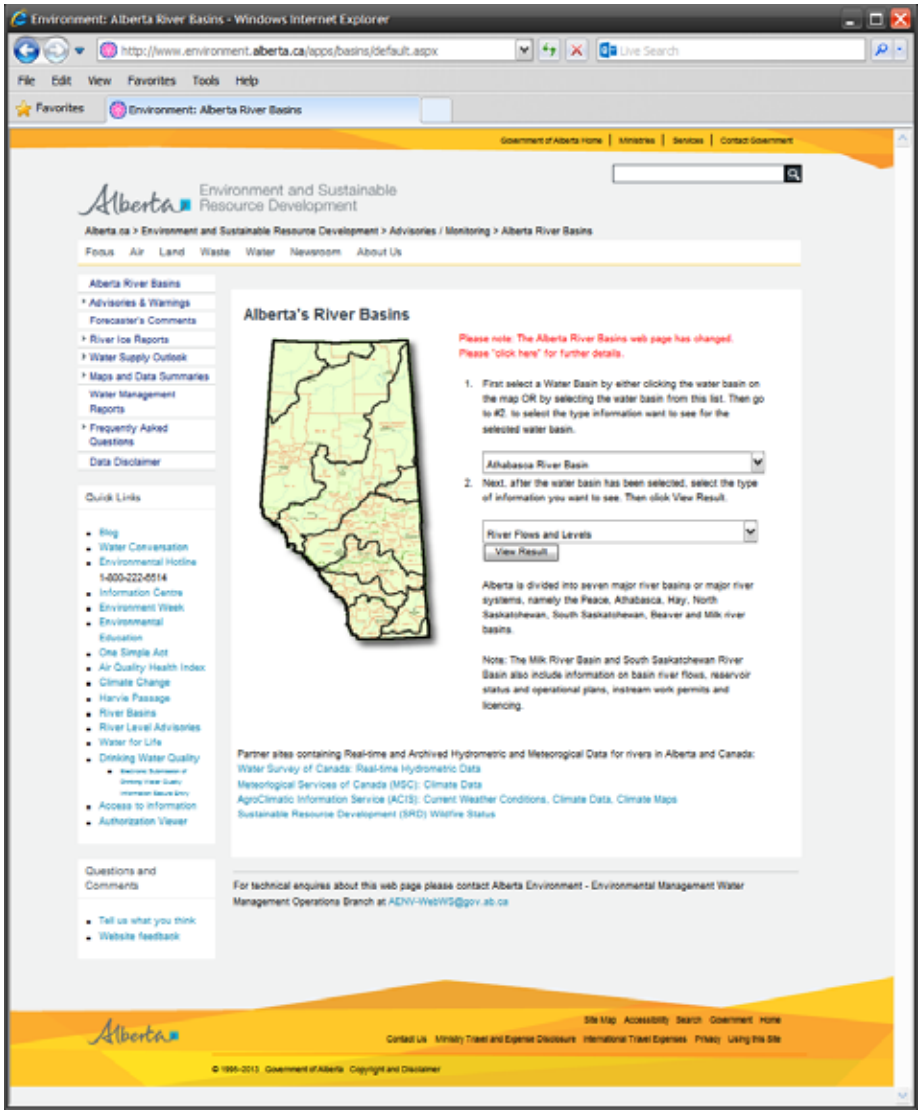
- We acquire data from many sources to support operations
- Many operated through partnerships with other agencies
  - Water Survey Canada
  - Alberta Agriculture and Rural Development
  - TransAlta Utilities, etc.
- ESRD only owns and operates a portion of these stations

  ~100 Met Stations, ~ 45 Hydro Stations
- Collaboration vital for supplying data & supporting our operations
  - ESRD primary focus is near-real-time data

Alberta's River Basin Website

http://www.environment.alberta.ca/apps/basins

- Near-real-time data
  - Water Level & Streamflow
  - Reservoir & Lake levels
  - Snow
  - Meteorological
  - Etc.



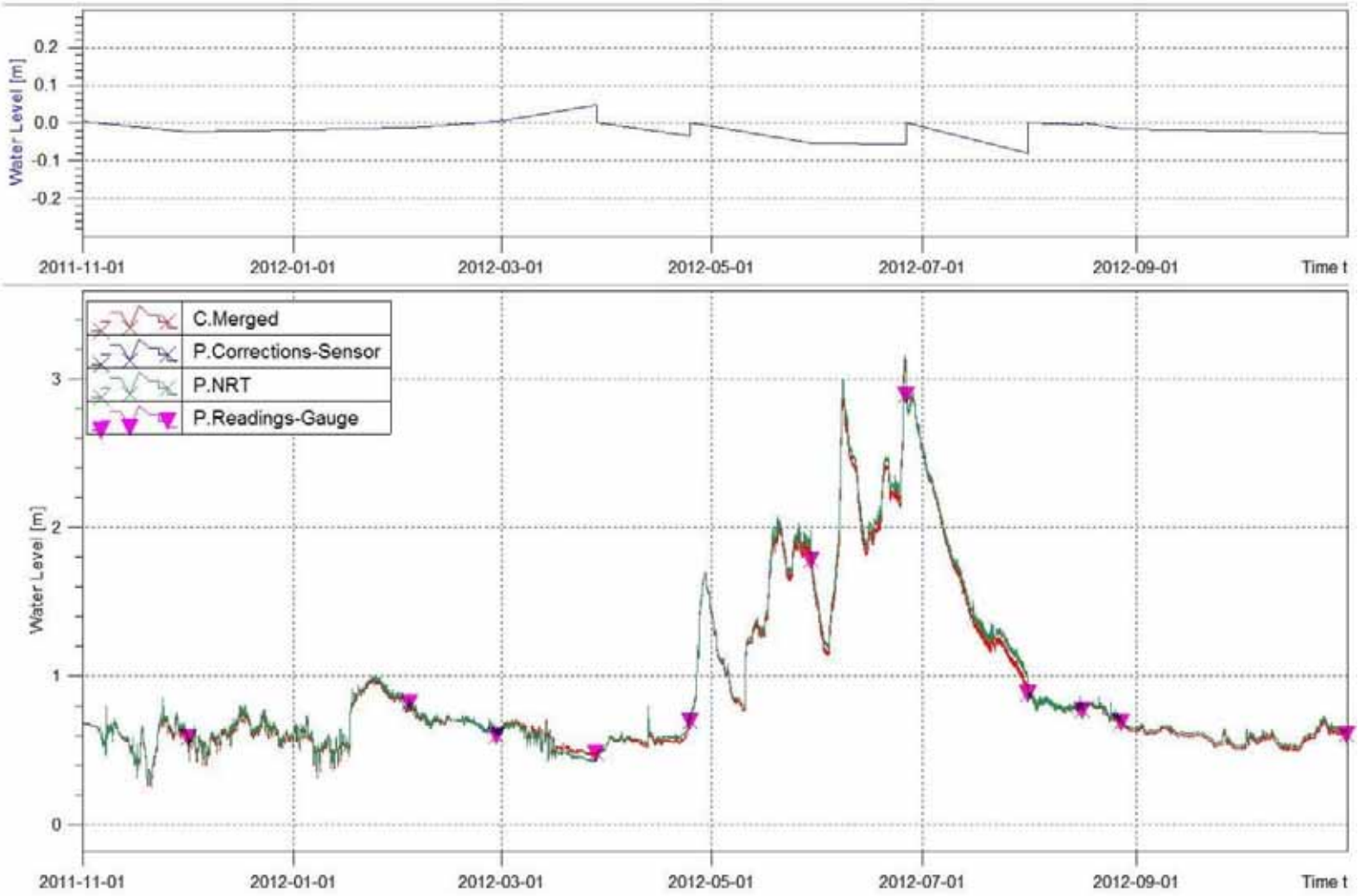
Data Availability: Our Role

- Our mandate is to only QA/QC, manage, and distribute historical data from stations owned and operated by ESRD.
  - ~100 Met Stations, ~ 45 Hydro Stations, Lake Levels
- When third party data is requested, Data Management prefers to re-direct them to the original sources for the final, official archive.
  - Example: WSC publishes historical stream flow
- If not available, we provide the preliminary data
  - Minimum QA/QC processes for internal purposes
  - Subject to revision

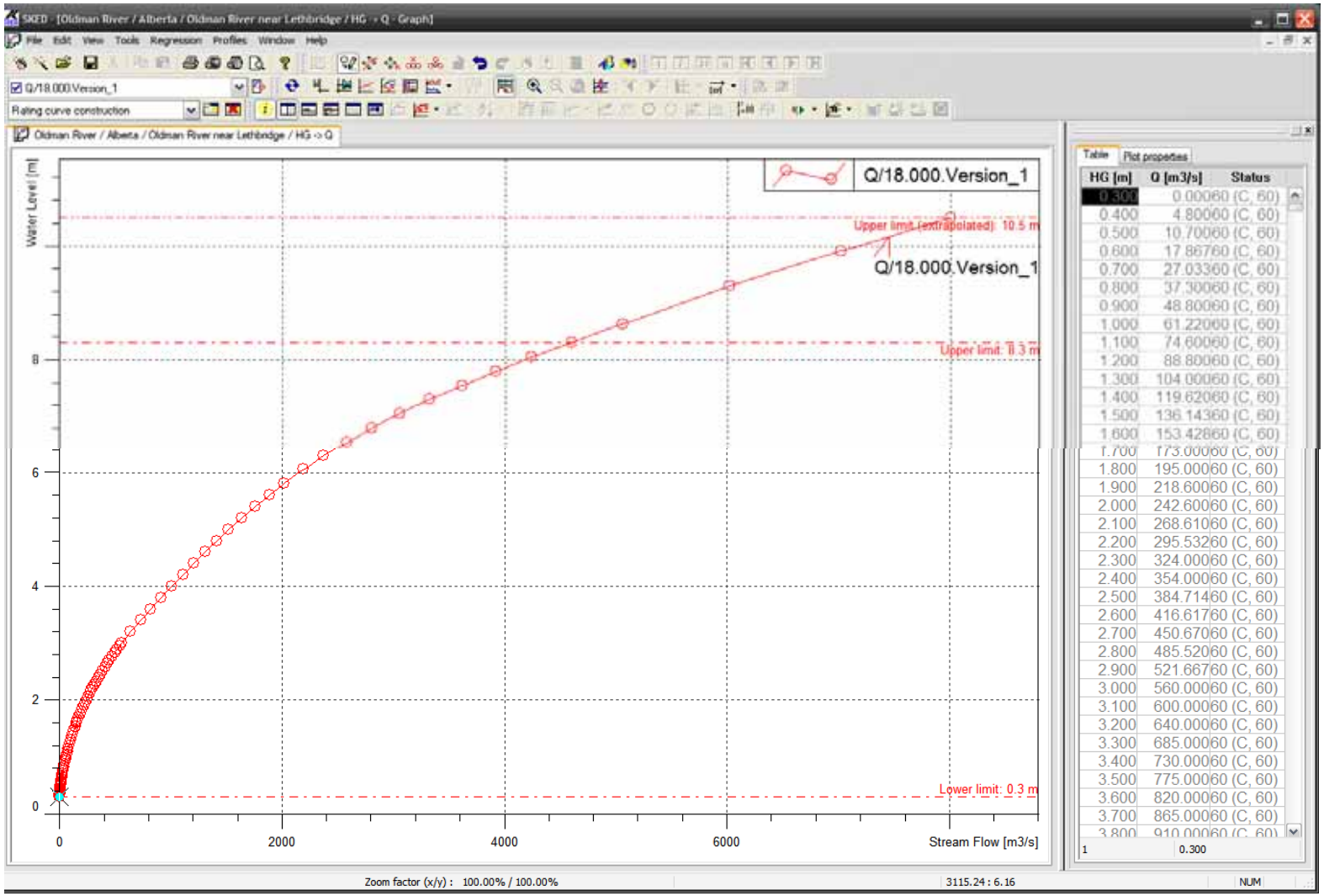
Data Requests: Rivers

- Gauge Height (Water Level)
  - P.NRT (15 minute & before corrections)
  - C.Merged (15 minute & after corrections)
  - A.60 (hourly)
- Streamflow
  - C.Merged-NRT (15 minute)
  - A.60 hourly
  - A.DayMean
  - A.MonthMean
  - A.YearMean

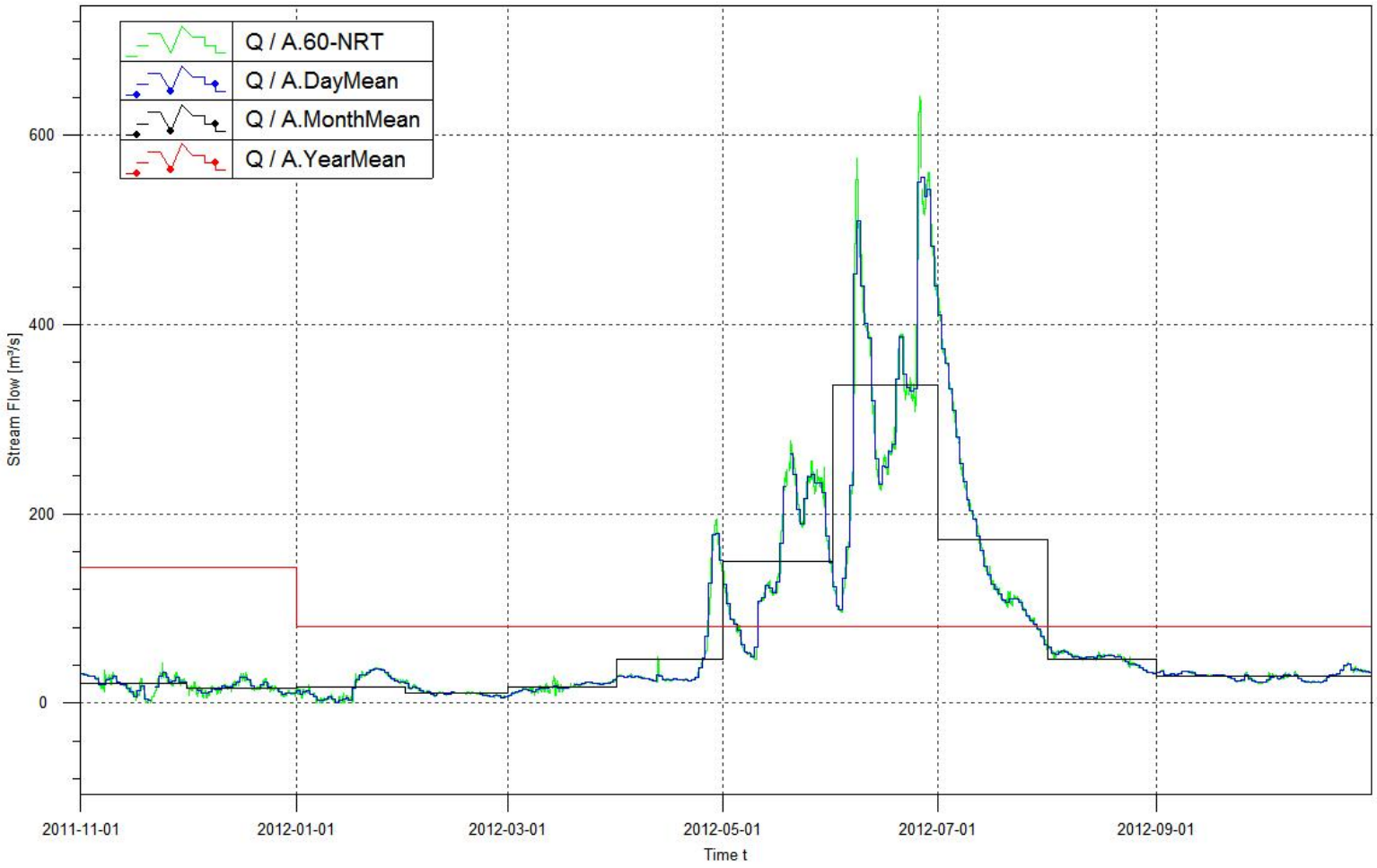
Oldman River near Lethbridge Water Level



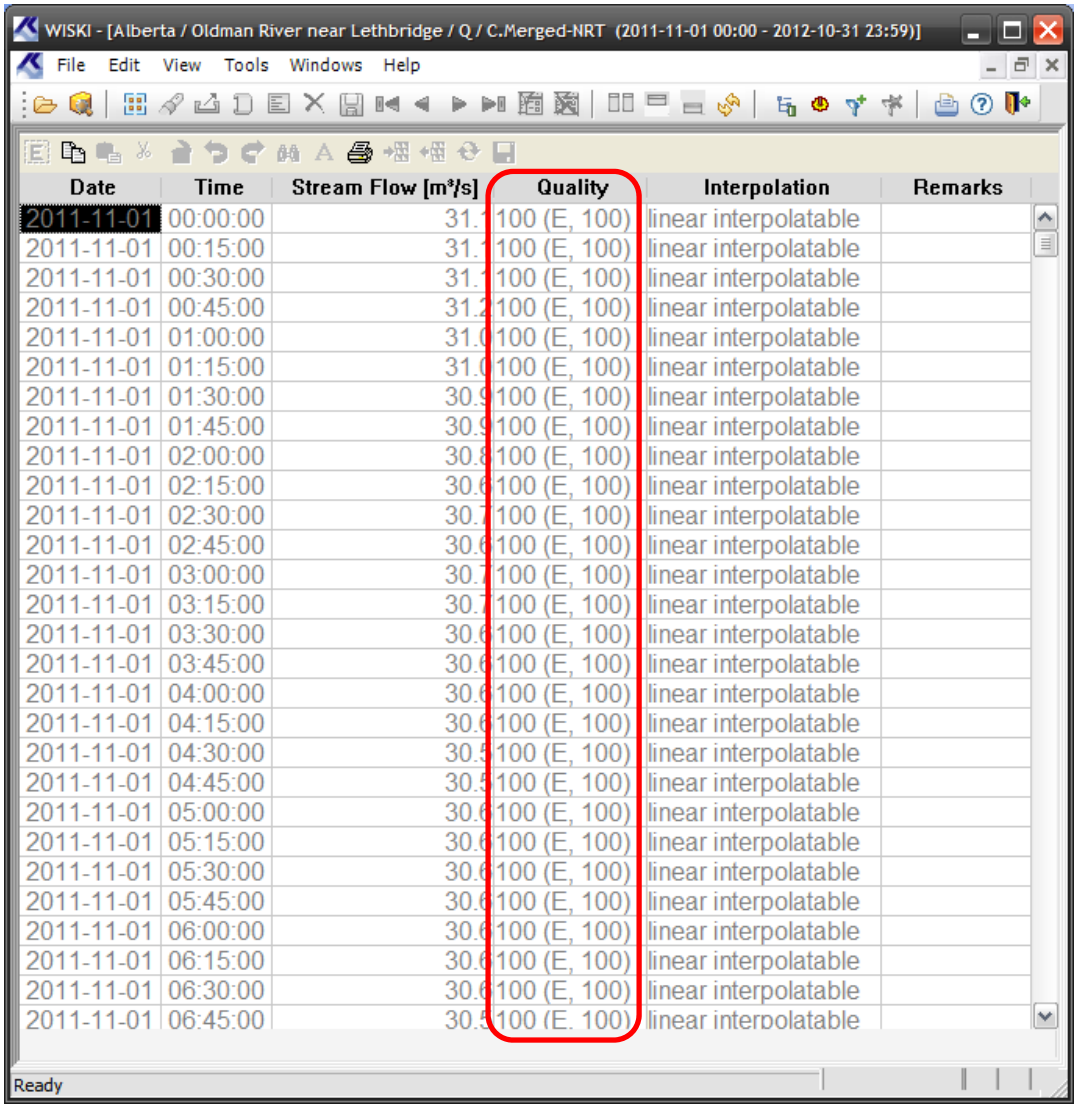
Rating Curve Management
SKED



Oldman River near Lethbridge Streamflow Aggregates



Oldman River near Lethbridge Streamflow: Tabular View

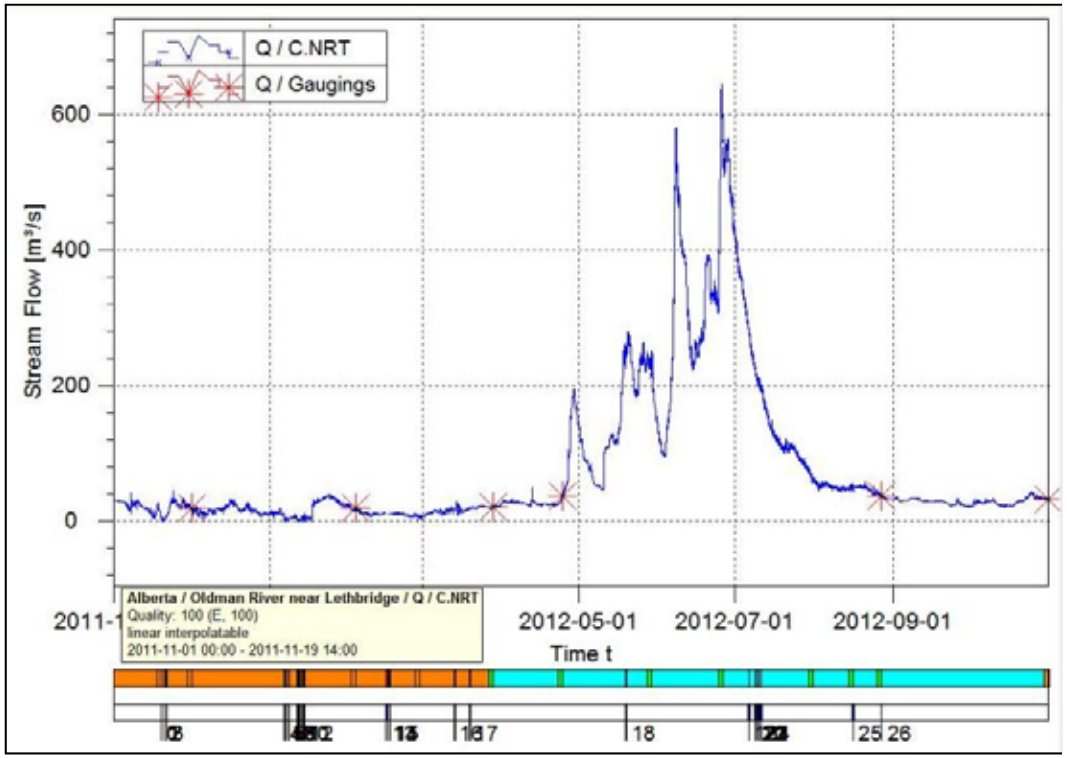


Data Management: Quality Codes

- Each data point has quality code
- Users can define automatic quality flags
- Edited data maintains audit trail

  Tracks:

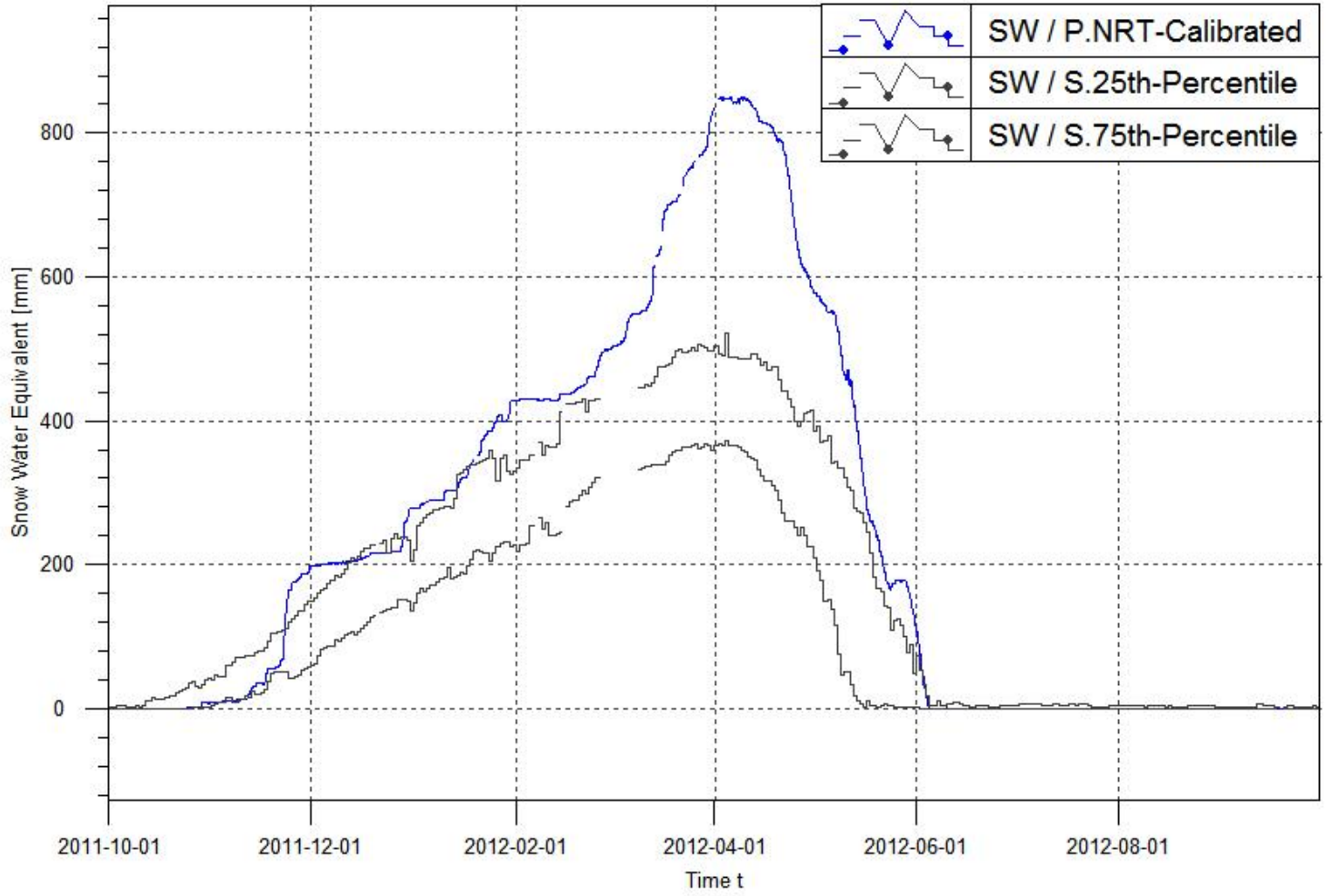
  – User
  – Date edited
  – Time period
  – Descriptions
- Quality codes displayed when graphing



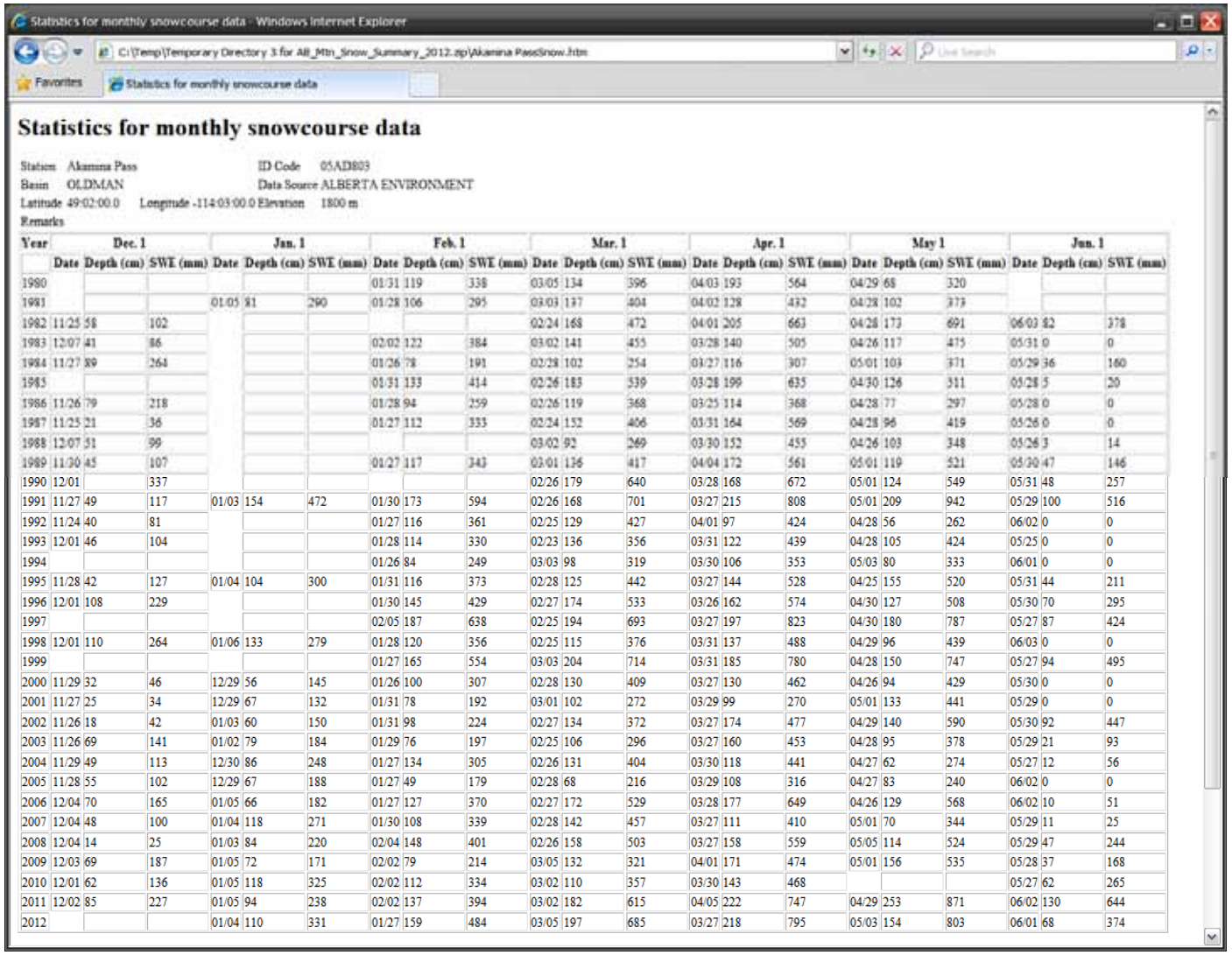
Data Requests: Precipitation

- Precipitation
  - NRT (15 min) accumulated
  - NRT (15 min) de-accumulated
  - Hourly Total
  - Day Total
  - Month Total
  - Year Total
- Snow
  - Snow Pillow
  - Snow Survey (program began ~1970)
    - Depth (once per month)
    - Snow Water Equivalent

Data Requests: Snow Pillow



Data Requests: Snow Course



Statistics for monthly snowcourse data - Windows Internet Explorer

C:\Temp\Temporary Directory 3 for All_Mtn_Snow_Summary_2012.zip\Akamina PassSnow.htm

Favorites | Statistics for monthly snowcourse data

Statistics for monthly snowcourse data

Station Akamina Pass ID Code 05AD803
Basin OLDMAN Data Source ALBERTA ENVIRONMENT
Latitude 49:02:00.0 Longitude -114:03:00.0 Elevation 1800 m
Remarks

Year	Dec. 1			Jan. 1			Feb. 1			Mar. 1			Apr. 1			May 1			Jun. 1		
	Date	Depth (cm)	SWE (mm)	Date	Depth (cm)	SWE (mm)	Date	Depth (cm)	SWE (mm)	Date	Depth (cm)	SWE (mm)	Date	Depth (cm)	SWE (mm)	Date	Depth (cm)	SWE (mm)	Date	Depth (cm)	SWE (mm)
1980							01/31	119	338	03/05	134	396	04/03	193	564	04/29	68	320			
1981				01/05	81	290	01/28	106	295	03/03	137	404	04/02	128	432	04/28	102	373			
1982	11/25	58	102							02/24	168	472	04/01	205	663	04/28	173	691	06/03	82	378
1983	12/07	41	86				02/02	122	384	03/02	141	455	03/28	140	505	04/26	117	475	05/31	0	0
1984	11/27	89	264				01/26	78	191	02/28	102	254	03/27	116	307	05/01	103	371	05/29	36	160
1985							01/31	133	414	02/26	183	539	03/28	199	635	04/30	126	511	05/28	5	20
1986	11/26	79	218				01/28	94	259	02/26	119	368	03/25	114	368	04/28	77	297	05/28	0	0
1987	11/25	21	36				01/27	112	333	02/24	152	406	03/31	164	569	04/28	96	419	05/26	0	0
1988	12/07	51	99							03/02	92	269	03/30	152	455	04/26	103	348	05/26	3	14
1989	11/30	45	107				01/27	117	343	03/01	136	417	04/04	172	561	05/01	119	521	05/30	47	146
1990	12/01		337							02/26	179	640	03/28	168	672	05/01	124	549	05/31	48	257
1991	11/27	49	117	01/03	154	472	01/30	173	594	02/26	168	701	03/27	215	808	05/01	209	942	05/29	100	516
1992	11/24	40	81				01/27	116	361	02/25	129	427	04/01	97	424	04/28	56	262	06/02	0	0
1993	12/01	46	104				01/28	114	330	02/23	136	356	03/31	122	439	04/28	105	424	05/25	0	0
1994							01/26	84	249	03/03	98	319	03/30	106	353	05/03	80	333	06/01	0	0
1995	11/28	42	127	01/04	104	300	01/31	116	373	02/28	125	442	03/27	144	528	04/25	155	520	05/31	44	211
1996	12/01	108	229				01/30	145	429	02/27	174	533	03/26	162	574	04/30	127	508	05/30	70	295
1997							02/05	187	638	02/25	194	693	03/27	197	823	04/30	180	787	05/27	87	424
1998	12/01	110	264	01/06	133	279	01/28	120	356	02/25	115	376	03/31	137	488	04/29	96	439	06/03	0	0
1999							01/27	165	554	03/03	204	714	03/31	185	780	04/28	150	747	05/27	94	495
2000	11/29	32	46	12/29	56	145	01/26	100	307	02/28	130	409	03/27	130	462	04/26	94	429	05/30	0	0
2001	11/27	25	34	12/29	67	132	01/31	78	192	03/01	102	272	03/29	99	270	05/01	133	441	05/29	0	0
2002	11/26	18	42	01/03	60	150	01/31	98	224	02/27	134	372	03/27	174	477	04/29	140	590	05/30	92	447
2003	11/26	69	141	01/02	79	184	01/29	76	197	02/25	106	296	03/27	160	453	04/28	95	378	05/29	21	93
2004	11/29	49	113	12/30	86	248	01/27	134	305	02/26	131	404	03/30	118	441	04/27	62	274	05/27	12	56
2005	11/28	55	102	12/29	67	188	01/27	49	179	02/28	68	216	03/29	108	316	04/27	83	240	06/02	0	0
2006	12/04	70	165	01/05	66	182	01/27	127	370	02/27	172	529	03/28	177	649	04/26	129	568	06/02	10	51
2007	12/04	48	100	01/04	118	271	01/30	108	339	02/28	142	457	03/27	111	410	05/01	70	344	05/29	11	25
2008	12/04	14	25	01/03	84	220	02/04	148	401	02/26	158	503	03/27	158	559	05/05	114	524	05/29	47	244
2009	12/03	69	187	01/05	72	171	02/02	79	214	03/05	132	321	04/01	171	474	05/01	156	535	05/28	37	168
2010	12/01	62	136	01/05	118	325	02/02	112	334	03/02	110	357	03/30	143	468				05/27	62	265
2011	12/02	85	227	01/05	94	238	02/02	137	394	03/02	182	615	04/05	222	747	04/29	253	871	06/02	130	644
2012				01/04	110	331	01/27	159	484	03/05	197	685	03/27	218	795	05/03	154	803	06/01	68	374

Data Requests: MSLL

- Miscellaneous Stream and Lake Levels
- ~ 250 active Lakes monitored
  - Many discontinued Lakes
- WL measured at least 3 times per year
- 30+ years of data
- Data not available on web

STA_NBR	STA_NM	LS_DATE	LS_ELEV	LS_COMMENT
05CE902	PINE LAKE NEAR PINE LAKE	13-Oct-12	889.313	Staff Gauge Survey
05CE902	PINE LAKE NEAR PINE LAKE	24-Oct-12	889.278	Staff Gauge Survey
05CE902	PINE LAKE NEAR PINE LAKE	27-Oct-12	889.237	Staff Gauge Survey
05CE902	PINE LAKE NEAR PINE LAKE	05-Nov-12	889.285	Normal Level Survey
05CE902	PINE LAKE NEAR PINE LAKE	16-May-13	889.554	Normal Level Survey

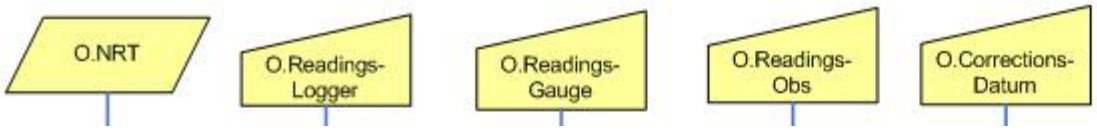
- Miscellaneous Steams monitored by ESRD
  - Non-recording sites for projects, etc.
  - Hundreds of sites

Resources & Contacts

- Alberta's River Basin Website
  http://www.environment.alberta.ca/apps/basins
- ESRD Surface Water Quantity Data Requests
  AENV.dmNRT@gov.ab.ca
  adam.minke@gov.ab.ca
- Alberta Agriculture and Rural Development
  http://agriculture.alberta.ca/acis/
- Alberta Groundwater Observation Well Network (GOWN)
  http://environment.alberta.ca/apps/GOWN/
- ESRD Water Quality Data Requests
  swq.requests@gov.ab.ca
- Water Survey of Canada
  www.ec.gc.ca/rhc-wsc
- Meteorological Service of Canada
  http://climate.weather.gc.ca/index_e.html
  climate.services@ec.gc.ca


Alberta

Type 4 River Station: NRT Water Level (HG)



Type 4 River Station: NRT Flow (Q)