Total Dissolved Gas Monitoring 2009: Chief Joseph Dam, Albeni Falls Dam, and Libby Dam

TDG Monitoring 2009

- Introduction
  - 5 monitoring sites
    - Libby tailwater
    - Chief Joseph forebay and tailwater
    - Albeni Falls forebay and tailwater
  - Seasonal sites (April 1 – September 30)
  - Sites calibrated every two weeks
    - COE data quality criteria
    - Laboratory calibrations
    - Field calibrations
    - Performance checks

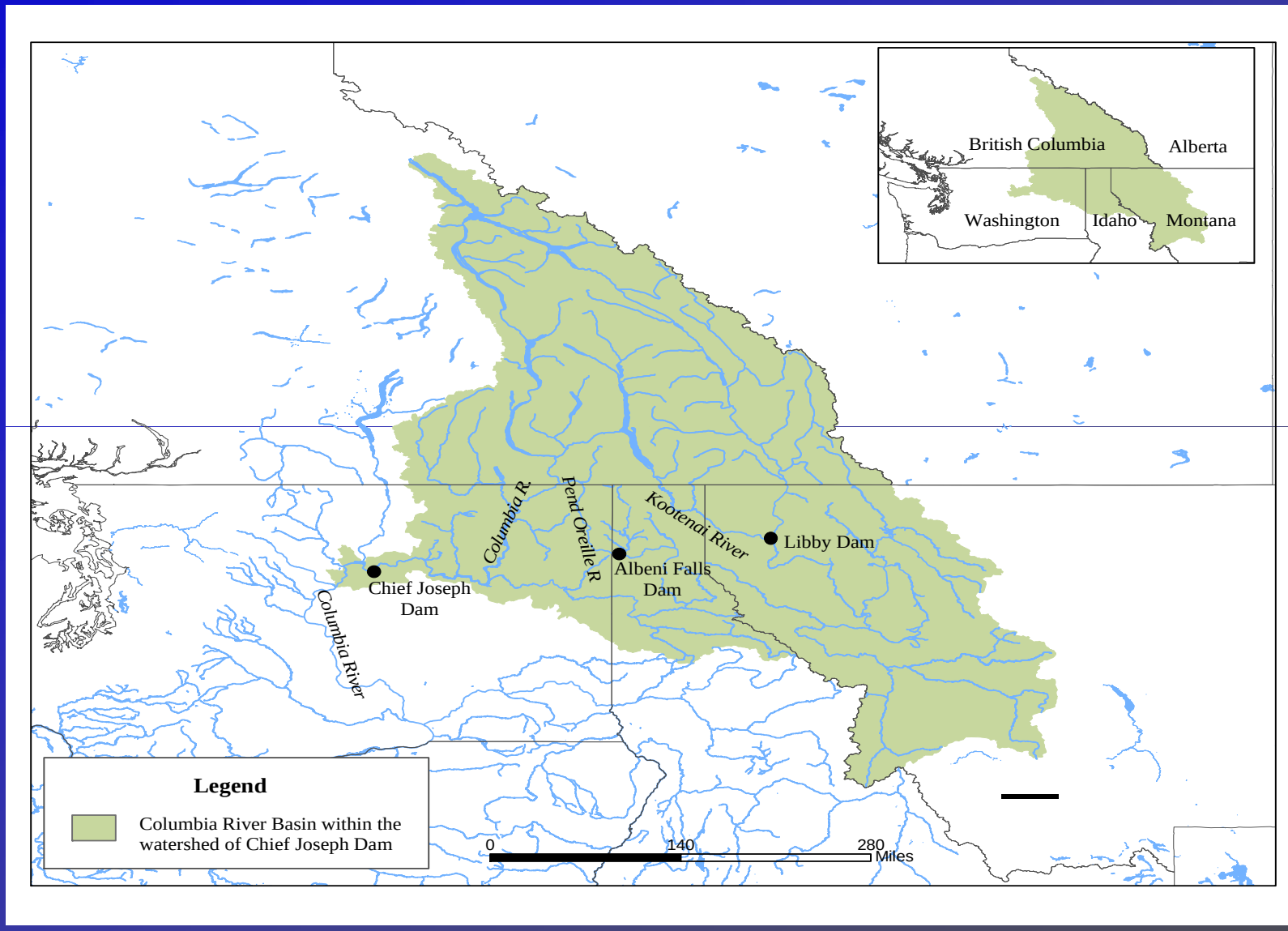
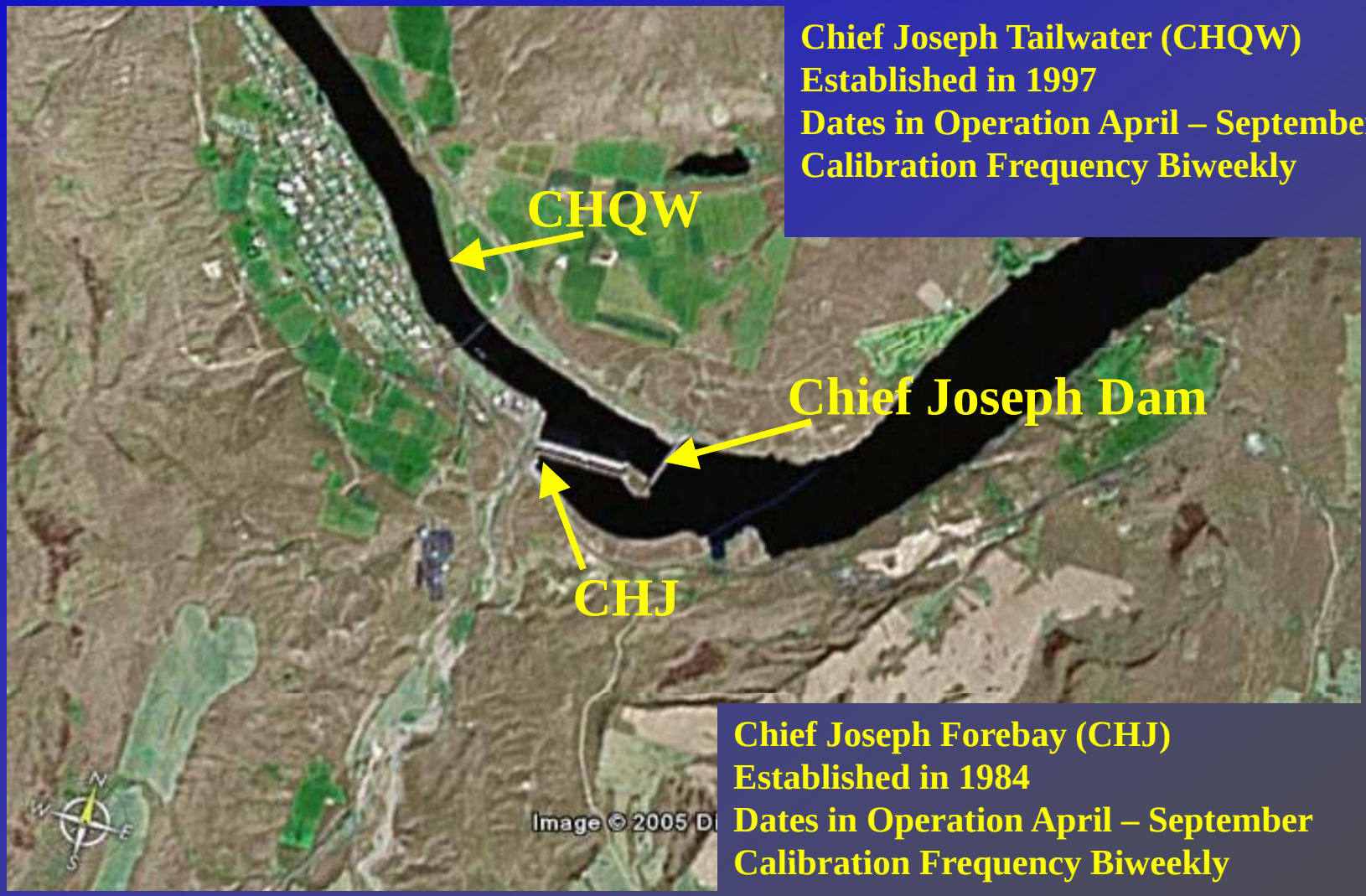


Figure 1. Location of the Seattle District's projects in the Upper Columbia River Basin.

TDG Monitoring 2009

- Chief Joseph
  - Equipment
    - Hydrolab MiniSonde 4a TDG sensor/Common Sensing barometer
    - Sutron 9210 XLite DCP, AC Power
    - Radio transmission and GOES station
- Albeni Falls
  - Equipment
    - Hydrolab MiniSonde 4a TDG sensor/Common Sensing barometer
    - Sutron 9210 XLite DCP, AC and Solar Power
    - Radio transmission station
- Libby
  - Equipment
    - Hydrolab MiniSonde 4a TDG sensor/Common Sensing barometer
    - Sutron 9210 XLite DCP, Solar Power
    - Radio transmission station

TDG Monitoring 2009

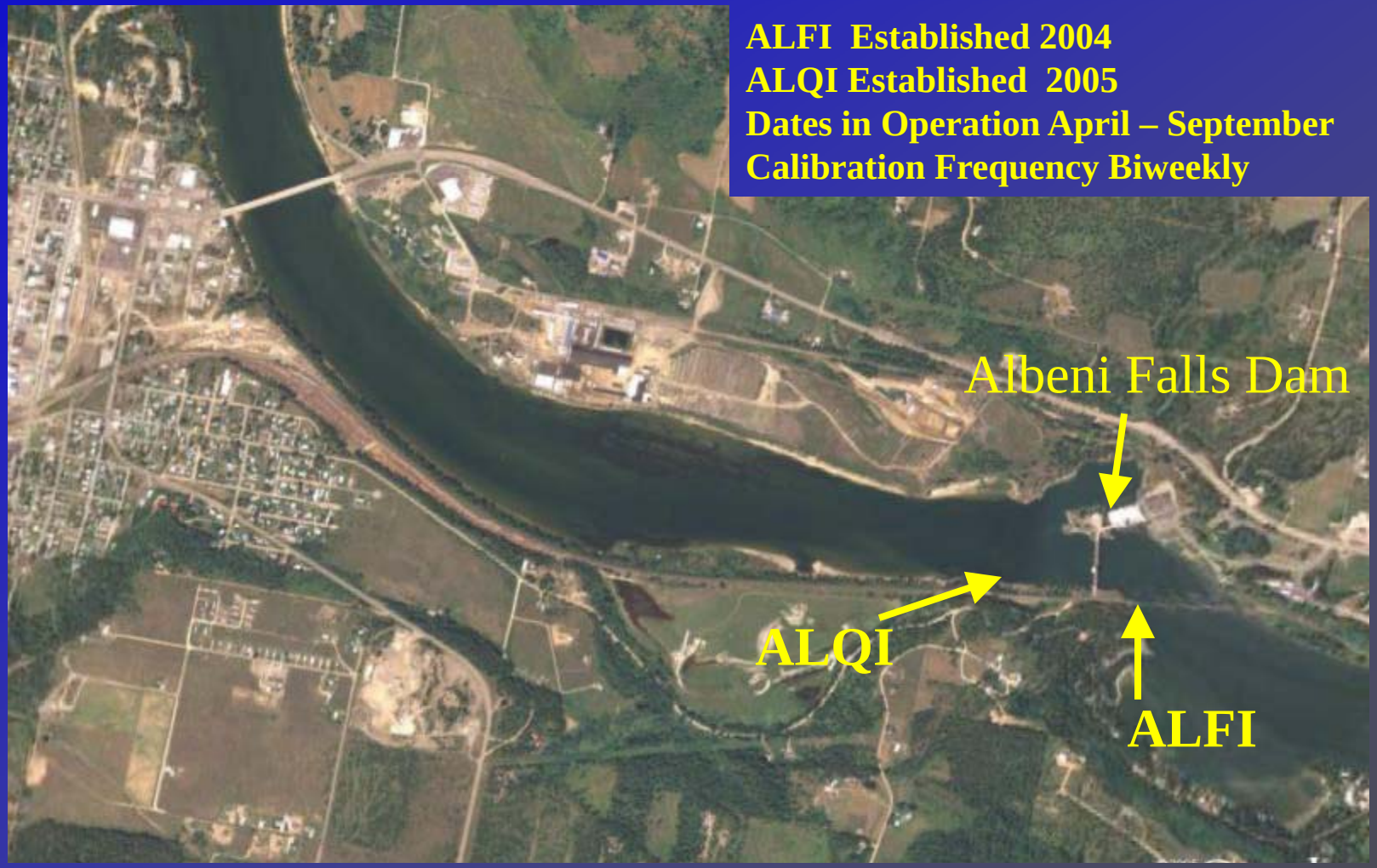


Chief Joseph Tailwater (CHQW)
Established in 1997
Dates in Operation April – September
Calibration Frequency Biweekly

Chief Joseph Forebay (CHJ)
Established in 1984
Dates in Operation April – September
Calibration Frequency Biweekly

Chief Joseph Total Dissolved Gas Monitoring System

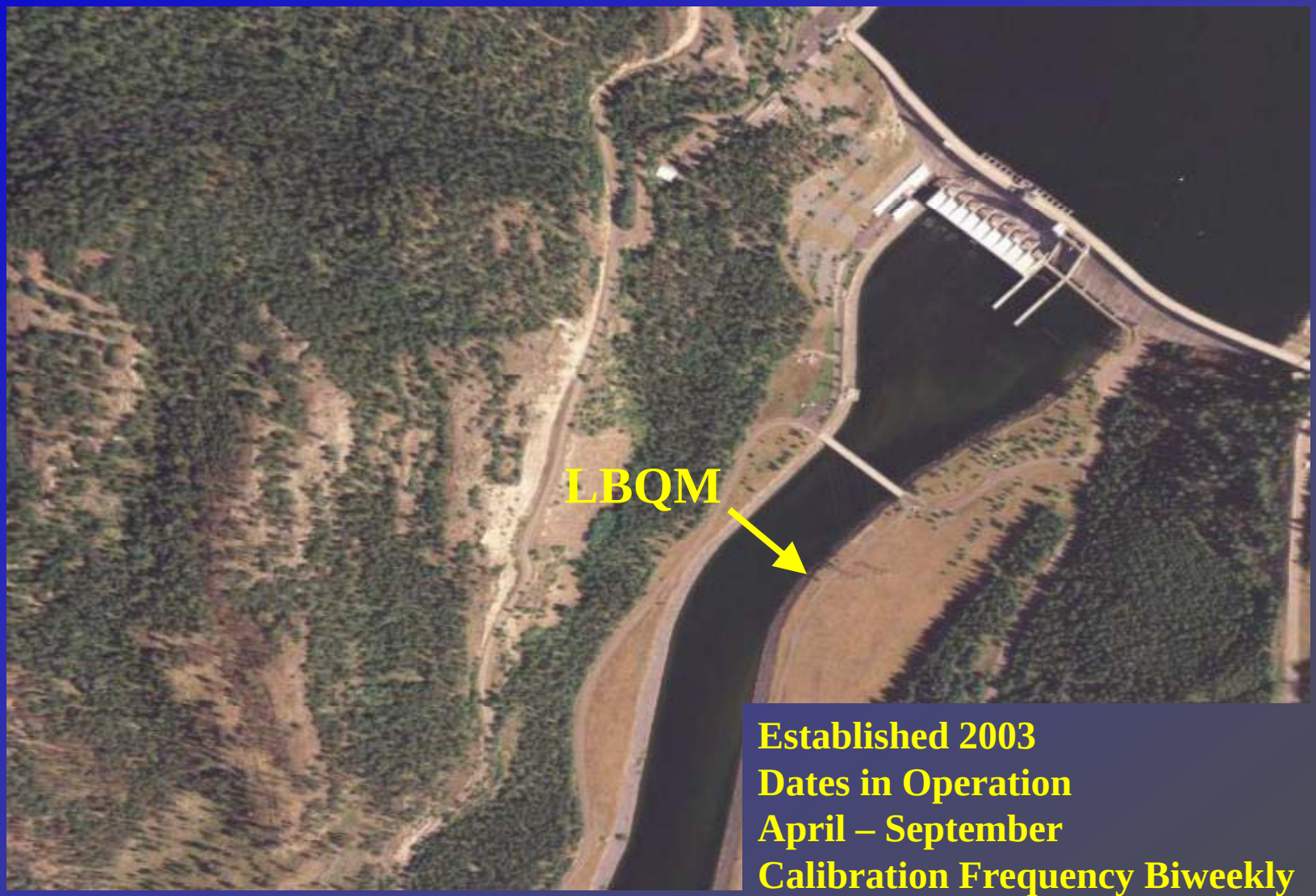
TDG Monitoring 2009



ALFI Established 2004
ALQI Established 2005
Dates in Operation April – September
Calibration Frequency Biweekly

Albeni Falls Total Dissolved Gas Monitoring System

TDG Monitoring 2009



Established 2003
Dates in Operation
April – September
Calibration Frequency Biweekly

Libby Dam Total Dissolved Gas Monitoring System

TDG Data Completeness 2009

Station Name	Station Abbreviation	Planned monitoring in hours	Number of missing hourly values	Percentage of real-time TDG monitoring data received	Percentage of real-time TDG data received and passing quality assurance
Chief Joseph Forebay	CHJ	4392	90	98.0	98.0
Chief Joseph Tailwater	CHQW	4392	93	97.9	97.9
Albeni Falls Forebay	ALFI	4392	35	99.2	99.2
Albeni Falls Tailwater	ALQI	4392	269	93.9	90.1
Libby Tailwater	LBQM	4392	54	98.8	98.8

Temperature Data Completeness 2009

Station Name	Station Abbreviation	Planned monitoring in hours	Number of missing hourly values	Percentage of real-time Temperature monitoring data received	Percentage of real-time Temperature data received and passing quality assurance
Chief Joseph Forebay	CHJ	4392	91	97.9	97.9
Chief Joseph Tailwater	CHQW	4392	93	97.9	97.9
Albeni Falls Forebay	ALFI	4392	28	99.4	99.4
Albeni Falls Tailwater	ALQI	4392	269	93.9	92.3
Libby Tailwater	LBQM	4392	53	98.8	98.8

TDG Monitoring 2009

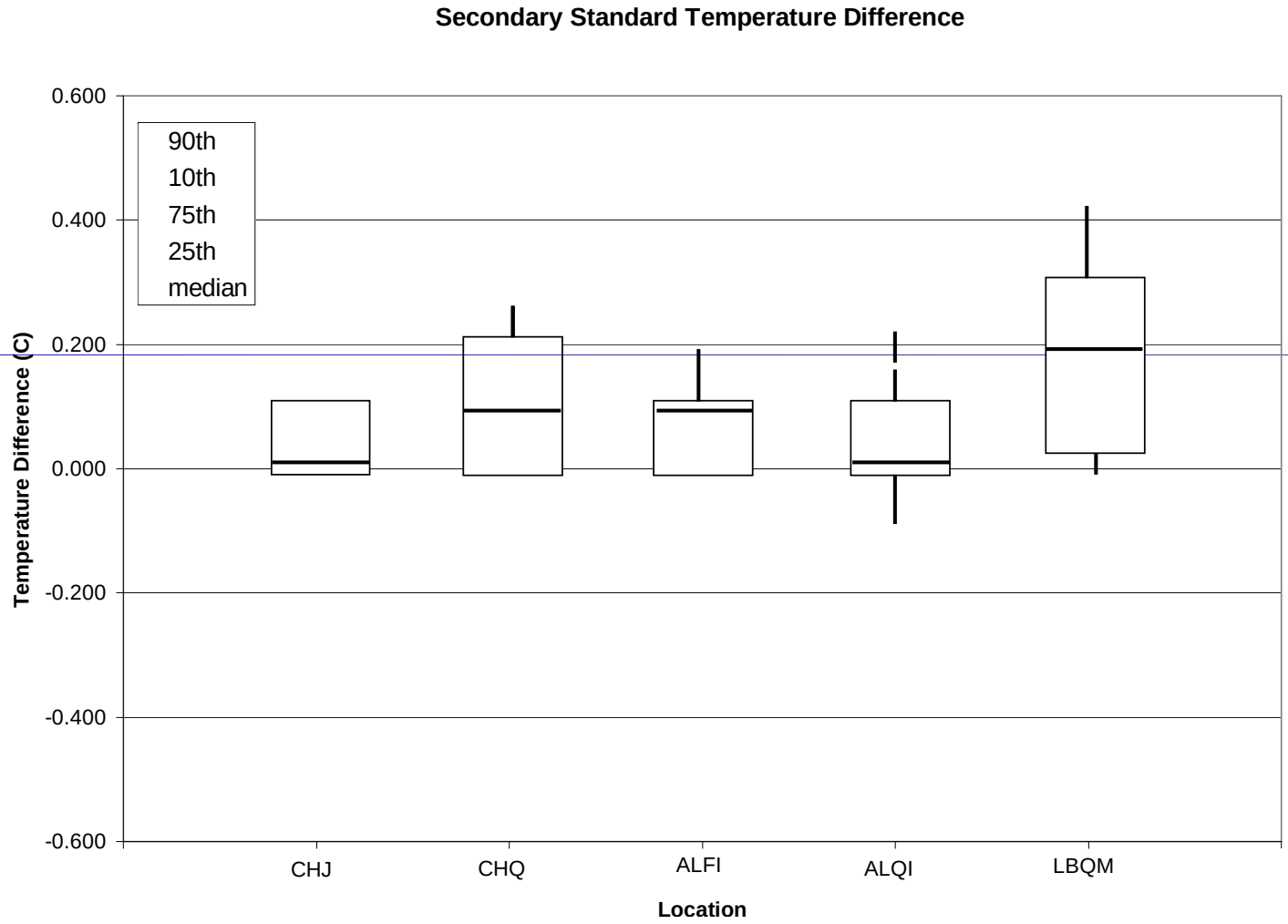
- Overview of 2009 TDG and Temperature Data
  - Data completeness
    - Chief Joseph Forebay (CHJ) and Tailwater (CHQW)
      - DCP malfunctions and programming problems
    - Albeni Falls Forebay (ALFI) and Tailwater (ALQI)
      - DCP malfunctions and programming problems
      - Probe out of water
    - Libby Tailwater (LBQM)
      - DCP malfunctions and programming problems
      - Lightning strikes

TDG and Temperature QA/QC 2009

	Temperature	Total Dissolved Gas Pressure (% Saturation)			
	°C	100%	113%	126%	139%
N	77	77.00	77.00	77.00	77.00
Minimum	-0.05	-0.41	-0.28	-0.28	-0.41
Maximum	0.11	1.24	1.10	0.82	0.77
Median	0.04	0.04	0.04	0.04	-0.04
Average	0.05	0.02	0.05	0.04	-0.02
Standard Deviation	0.04	0.20	0.19	0.17	0.17

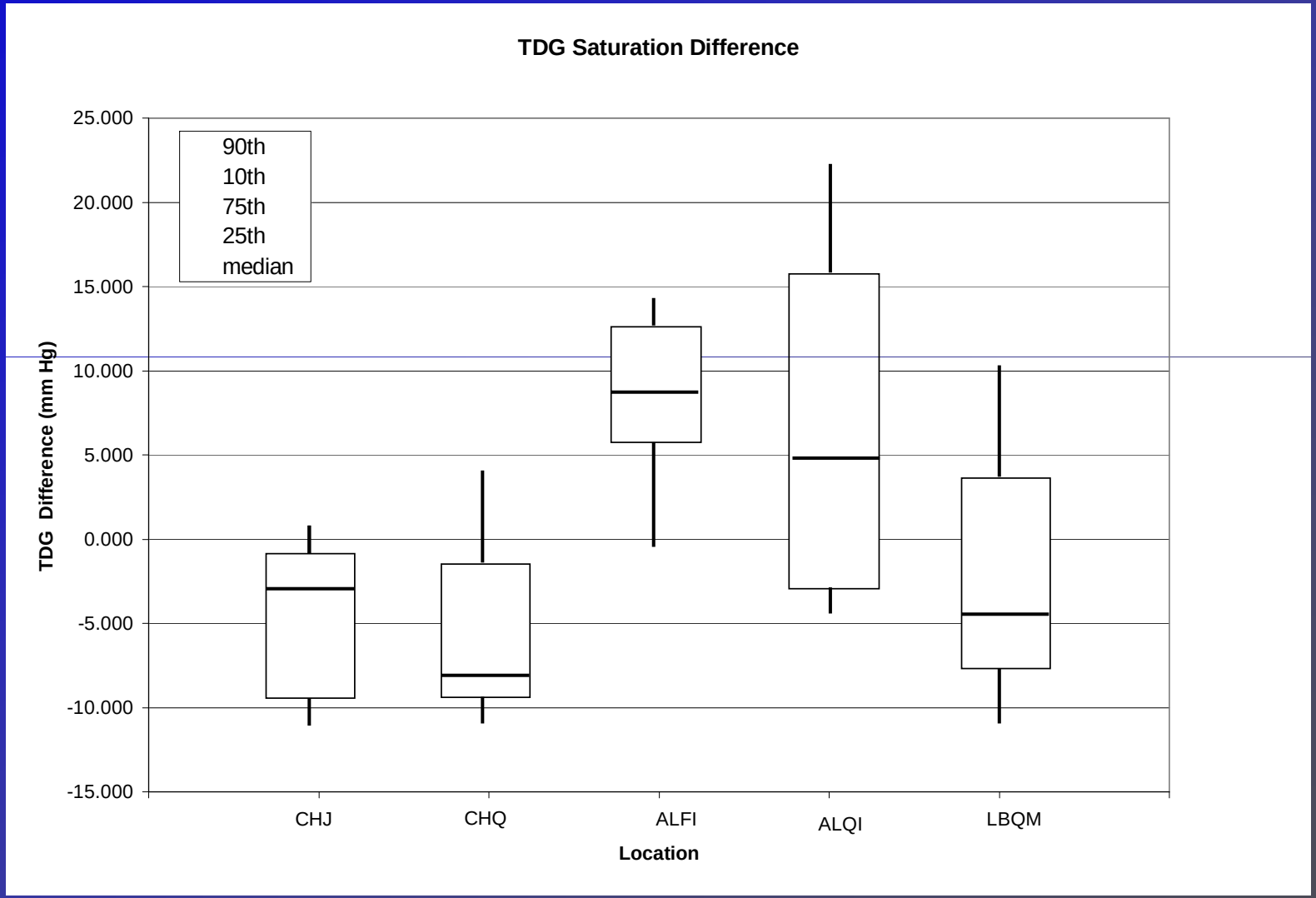
Difference between the primary standard and total dissolved gas instrument.

TDG and Temperature QA/QC 2009



Difference between the secondary standard and the field thermometer

TDG and Temperature QA/QC 2009



Difference between the secondary standard and the TDG instrument

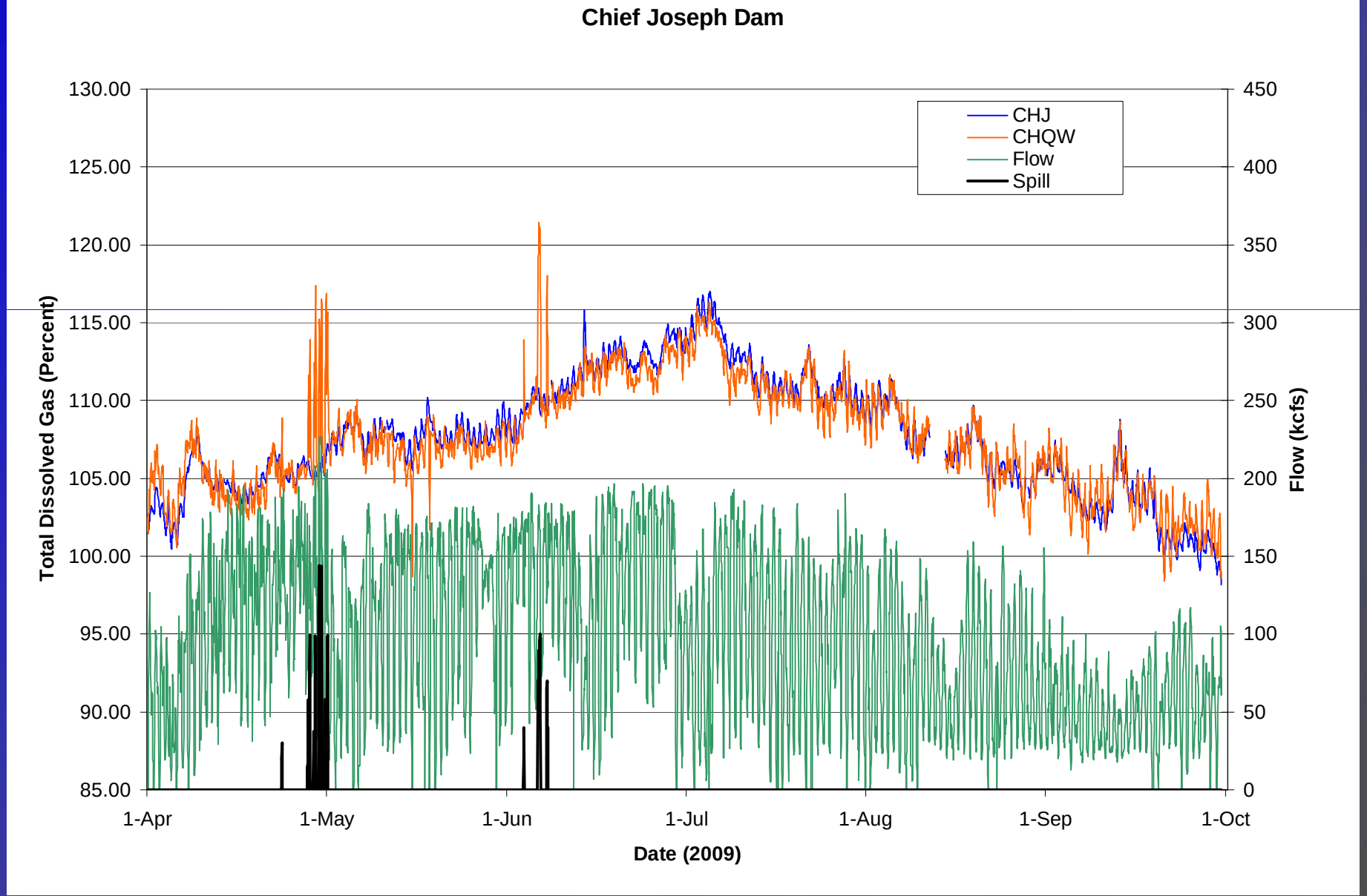
TDG Monitoring 2009

- Overview of 2009 Data QA/QC
  - Laboratory calibration data were good and within 0.1 º C for temperature and 1% saturation for TDG
  - Field calibration data for temperature were good and generally within 0.2ºC of the secondary standard thermometer
  - Field calibration data for TDG were generally within 10 mm Hg of the secondary standard TDG instrument
  - Field calibration problems were encountered at station ALFI and ALQI

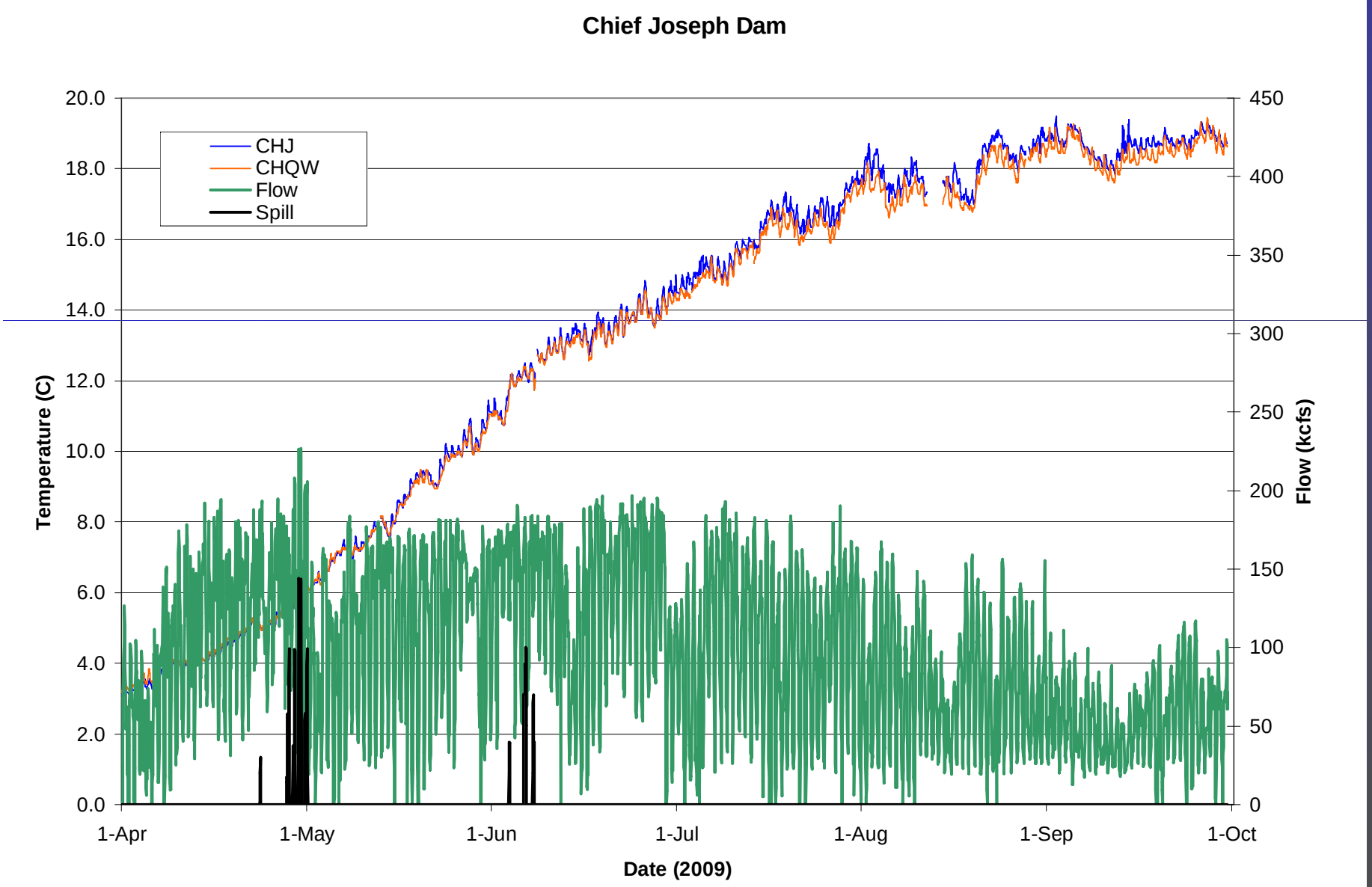
TDG Monitoring 2009

- 2009 Spill Season Results for Chief Joseph Dam
  - TDG-Forebay (CHJ)
    - Exceeded 110% from about Mid May to August
    - Forebay TDG levels were a function of Grand Coulee tailwater TDG levels
    - Maximum TDG of about 116%
  - TDG-Tailwater (CHQW)
    - Exceeded 110% from Mid May to August
    - Maximum TDG of about 122% during a 95 kcfs spill
    - Deflectors reduced TDG to system
  - Temperature-Forebay/Tailwater
    - Forebay temperatures exceeded the CCT standard (16ºC) from about Mid July through the end of sampling on Sept 30, and the WDOE standard (18 ºC) from about Mid August through the end of sampling on Sept 30
    - Tailwater temperatures exceeded the WDOE and CCT standard (18ºC) from about Mid August through the end of sampling on Sept 30

TDG Monitoring 2009



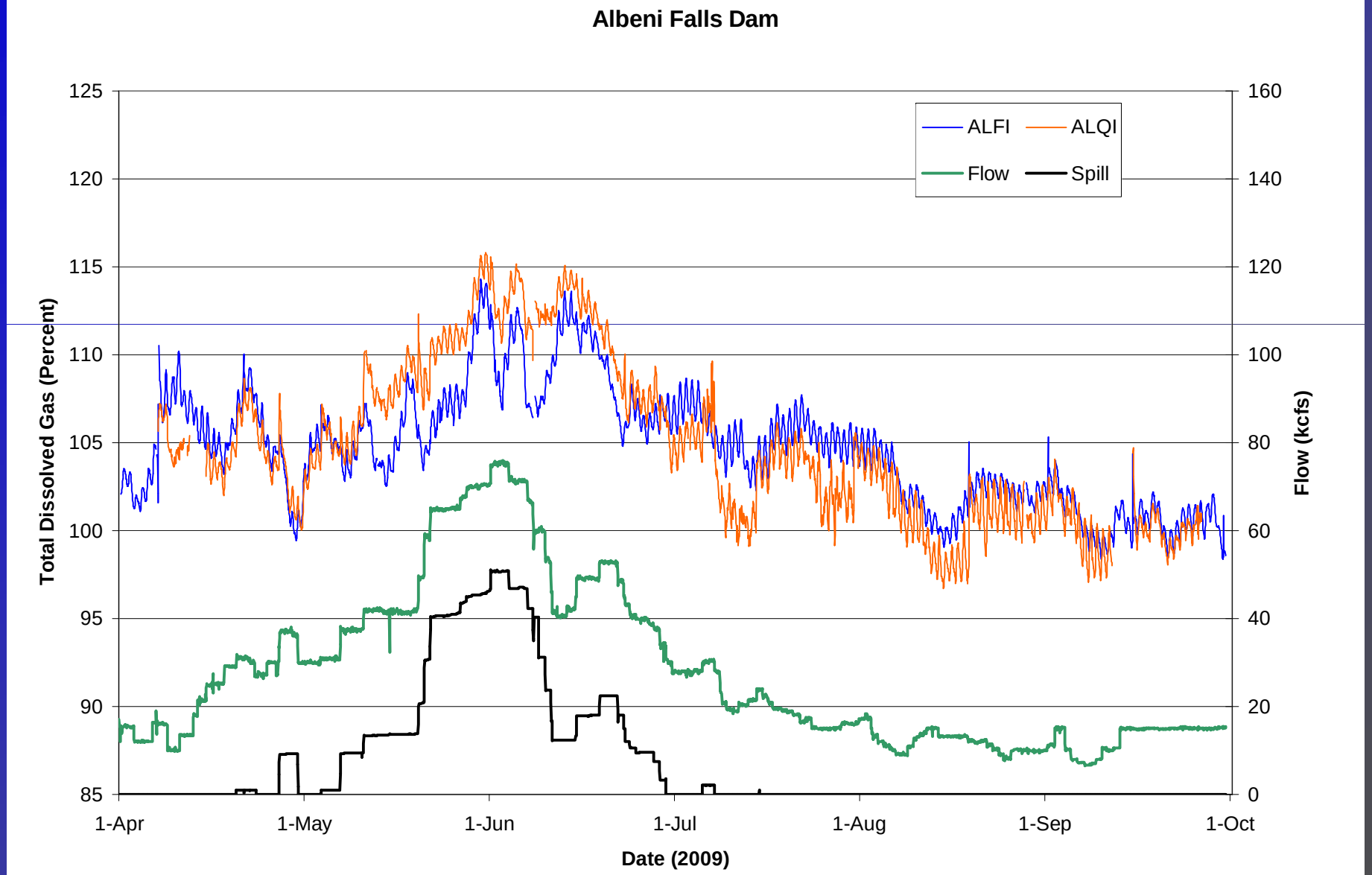
TDG Monitoring 2009



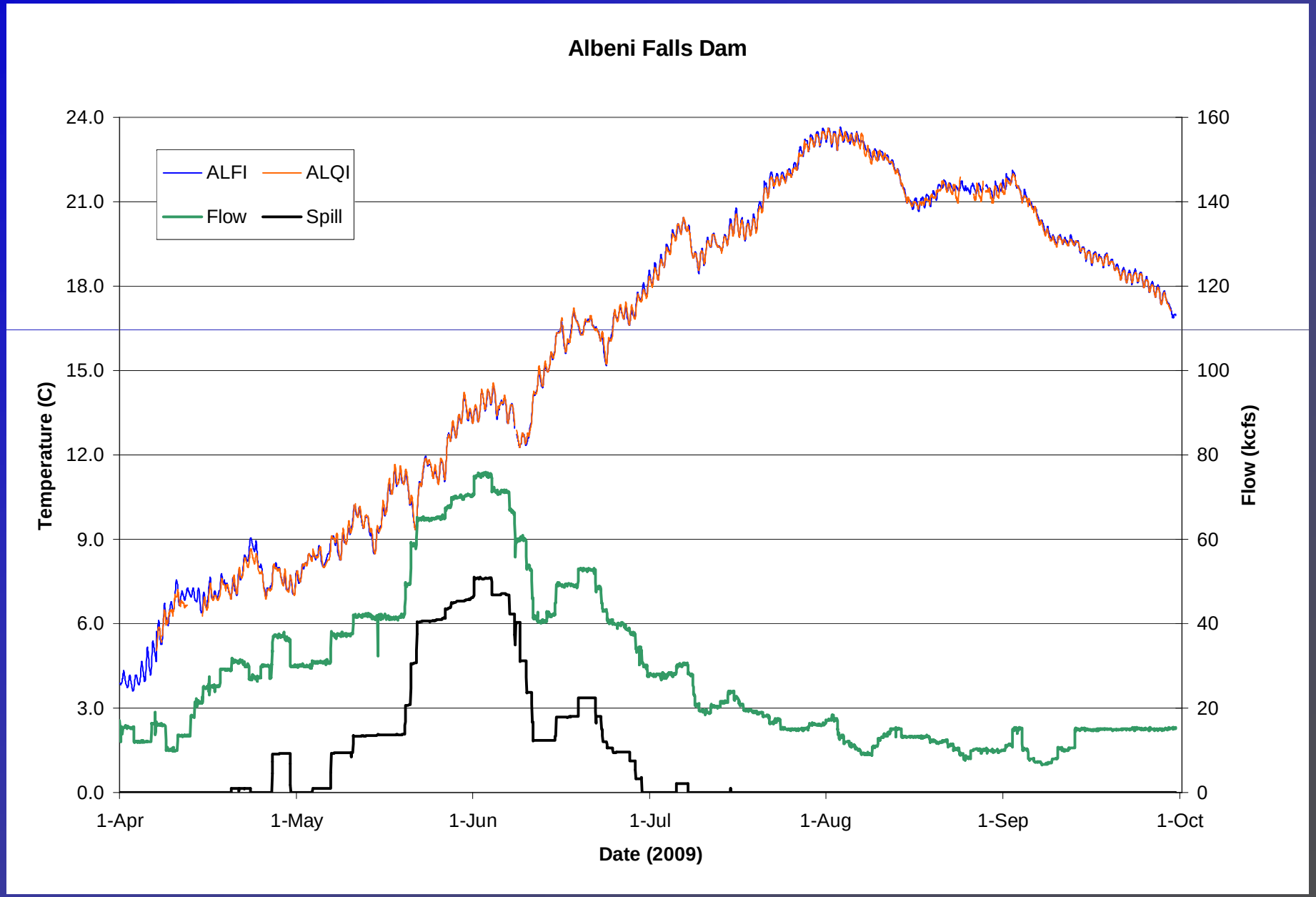
TDG Monitoring 2009

- 2009 Spill Season Results for Albeni Falls Dam
  - TDG-Forebay (ALFI)
    - Exceeded 110% periodically from the end of May through the end of June
    - Forebay TDG levels were largely a function of upstream TDG levels
  - TDG-Tailwater (ALFW and ALQI)
    - Exceeded 110% periodically from the middle of May through the end of June
    - Highest TDG value recorded was about 115%
    - Higher spill volumes did not produce higher TDG saturations
    - TDG saturations largely a function of forebay TDG, head, and number of spillbays used
  - Temperature-Forebay/Tailwater
    - Forebay and tailwater exceeded IDEQ daily average temperature standard (19ºC) from about July through the end of August
    - Forebay and tailwater exceeded IDEQ maximum daily temperature standard (22ºC) from about mid July through mid August

TDG Monitoring 2009



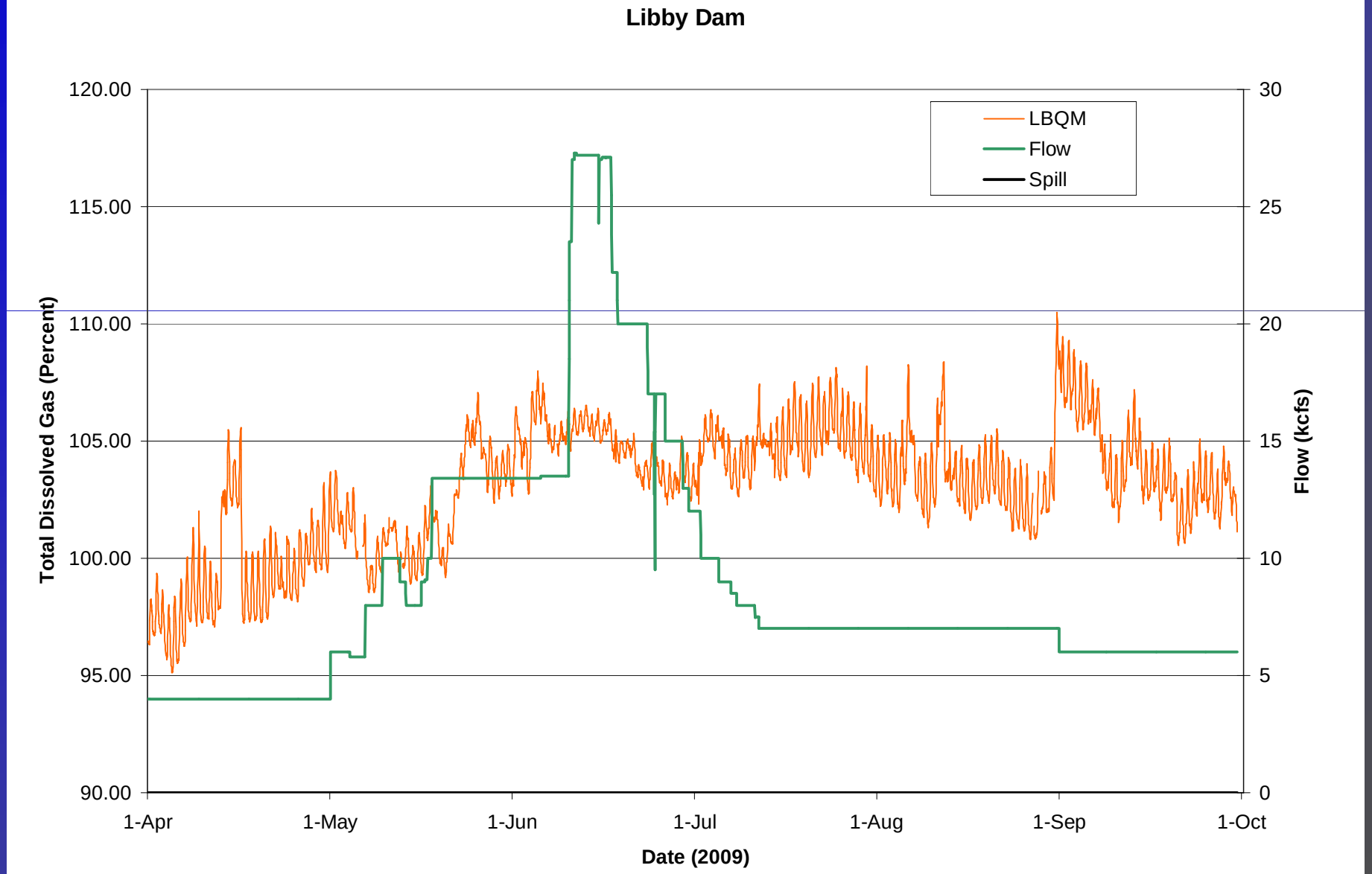
TDG Monitoring 2009



TDG Monitoring 2009

- 2009 Spill Season Results for Libby Dam
  - No Spill during 2008
  - TDG exceeded 110% in September
  - Temperature did not exceed 18C

TDG Monitoring 2009



TDG Monitoring 2009