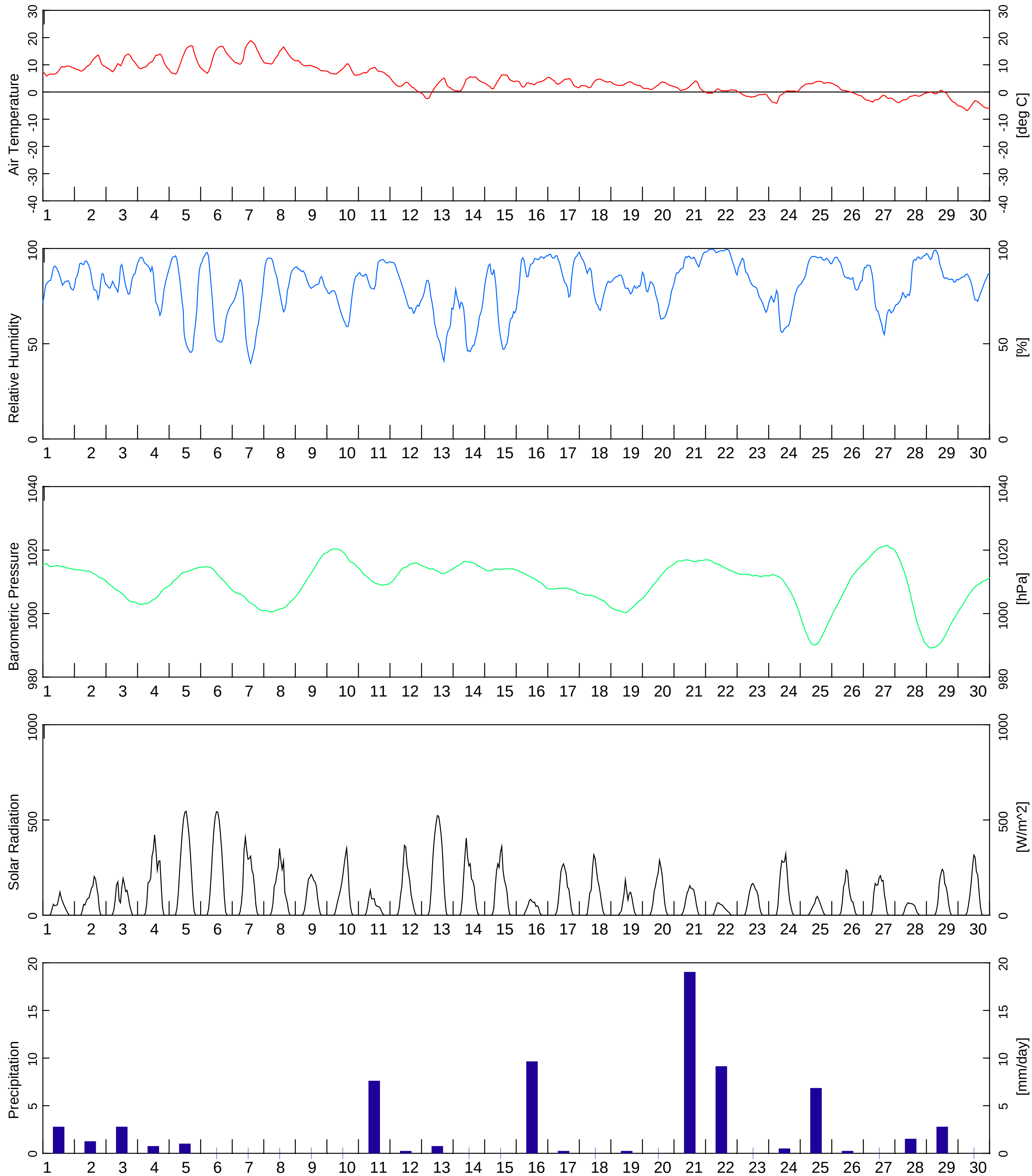


NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

eba

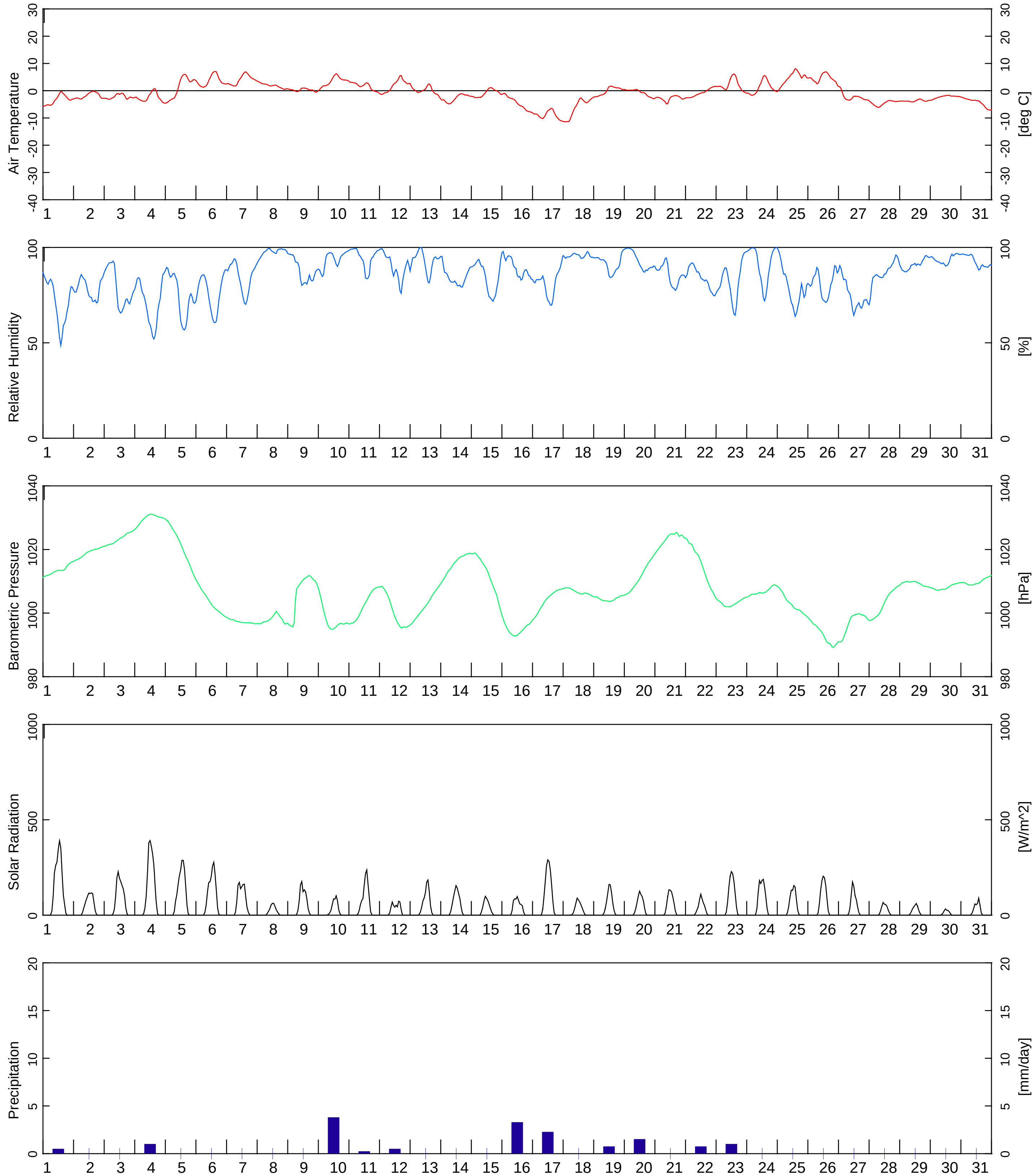
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
September 2005

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-13

Wed Aug 05 11:21:57 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

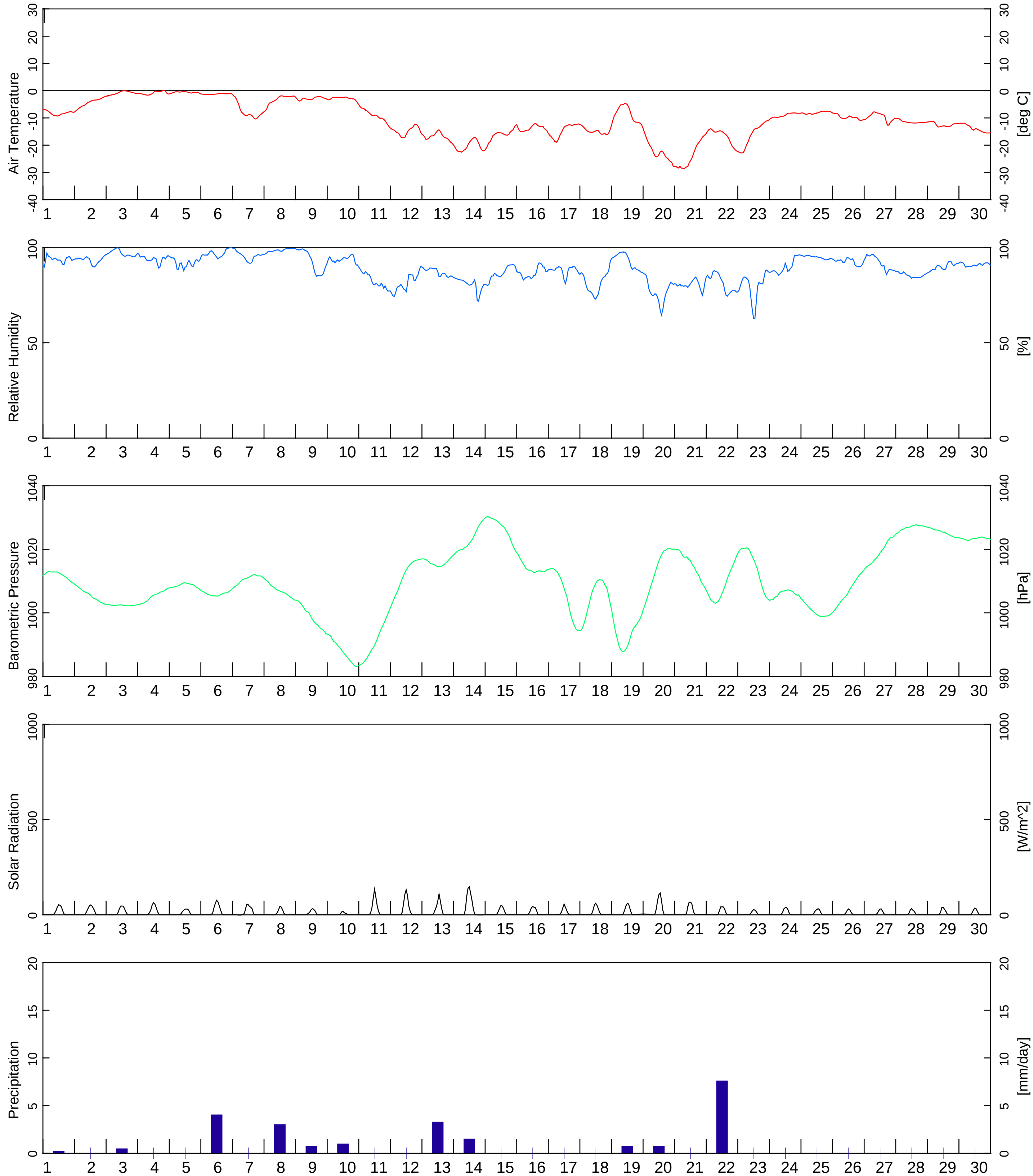
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
October 2005

PROJECT NO.	DWN	CHK	REV	
Y22101057	RED	JAS	0	**Figure D-14**
OFFICE	DATE			
EBA-VANC	July 2009			

Wed Aug 05 11:21:59 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

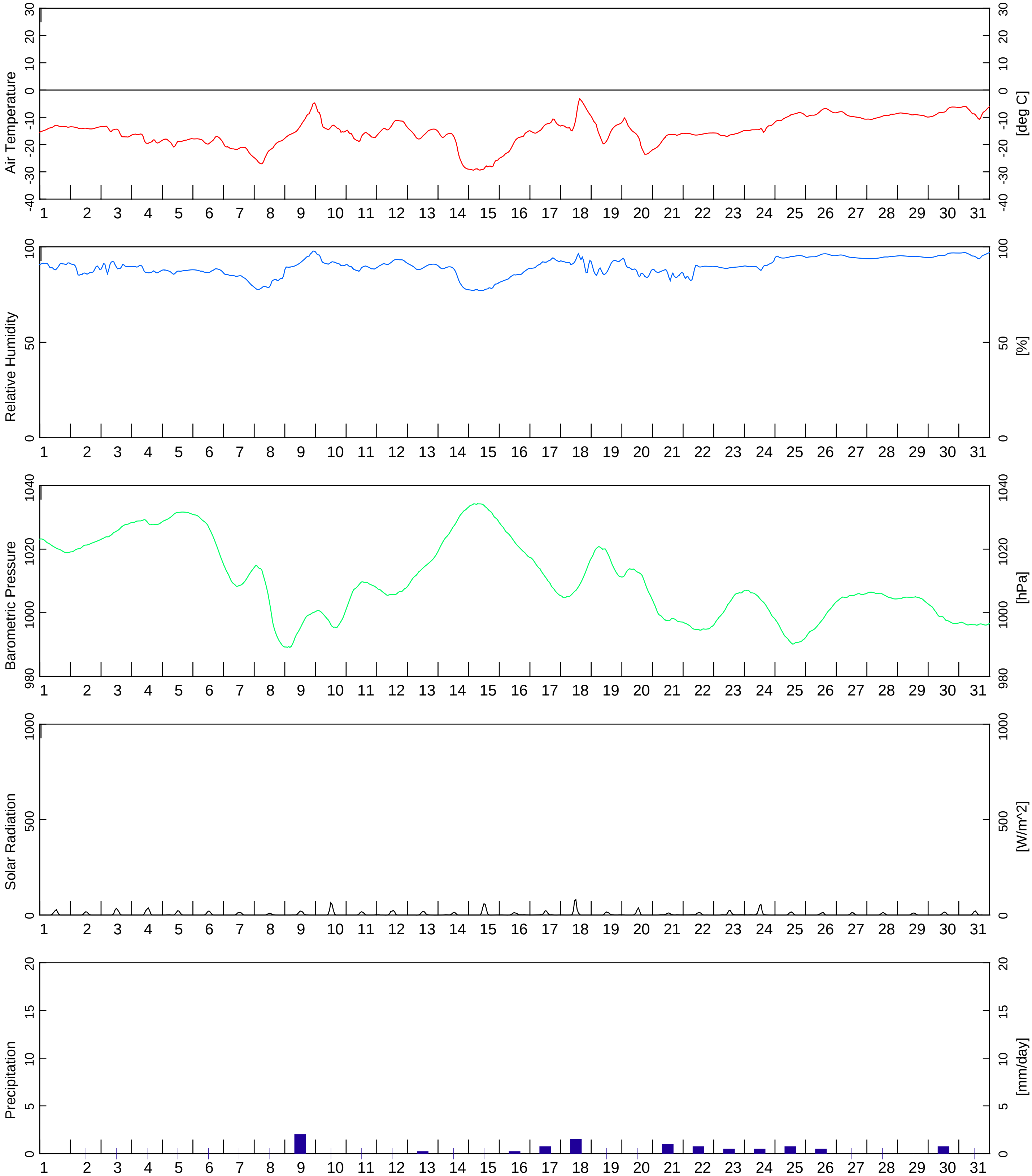
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
November 2005

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-15

Wed Aug 05 11:22:01 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

eba

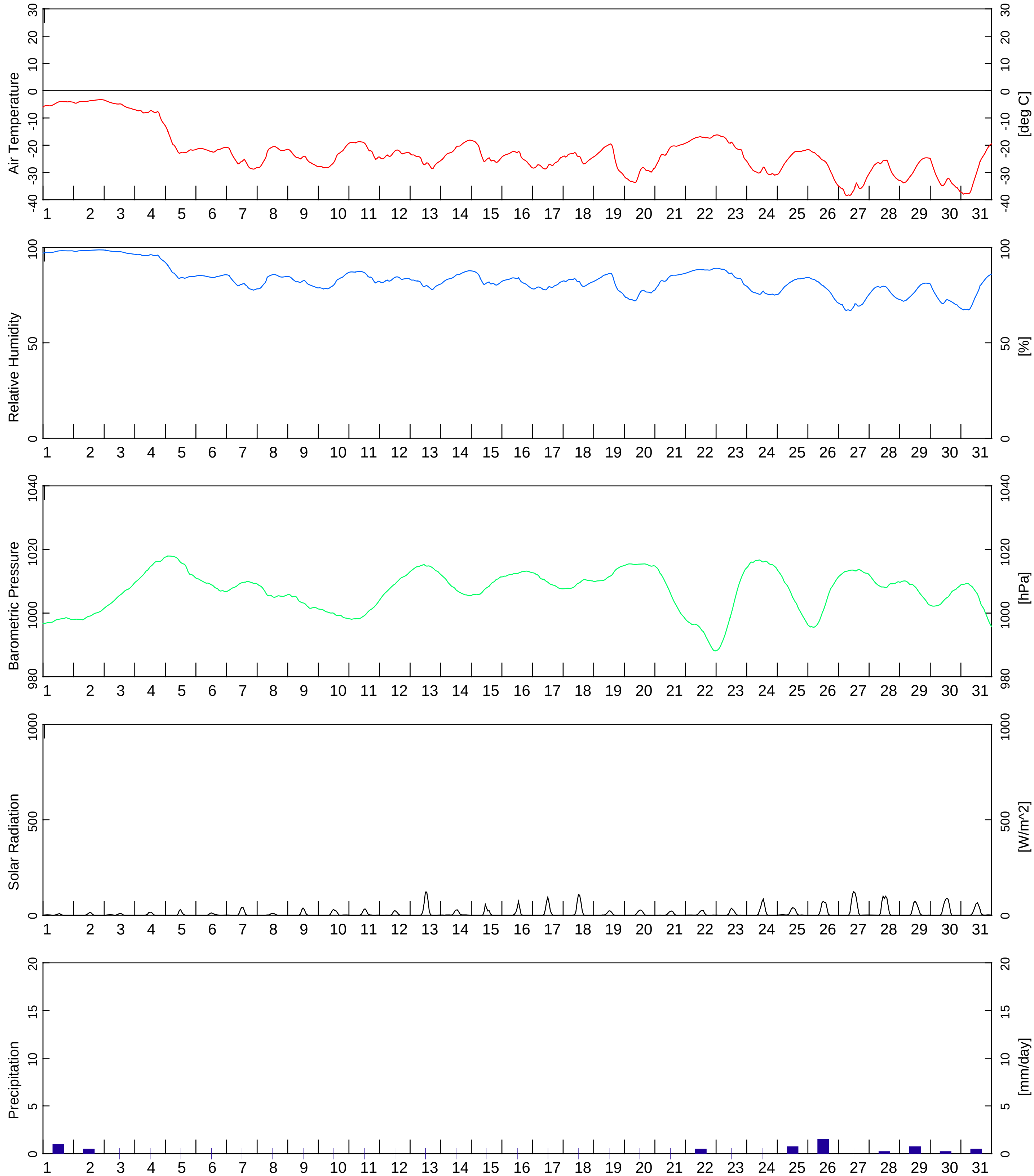
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
December 2005

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-16

Wed Aug 05 11:22:02 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

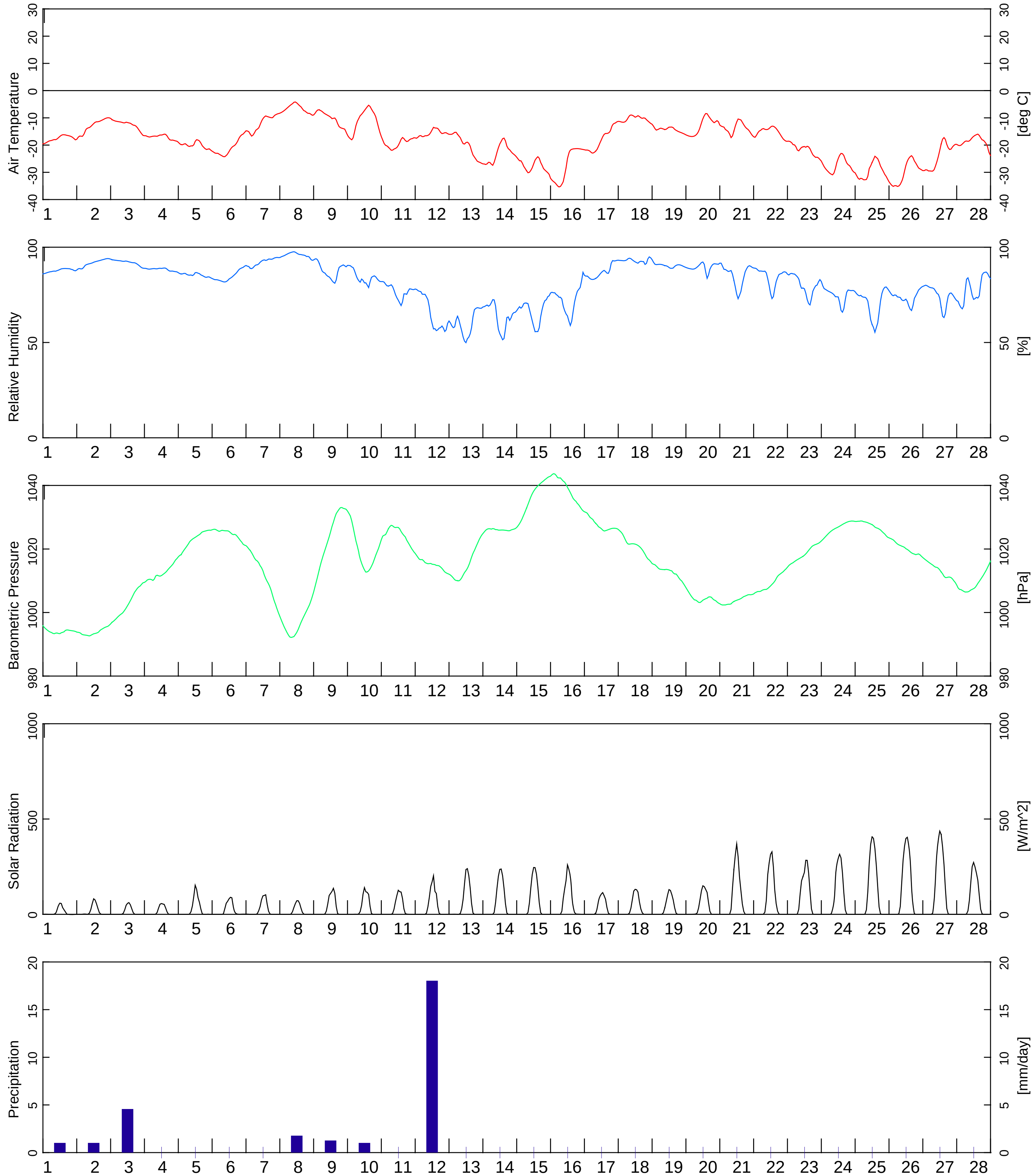
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
January 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-17



NOTES

CLIENT

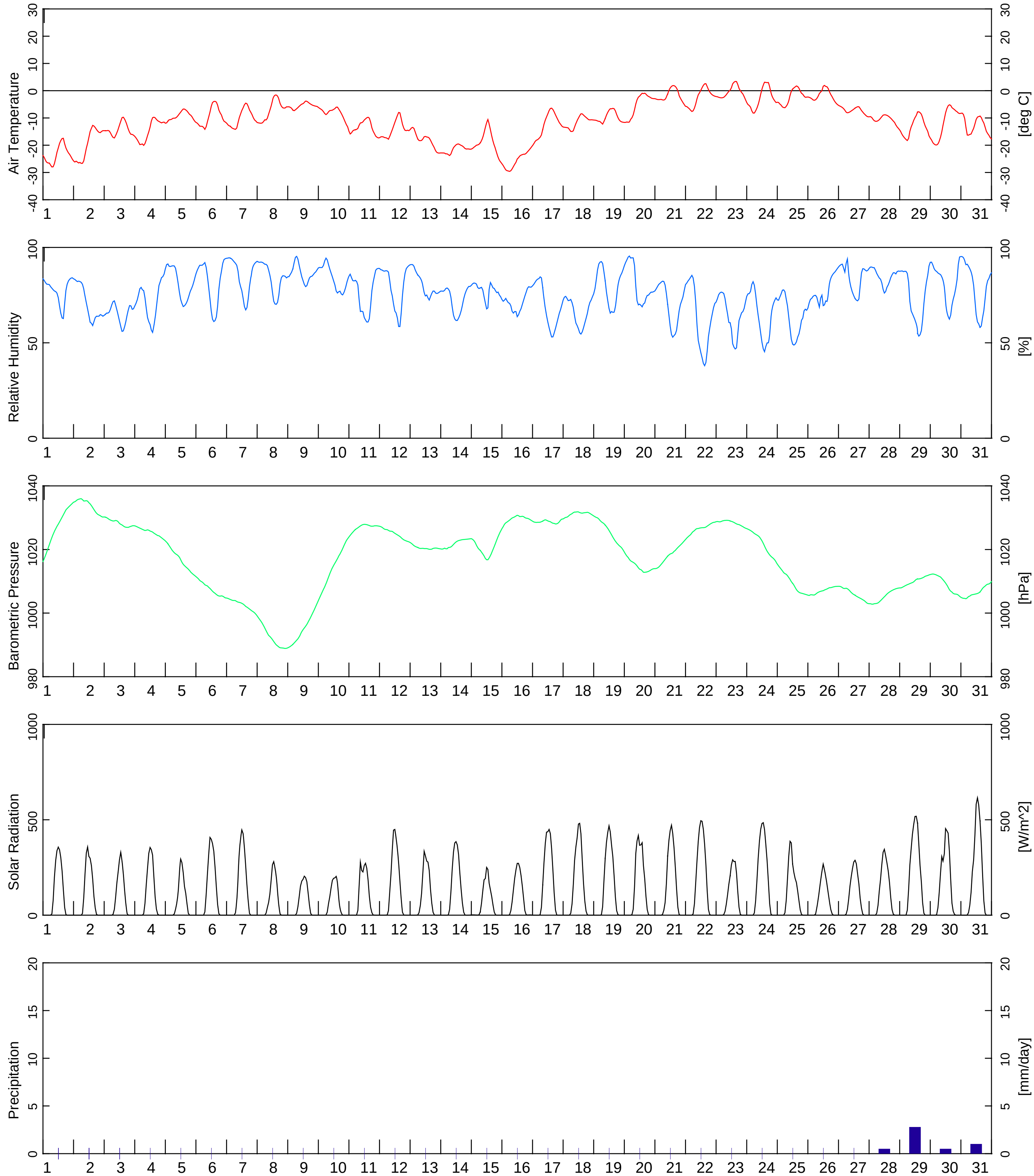
Tyhee NWT Corp

EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
February 2006

PROJECT NO.	DWN	CHK	REV	
Y22101057	RED	JAS	0	**Figure D-18**
OFFICE	DATE			
EBA-VANC	July 2009			



NOTES

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Tyhee NWT Corp

EBA Engineering Consultants Ltd.

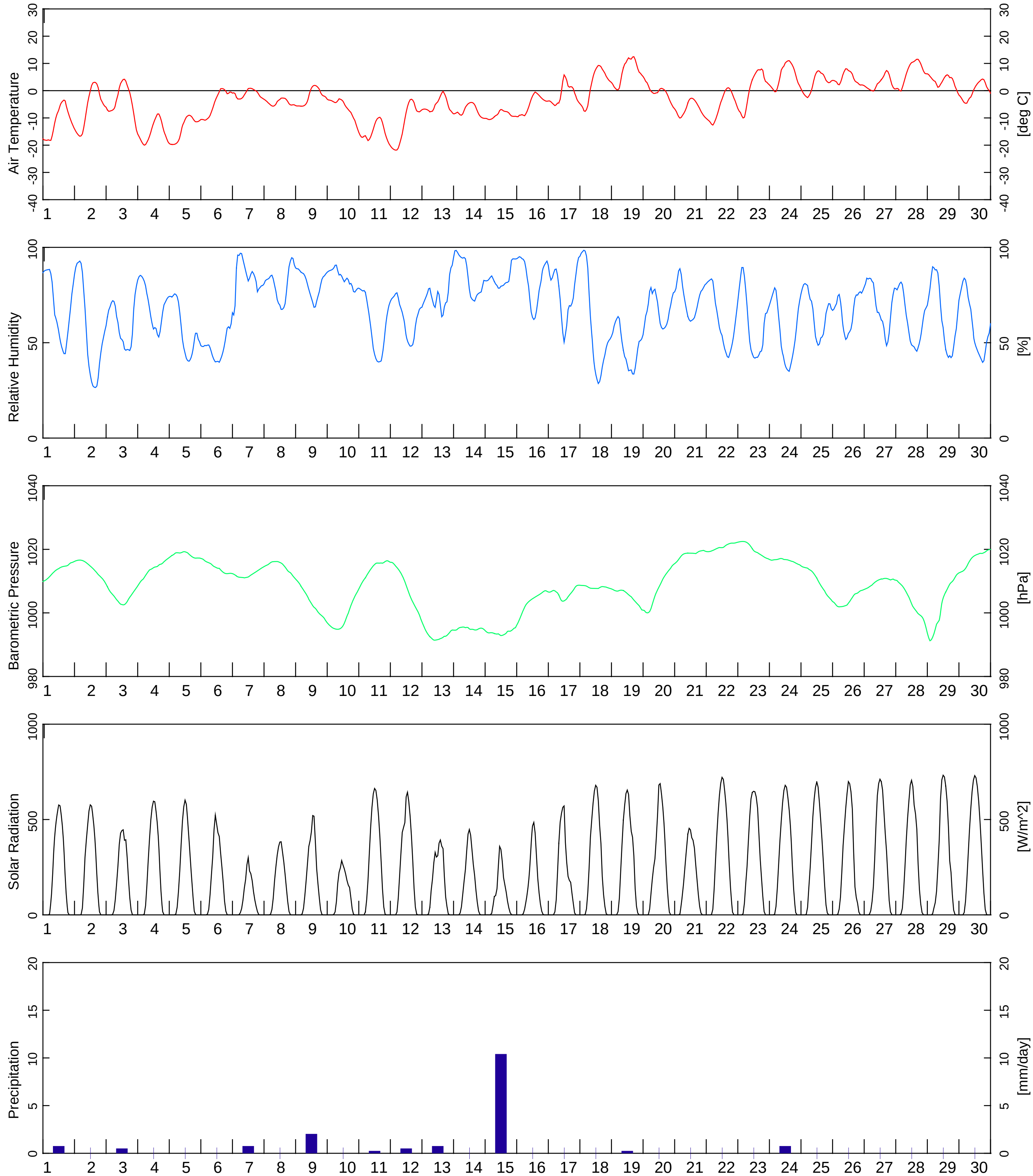
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
March 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-19

Wed Aug 05 11:23:19 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

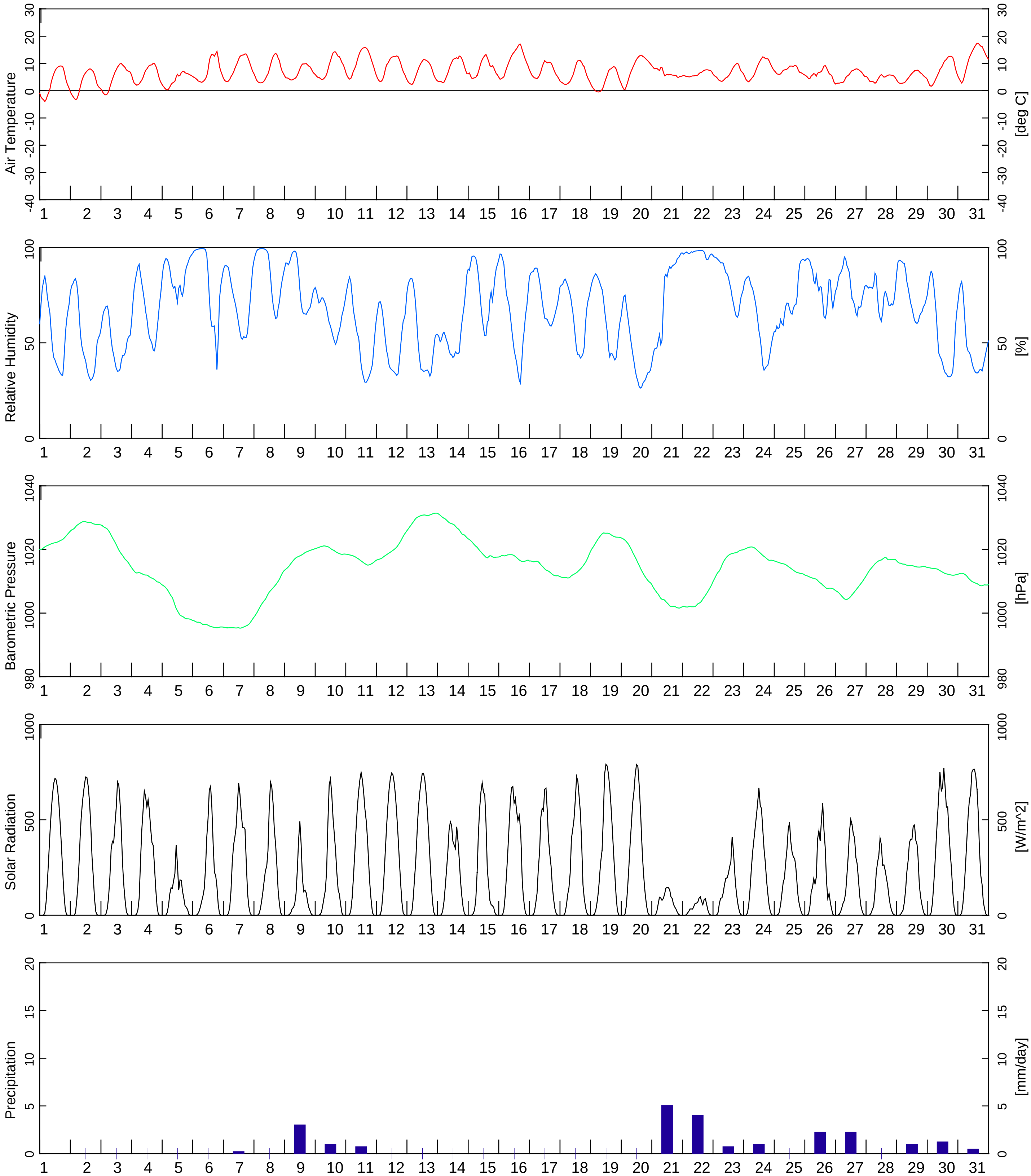
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
April 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-20



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

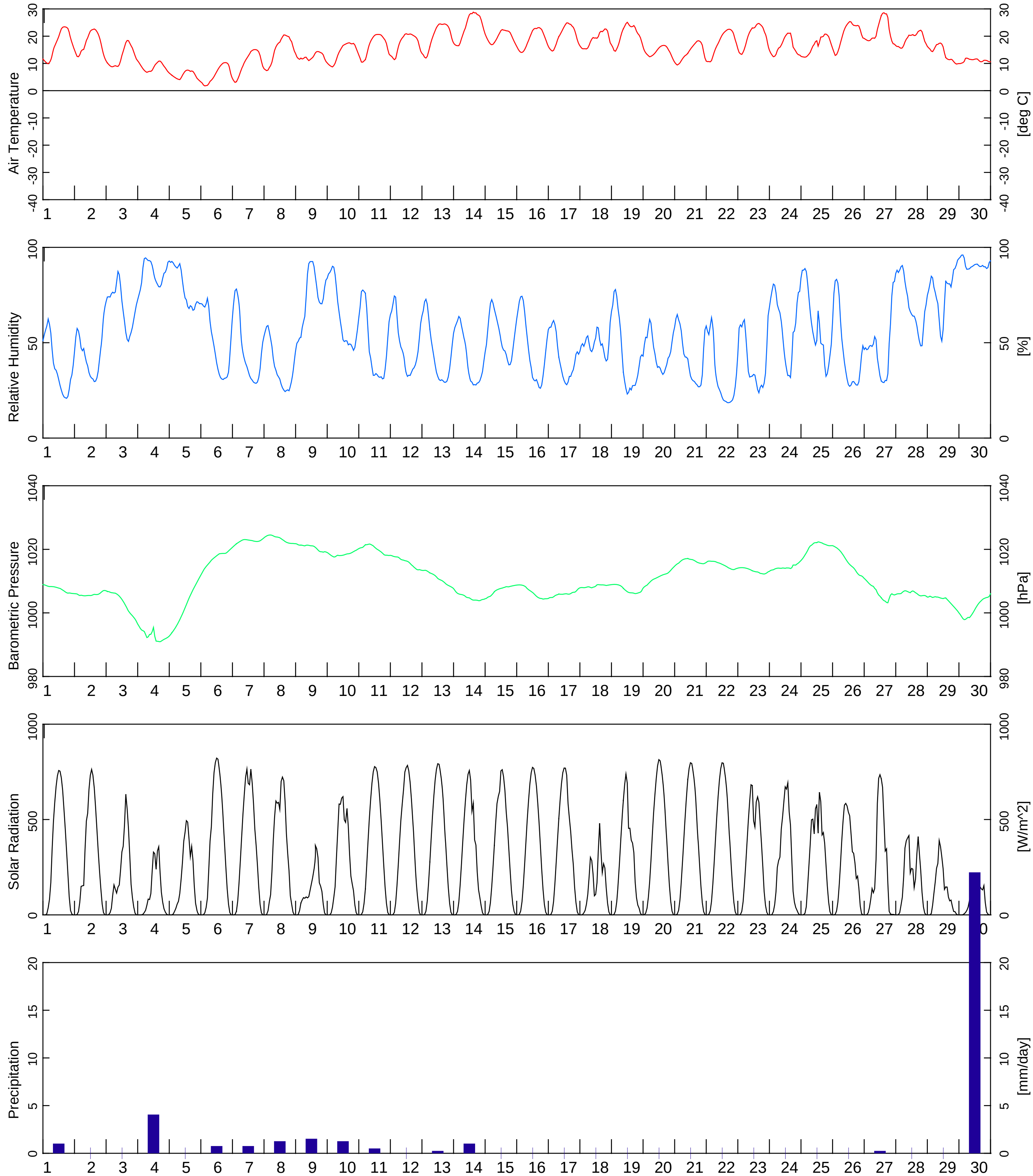
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
May 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-21

Wed Aug 05 11:23:22 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

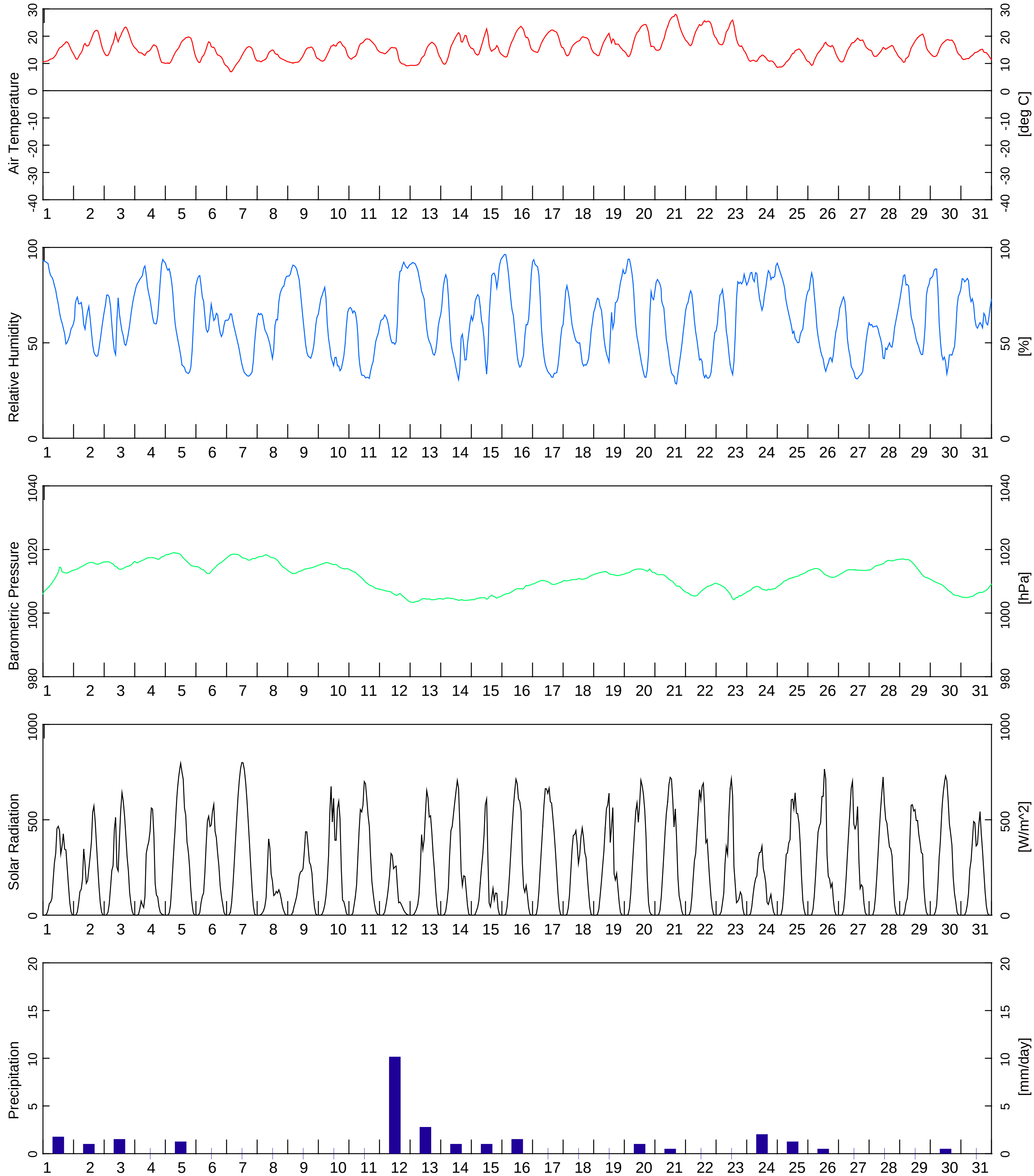
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
June 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-22



NOTES

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Tyhee NWT Corp

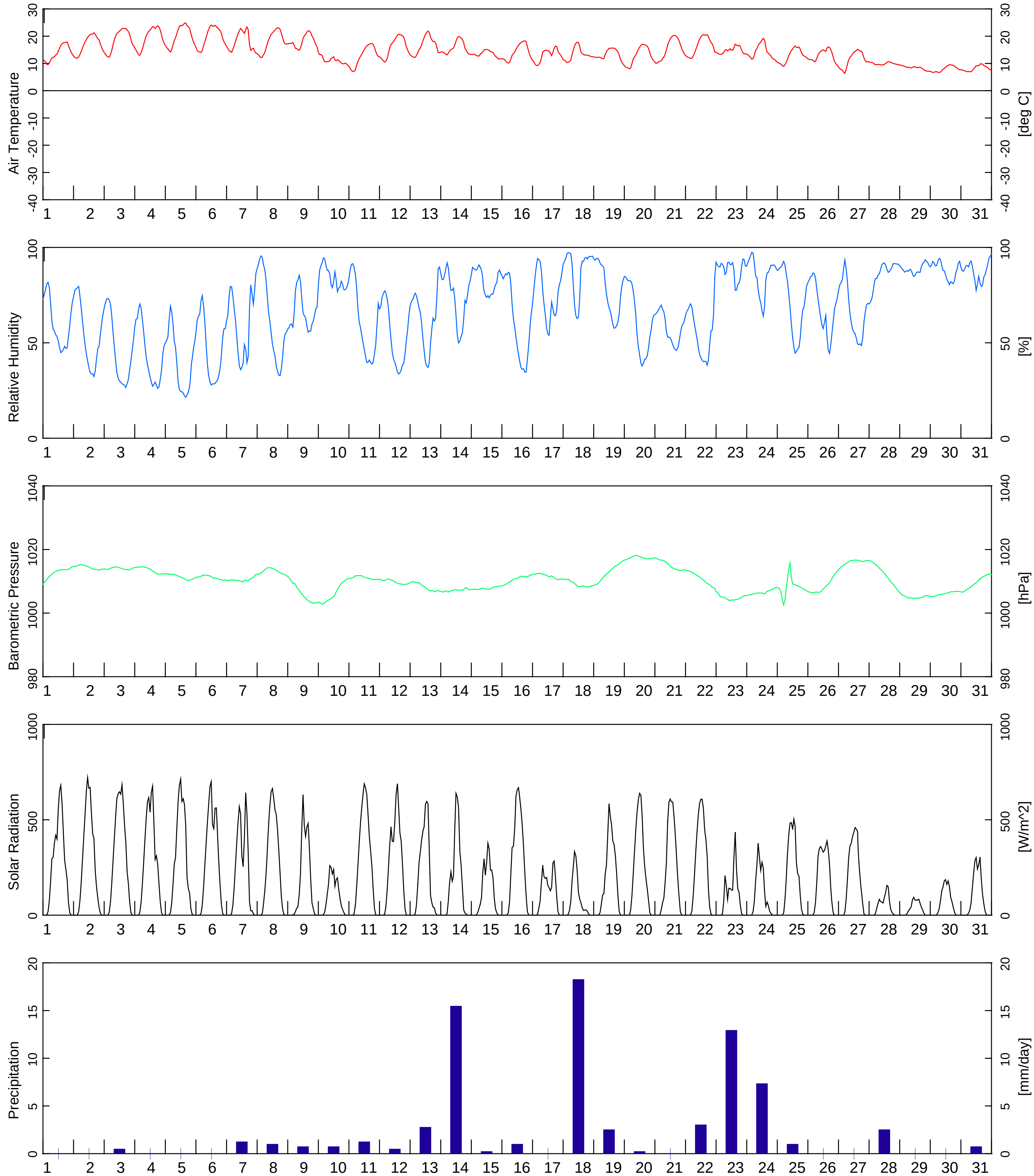
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
July 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-23



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

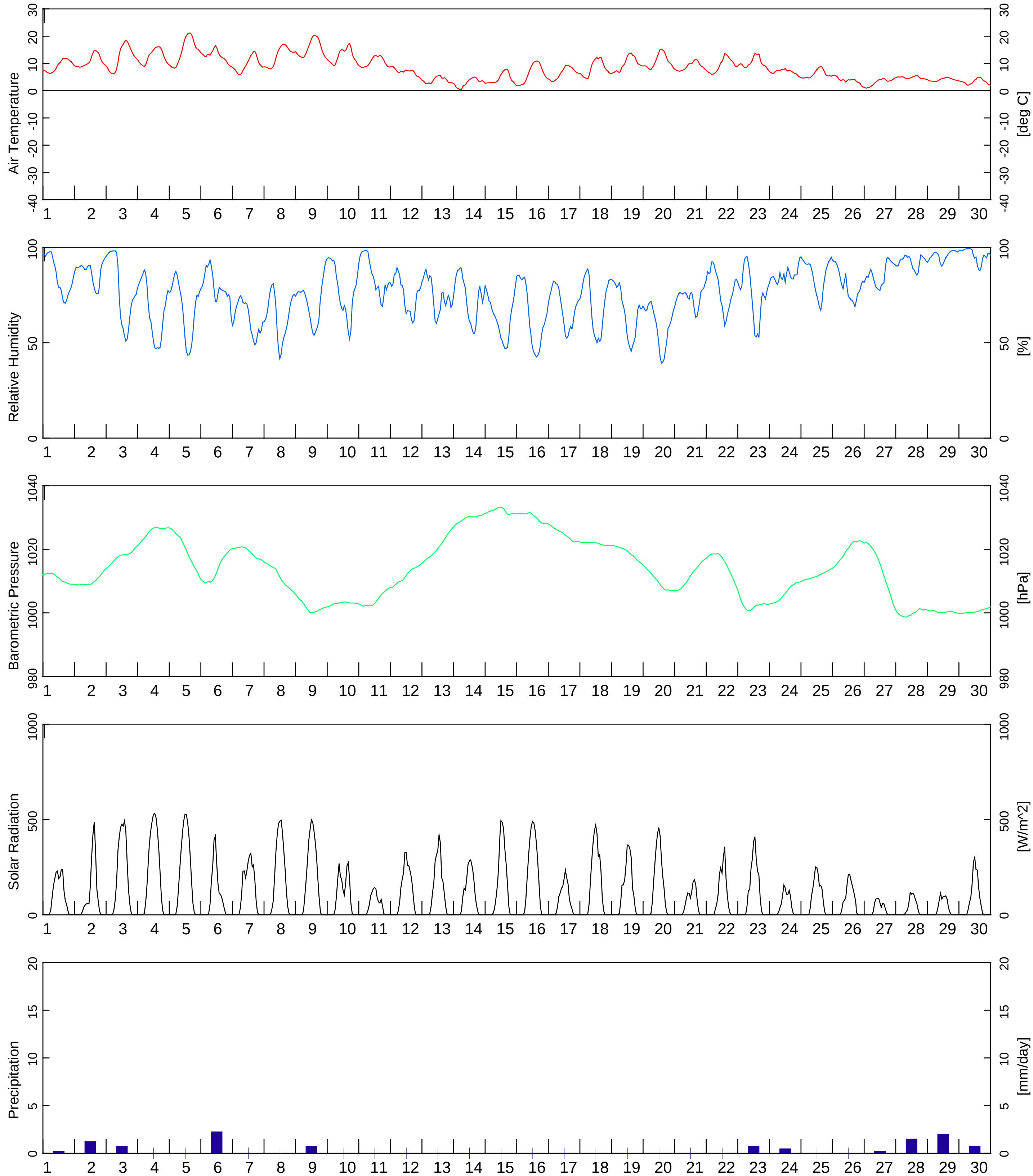
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
August 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-24

Wed Aug 05 11:23:28 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

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Tyhee NWT Corp

EBA Engineering Consultants Ltd.

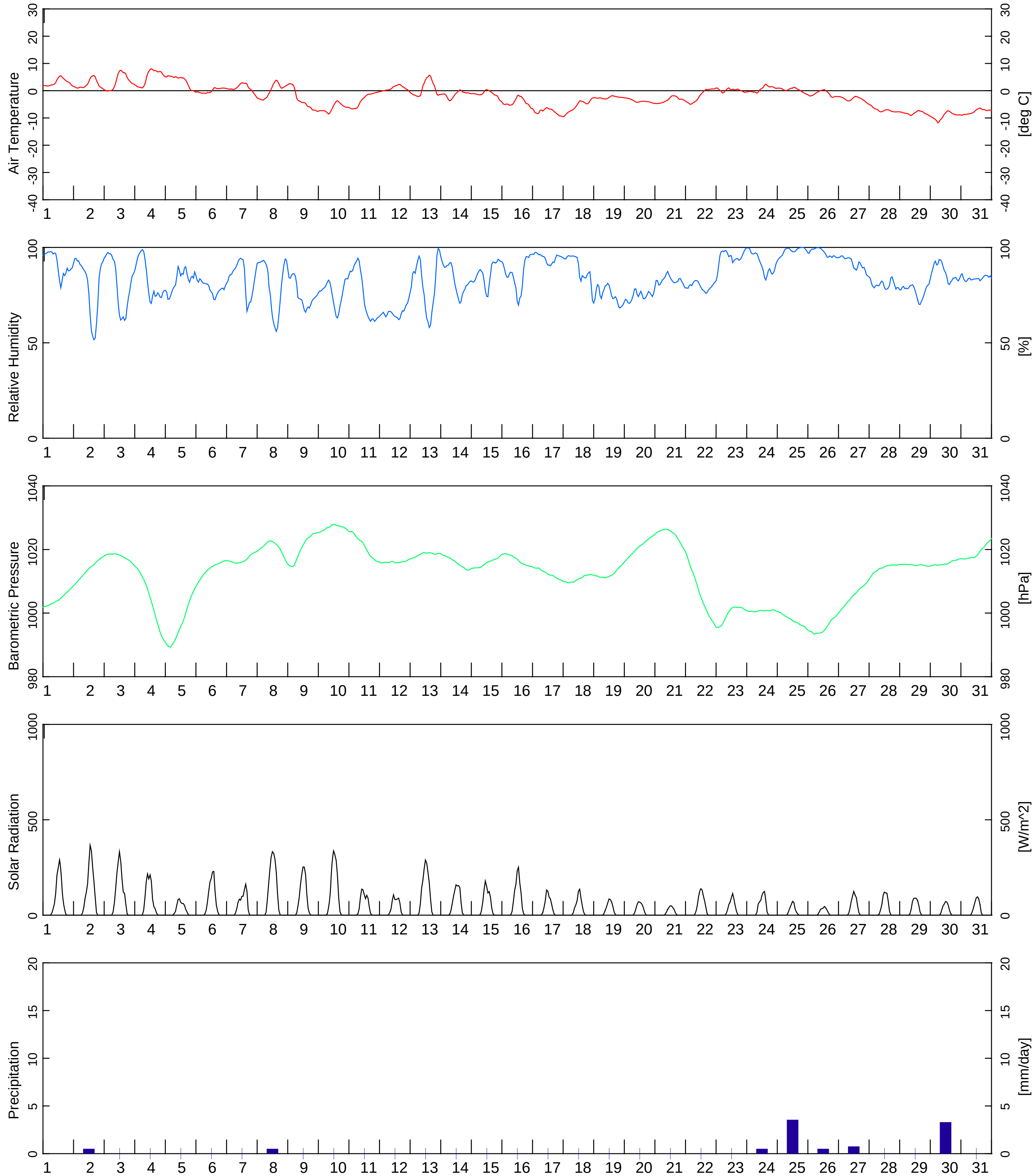
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
September 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-25

Wed Aug 05 11:23:29 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

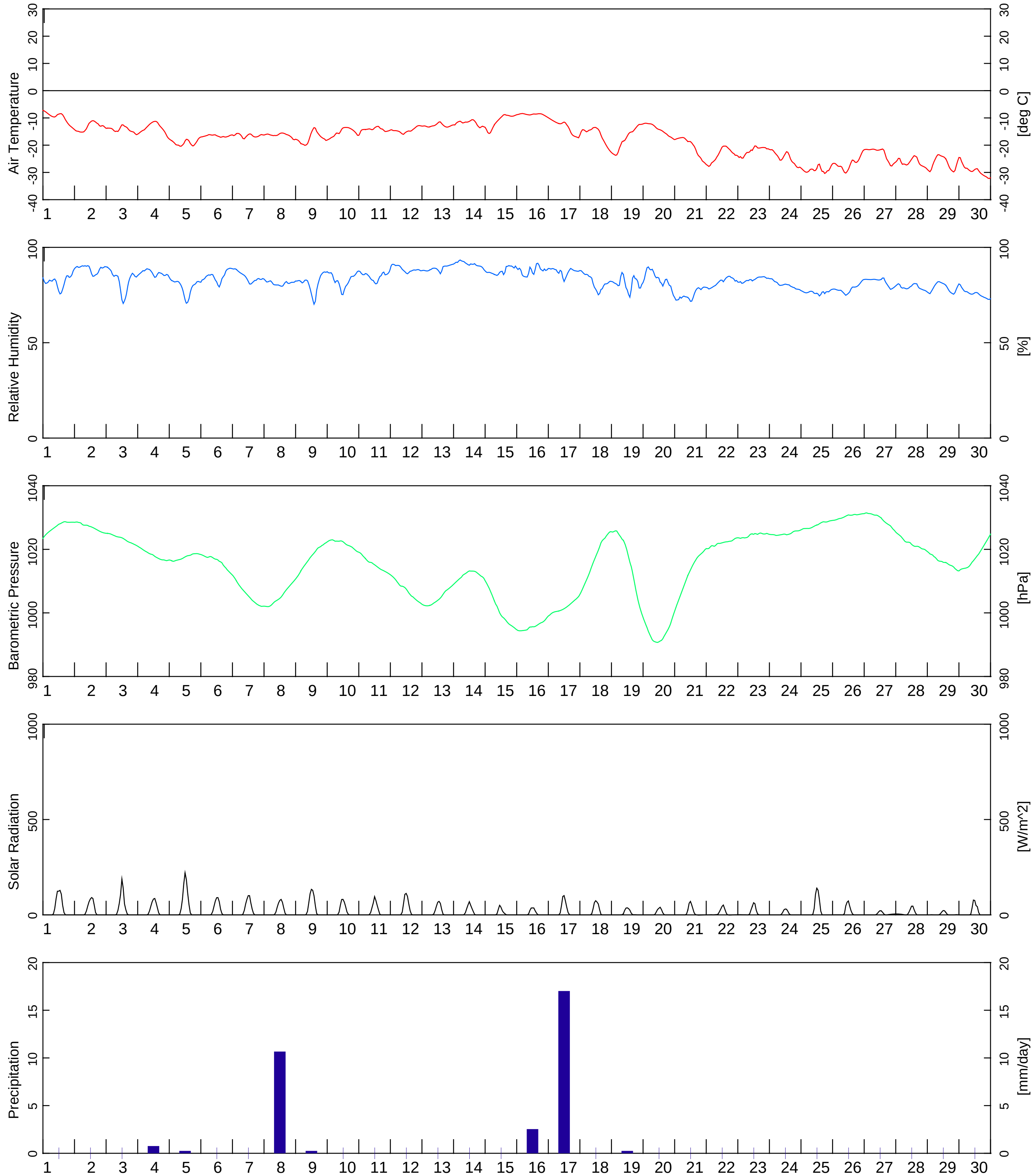
Tyhee Station
Weather Data
October 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0

OFFICE	DATE
EBA-VANC	July 2009

Figure D-26

Wed Aug 05 11:23:31 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

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Tyhee NWT Corp

EBA Engineering Consultants Ltd.

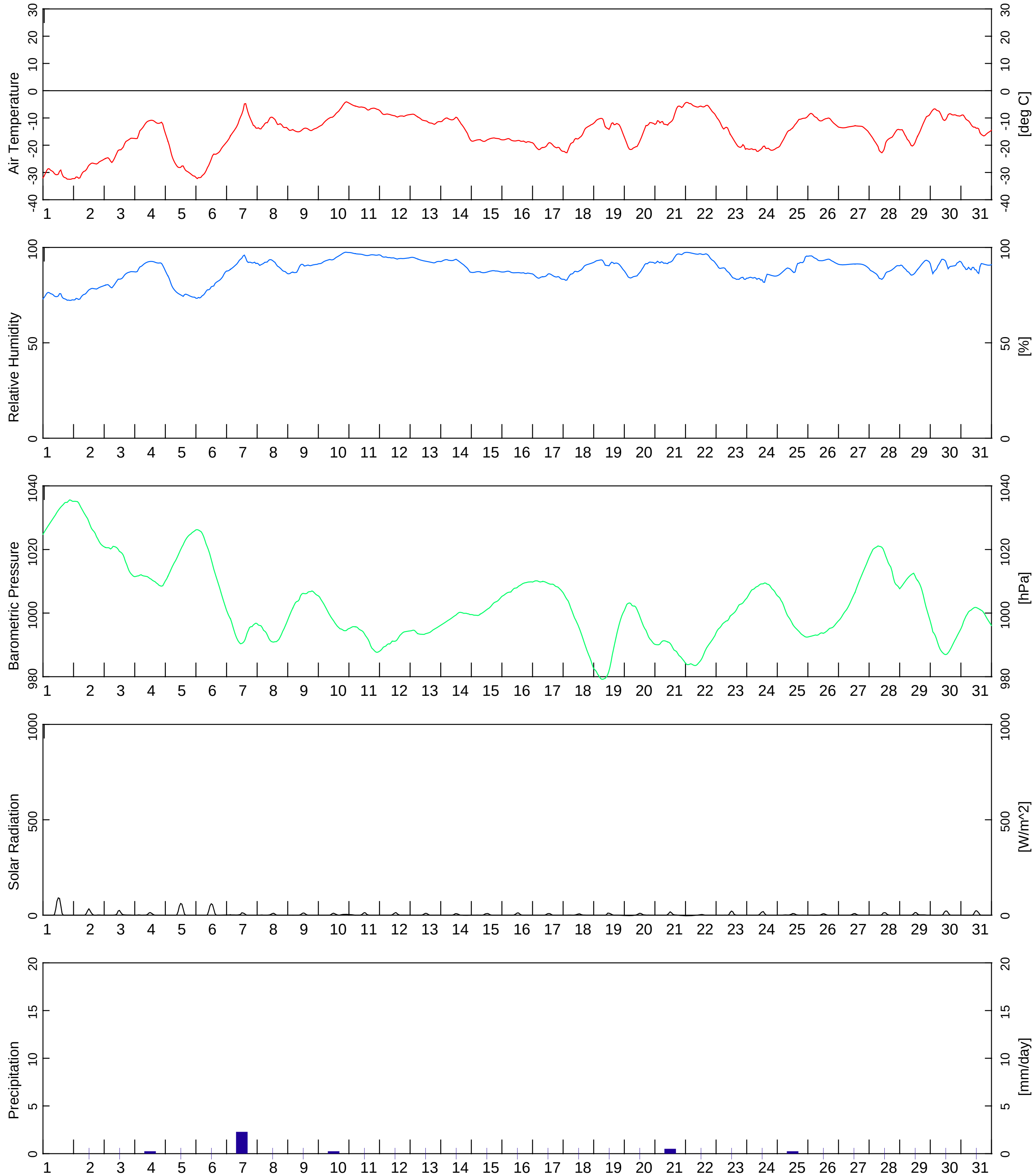
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
November 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-27

Wed Aug 05 11:23:32 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

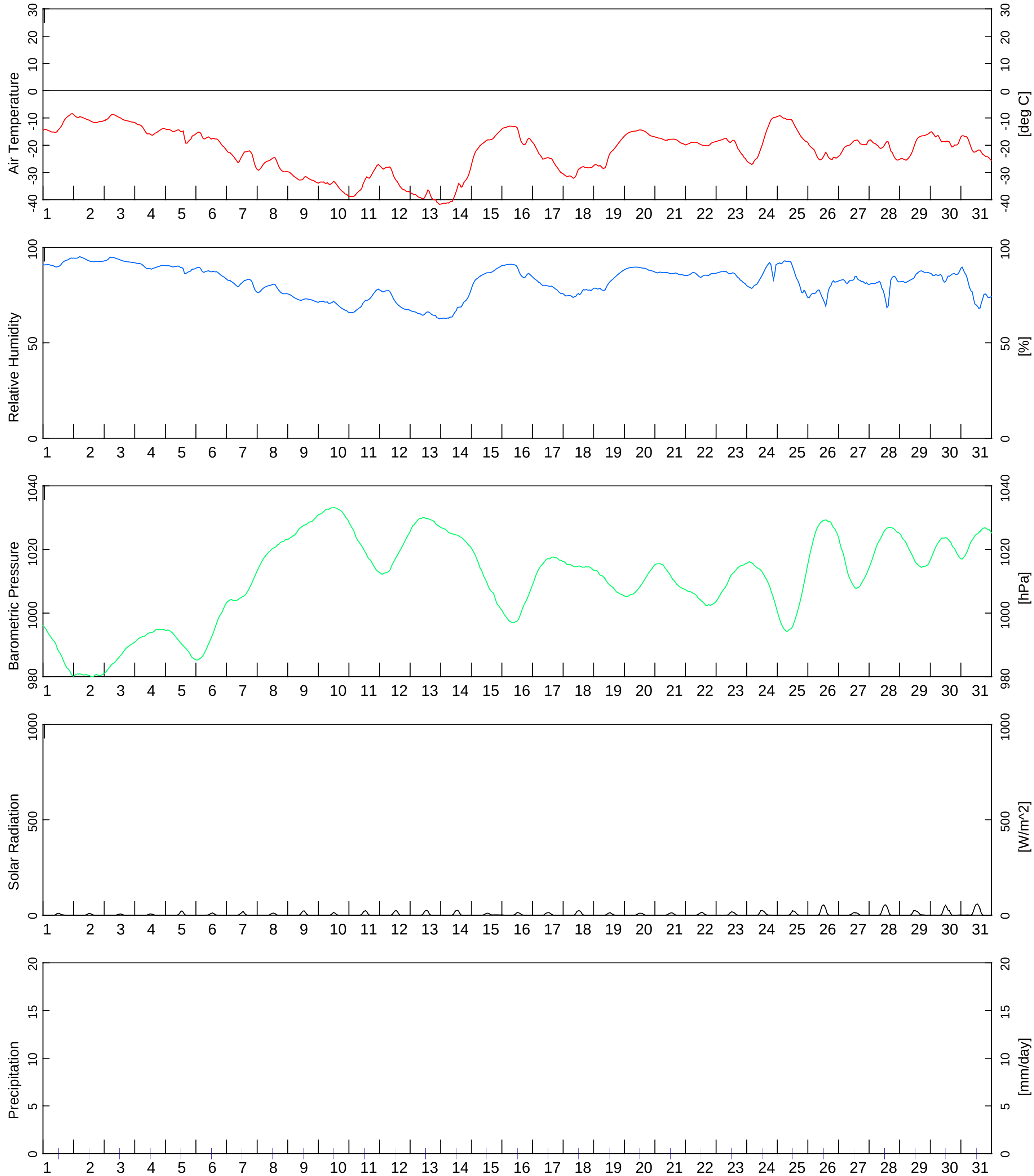
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather Data December 2006

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-28

Wed Aug 05 11:23:33 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

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Tyhee NWT Corp

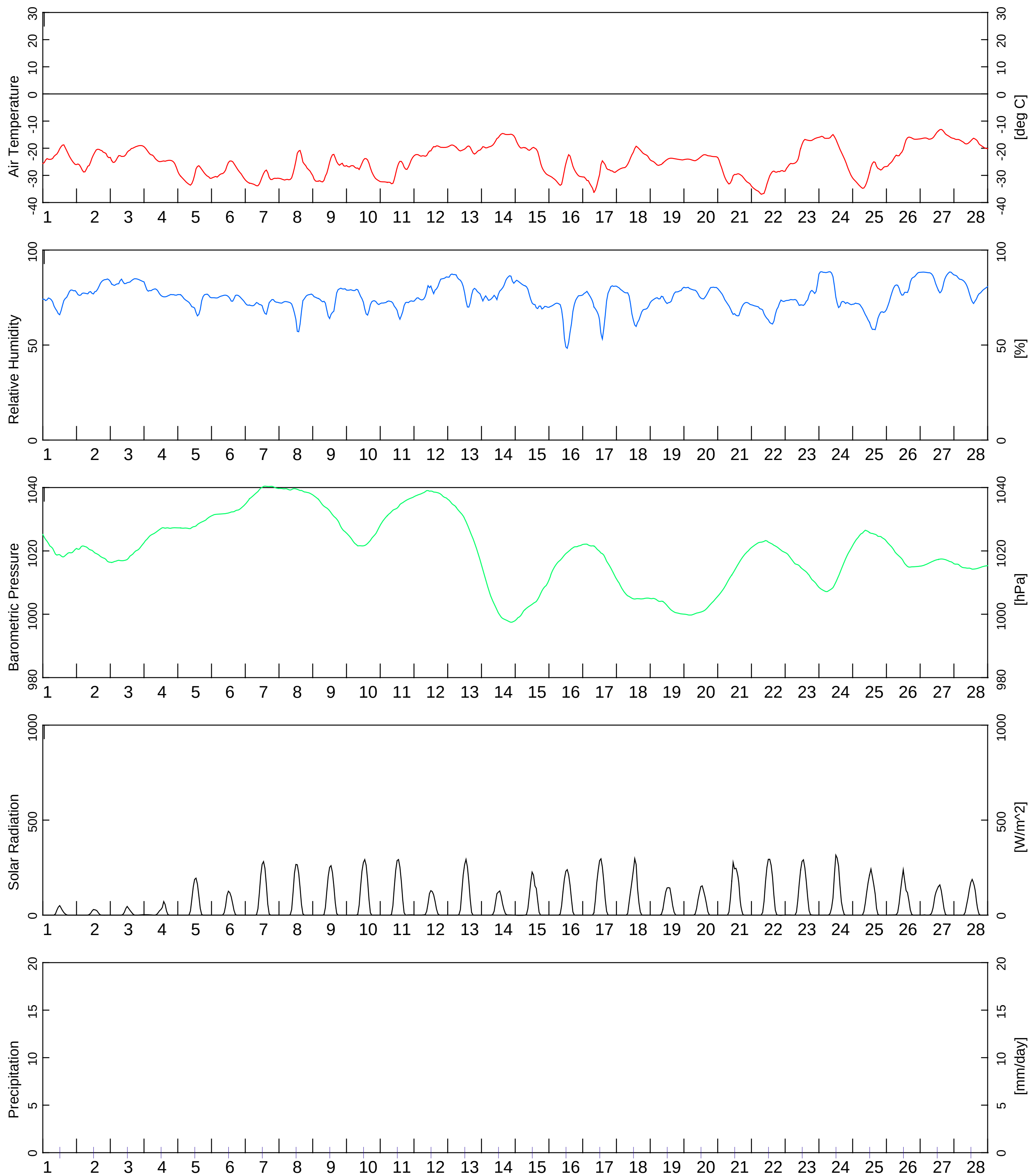
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
January 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-29



NOTES

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Tyhee NWT Corp

EBA Engineering Consultants Ltd.

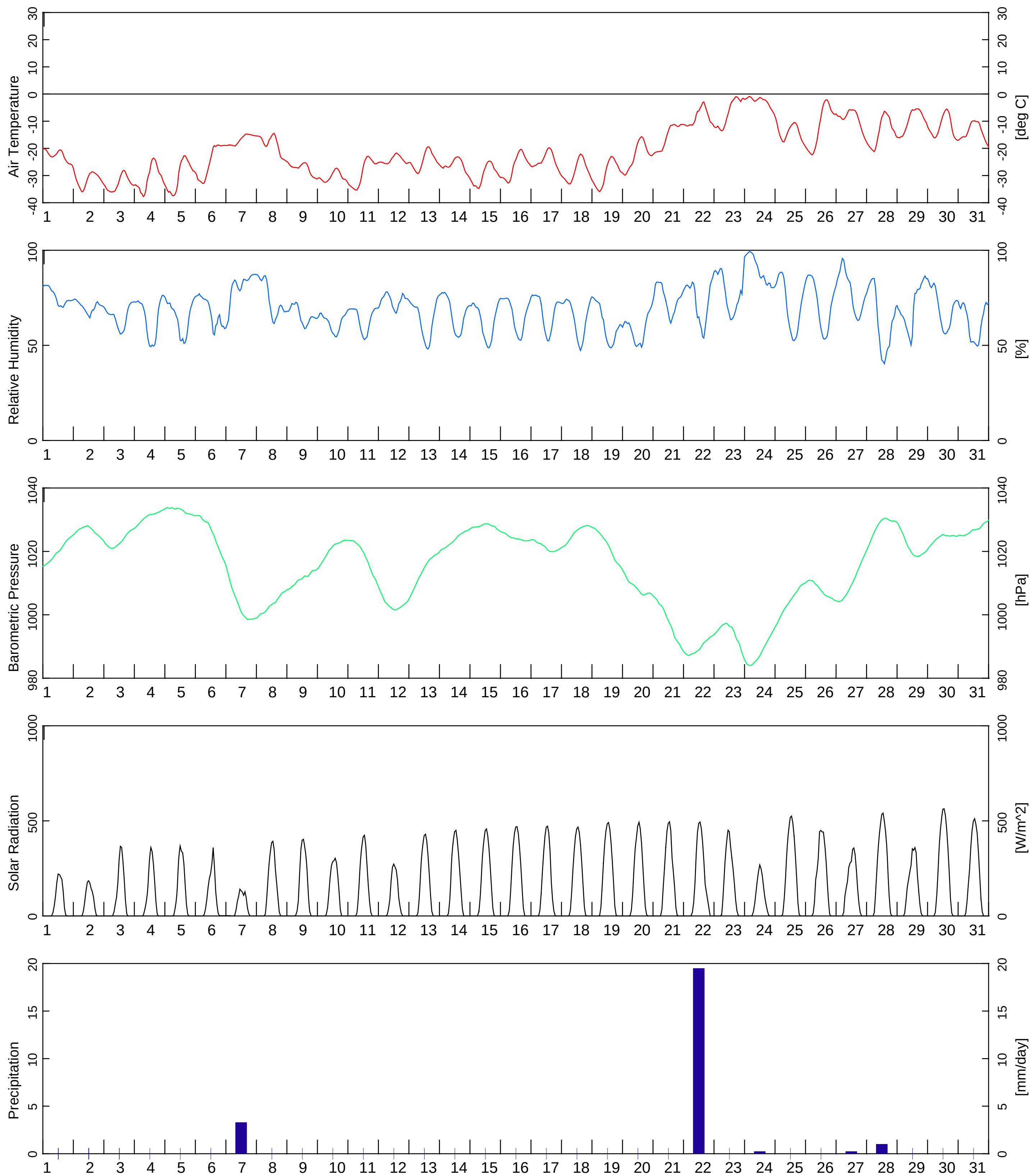
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
February 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-30

Wed Aug 05 11:24:40 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

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Tyhee NWT Corp

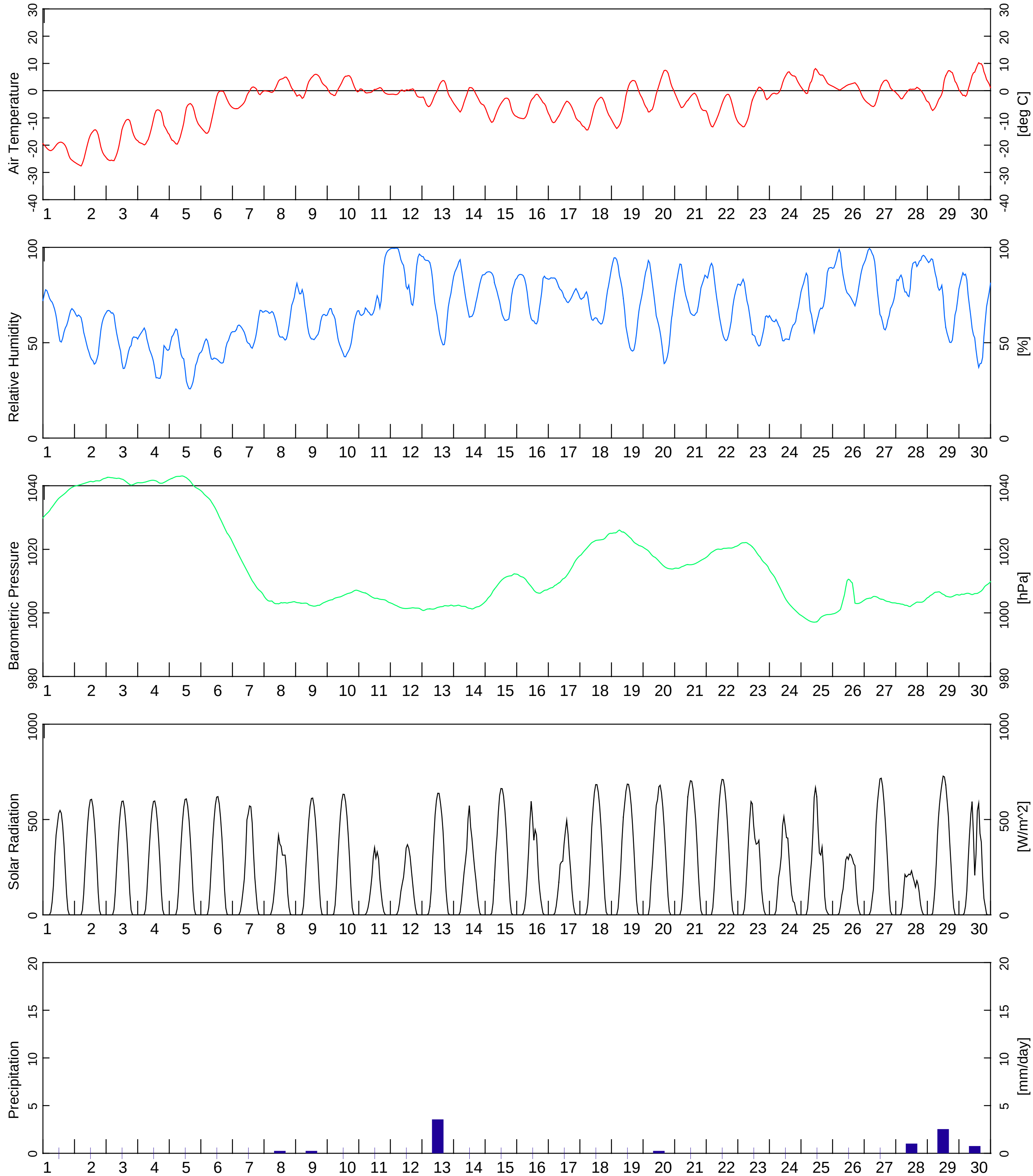
EBA Engineering Consultants Ltd.

eba

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
March 2007

PROJECT NO.	DWN	CHK	REV	
Y22101057	RED	JAS	0	**Figure D-31**
OFFICE	DATE			
EBA-VANC	July 2009			



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

eba

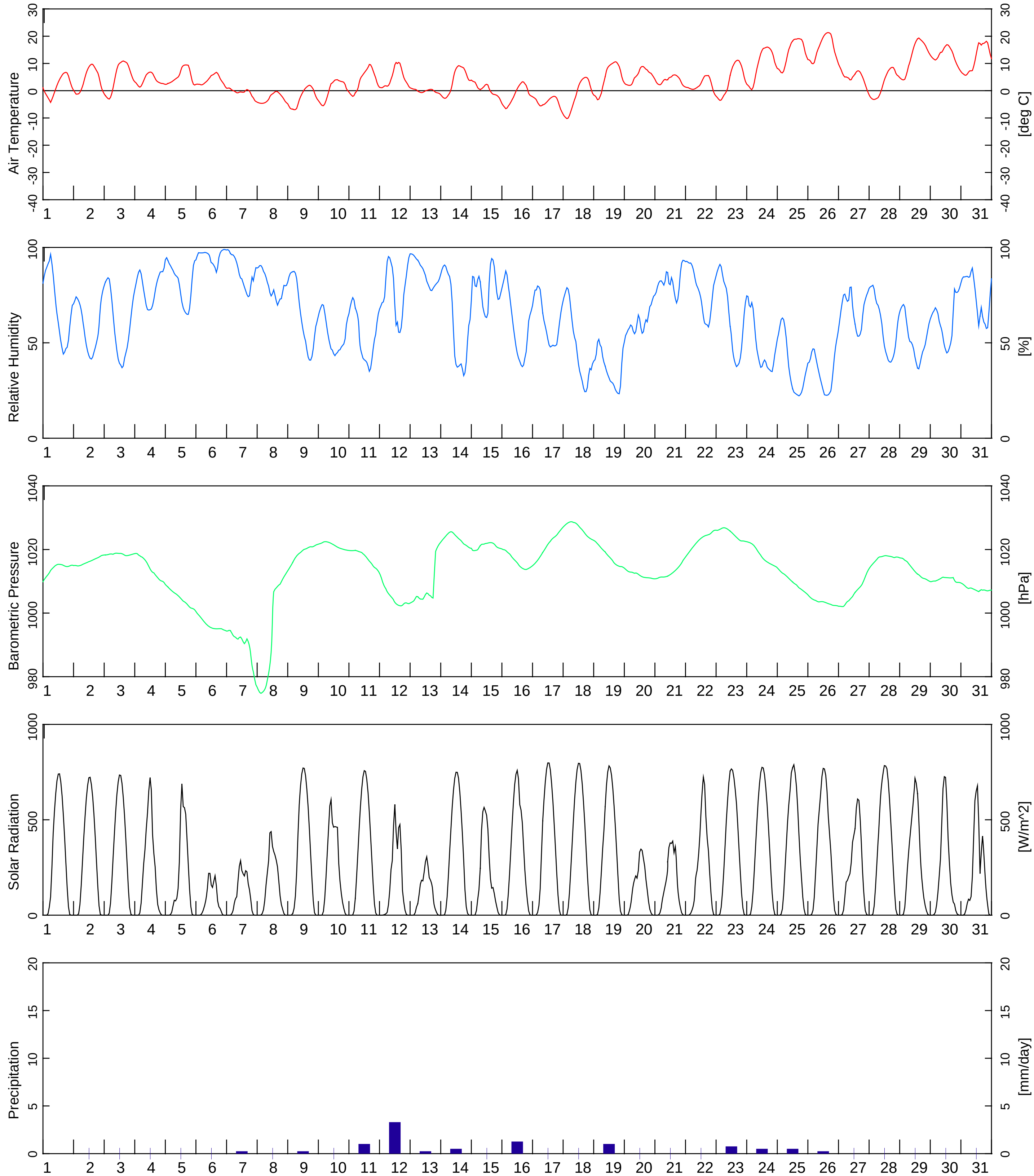
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
April 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-32

Wed Aug 05 11:24:44 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

eba

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
May 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D33

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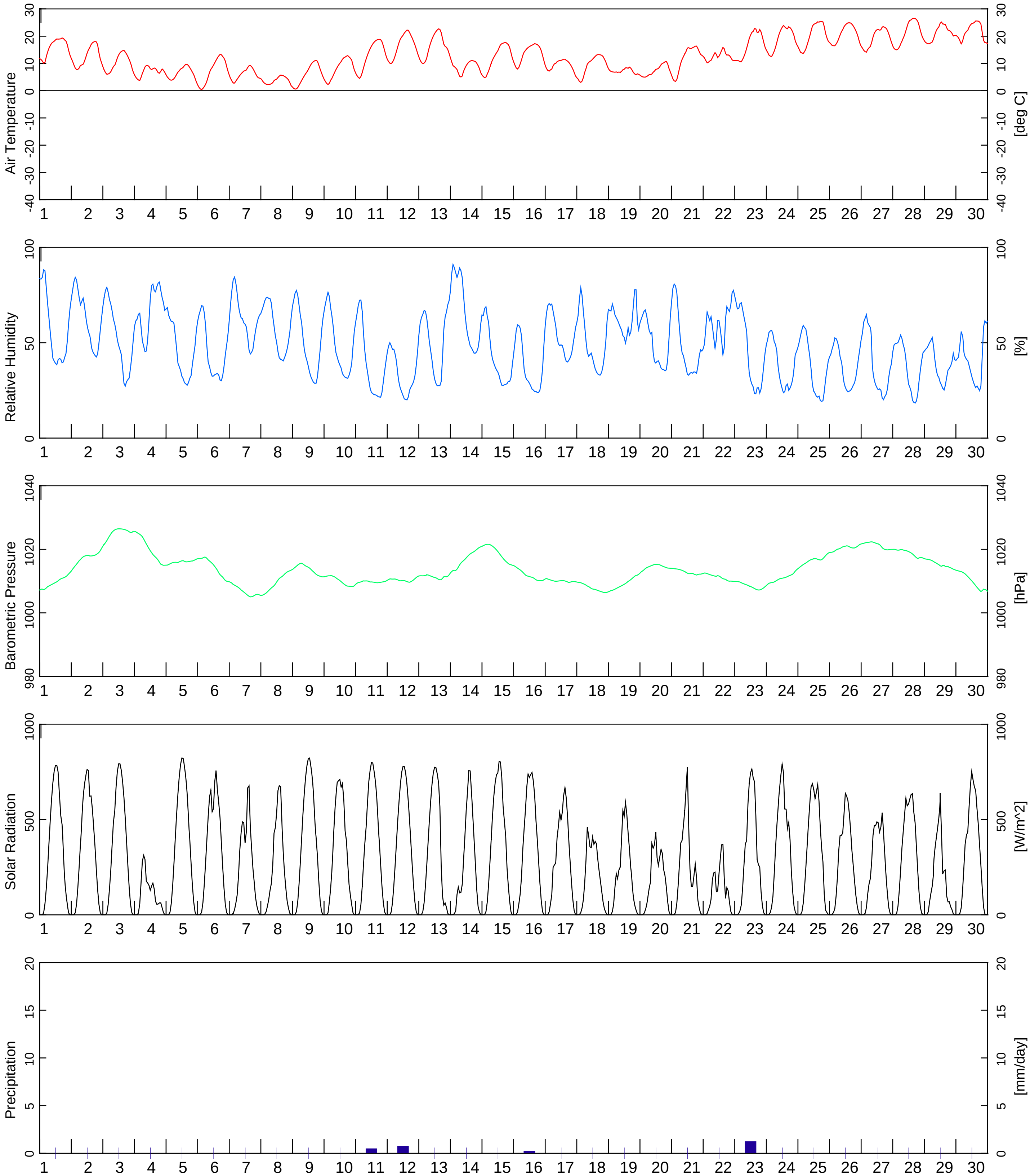


NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

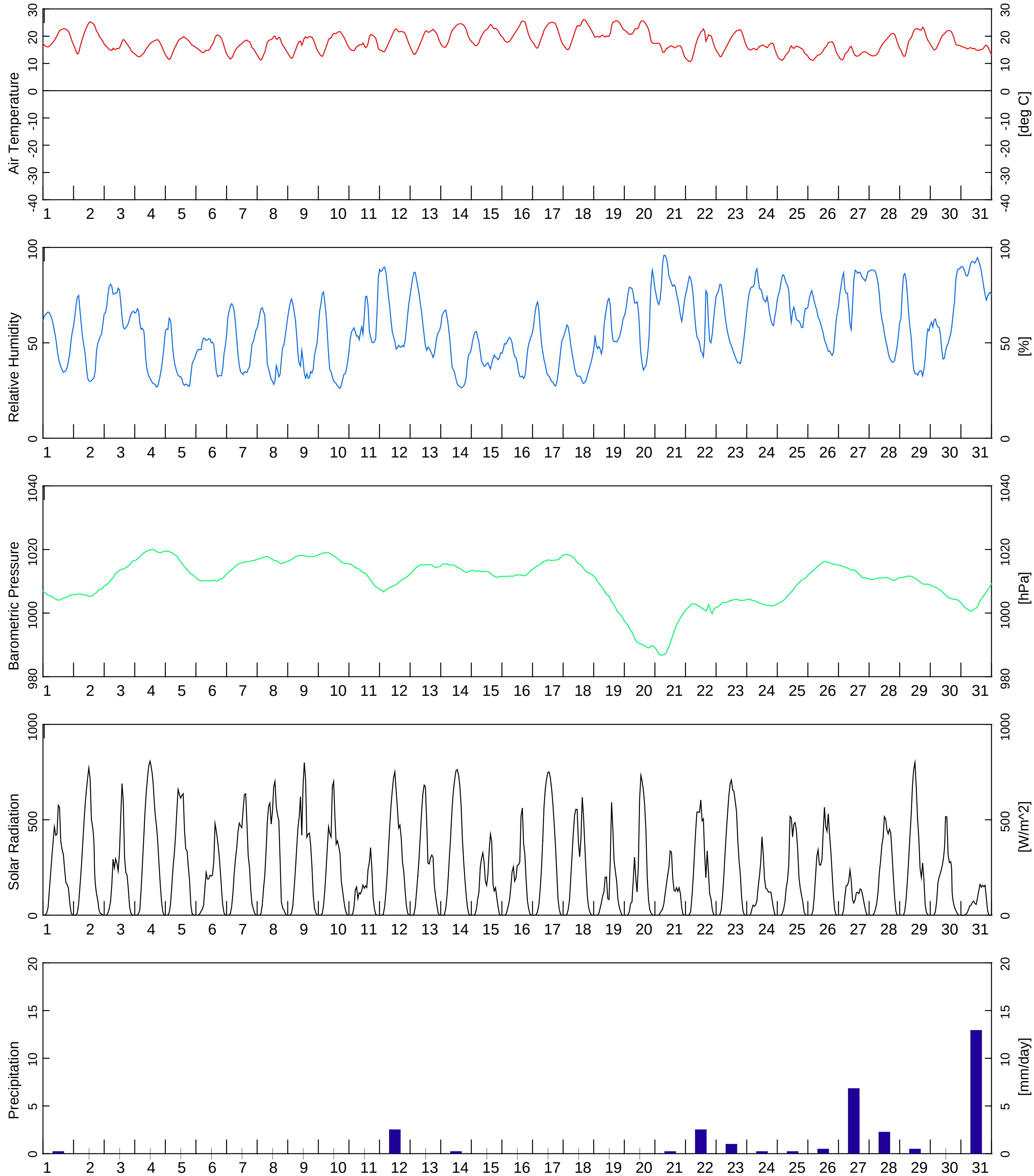
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
June 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-34

Wed Aug 05 11:24:47 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

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Tyhee NWT Corp

EBA Engineering Consultants Ltd.

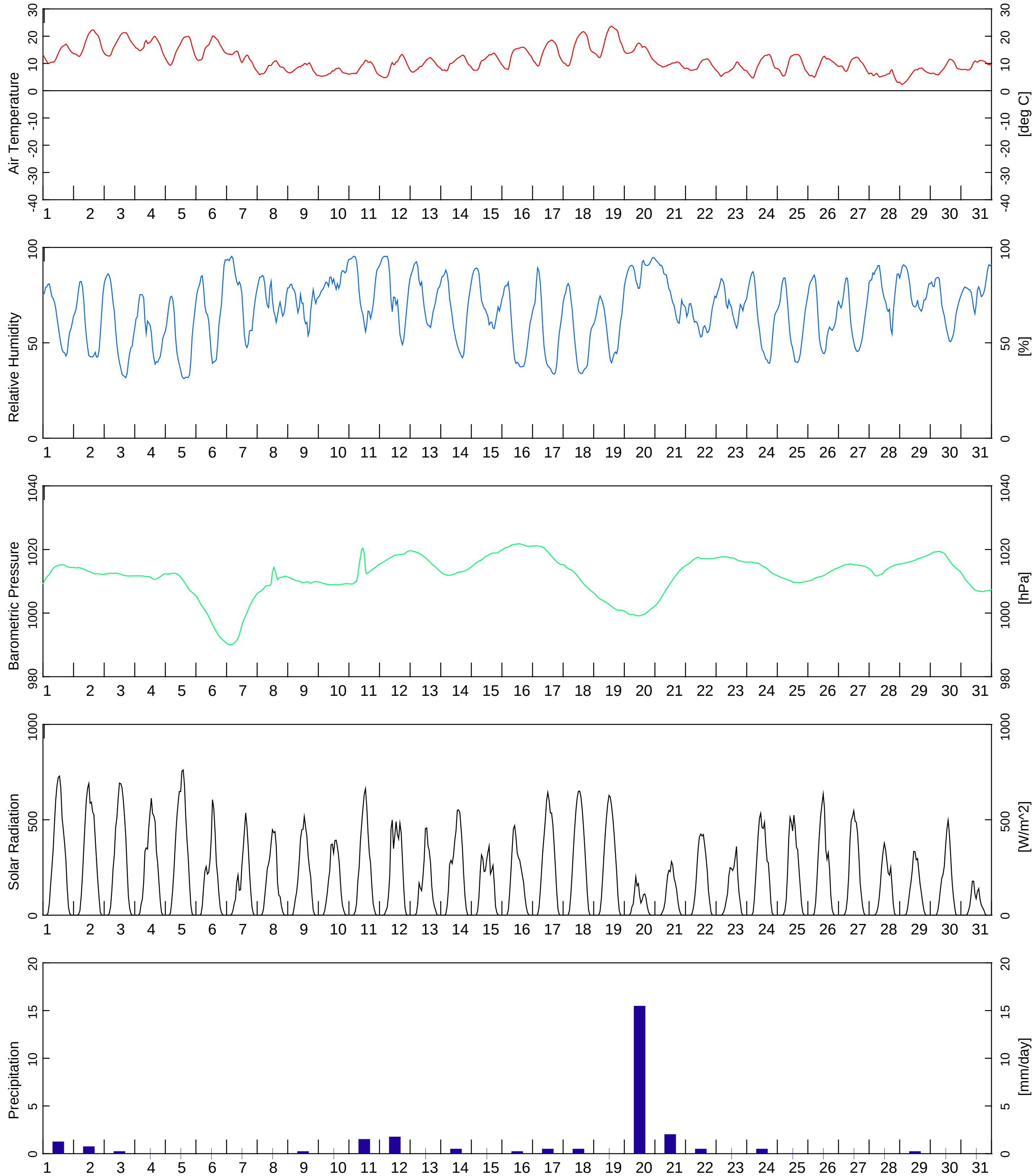
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
July 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-35

Wed Aug 05 11:24:48 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

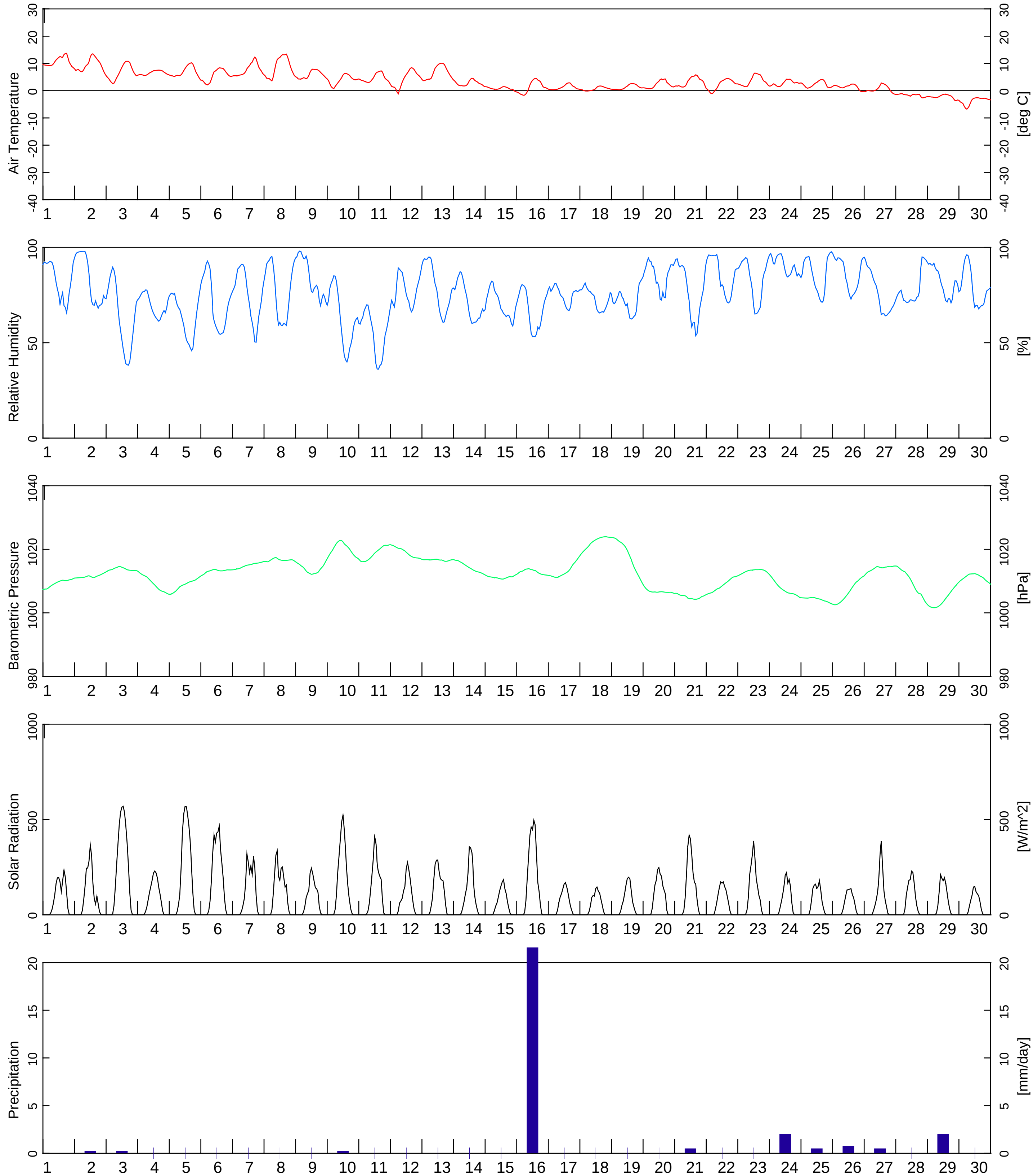
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
August 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-36



NOTES

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Tyhee NWT Corp

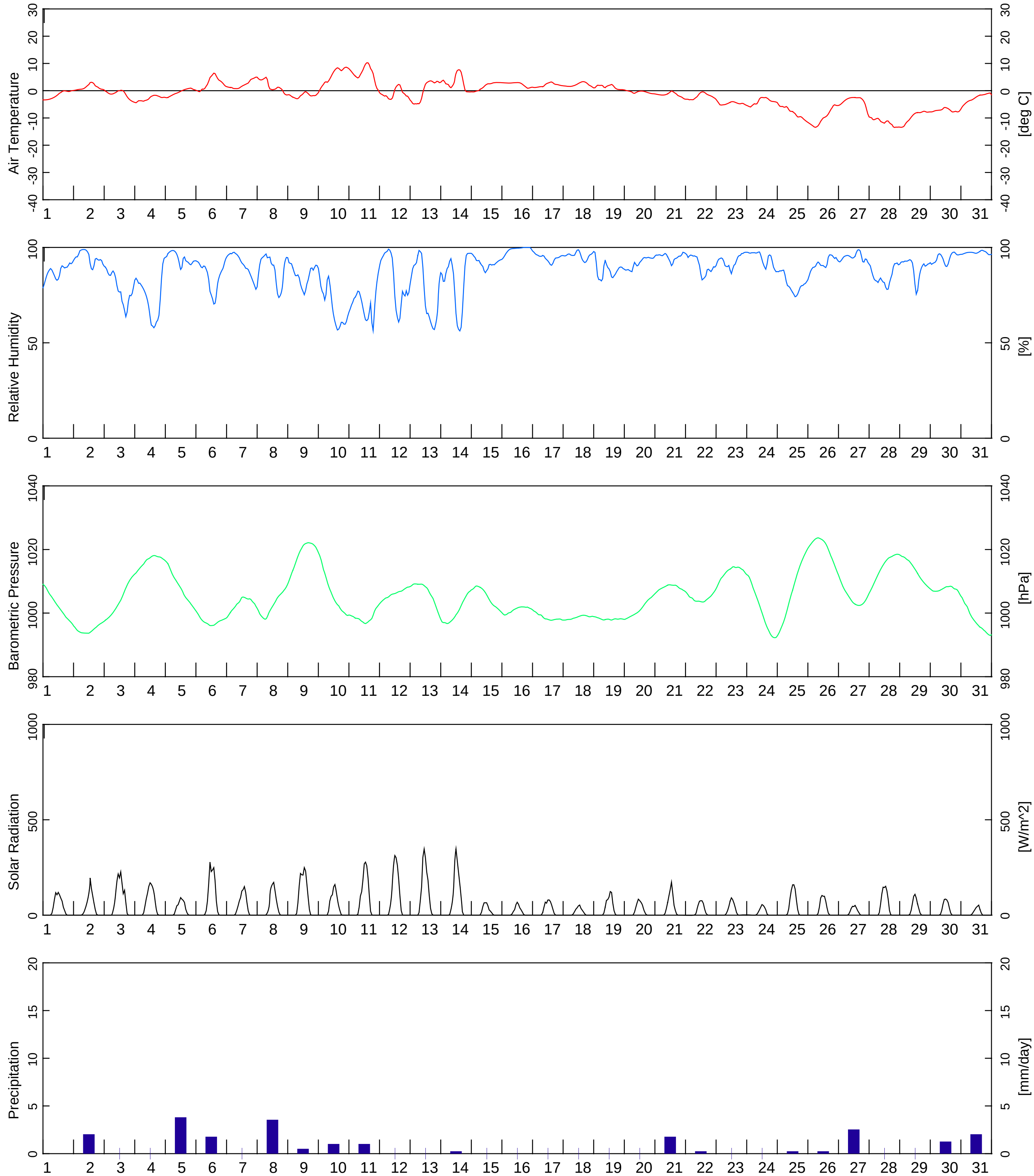
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
September 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-37



NOTES

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Tyhee NWT Corp

EBA Engineering Consultants Ltd.

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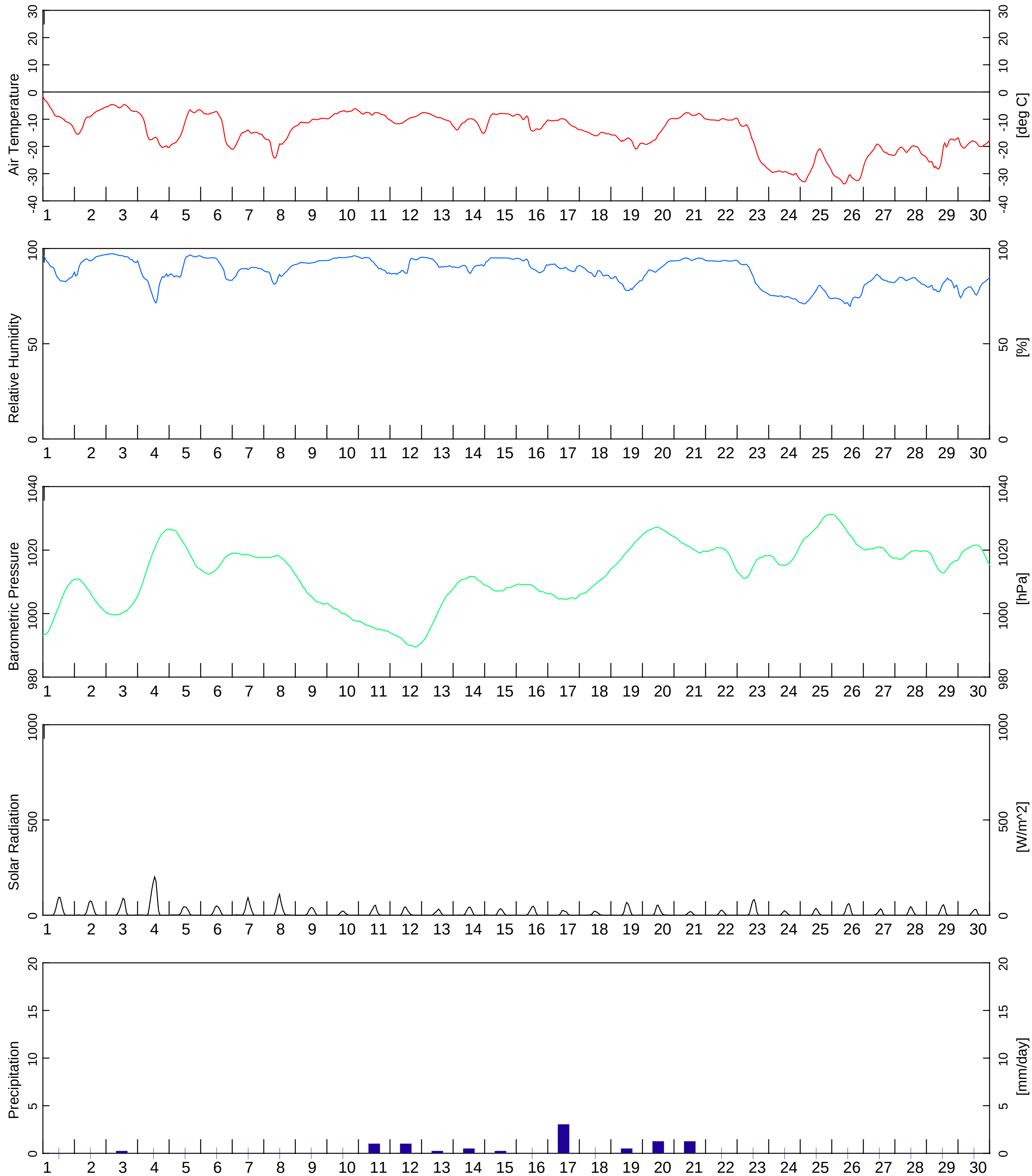
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
October 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-38

Wed Aug 05 11:24:53 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

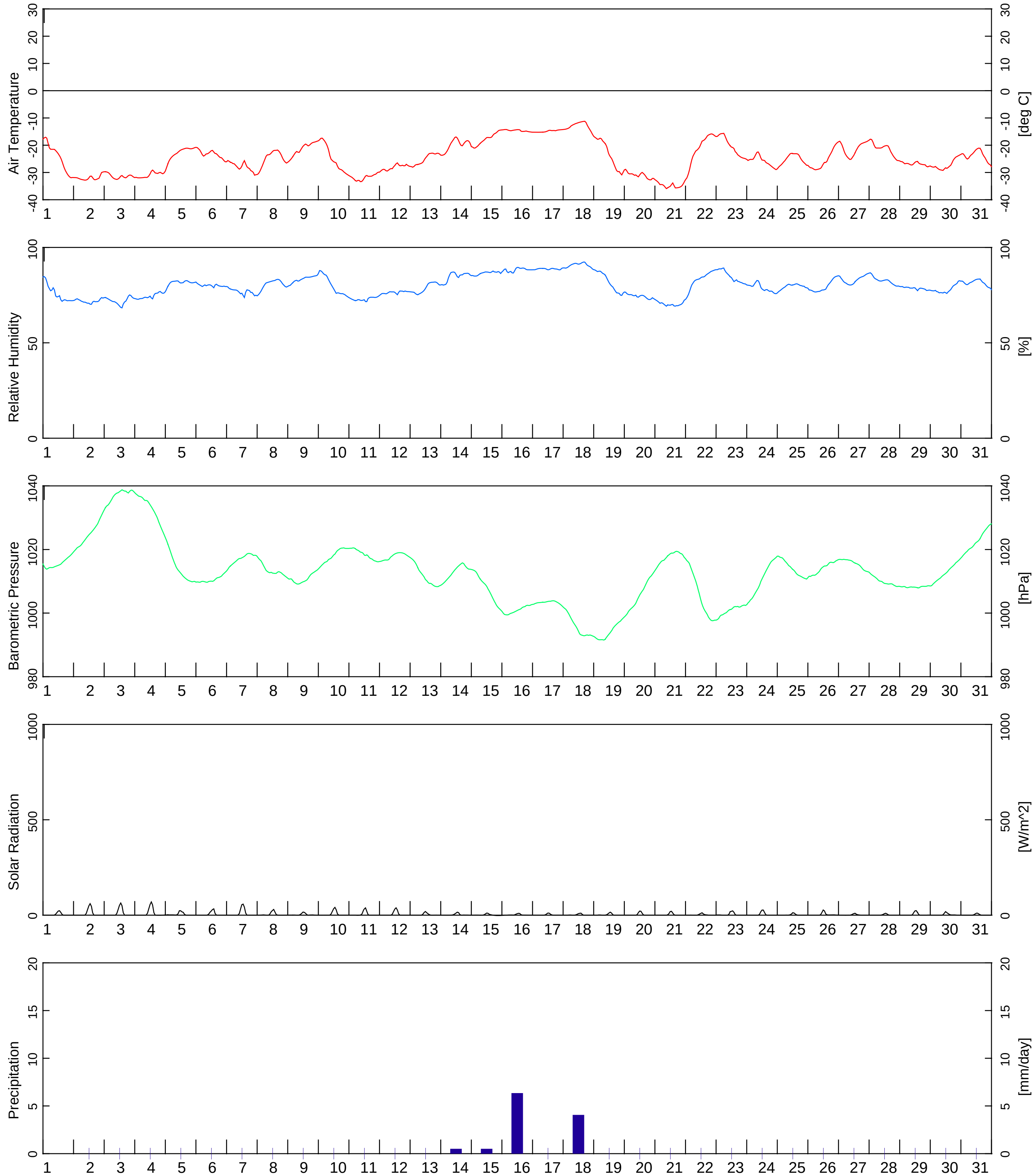
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
November 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-39

Wed Aug 05 11:24:55 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

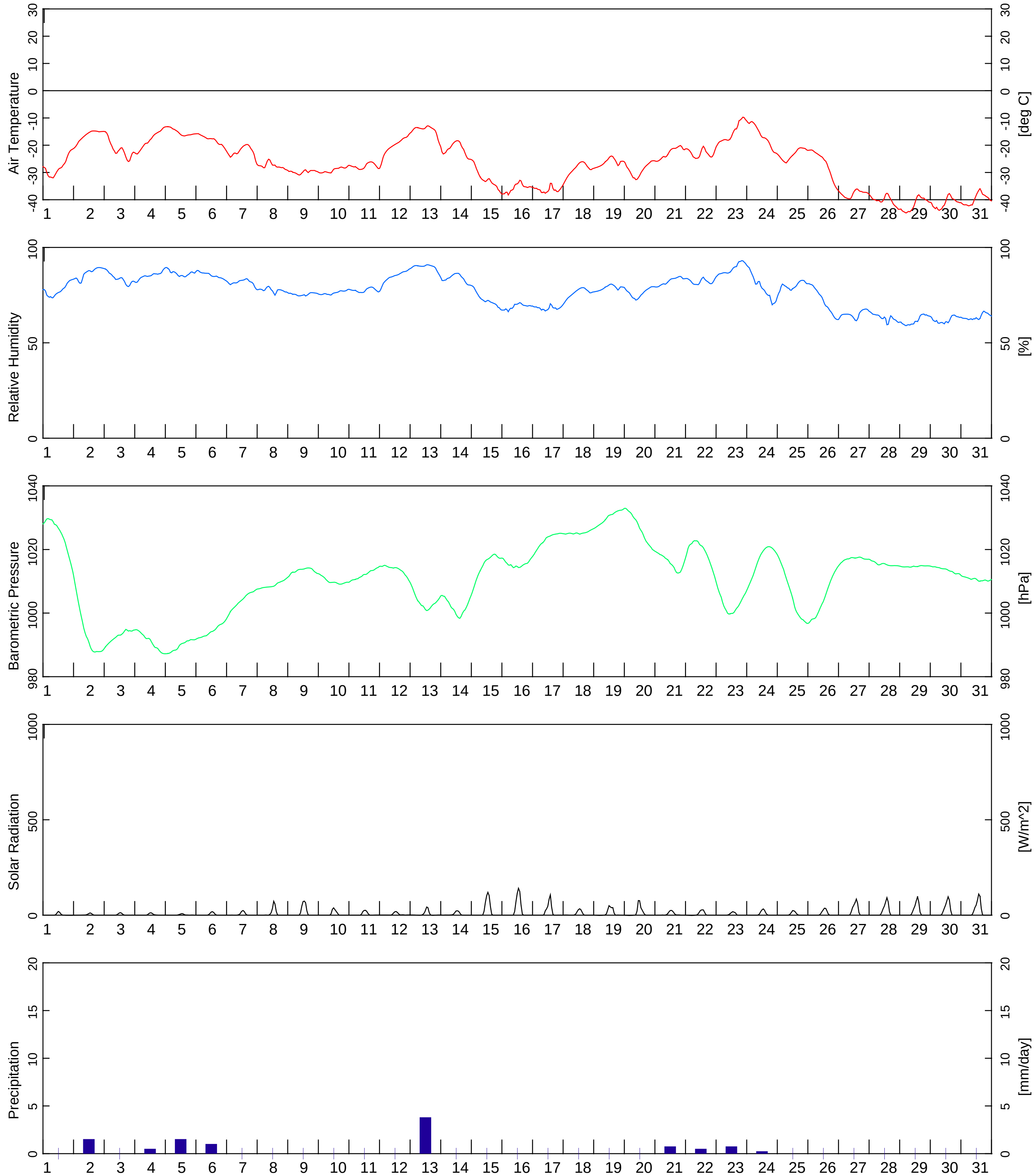
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
December 2007

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-40



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

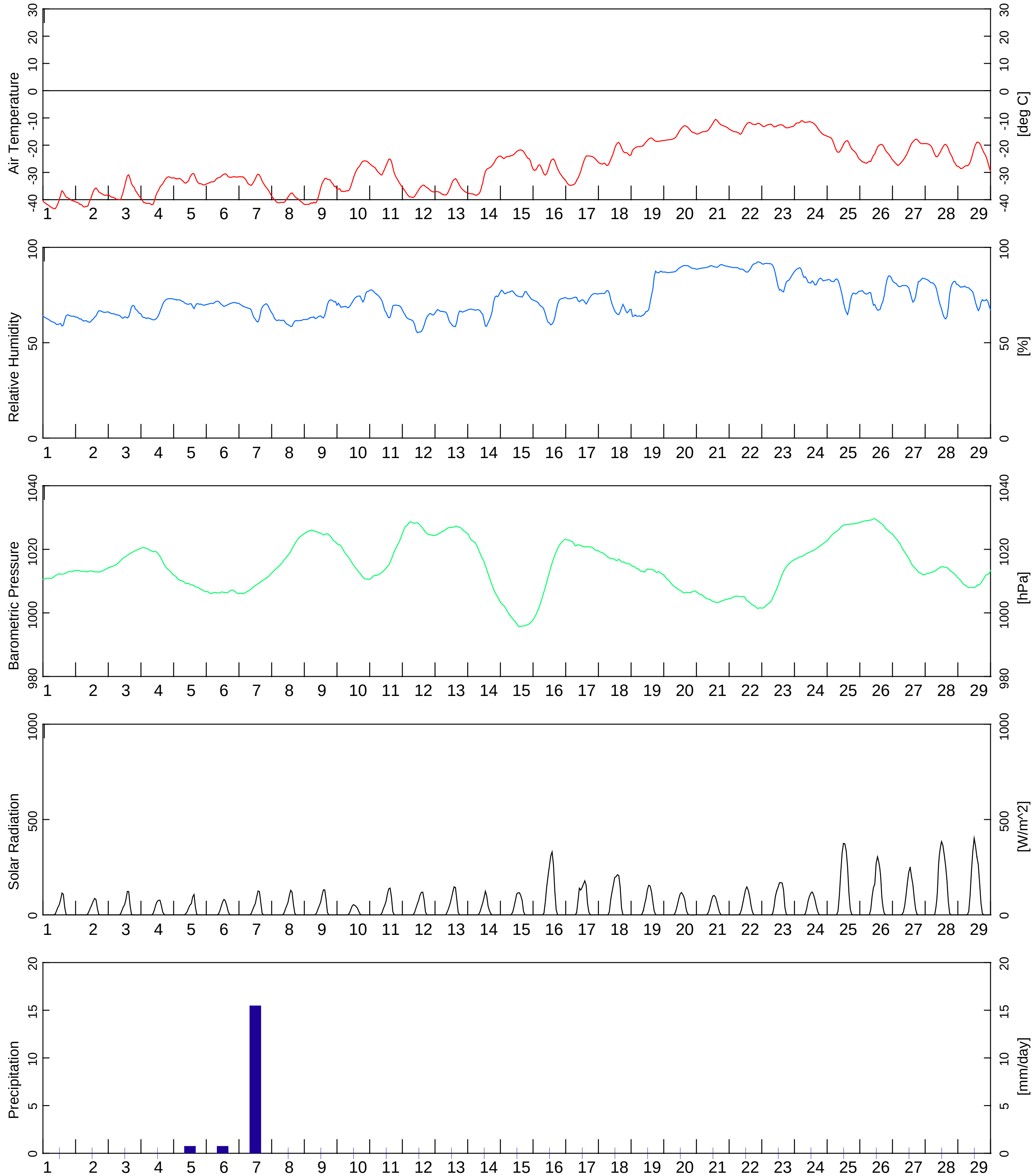
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
January 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-41

Wed Aug 05 11:26:21 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

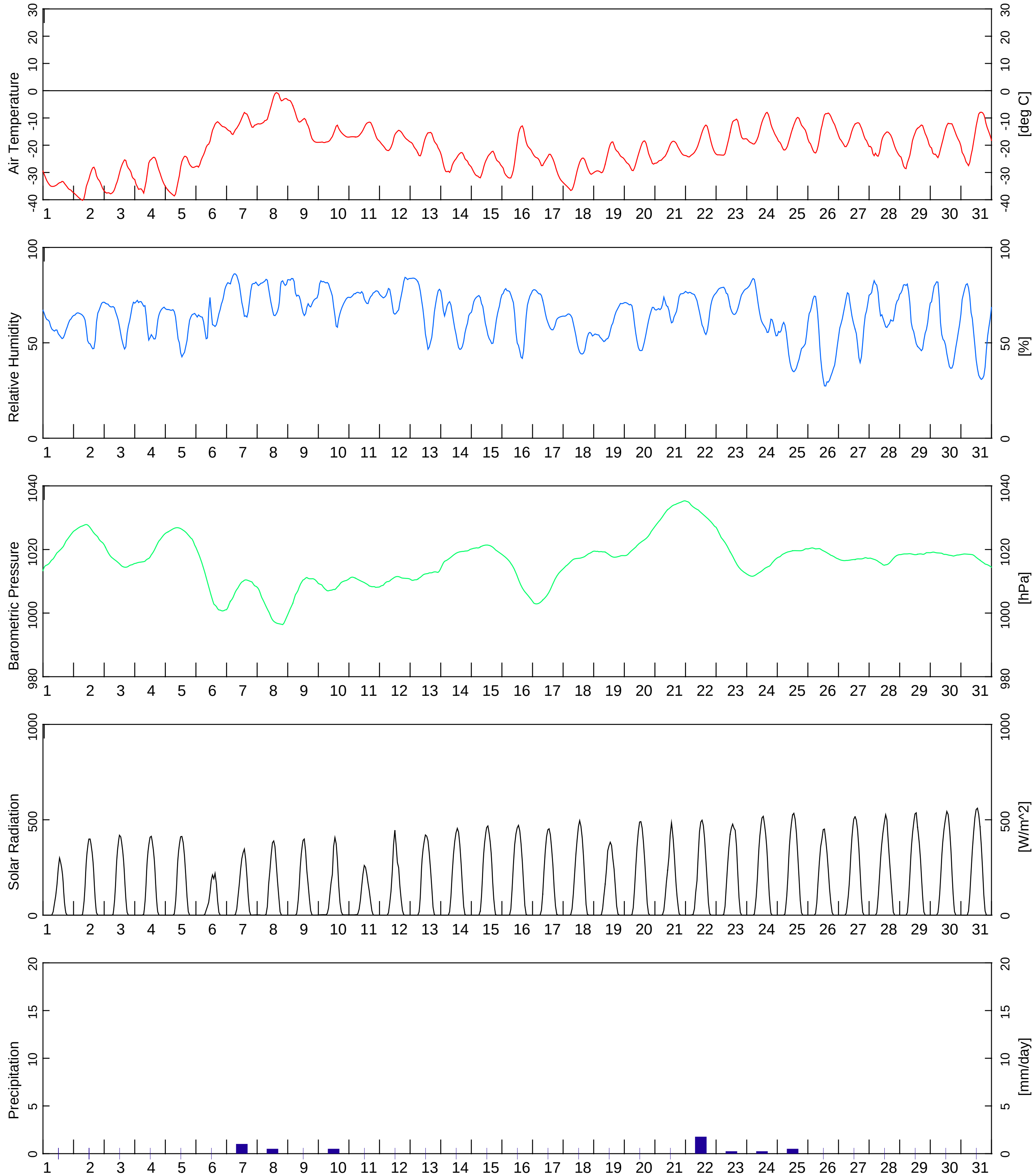
CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT 2008 HYDROMETEOROLOGICAL REPORT				
Tyhee Station Weather Data February 2008				
PROJECT NO. Y22101057	DWN RED	CHK JAS	REV 0	Figure D-42
OFFICE EBA-VANC	DATE July 2009			

Wed Aug 05 11:26:22 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

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Tyhee NWT Corp

EBA Engineering Consultants Ltd.

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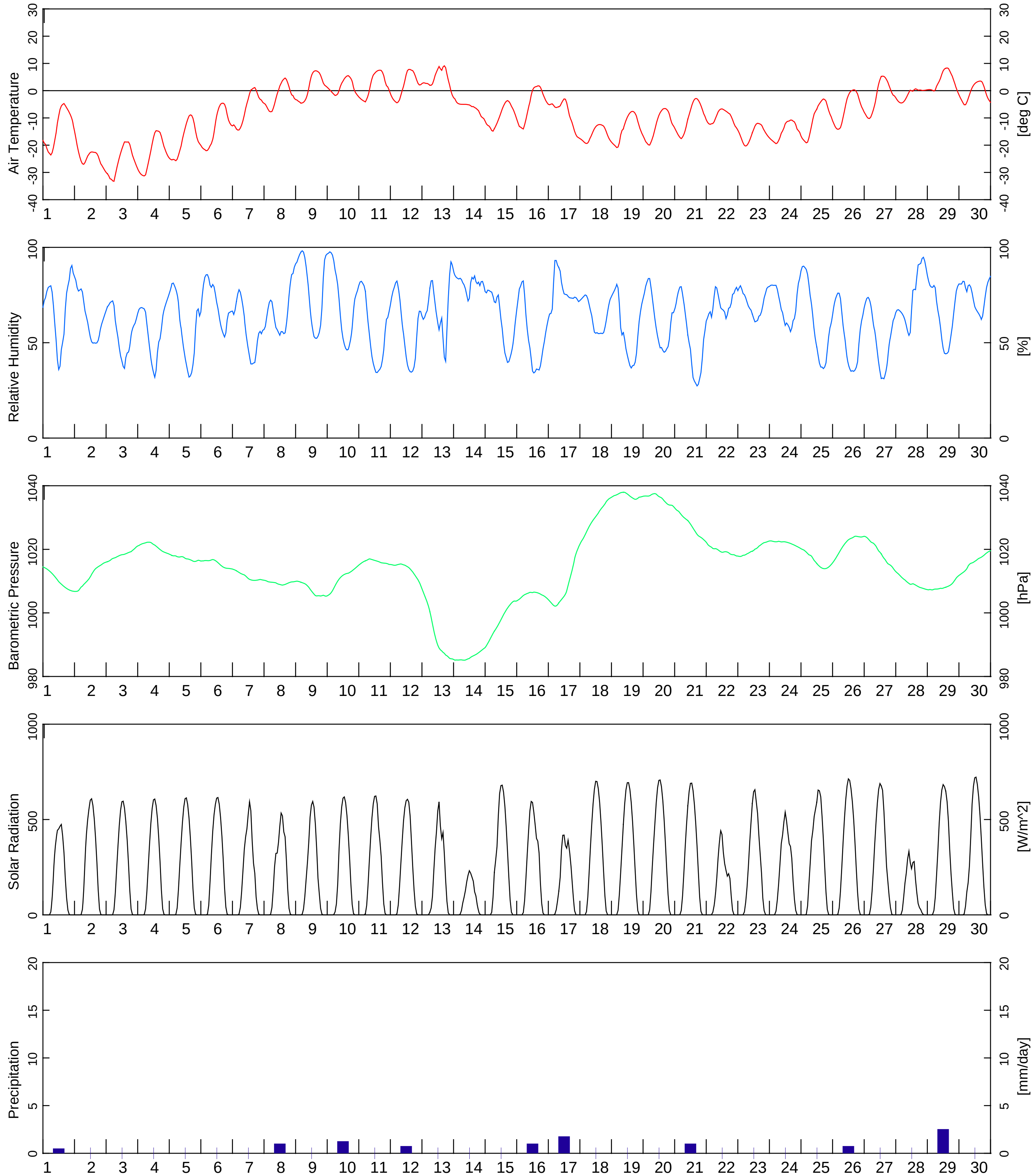
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
March 2008

PROJECT NO.	DWN	CHK	REV	
Y22101057	RED	JAS	0	**Figure D-43**
OFFICE	DATE			
EBA-VANC	July 2009			

Wed Aug 05 11:26:24 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

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Tyhee NWT Corp

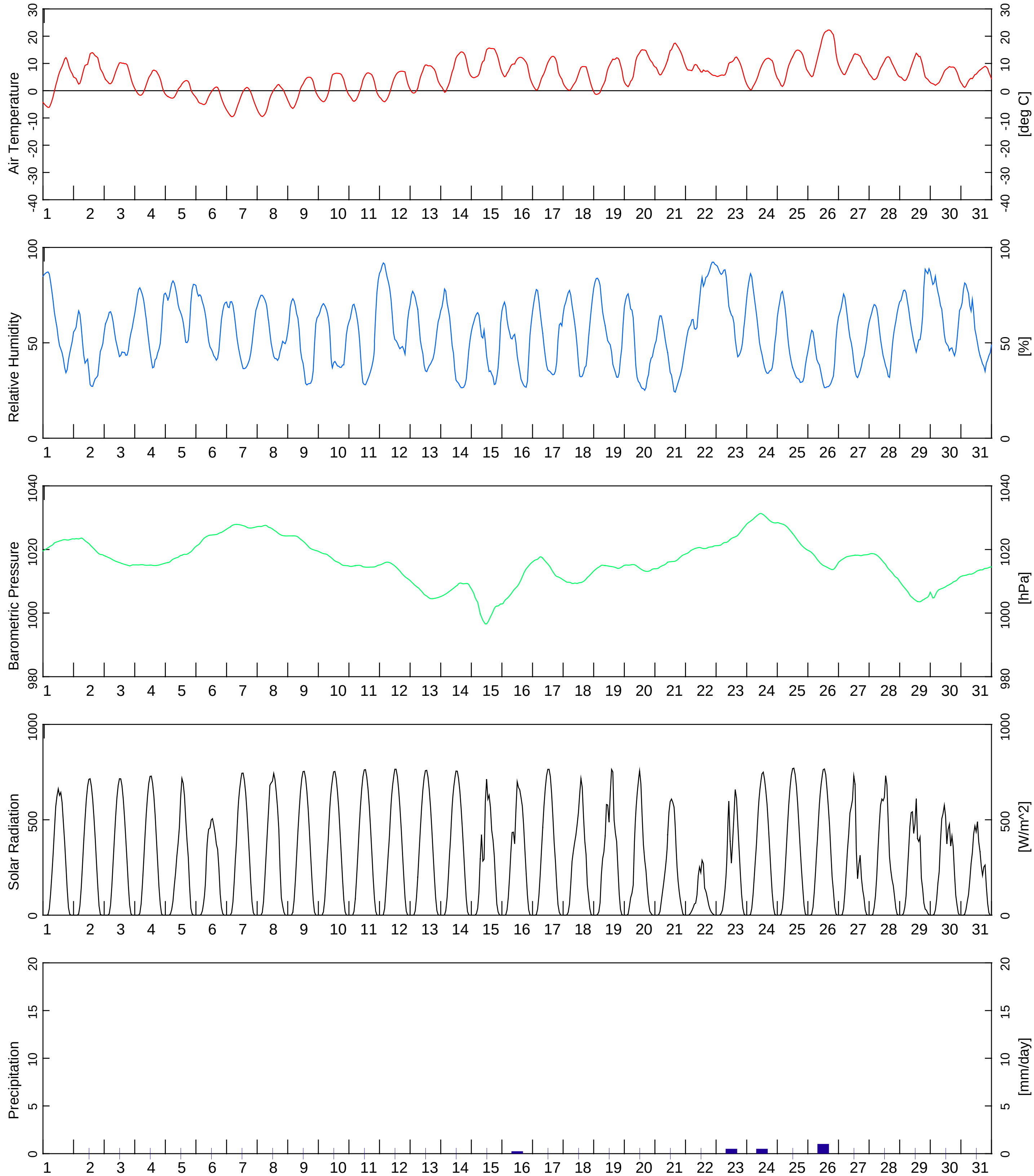
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
April 2008

PROJECT NO.	DWN	CHK	REV	
Y22101057	RED	JAS	0	**Figure D-44**
OFFICE	DATE			
EBA-VANC	July 2009			

Wed Aug 05 11:26:25 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

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Tyhee NWT Corp

EBA Engineering Consultants Ltd.

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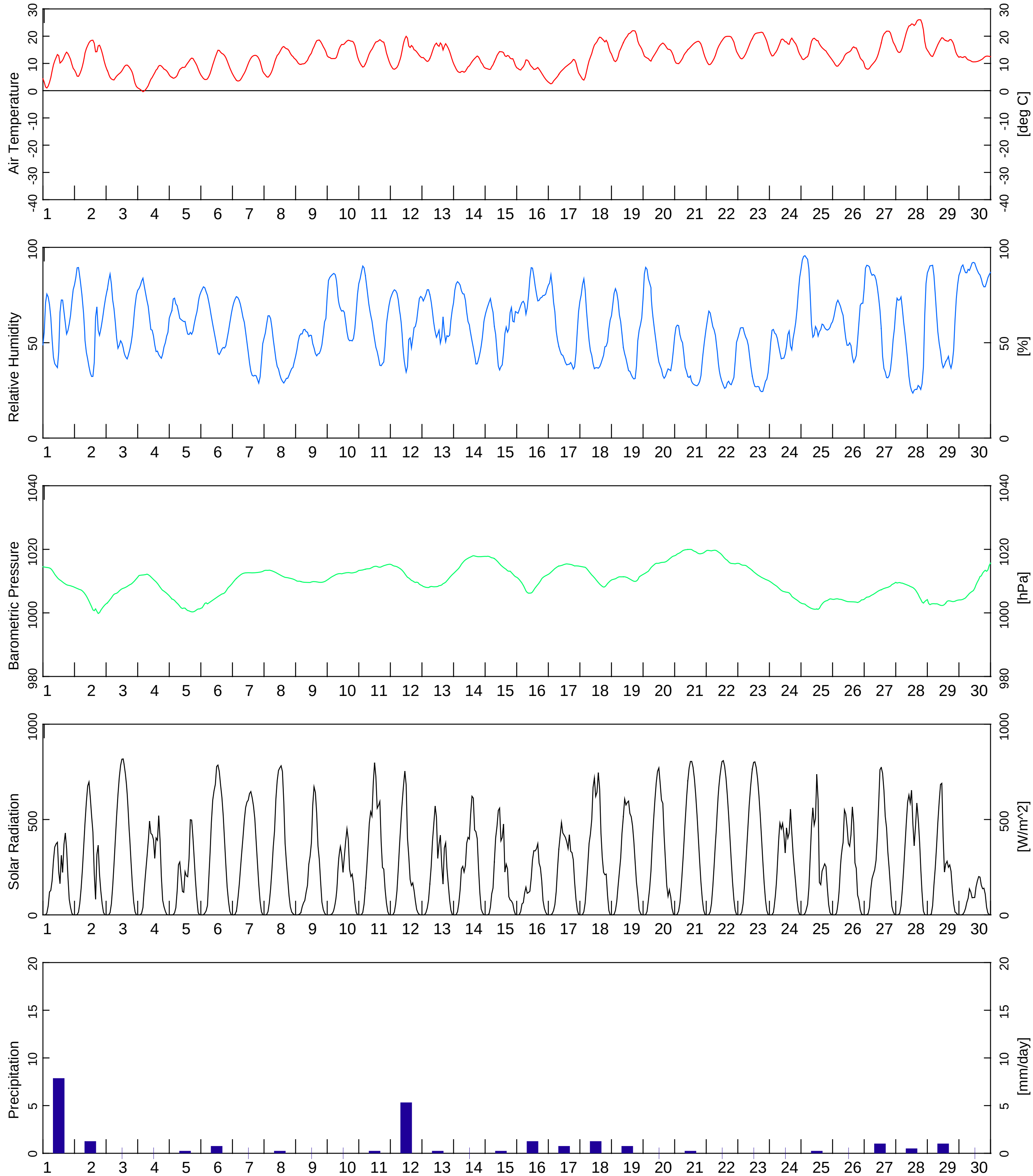
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
May 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-45

Wed Aug 05 11:26:28 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

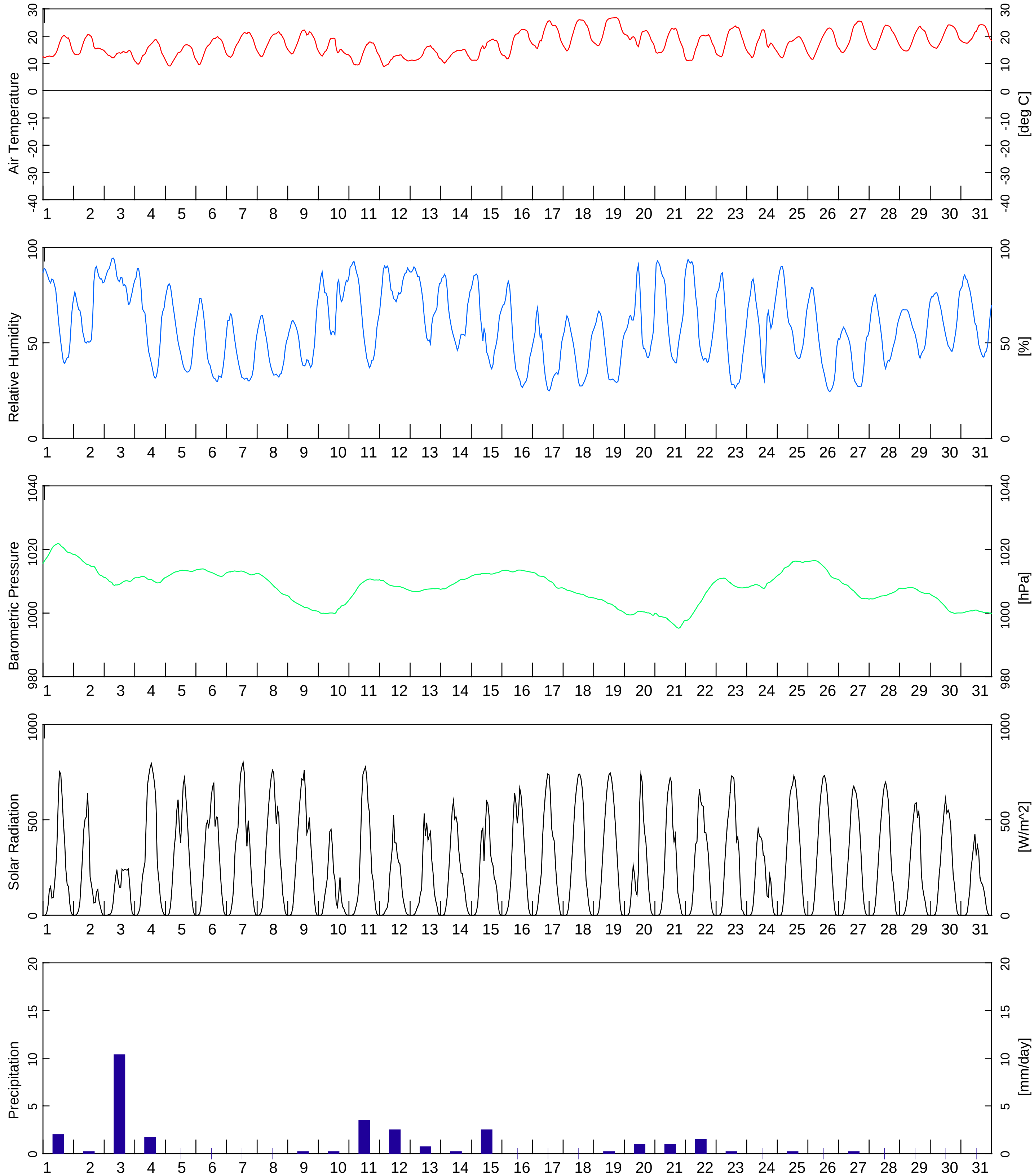
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
June 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-46



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

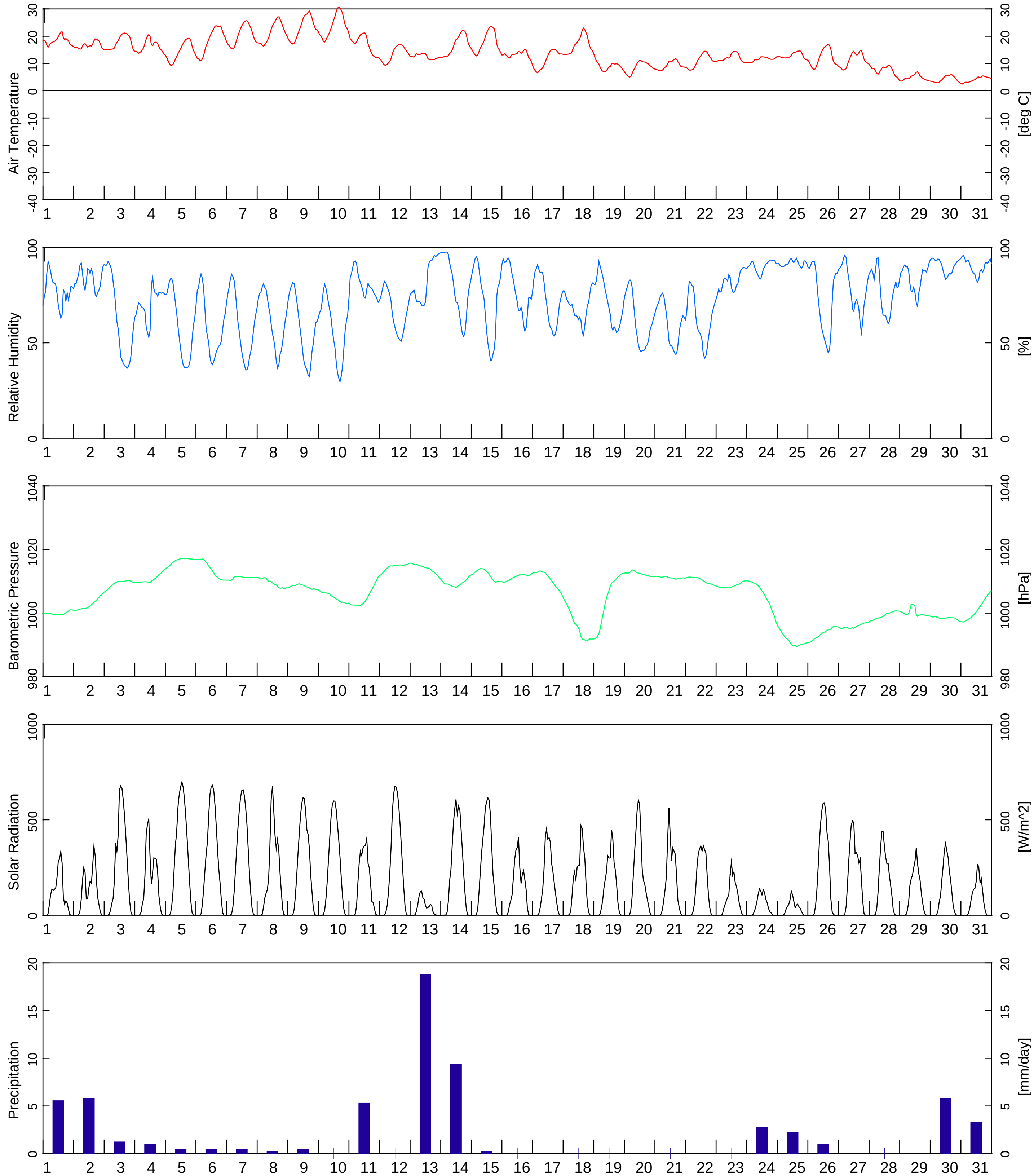
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
July 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-47

Wed Aug 05 11:26:31 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

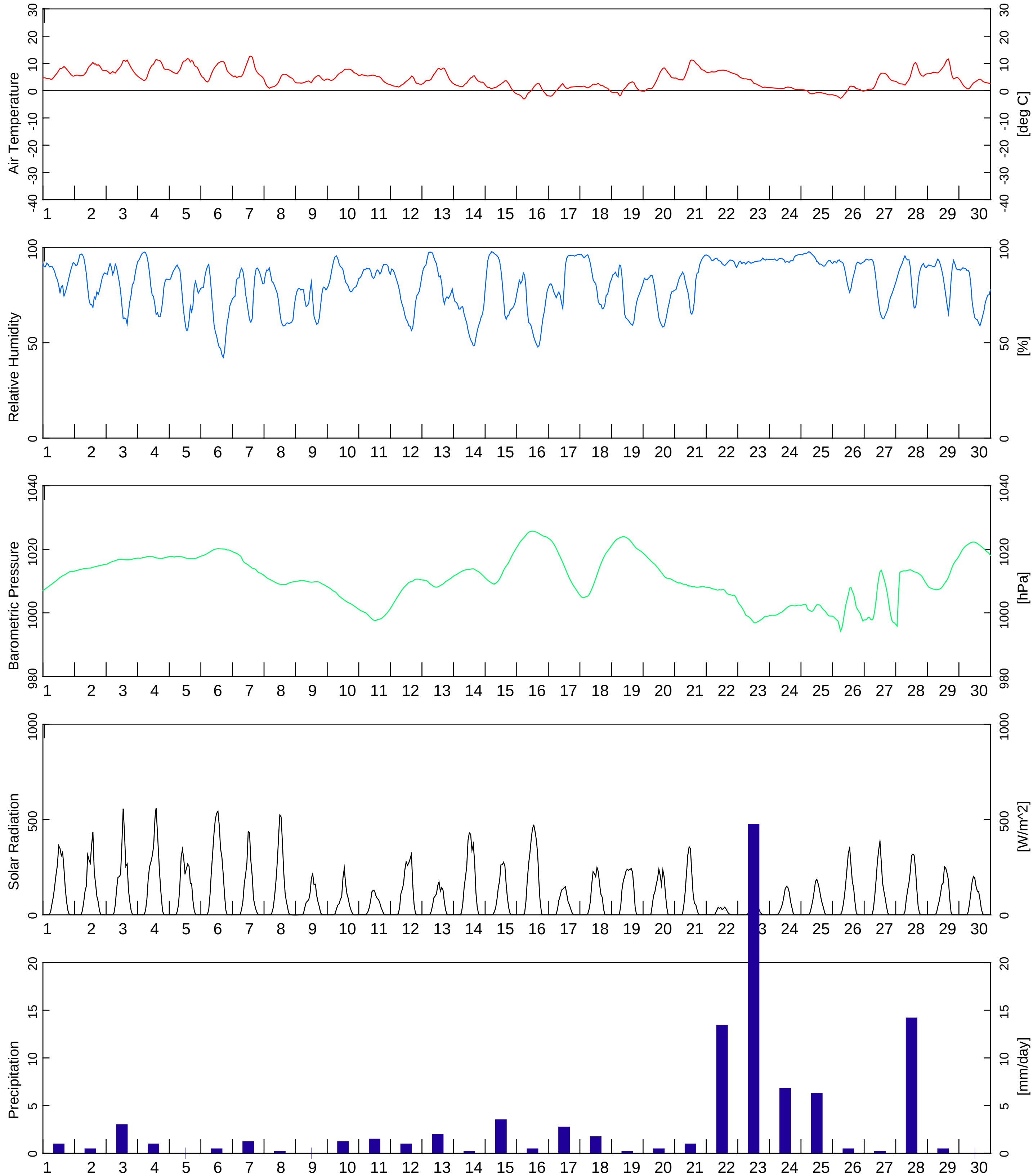
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
August 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-48

Wed Aug 05 11:26:32 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

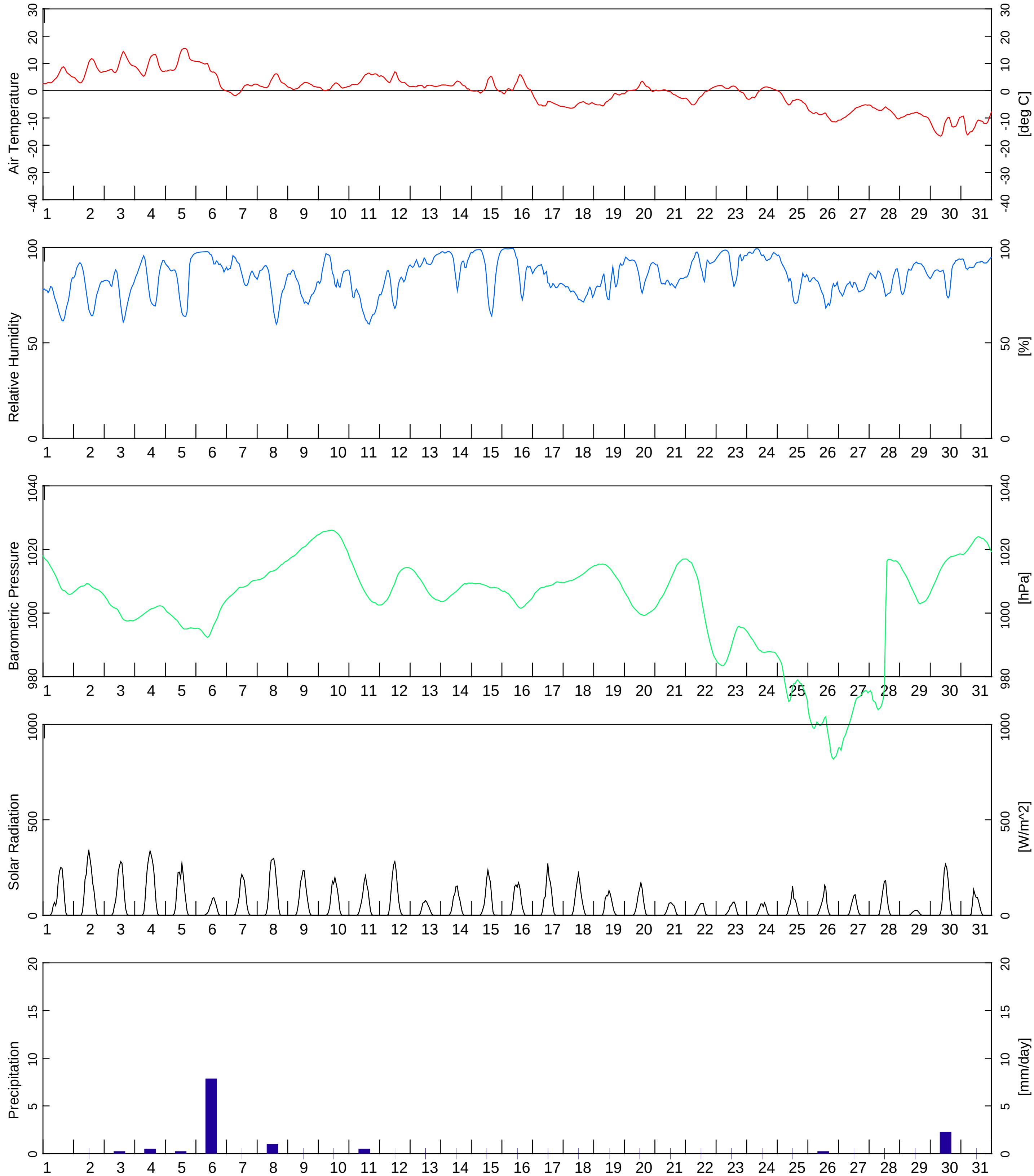
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
September 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-49

Wed Aug 05 11:26:34 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

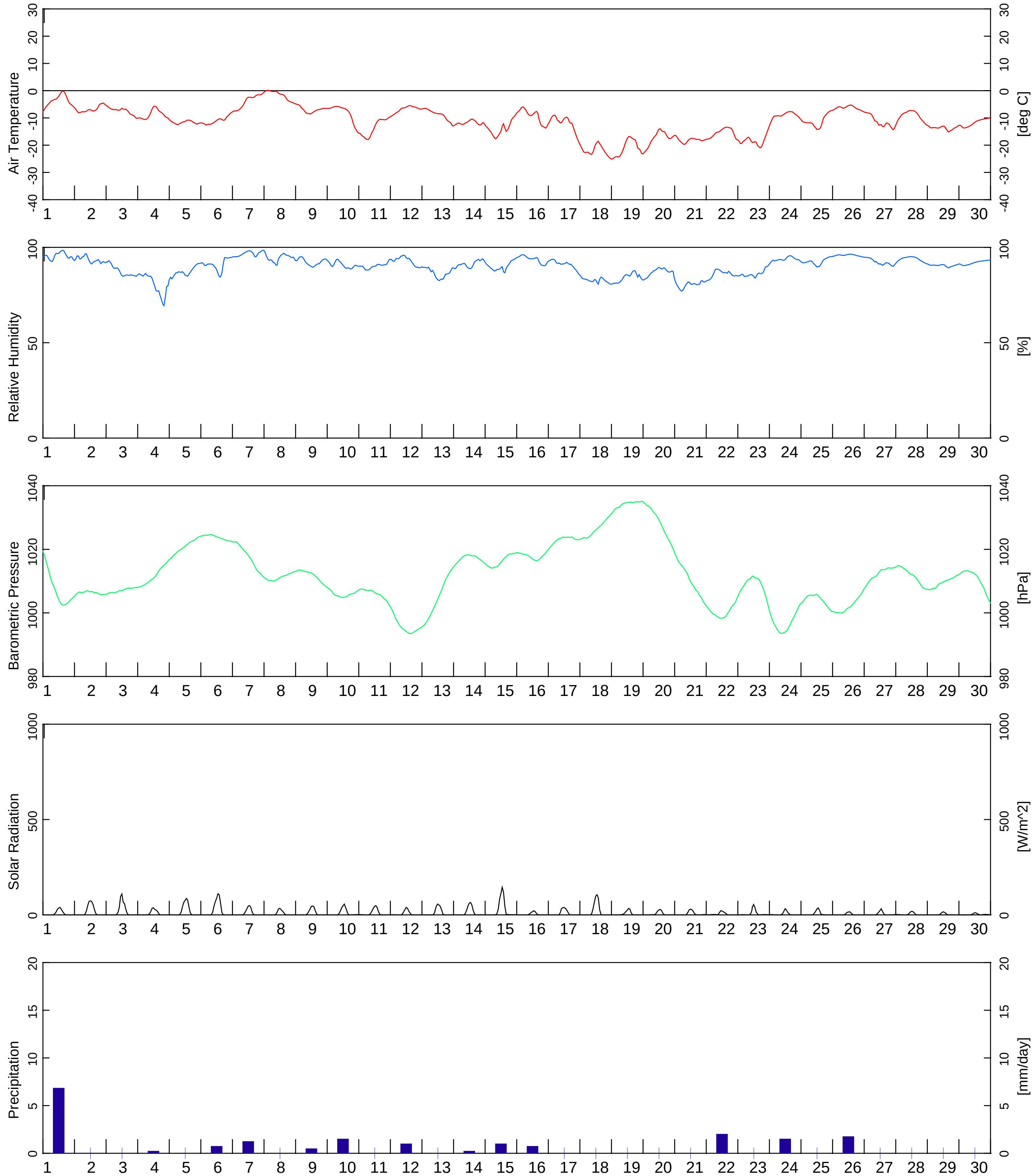
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
October 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-50

Wed Aug 05 11:26:35 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

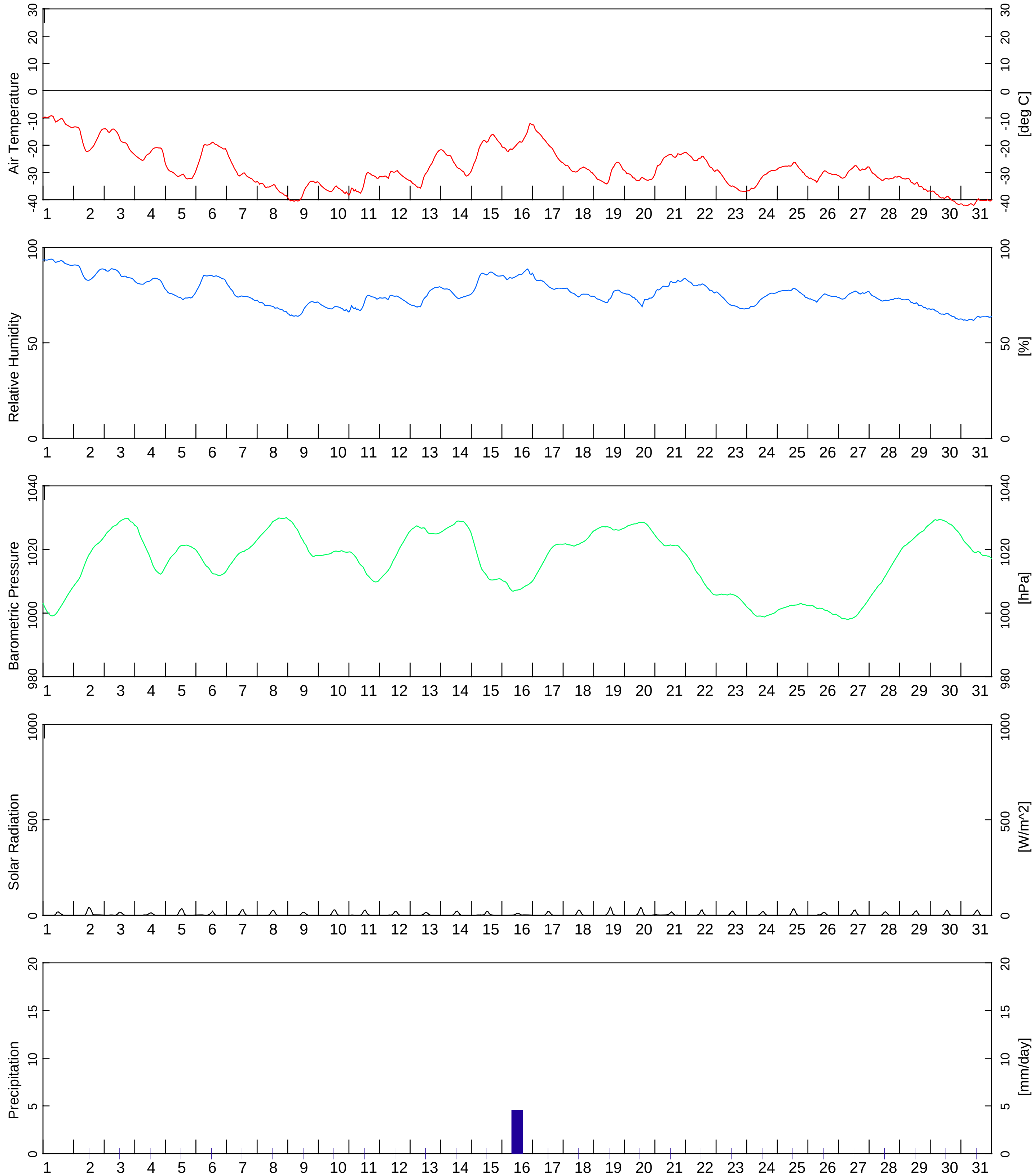
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
November 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-51

Wed Aug 05 11:26:37 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

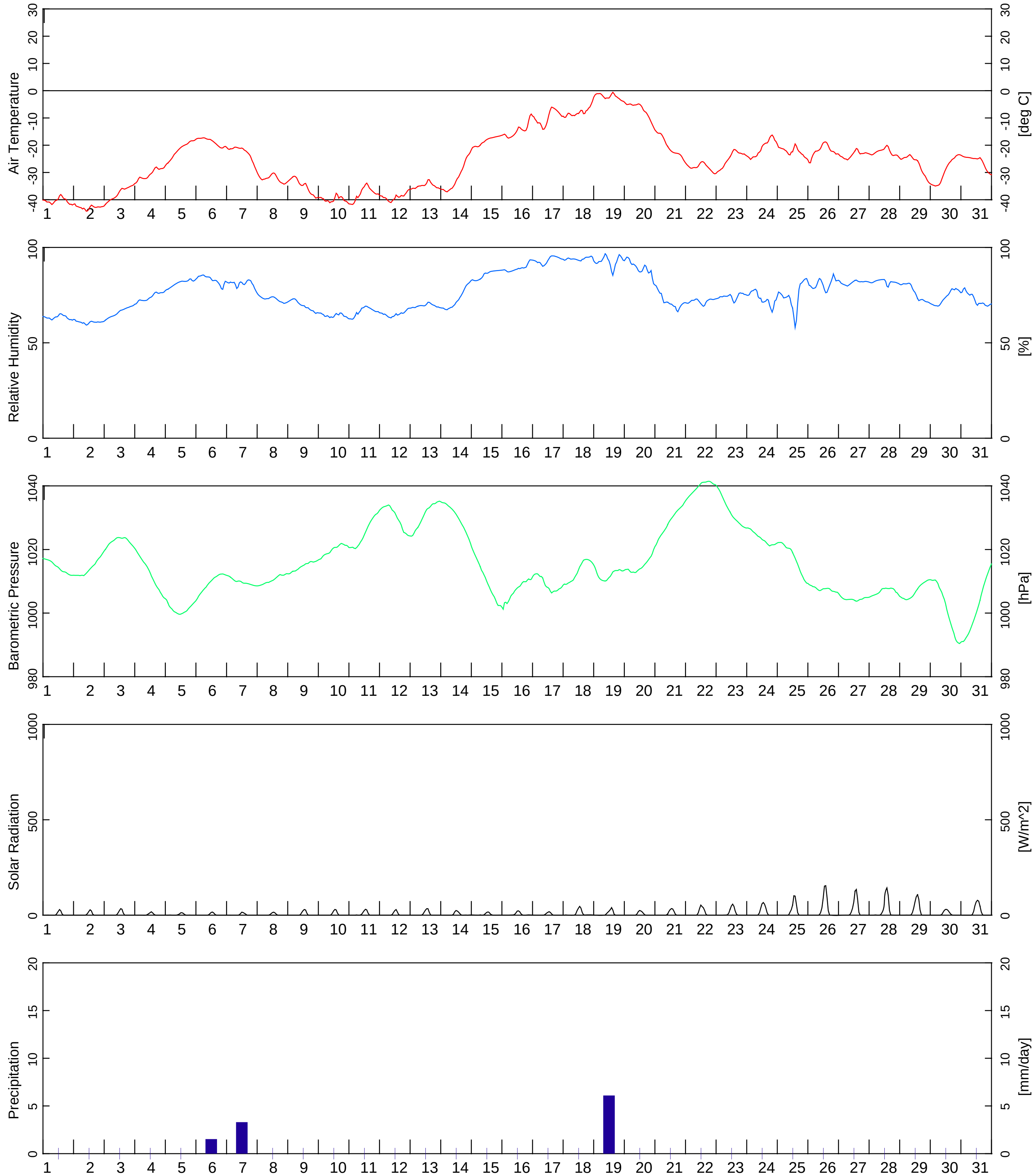
YELLOWKNIFE GOLD PROJECT
2008 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
December 2008

PROJECT NO.	DWN	CHK	REV
Y22101057	RED	JAS	0
OFFICE	DATE		
EBA-VANC	July 2009		

Figure D-52

Wed Aug 05 11:26:39 2009:Q:\Vancouver\Engineering\V132\Projects\Y22101057- Tyhee_2008\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

eba

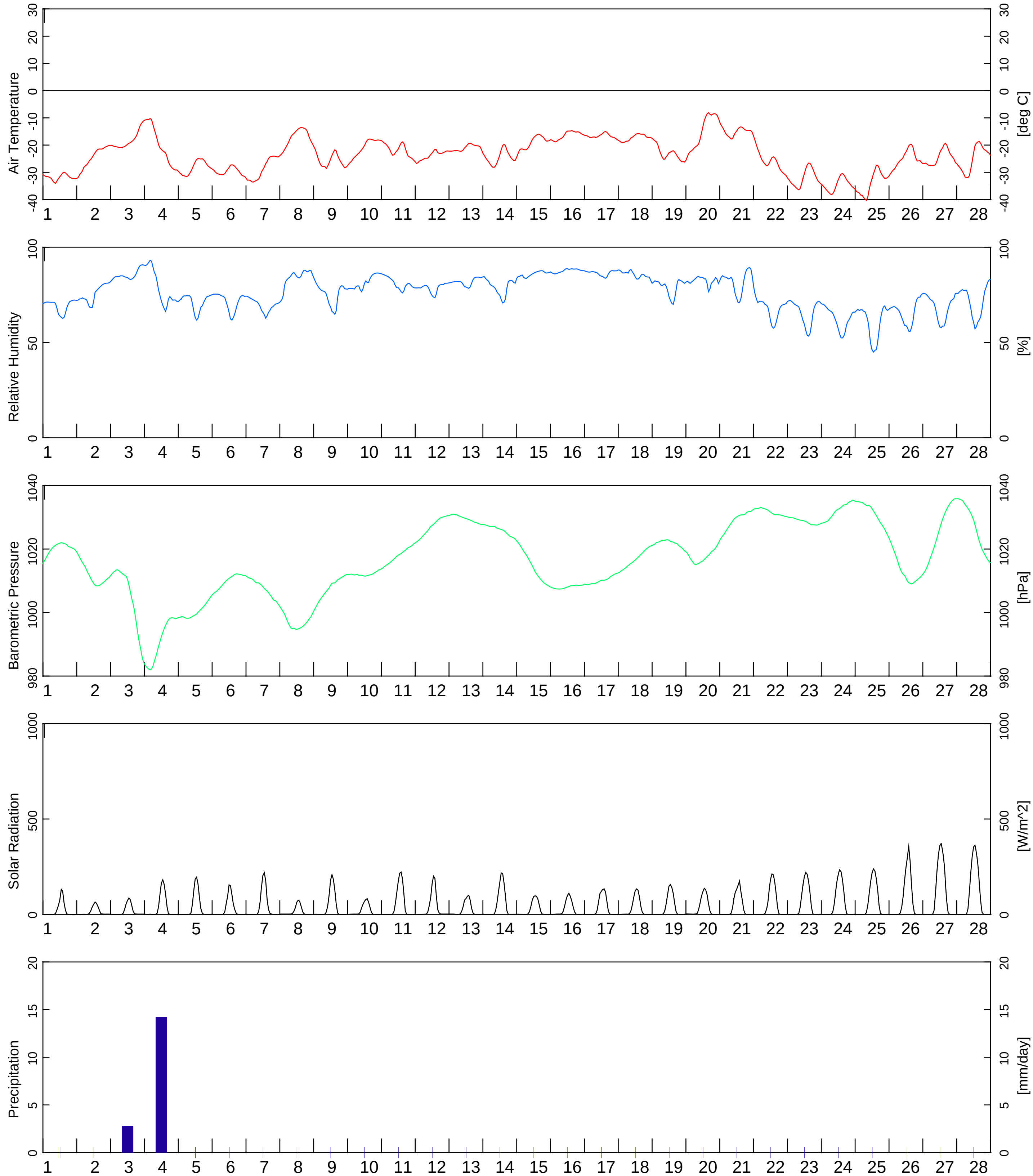
YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
January 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0
OFFICE	DATE		
EBA-VANC	February 2010		

Figure D-53

Thu Jan 28 16:17:17 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

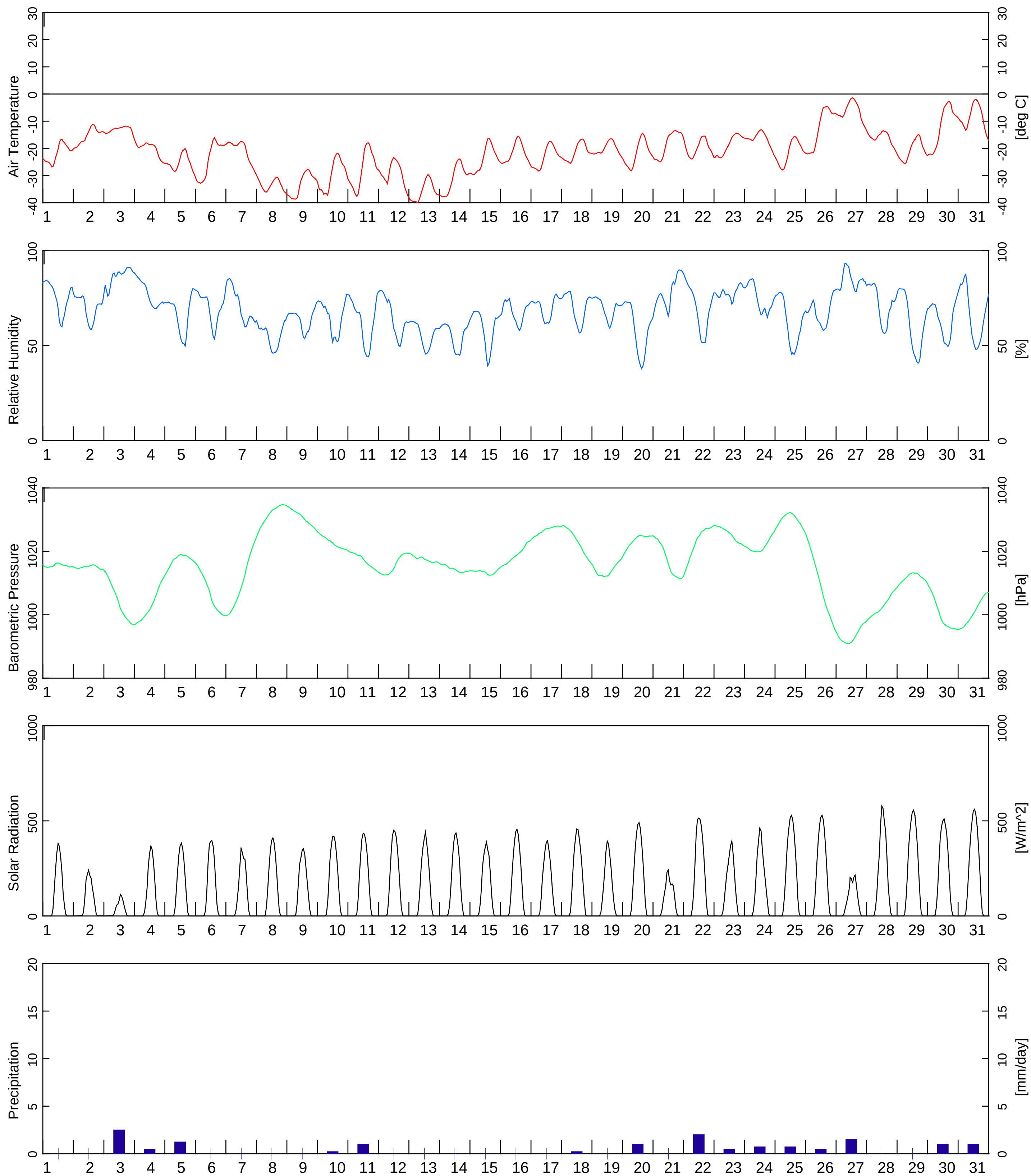
YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
February 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0
OFFICE	DATE		
EBA-VANC	February 2010		

Figure D-54

Thu Jan 28 16:17:18 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

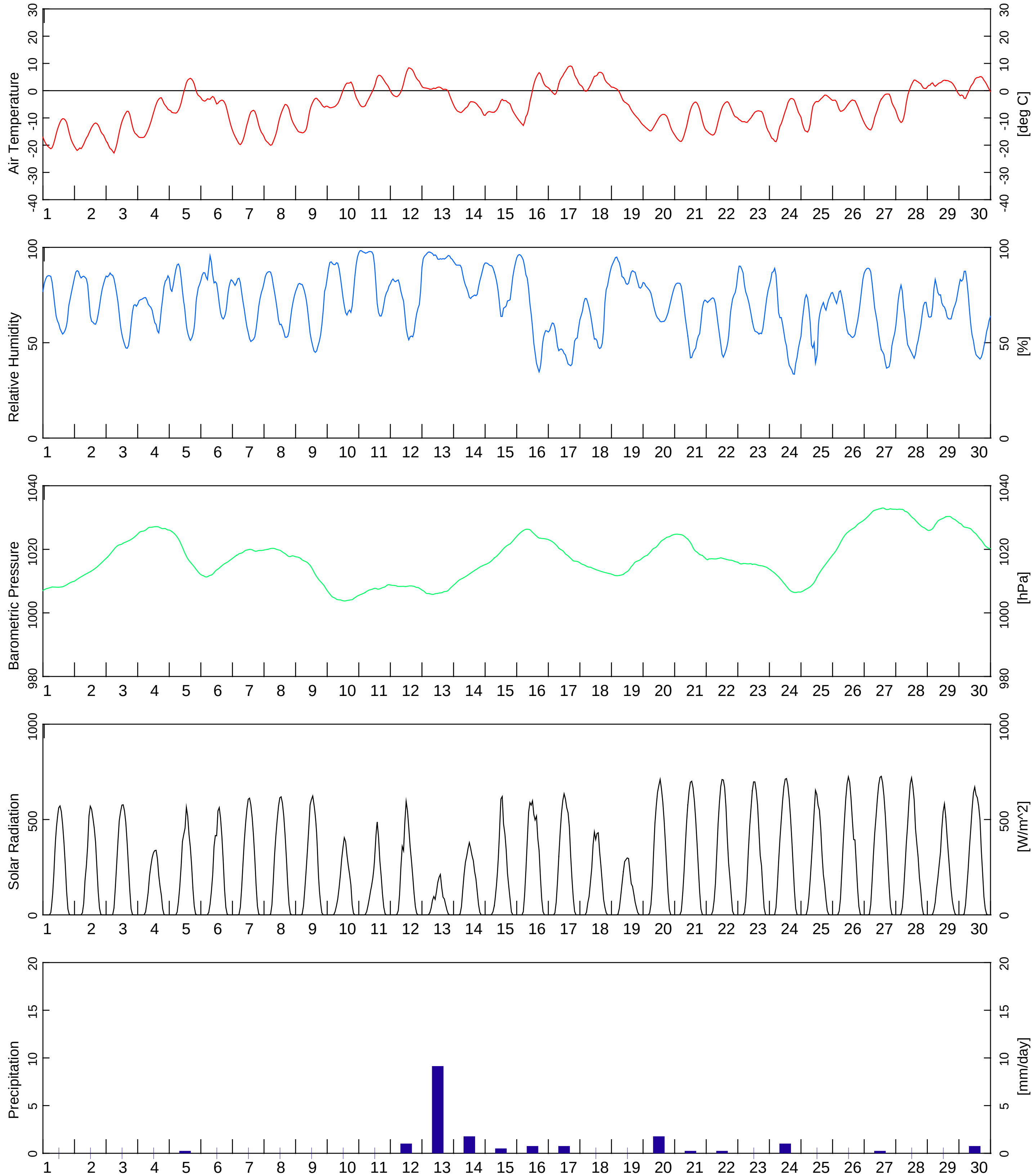
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
March 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0
OFFICE	DATE		
EBA-VANC	February 2010		

Figure D-55



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

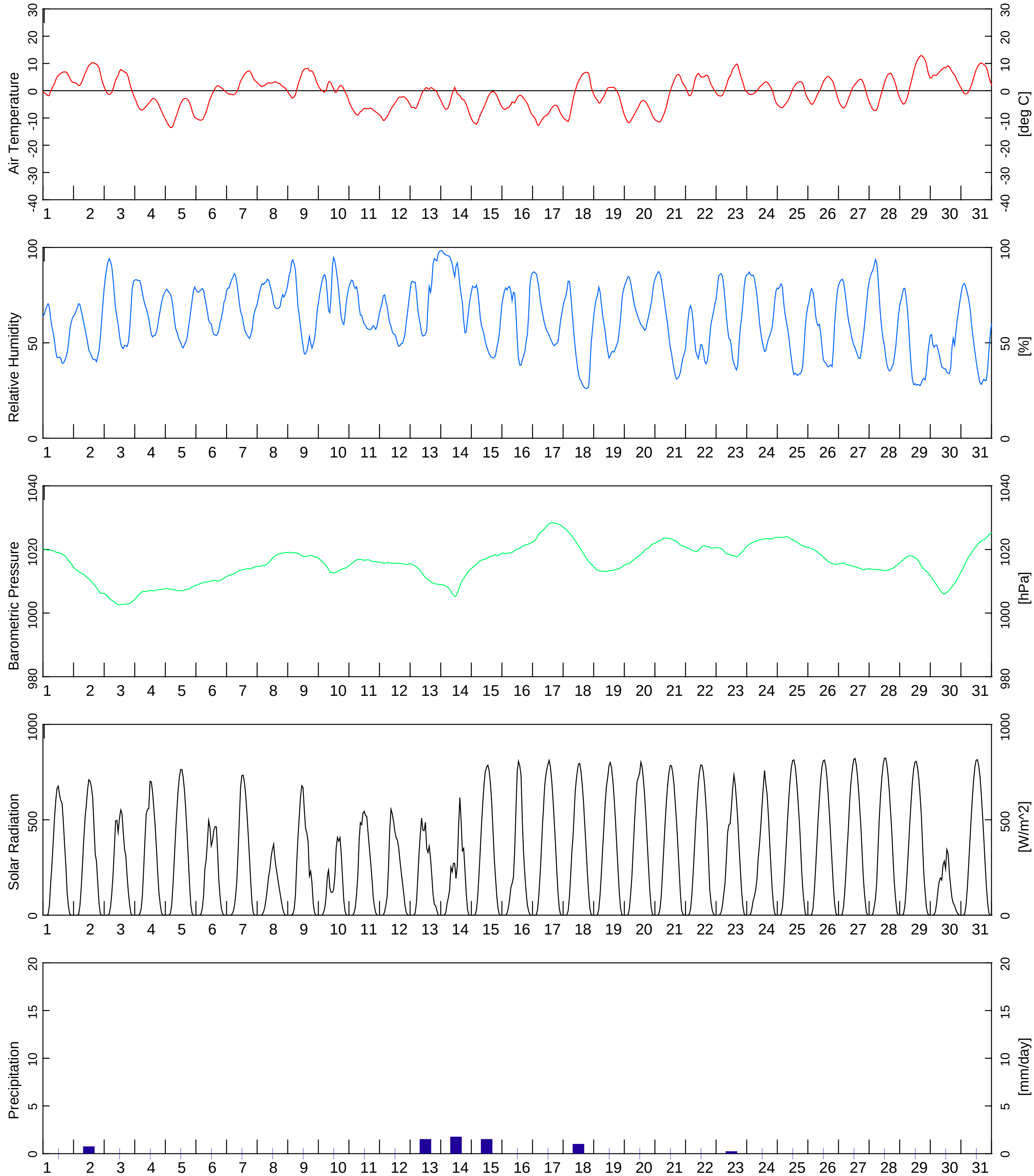
Tyhee Station
Weather Data
April 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0

OFFICE	DATE
EBA-VANC	February 2010

Figure D-56

Thu Jan 28 16:17:20 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

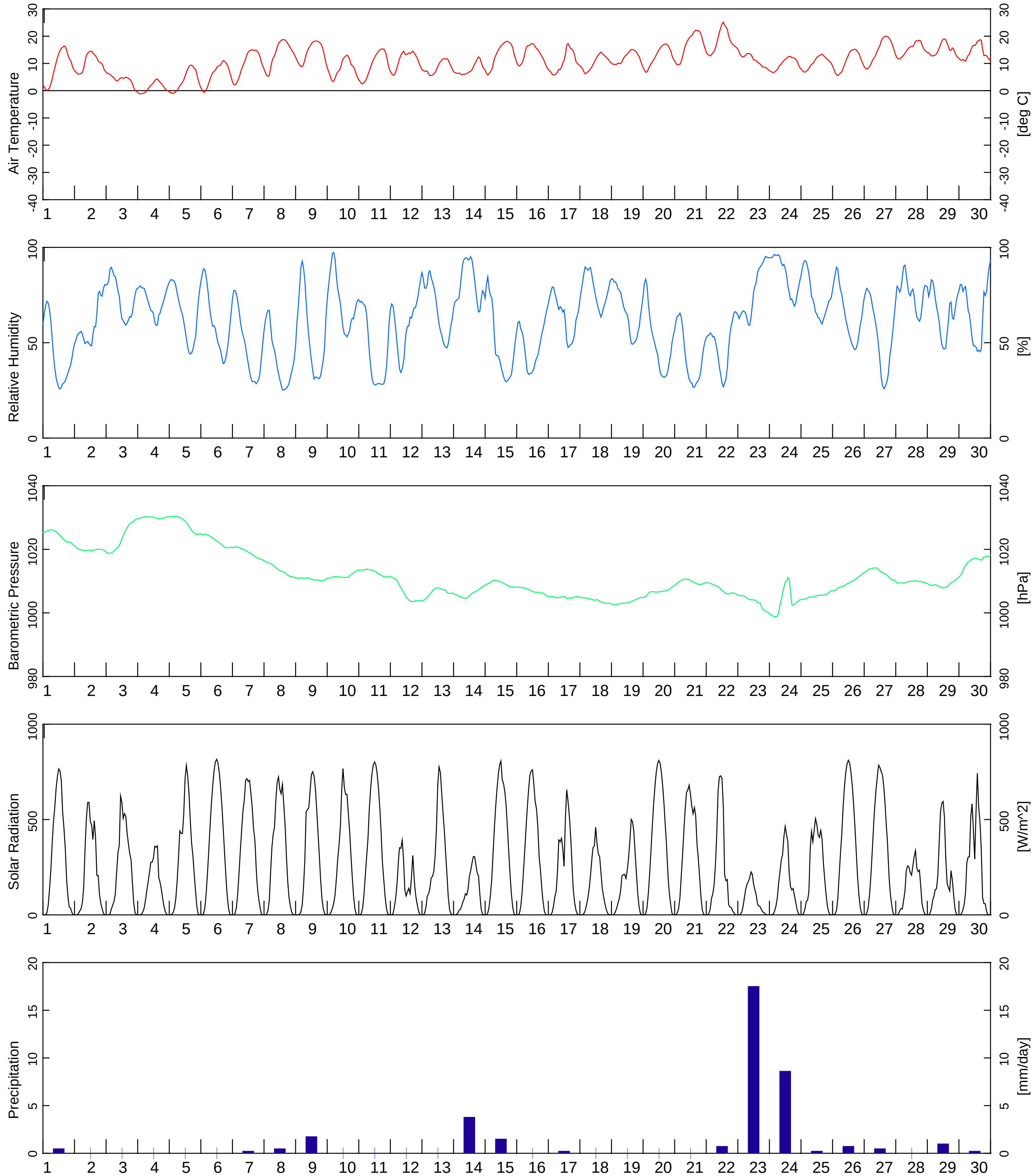
YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
May 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0
OFFICE	DATE		
EBA-VANC	February 2010		

Figure D-57

Thu Jan 28 16:17:21 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

eba

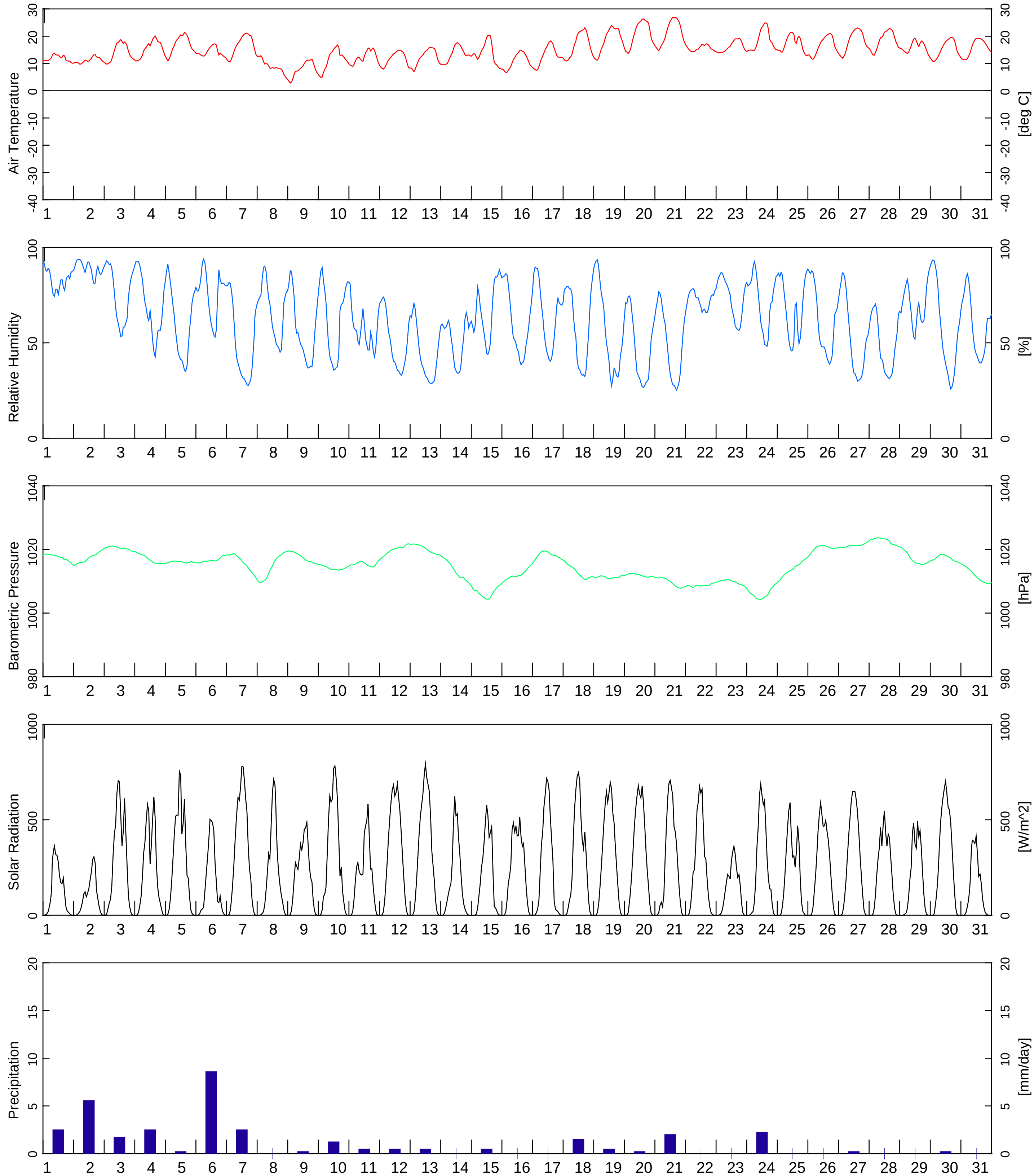
YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
June 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0
OFFICE	DATE		
EBA-VANC	February 2010		

Figure D-58

Thu Jan 28 16:17:23 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

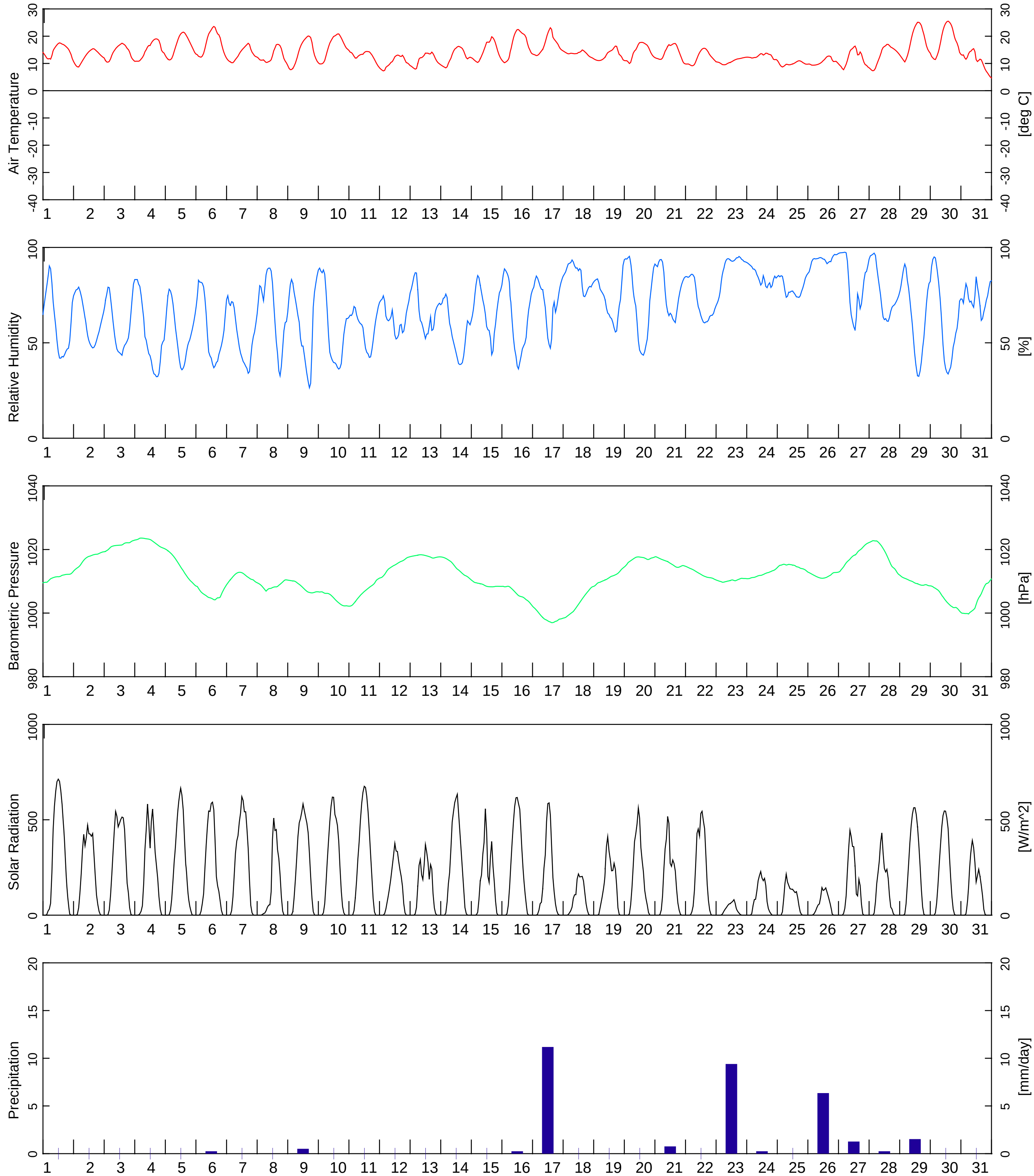
YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
July 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0
OFFICE	DATE		
EBA-VANC	February 2010		

Figure D-59

Thu Jan 28 16:17:25 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

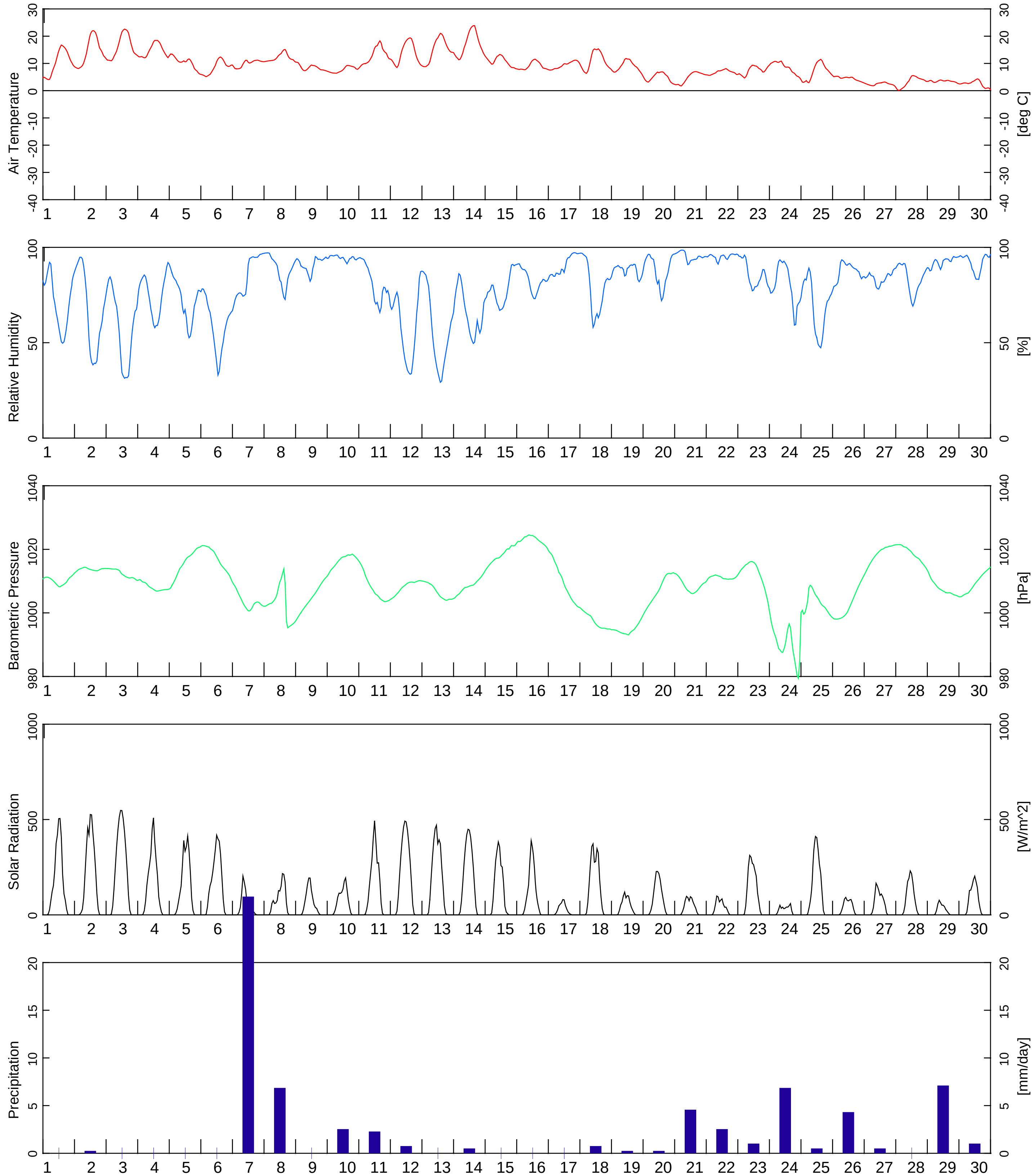
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
August 2009

PROJECT NO.	DWN	CHK	REV	
Y22101103	RED	JAS	0	Figure D-60
OFFICE	DATE			
EBA-VANC	February 2010			

Thu Jan 28 16:17:26 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

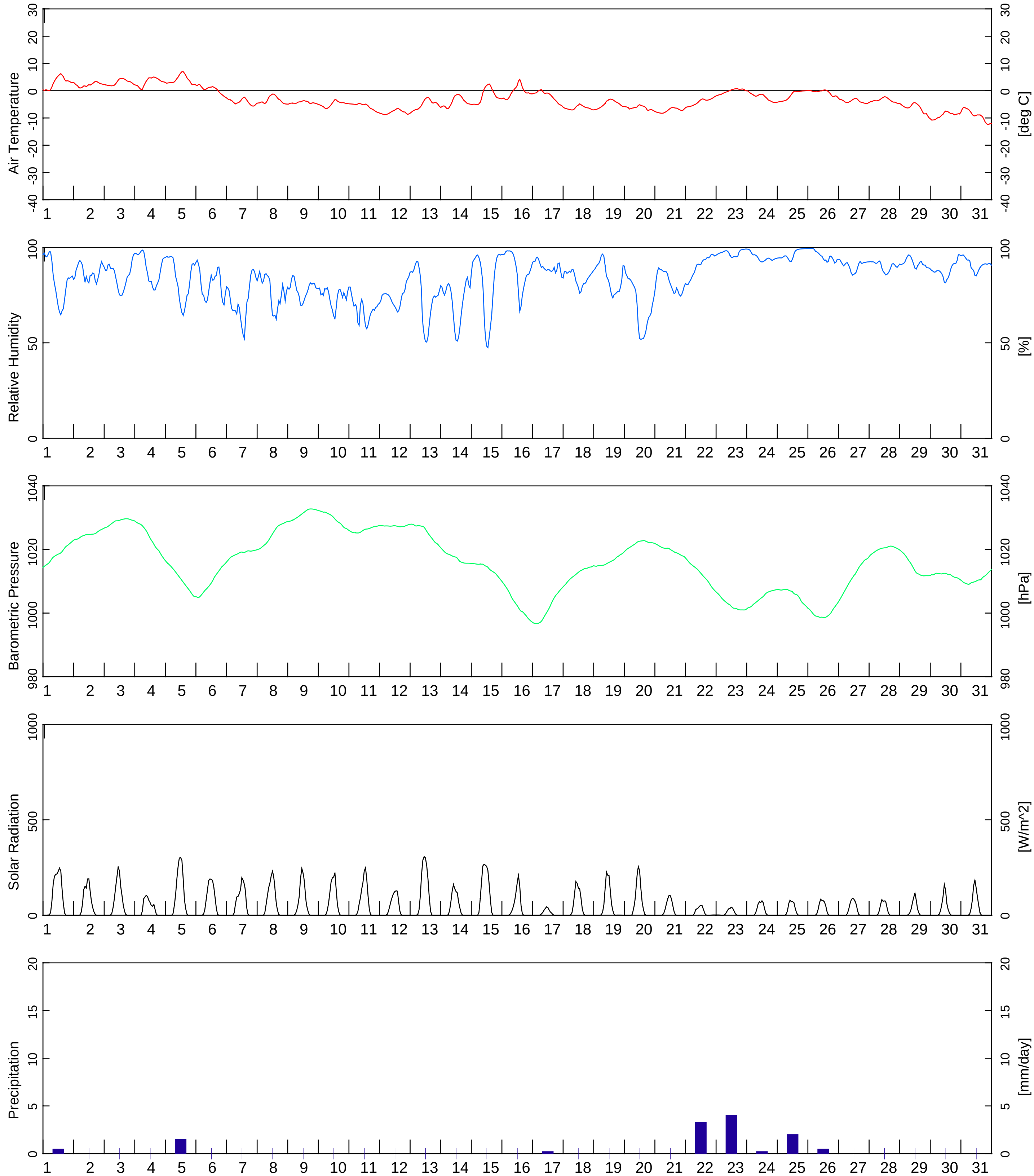
YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
September 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0
OFFICE	DATE		
EBA-VANC	February 2010		

Figure D-61

Thu Jan 28 16:17:27 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

eba

YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

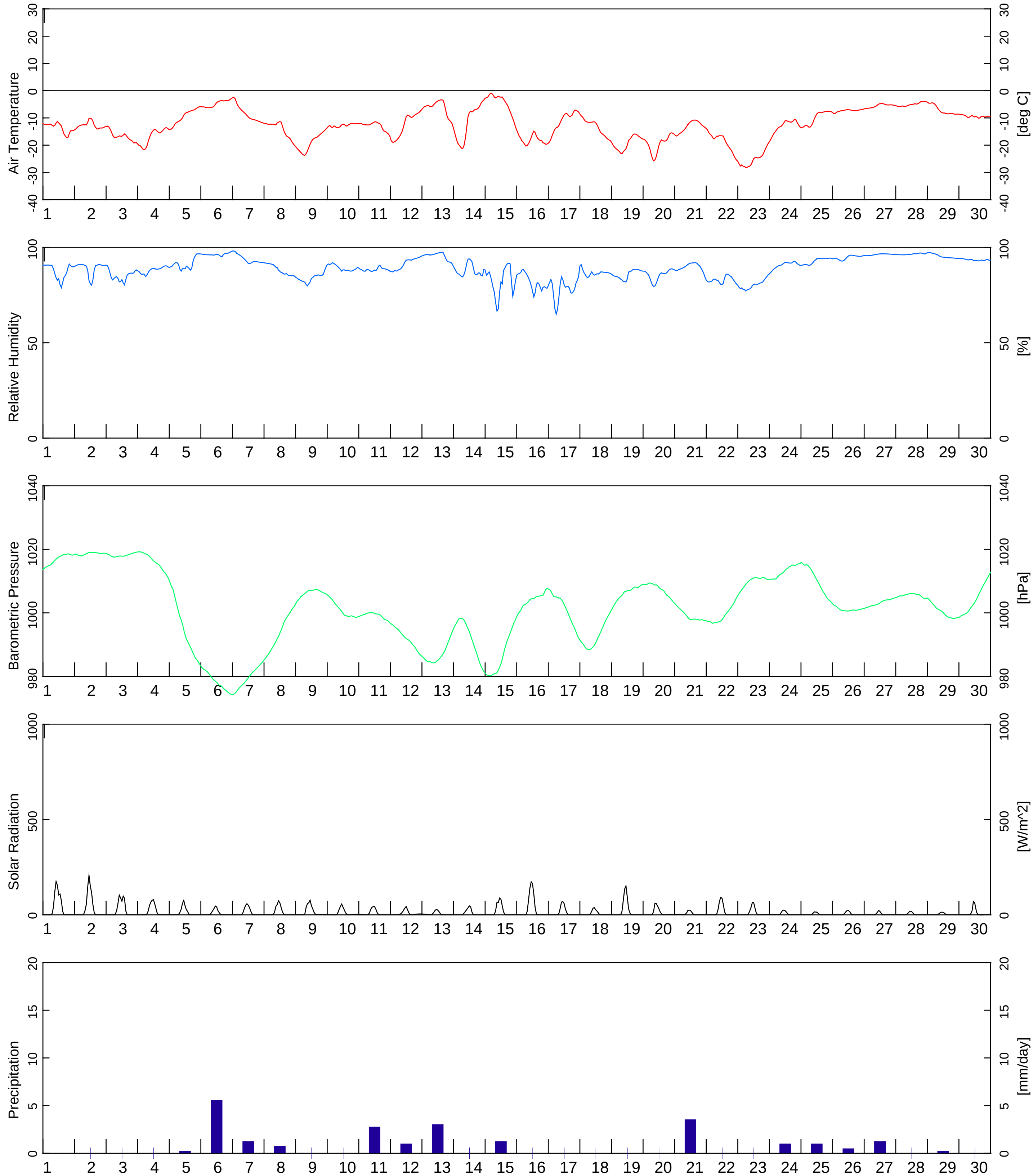
Tyhee Station
Weather Data
October 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0

OFFICE	DATE
EBA-VANC	February 2010

Figure D-62

Thu Jan 28 16:17:28 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

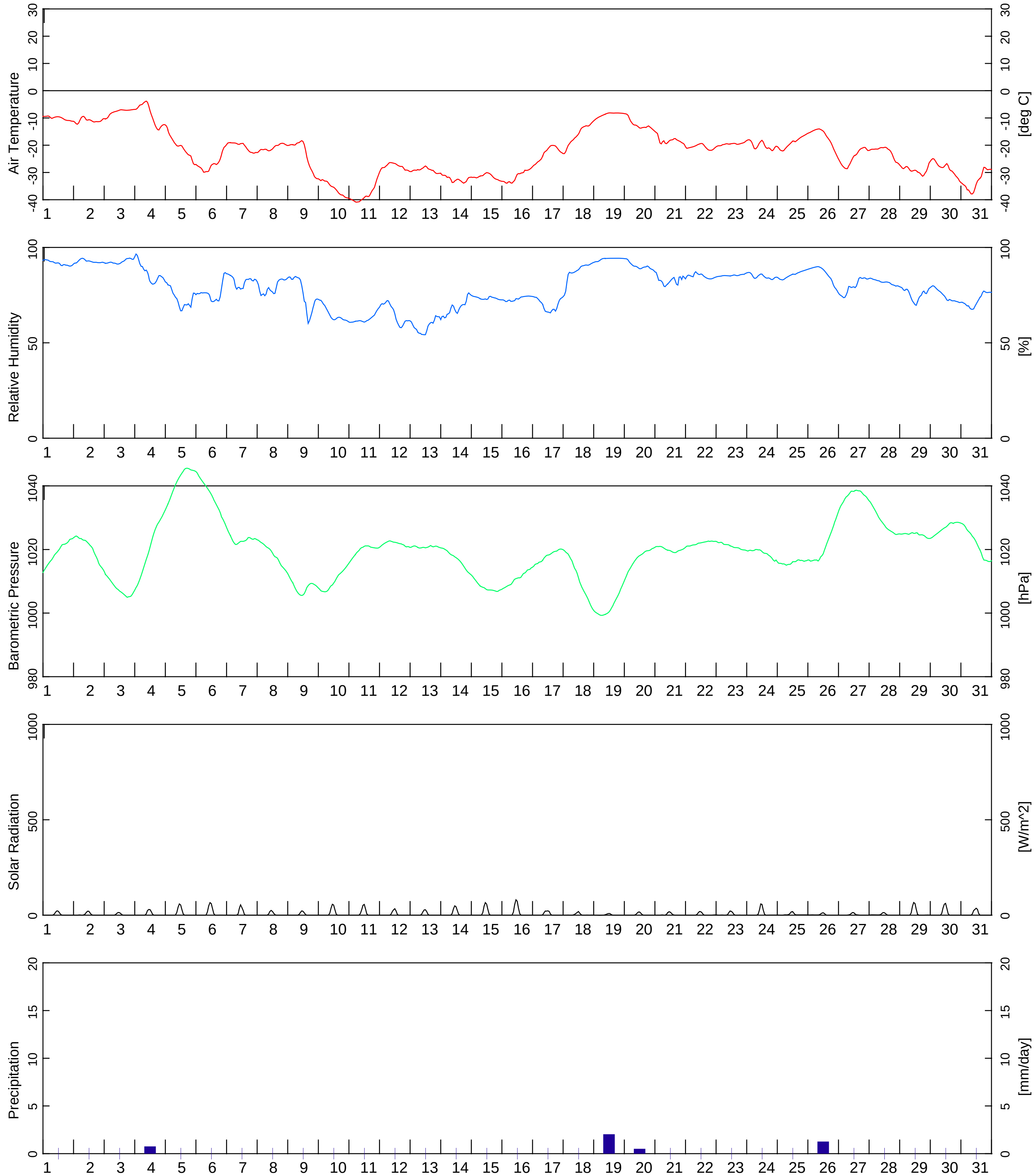
Tyhee Station
Weather Data
November 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0

OFFICE	DATE
EBA-VANC	February 2010

Figure D-63

Thu Jan 28 16:17:29 2010:Q:\Vancouver\Engineering\V132\Projects\Y22101103_Tyhee_2009\Working\Meteorology\data_reduction_programs



CLIENT

Tyhee NWT Corp

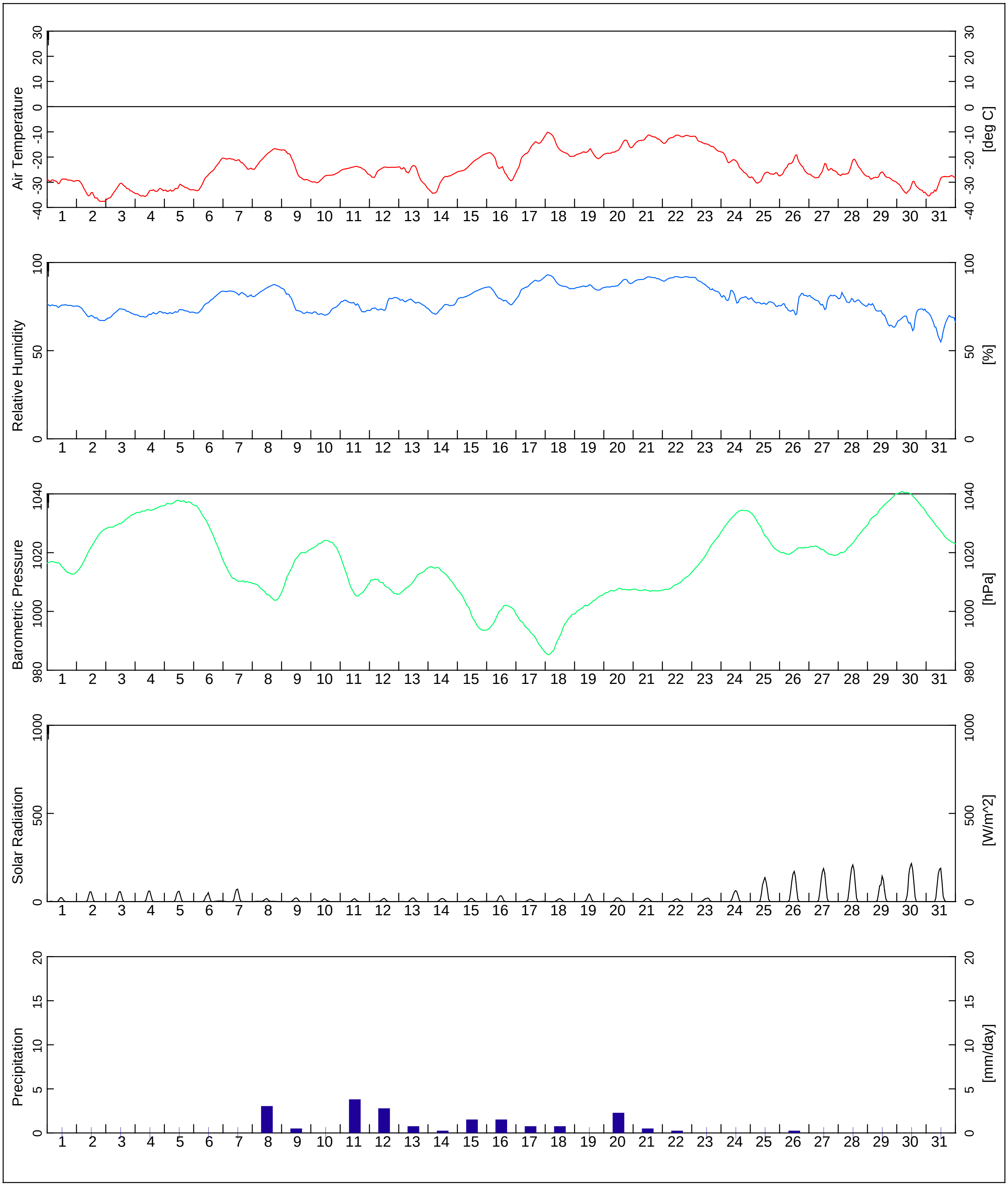
EBA Engineering Consultants Ltd.

YELLOWKNIFE GOLD PROJECT
2009 HYDROMETEOROLOGICAL REPORT

Tyhee Station
Weather Data
December 2009

PROJECT NO.	DWN	CHK	REV
Y22101103	RED	JAS	0
OFFICE	DATE		
EBA-VANC	February 2010		

Figure D-64



NOTES

CLIENT	YELLOWKNIFE GOLD PROJECT 2010 HYDROMETEOROLOGICAL REPORT
Tyhee NWT Corp	Tyhee Station Weather January 2010

PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

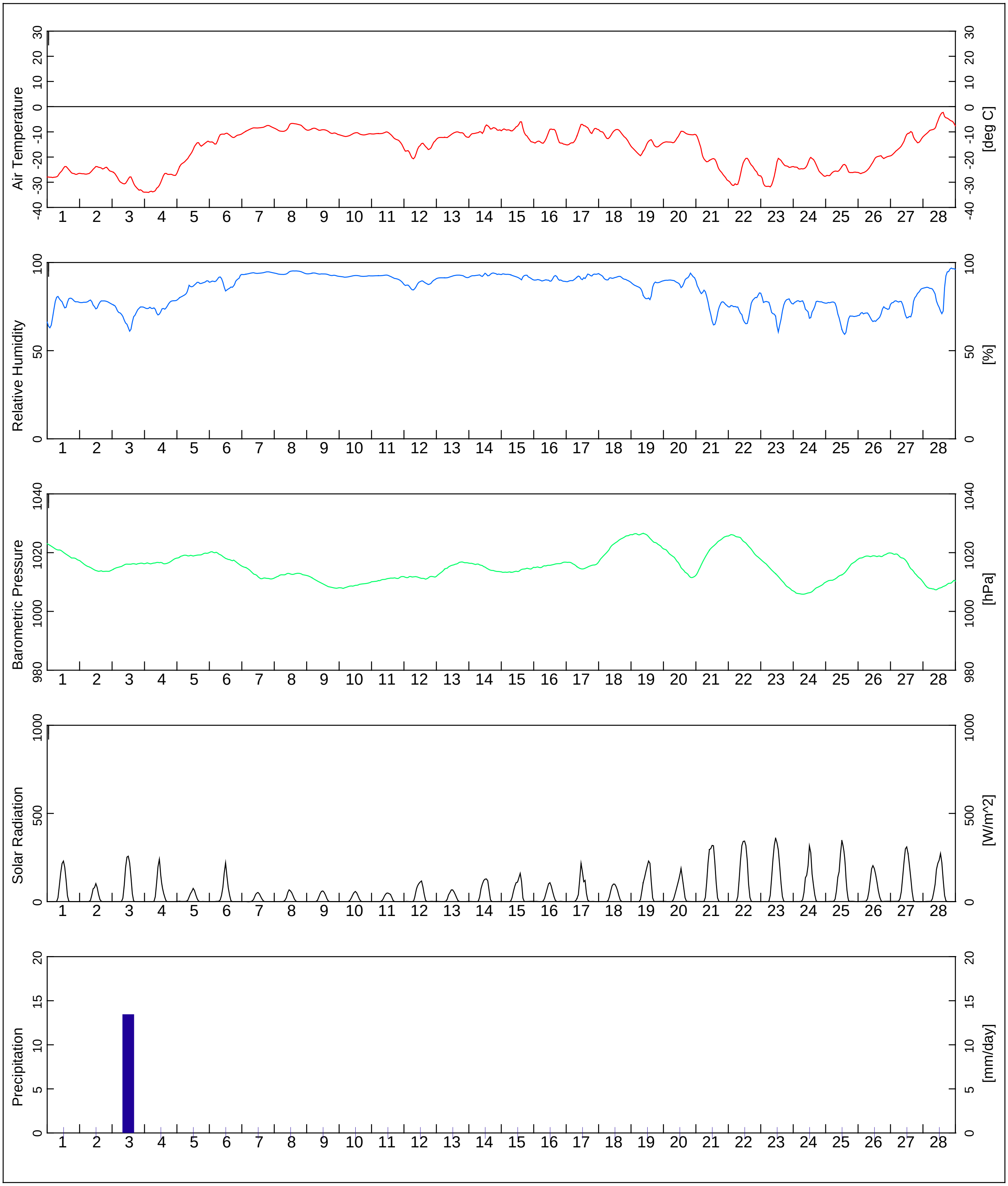
OFFICE	DATE
EBA-VANC	January 2011

Figure D-65

STATUS
ISSUED FOR USE

eba A TETRA TECH COMPANY

Fri Jan 21 14:02:08 2011:Q:\Vancouver\Engineering\V132\Projects\Y22101170-Tyhee_2010\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

eba
A TETRA TECH COMPANY

YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
February 2010

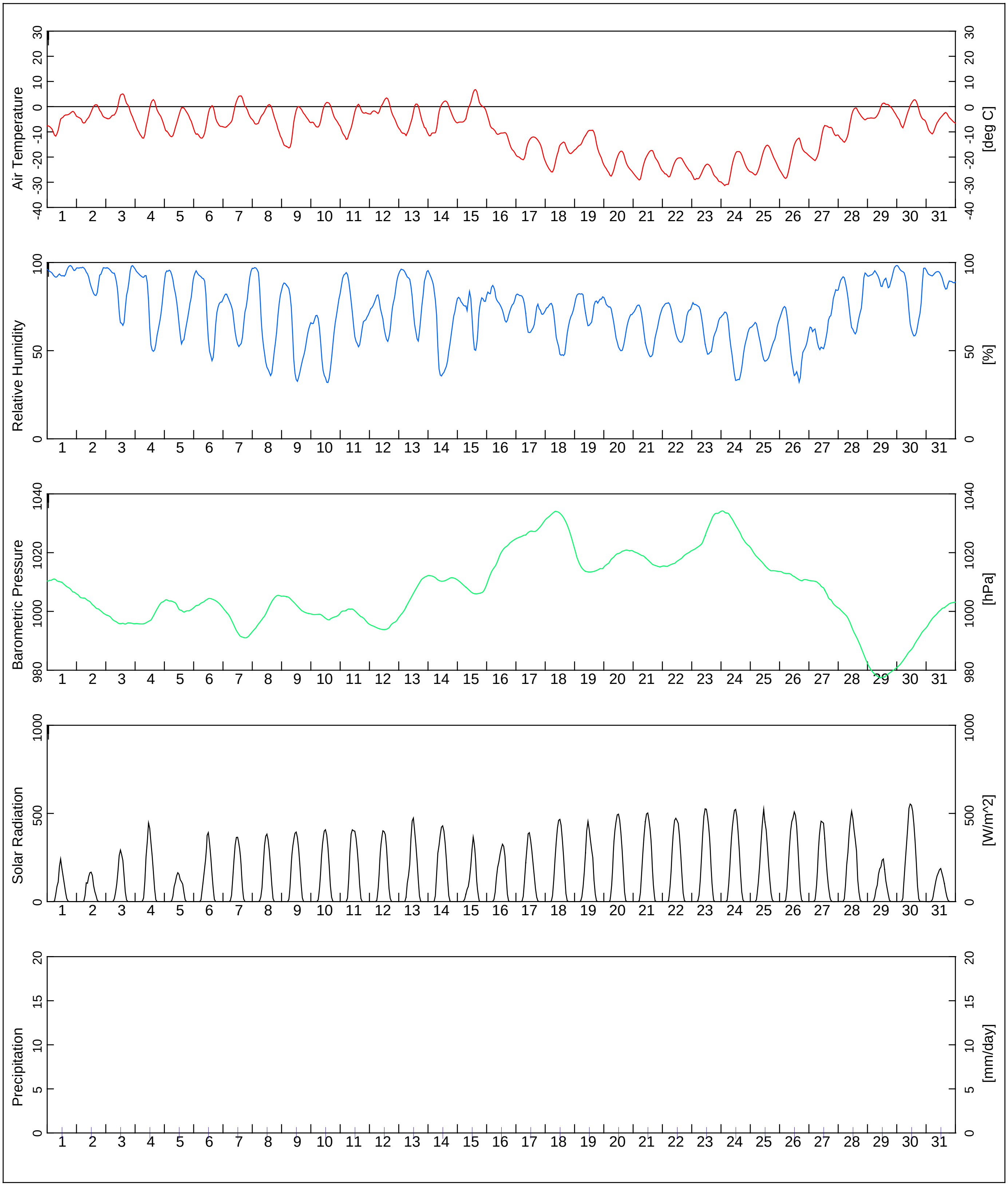
PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-66

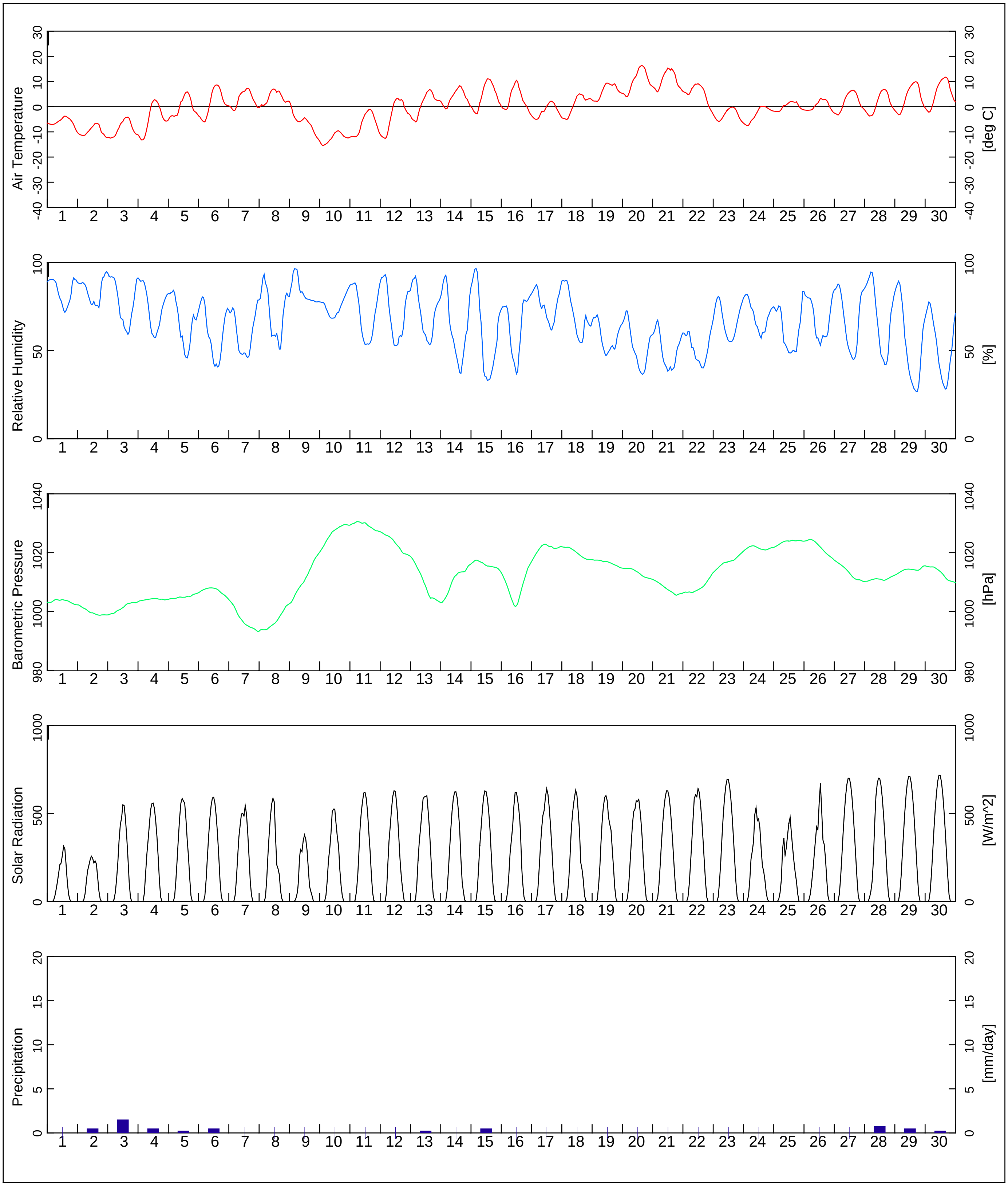
STATUS
ISSUED FOR USE

Fri Jan 21 14:02:09 2011:Q:\Vancouver\Engineering\V132\Projects\Y22101170-Tyhee_2010\Working\Meteorology\data_reduction_programs



NOTES	CLIENT	YELLOWKNIFE GOLD PROJECT 2010 HYDROMETEOROLOGICAL REPORT
	Tyhee NWT Corp	Tyhee Station Weather March 2010
STATUS ISSUED FOR USE	eba A TETRA TECH COMPANY	PROJECT NO. Y22101170; DWN RED; CHK JAS; APVD JAS; REV 0; OFFICE EBA-VANC; DATE January 2011

Figure D-67



NOTES

CLIENT

Tyhee NWT Corp

YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
April 2010

PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE: EBA-VANC

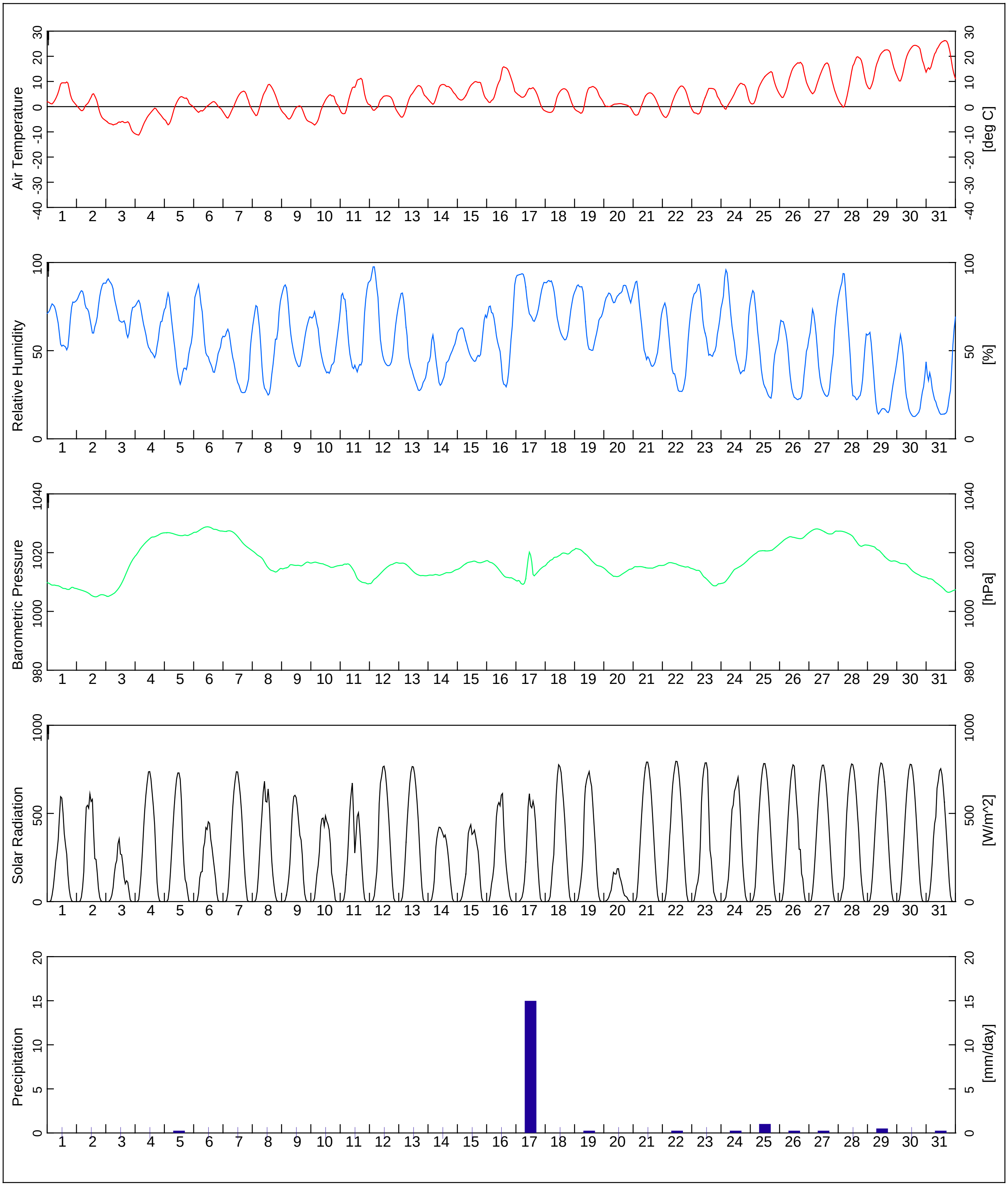
DATE: January 2011

Figure D-68

STATUS
ISSUED FOR USE

eba
A TETRA TECH COMPANY

Fri Jan 21 14:02:11 2011:Q:\Vancouver\Engineering\V132\Projects\Y22101170-Tyhee_2010\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

eba
A TETRA TECH COMPANY

STATUS
ISSUED FOR USE

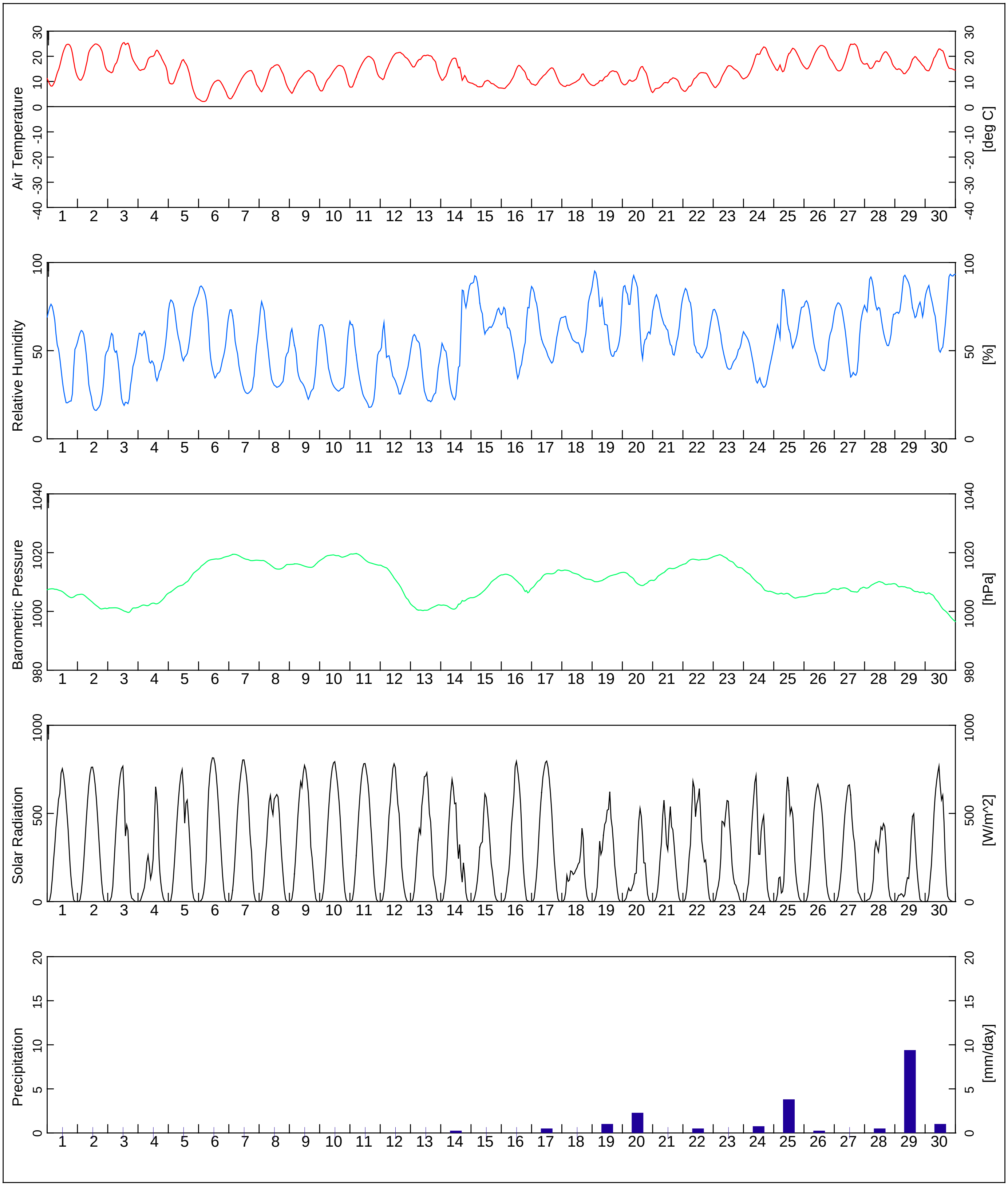
YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
May 2010

PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-69



NOTES

CLIENT

Tyhee NWT Corp

eba
A TETRA TECH COMPANY

YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
June 2010

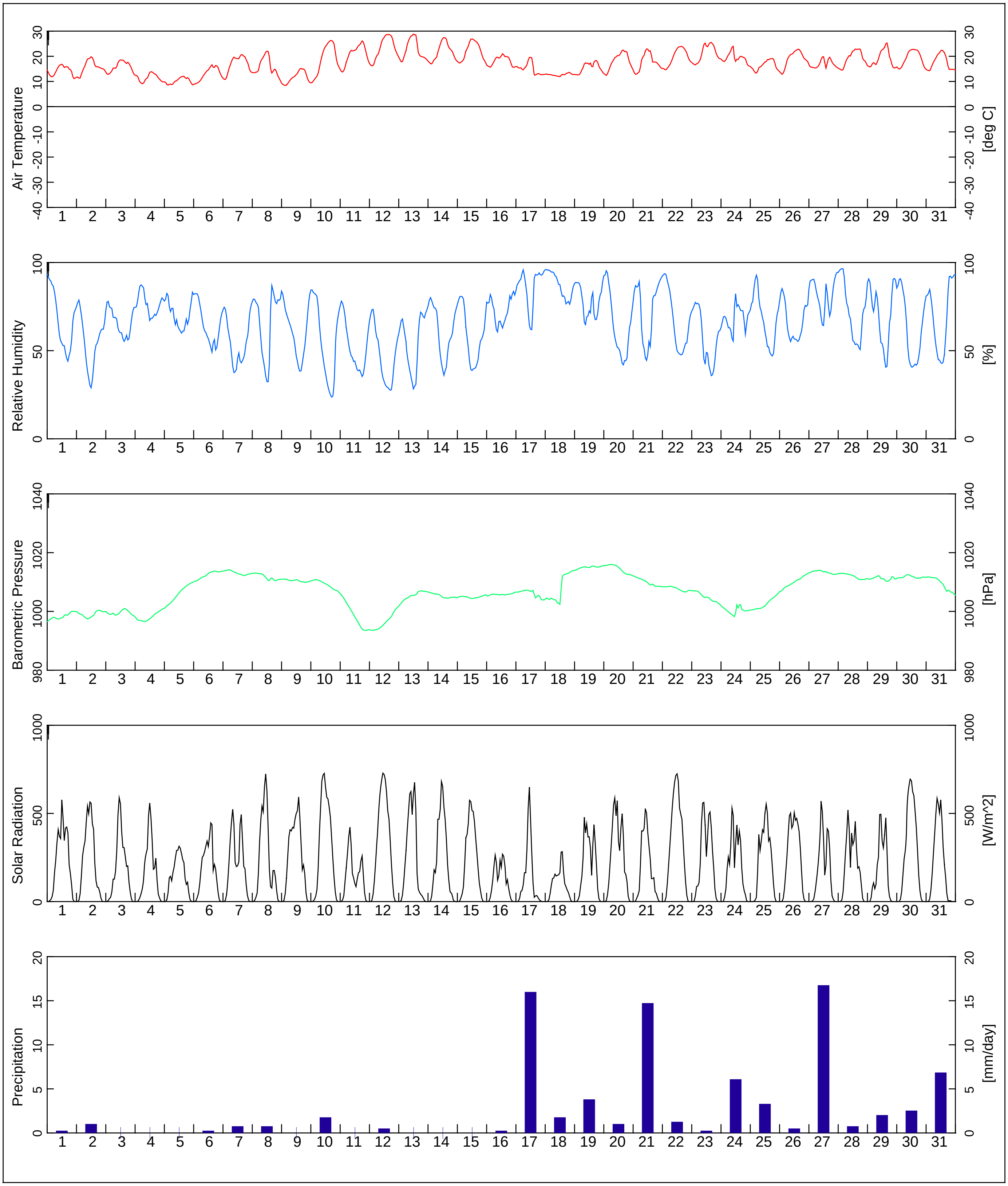
PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-70

STATUS
ISSUED FOR USE

Fri Jan 21 14:02:14 2011:Q:\Vancouver\Engineering\V132\Projects\Y22101170-Tyhee_2010\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

A TETRA TECH COMPANY

STATUS
ISSUED FOR USE

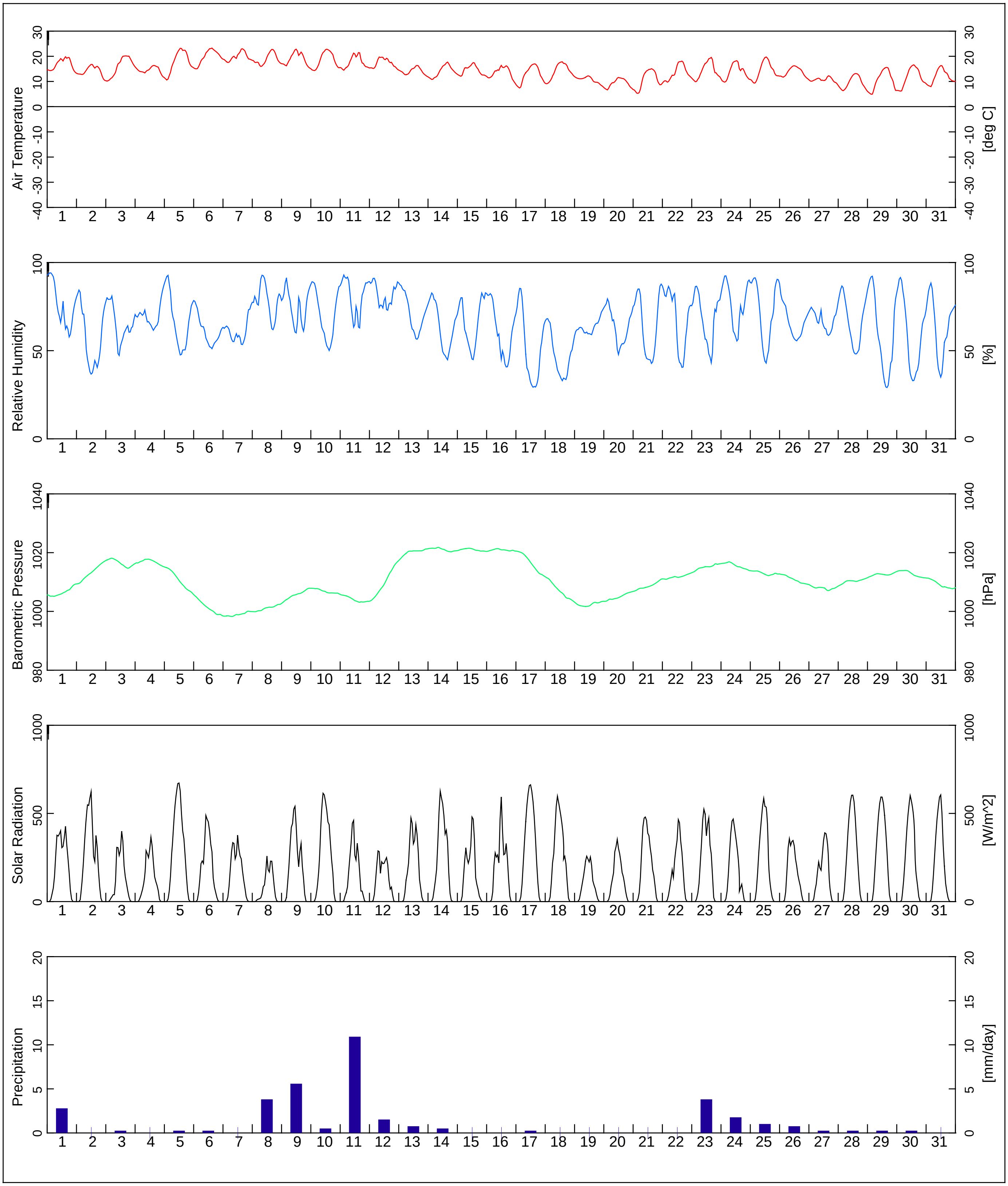
YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
July 2010

PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-71



NOTES

CLIENT

Tyhee NWT Corp

eba A TETRA TECH COMPANY

STATUS
ISSUED FOR USE

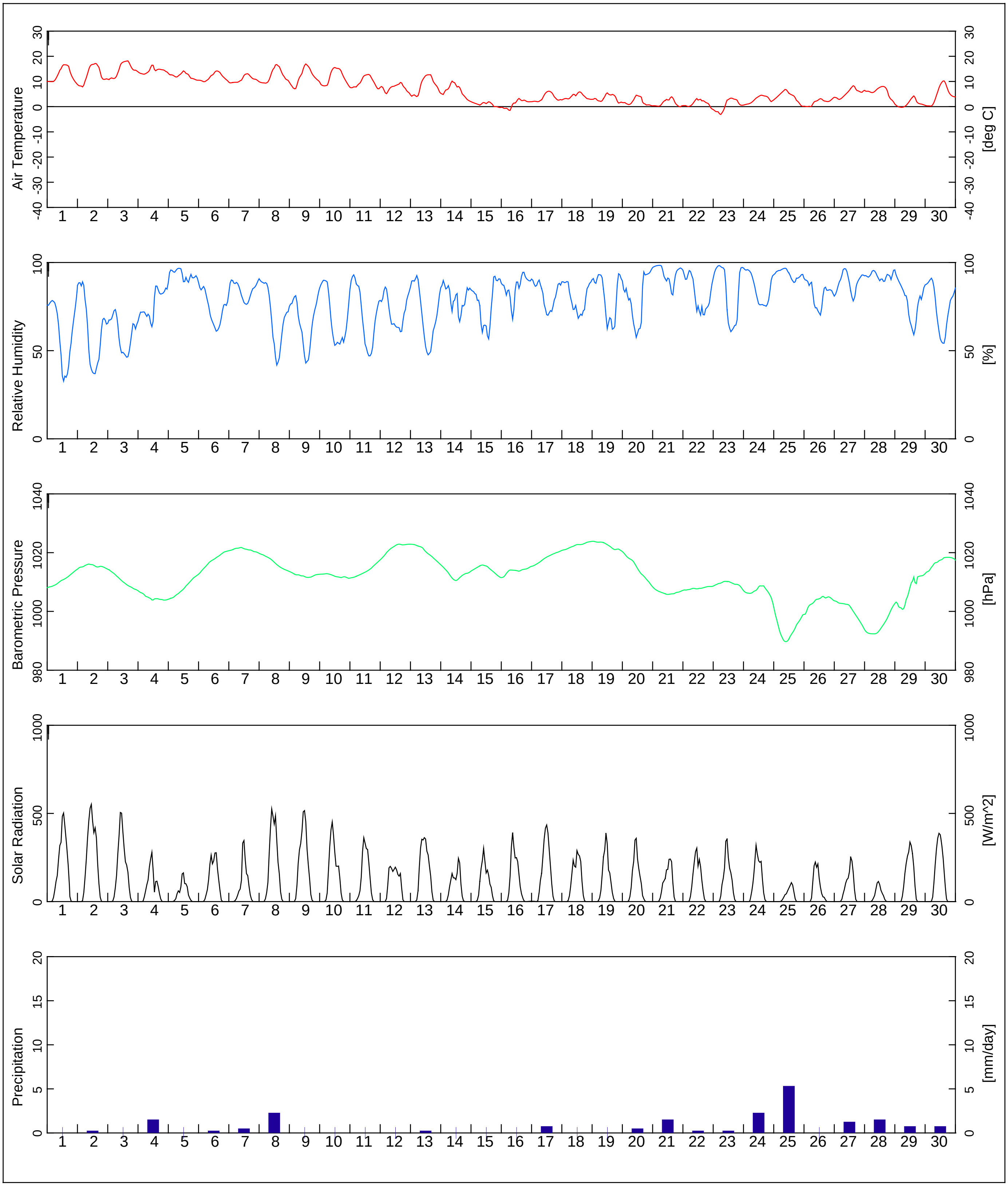
YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
August 2010

PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-72



NOTES

CLIENT

Tyhee NWT Corp

A TETRA TECH COMPANY

YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
September 2010

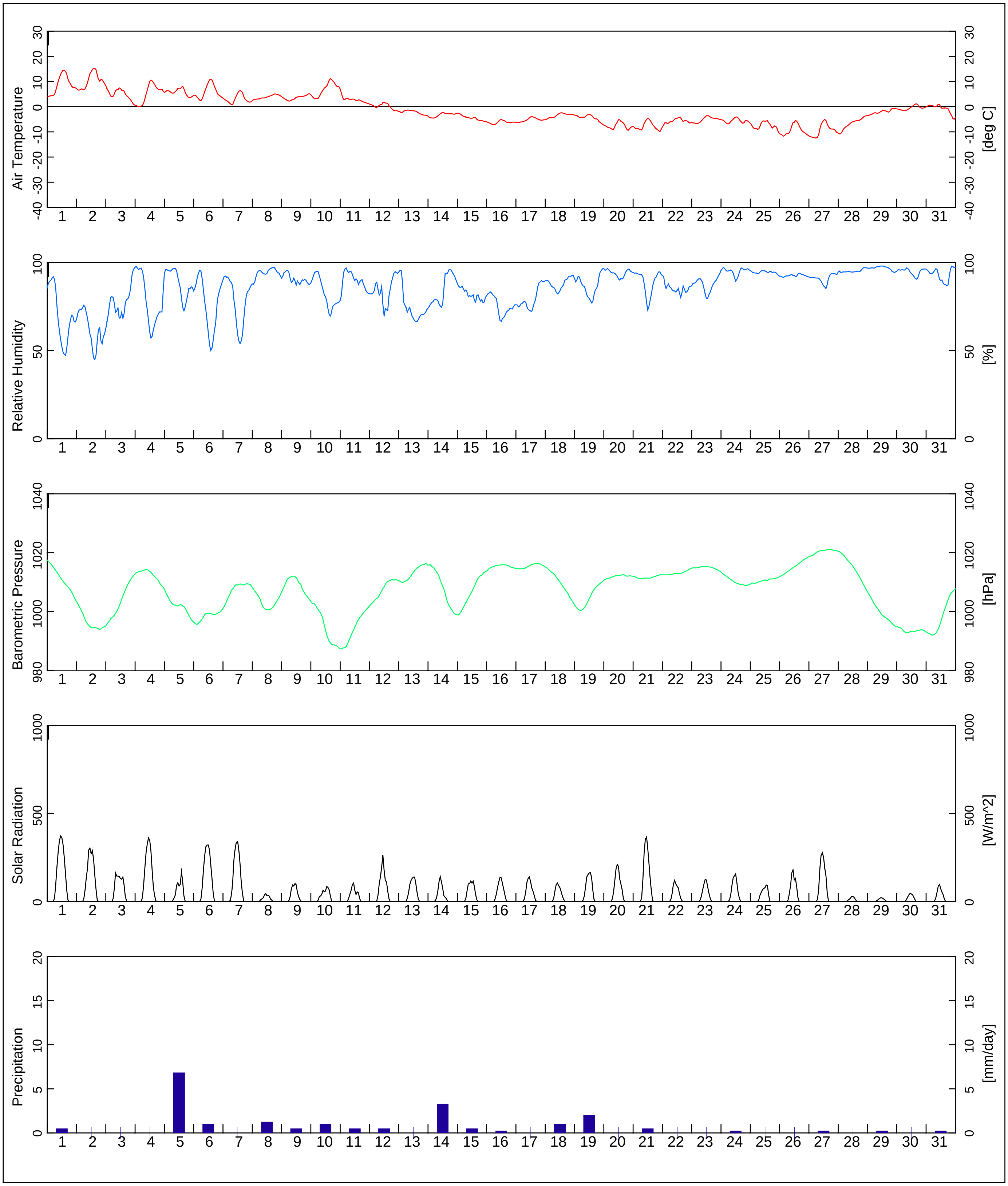
PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-73

STATUS
ISSUED FOR USE

Fri Jan 21 14:02:17 2011:Q:\Vancouver\Engineering\V132\Projects\Y22101170-Tyhee_2010\Working\Meteorology\data_reduction_programs



NOTES

CLIENT

Tyhee NWT Corp

YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
October 2010

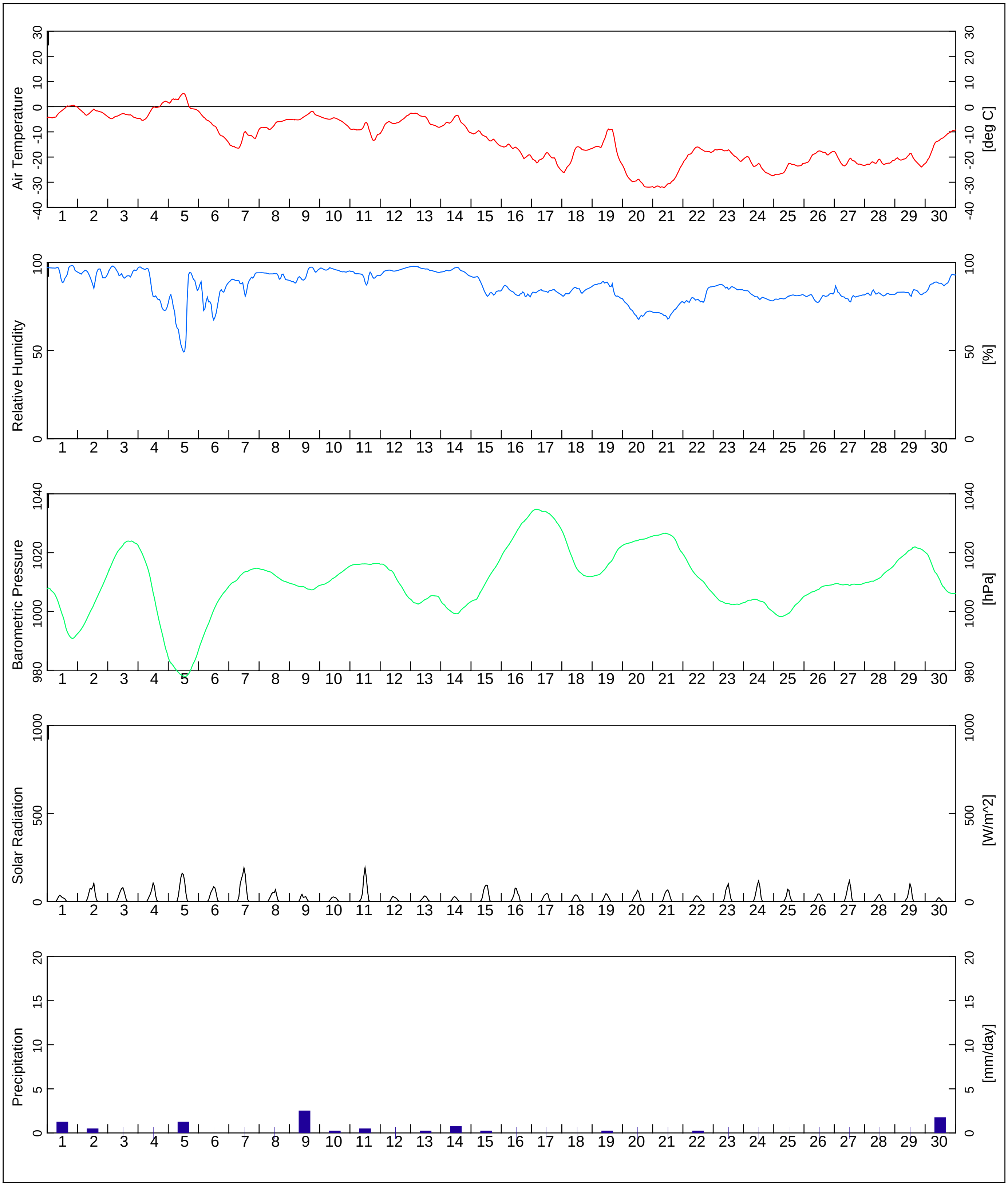
PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-74

STATUS
ISSUED FOR USE

eba
A TETRA TECH COMPANY



NOTES

CLIENT

Tyhee NWT Corp

YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
November 2010

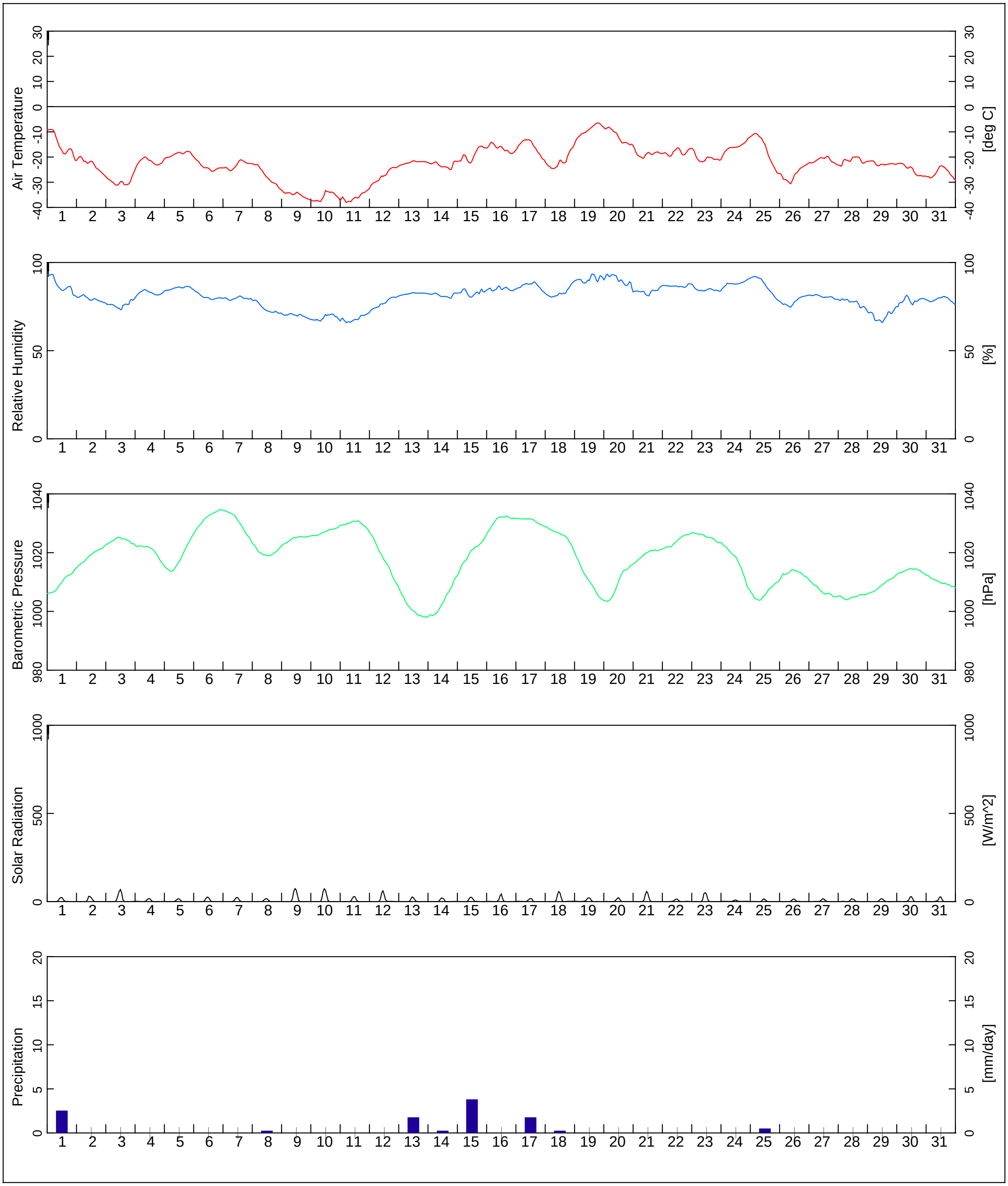
PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-75

STATUS
ISSUED FOR USE

eba
A TETRA TECH COMPANY



NOTES

CLIENT

Tyhee NWT Corp

eba
A TETRA TECH COMPANY

STATUS
ISSUED FOR USE

YELLOWKNIFE GOLD PROJECT
2010 HYDROMETEOROLOGICAL REPORT

Tyhee Station Weather
December 2010

PROJECT NO.	DWN	CHK	APVD	REV
Y22101170	RED	JAS	JAS	0

OFFICE	DATE
EBA-VANC	January 2011

Figure D-76

APPENDIX E

APPENDIX E DESCRIPTION OF DATA FILES ON THE REPORT CD

DESCRIPTION OF THE DATA FILES FOR THE YELLOWKNIFE GOLD PROJECT 2010 HYDROMETEOROLOGICAL REPORT

The data directory section of the Yellowknife Gold Project 2010 Hydrometeorological Report CD contains the meteorology and hydrology field data collected by Hay & Company Consultants/EBA Engineering Consultants over the period from September 28, 2004 to December 31, 2010. All the files are in space delineated format with the file extension "dat". A flag of -9999 is used to indicate records with no data.

1.0 METEOROLOGICAL DATA

There are 17 meteorological station files. The station is located on the northeast end the Yellowknife Gold Project Airstrip.

1.1 Hourly Meteorological Data

The 6 data files named **"2004_hr_lp_metdata.dat"** to **"2010_hr_lp_metdata.dat"** contains space delineated hourly meteorological data over the period from September 28, 2004 to December 31, and January 1 to December 31, for the years from 2005 to 2010. The data was collected at 15-minute intervals and was low pass filtered and sub-sampled at hourly intervals such that only hourly data is contained in this file. The file format is such that each data record represents one sample time period.

The 12 data columns identified from left to right are year, month, day, hour, minute, wind vector [u], wind vector [v], standard deviation of wind direction (degrees), air temperature [C°], relative humidity [%], barometric pressure at sea level [hPa], and incident solar radiation [W/m^2].

1.2 Daily Meteorological Data

The data file named **"2004-2010_Tyhee_daily_summary.dat"** contains the daily mean, maximum and minimum data saved at midnight for each day for 2010.

The 17 data columns identified from left to right are year, month, day, hour, minute, maximum wind speed [m/s], 3 columns for mean, maximum and minimum sea level equivalent barometric pressure [hPa], precipitation [mm/day of water], 3 columns for mean, maximum and minimum relative humidity [%], 3 columns for mean, maximum and minimum air temperature [°C] and the last column is incident solar radiation [W/m^2].

1.3 15 Minute Precipitation Data

The 7 data files named **"2004_Tyhee_15_min_Precipitation.dat"** to **"2010_Tyhee_15_min_Precipitation.dat** contains the 15 minute water equivalent precipitation data collected from the all-weather precipitation gauge installed at the Yellowknife Gold Project site for the period from September 28, 2004 to December 31, 2010.

The 6 data columns identified from left to right are year, month, day, hour, minute and water equivalent precipitation [mm/15 min].

1.4 Daily Precipitation Data

The data file named **"2004-2010_Tyhee_daily_precip.dat"** contains the daily water equivalent precipitation data collected from the all-weather precipitation gauge installed at the Yellowknife Gold Project site for the period from September 28, 2004 to December 31, 2010.

The 6 data columns identified from left to right are year, month, day, hour, minute and water equivalent precipitation [mm/day].

1.5 Daily Evaporation Data

The data file named **"2005-2010_Tyhee_Pan_Evap.dat"** contains the pan evaporation rates data collected from the Evaporation pan installed at the Yellowknife Gold Project site for the summer periods from 2005 to 2010.

The 6 data columns identified from left to right are year, month, day, hour, minute and pan evaporation in [mm/day].

2.0 HYDROLOGICAL DATA

This directory contains the four stream flow data file for the stations (Narrow, Winter, Round and Nicholas Lake Outlets) that were monitored over the 2005 to 2010 study period.

The Narrow Lake discharge data is contained in the file:

"2005-2010_Narrow_Lake_Outlet_Discharges.txt"

The Winter Lake discharge data is contained in the file:

"2005-2010_Winter_lake_discharges.txt"

The Round Lake discharge data is contained in the file:

"2005-2010_Round_lake_discharges.txt"

Each space delineated data file contains 6 data columns identified from left to right as year, month, day, hour, minute and the last column is outlet discharge in [L/s].

The Nicholas Lake Outlet hydrometric station recorded water temperatures as well as discharge data. This data is contained in the file **"2005-2010_Nicholas_Lake_Outlet_Discharges.txt".**

This space delineated data file contains 7 data columns identified from left to right as year, month, day, hour, minute, creek temperature [°C], and outlet discharge [L/s].

APPENDIX F

APPENDIX F GENERAL CONDITIONS

GENERAL CONDITIONS

DESIGN REPORT

This Design Report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This Design Report pertains to a specific site, a specific development, and a specific scope of work. The Design Report may include plans, drawings, profiles and other support documents that collectively constitute the Design Report. The Report and all supporting documents are intended for the sole use of EBA’s Client. EBA does not accept any responsibility for the accuracy of any of the data, analyses or other contents of the Design Report when it is used or relied upon by any party other than EBA’s Client, unless authorized in writing by EBA. Any unauthorized use of the Design Report is at the sole risk of the user.

All reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

2.0 ALTERNATIVE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA’s instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless so stipulated in the Design Report, EBA was not retained to investigate, address or consider, and has not investigated, addressed or considered any environmental or regulatory issues associated with the project specific design.

4.0 CALCULATIONS AND DESIGNS

EBA has undertaken design calculations and has prepared project specific designs in accordance with terms of reference that were previously set out in consultation with, and agreement of, EBA’s client. These designs have been prepared to a standard that is consistent with industry practice. Notwithstanding, if any error or omission is detected by EBA’s Client or any party that is authorized to use the Design Report, the error or omission should be immediately drawn to the attention of EBA.

5.0 GEOTECHNICAL CONDITIONS

A Geotechnical Report is commonly the basis upon which the specific project design has been completed. It is incumbent upon EBA’s Client, and any other authorized party, to be knowledgeable of the level of risk that has been incorporated into the project design, in consideration of the level of the geotechnical information that was reasonably acquired to facilitate completion of the design.

If a Geotechnical Report was prepared for the project by EBA, it will be included in the Design Report. The Geotechnical Report contains General Conditions that should be read in conjunction with these General Conditions for the Design Report.

6.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

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Tyhee Yellowknife Gold Project

Report

Air Quality Assessment

RWDI # 0941071
April 26, 2011

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1 INTRODUCTION

Tyhee NWT Corp. is proposing to construct and operate the Yellowknife Gold Project (the Project). The Project is located approximately 90 km north of Yellowknife, NWT, as shown in Figure 1.1. The mining operation of the Project will consist of two separate mining locations: Ormsby, where the major mining infrastructure will be located, and Nicholas Lake, which is approximately 9 km to the northeast of Ormsby. The production rate of ore for the Project is expected to be 3,000 tpd, which will be processed at the mill located at Ormsby. The Ormsby site will host a 79 Mt (5 Mt ore and 74 Mt waste) conventional open pit (Ormsby Open Pit) followed by a 1.4 Mt underground operation (Ormsby Underground) and a mill. The Nicholas Lake site will host a 1.3 Mt underground operation (Nicholas Lake Underground).

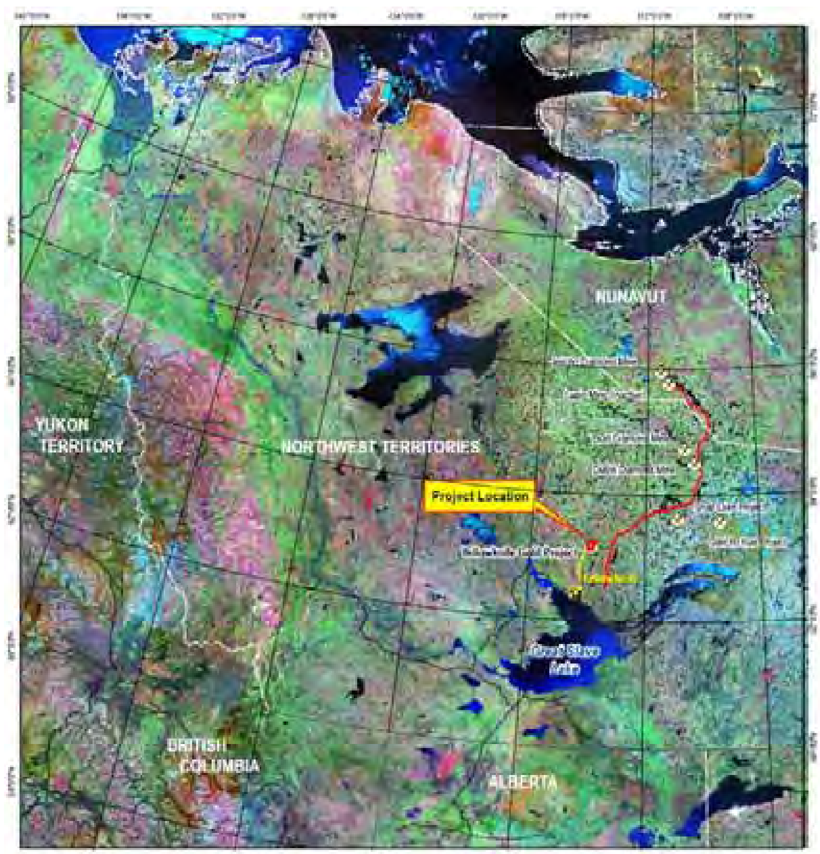

Figure 1.1 Location of Project

2 SCOPE OF ASSESSMENT

The scope of the air quality assessment of the Project was defined by the *Mackenzie Valley Review Board's Final Terms of Reference* (Mackenzie Valley Review Board, 2009) with three exceptions. First, since doré will be produced and poured at site and shipped to a qualified gold refinery, with the agreement for refining to be established at a later date, emissions from the gold refinery were not included in the scope of the assessment. Second, since electricity will be generated using diesel not coal, mercury emissions are not expected from this Project and therefore were not assessed. Third, since diesel will be used for electricity generation, the Project is not expected to be a large source of sulphur oxide emissions and therefore acidic precipitation was not assessed.

The valued components that were assessed are ambient air quality and greenhouse gas emissions.

2.1 Issues Scoping

The Project will be a source of criteria air contaminant (CAC) and greenhouse gas (GHG) emissions from diesel generators and equipment. There will also be sources of fugitive dust emissions including the mill, stockpiles, crushers, haul roads, handling and transfer of the ore.

The measureable parameters of the assessment are ambient concentrations or deposition levels of CACs and total emissions of GHGs.

The specific CACs included in the scope of this assessment are:

- nitrogen dioxide (NO_2),
- sulphur dioxide (SO_2),
- carbon monoxide (CO), and
- particulate matter (PM).

The specific GHGs included in the scope of this assessment are:

- nitrous oxide (N_2O),
- methane (CH_4), and
- carbon dioxide (CO_2).

Greenhouse gases are a concern due to their potential to affect global climate changes. Ambient concentrations of CACs are a concern due to their potential to affect human and wildlife health and deposition levels of particulate matter can affect vegetation and water quality.

Oxides of nitrogen (NO_X) are produced when fossil fuels are burned at high temperatures and are composed primarily of nitric oxide (NO) and NO_2. In humans, NO_2 acts as an irritant affecting the mucous membranes of the eyes, nose, throat, and respiratory tract. Continued exposure to NO_2 can irritate the lungs and lower resistance to respiratory infection, especially for people with pre-existing asthma and bronchitis. For this reason, ambient air quality standards are based on NO_2, not NO or NO_X. Nitrogen dioxide can combine with other air contaminants to form fine particulates, which can reduce visibility. It can be further oxidized to form nitric acid, a component of acid rain. Nitrogen dioxide also plays a major role in the secondary formation of ozone.

Sulphur dioxide is produced primarily by the combustion of fossil fuels containing sulphur. Sulphur dioxide reacts in the atmosphere to form sulphuric acid, a major contributor to acid rain, and particulate sulphates, which can reduce visibility. Sulphur dioxide is irritating to the lungs and is frequently described as smelling of burning sulphur.

Carbon monoxide is produced by incomplete combustion of fossil fuels. It is the most widely distributed and commonly occurring air pollutant and comes primarily from motor vehicle emissions. Space heating and commercial and industrial operations are also contributors. Short-term health effects related to CO exposure include headache, dizziness, light-headedness and fainting. Exposure to high CO concentrations can decrease the ability of the blood to carry oxygen and can lead to respiratory failure and death.

Particulate matter is often defined in terms of size fractions. Dustfall refers to the amount of particulate matter of all size classes that settles onto a collection surface in a given amount of time. It is a measure of the amount of particulate present in the ambient air that is deposited on the ground. Particles less than 40 μm in diameter typically remain suspended in the air for some time. This is referred to as total suspended particulate (TSP). Suspended particulate matter less than 2.5 μm in diameter is termed $PM_{2.5}$. Exposure to particulate matter aggravates a number of respiratory illnesses and may even cause premature death in people with existing heart and lung disease. The smaller particles ($PM_{2.5}$) are generally thought to be of greater concern to human health than the larger particles (TSP).

2.2 Spatial Boundaries

The local study area (LSA) for the air quality assessment of the Project includes both the Ormsby and Nicholas Lake sites. The LSA is a 30 km by 30 km area centred on the midpoint between the Ormsby site and the Nicholas Lake site, as shown in Figure 2.1

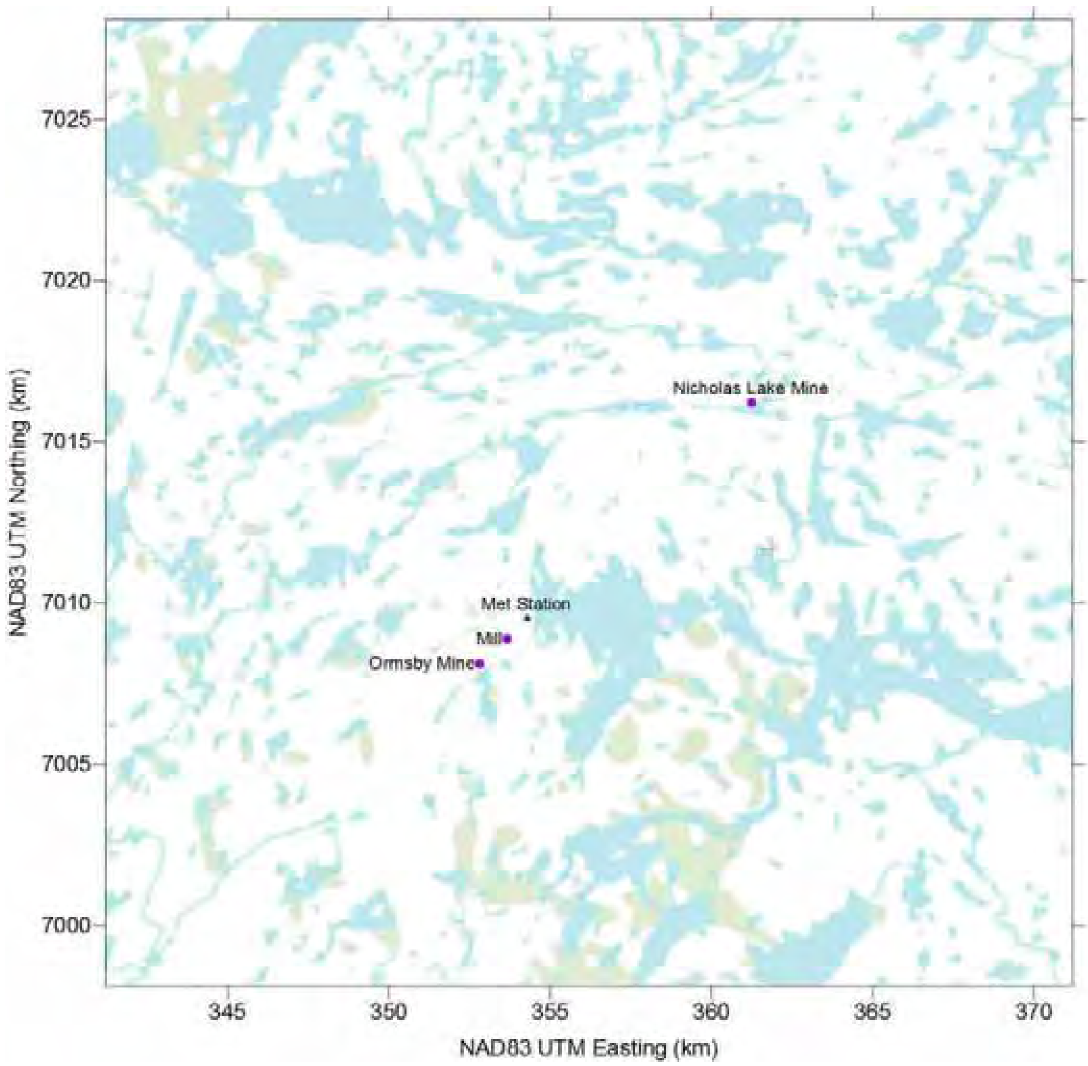

Figure 2.1 Project Local Study Area

2.3 Temporal Boundaries

The proposed Project is expected to start operation in 2015 and the estimated mine life is 7.5 years. The construction of the Project will commence one or two years before the start of operations. Production will start with mining the Ormsby Open Pit and Nicholas Lake Underground for the first three years of operation. From year four, Ormsby Underground operation will start and will last until the end of the mine life. After the mine life of 7.5 years, the mine will be decommissioned and reclamation will take place. Four phases were assessed: construction, operation, closure and post-closure.

2.4 Information Sources

The information sources for this assessment were the *Yellowknife Gold Project 2008 Project Description Report* (PDR, 2008) by Tyhee NWT Corp. and the *Technical Report on the Pre-Feasibility Study of the Yellowknife Gold Project* (PFS, 2010) by EBA Engineering Consultants Ltd. There have been some adjustments in the Project design since the PDR and PFS were issued. The Ormsby and Nicholas Lake site plans have changed; the power generation plant at the Ormsby site has been relocated to be adjacent to the truck shop, warehouses, office building, and the diesel storage building. The power generation plant at Nicholas Lake site is adjacent to the diesel storage building, which was previously not on the site plan. The camp at Ormsby site will be located at the primary camp location instead of the alternative camp location.

2.5 Assessment Endpoints

The assessment endpoints for CACs are the ambient air quality standards listed in the Government of the Northwest Territories' (GNWT) Environmental Protection Act. Air quality standards are developed by environmental and health authorities to provide guidance for environmental protection decisions. Contaminants that are included in the NWT's ambient air quality standards are NO_2, SO_2, CO, TSP and $PM_{2.5}$ (see Table 2.1).

Table 2.1 NWT Ambient Air Quality Standards for Criteria Air Contaminants

Contaminant	Averaging Period	NWT Standards ($\mu g/m^3$)
NO_2	1-hour	400
	24-hour	200
	Annual	60
SO_2	1-hour	450
	24-hour	150
	Annual	30
CO	1-hour	15,000
	8-hour	6,000
TSP	24-hour	120
	Annual	60
$PM_{2.5}$	24-hour	30

There are no air quality standards for dustfall in the NWT; however, there are objectives and guidelines for dustfall in other jurisdictions such as British Columbia, and Alberta. Table 2.2 shows the dustfall objectives and guidelines from these jurisdictions to provide context for dustfall prediction in this assessment.

Table 2.2 Dustfall Criteria in Other Jurisdictions

Jurisdiction	Criteria	Notes
BC	1.75 $mg/dm^2/day$	In residential areas
	2.9 $mg/dm^2/day$	In all other areas
Alberta	53 $mg/dm^2/$ 30 day	In residential and recreation areas
	158 $mg/dm^2/$ 30 day	In commercial and industrial areas

Assessment endpoints for GHGs include Canadian and territorial total GHG emissions, the federal GHG reporting threshold and emissions from other mining projects in the NWT. In 2008, Canada emitted 734 Mt of GHGs and the Northwest Territories and Nunavut contributed 1.81 Mt to this total (Environment Canada, 2010). Environment Canada has a GHG emissions reporting program: if a facility emits more than 50 kt of CO_2 equivalent, the facility has to report its GHG emissions in accordance with the requirements under the Canadian Environmental Protection Act, 1999. GHG emissions from other mining projects in the NWT are provided in Table 2.3.

Table 2.3 Annual GHG Emissions Summary for Mining Projects in the Northwest Territories

Project	Total Annual GHG Emissions (kt CO_2E)	Year and Comments
Snap Lake Mine[1]	63	2008 actual
Diavik Diamond Mine[2]	159	2006 actual
Ekati Diamond Mine[3]	210	2006 actual

Sources: 1. De Beers Canada (2008) 2. Diavik (2007); 3. BHP Billiton (2007).

2.6 Residual Effects Assessment Criteria

Residual Project effects are described in terms of direction, magnitude, likelihood, geographical extent, duration, frequency, ecological context and reversibility. The specific criteria ratings used for this air quality assessment are described in Table 2.4. Also defined in this table are various levels of confidence.

Table 2.4 Air Quality Residual Effects Assessment Criteria

<table>
<tr><th colspan="2">Assessment Criteria</th><th>Definition</th></tr>
<tr><td colspan="3">DIRECTION</td></tr>
<tr><td colspan="2">Positive</td><td>The emission or ambient concentration is expected to decrease.</td></tr>
<tr><td colspan="2">Neutral</td><td>There is no emission expected.</td></tr>
<tr><td colspan="2">Negative</td><td>The emission or ambient concentration is expected to increase.</td></tr>
<tr><td colspan="3">MAGNITUDE - of the residual effect</td></tr>
<tr><td colspan="2">Negligible</td><td>No detectable or measureable effect or within the range of natural or historical variation</td></tr>
<tr><td colspan="2">Low</td><td>CACs: Ambient concentration or deposition level is less than half the relevant standard.
GHGs: The Project will contribute less than ±1% of Territorial and less than ±0.01% of National total emissions.</td></tr>
<tr><td colspan="2">Medium</td><td>CACs: Ambient concentration or deposition level is greater than half but less than relevant standard.
GHGs: The Project will contribute more than ±1% but less than ±10% of Territorial and more than ±0.01% but less than ±0.1% of National total emissions.</td></tr>
<tr><td colspan="2">High</td><td>CACs: Ambient concentration or deposition level is greater than relevant standard.
GHGs: The Project will contribute more than ±10% of Territorial and more than ±0.1% of National total emissions.</td></tr>
<tr><td colspan="3">LIKELIHOOD – probability of occurrence</td></tr>
<tr><td colspan="2">High</td><td>Strong likelihood that the effect will occur.</td></tr>
<tr><td colspan="2">Low</td><td>Not likely that the effect will occur.</td></tr>
<tr><td colspan="3">GEOGRAPHICAL EXTENT - location of effect</td></tr>
<tr><td colspan="2">Local</td><td>The air quality effect is limited to the LSA.</td></tr>
<tr><td colspan="2">Regional</td><td>The air quality effect extends beyond the LSA but is contained within the territorial boundary.</td></tr>
<tr><td colspan="2">Global</td><td>Effect extends beyond the territorial boundary.</td></tr>
<tr><td colspan="3">TEMPORAL CONTEXT – of the event and residual effect</td></tr>
<tr><td rowspan="3">Duration
(interval of the event causing the residual effect)</td><td>Short-term</td><td>The effect is longer than two days but less than or equal to two years.</td></tr>
<tr><td>Medium-term</td><td>The effect is longer than two years but less than or equal to the lifetime of the Project.</td></tr>
<tr><td>Long-term</td><td>The effect is evident beyond the lifetime of the Project.</td></tr>
<tr><td rowspan="3">Frequency
(how often would the event that caused the residual effect is anticipated to occur)</td><td>Isolated</td><td>The effect is confined to a specific period (e.g., construction period; less than or equal to 10% of the assessment period).</td></tr>
<tr><td>Intermittent</td><td>The effect occurs intermittently but repeatedly over the construction and operations period (estimated >10% but <80% of the assessment period).</td></tr>
<tr><td>Continuous</td><td>The effect occurs near-continuously or continuously</td></tr>
<tr><td colspan="3">ECOLOGICAL CONTEXT – type of impact and nature of the affected environmental components</td></tr>
<tr><td colspan="2">Disturbed</td><td>Area has been substantially disturbed by human development.</td></tr>
<tr><td colspan="2">Undisturbed</td><td>Area has not been substantially disturbed by human development.</td></tr>
<tr><td colspan="3">REVERSIBILITY</td></tr>
<tr><td colspan="2">Reversible</td><td>The air quality effect is reversible.</td></tr>
<tr><td colspan="2">Irreversible</td><td>The air quality effect is permanent.</td></tr>
<tr><td colspan="3">SIGNIFICANCE – of the residual effect</td></tr>
<tr><td colspan="2">Significant</td><td>A high probability of occurrence of residual effect that cannot be avoided or mitigated, having a combination of characteristics that render it unacceptable to the public, regulators, and other stakeholders</td></tr>
<tr><td colspan="2">Less than significant</td><td>All other impacts</td></tr>
</table>

Assessment Criteria	Definition
LEVEL OF CONFIDENCE[1] - degree of certainty related to significance evaluation	
Low	Determination of significance based on incomplete understanding of cause-effect relationships and incomplete data pertinent to the project area.
Moderate	Determination of significance based on good understanding of cause-effect relationships using data from outside the project area or incompletely understood cause-effect relationships using data pertinent to the project area.
High	Determination of significance based on good understanding of cause-effect relationships and data pertinent to the project area.

Notes: (1) Level of confidence was affected by availability of data, precedence, degree of scientific uncertainty or other factors beyond the control of the assessment team.

3 EFFECT ASSESSMENT METHODOLOGY

3.1 General Approach

The project effects assessment focused on Project operations since the majority of the emissions will occur during this phase and therefore it could be used to bound the overall effects assessment. If the potential effect of emissions during operations was found to be not significant then the potential effect of construction, closure and post-closure emissions, which are expected to be of lower magnitude and shorter duration, would also be not significant. Thus, the operation phase was assessed quantitatively while construction, closure and post-closure were assessed qualitatively.

The quantitative assessment of Project emissions during operation phase consisted of the following steps:

- Use professional judgment to rank sources as being major, moderate, or minor.
- Estimate emissions and other stack parameters for major sources of emissions. Generally, CACs were estimated using a bottom-up approach whereas GHGs were estimated using a top-down approach based on total fuel consumption.
- Predict ground-level concentrations of CACs in the LSA using a dispersion model.
- Compare ground-level CAC concentrations to NWT air quality standards and dustfall levels to objectives and guidelines from other jurisdictions. Compare GHG emissions to territorial and national totals as well as emissions from other projects in NWT.

Based on the production schedule in the PFS, mining activities and production vary each year of the 7.5 years of mine life. A simplified production schedule is shown in Table 3.1, where the shaded cells indicate mining activities. Based on the production schedule, year four was selected to represent the worst-case year for dispersion modelling since there will be mining activities at three sites.

Table 3.1 Base Case Production Schedule

Area	Year							
	1	2	3	4	5	6	7	8
Ormsby Open Pit								
Ormsby Underground								
Nicholas Lake Underground								
Total Ore (million t)	0.9	1.3	1.1	1.3	1.3	1.1	0.4	0.09

3.2 Ranking of Emission Sources

For the estimation of CAC emissions using a bottom-up approach, sources were ranked as being major, moderate, or minor sources using professional judgment based on previous experience with similar projects. The sources considered major or moderate were assessed quantitatively whereas minor sources were assessed qualitatively. GHG emissions from the ammonium nitrate-fuel oil (ANFO) explosives were also assessed using a bottom-up approach. GHG emissions from most sources ranked minor were included in the top-down approach of emission estimation based on fuel consumption.

3.3 Emission Estimation

The emissions from this Project were estimated using a systematic approach. Since the Project has not been constructed, there are no direct measures of the emissions. Manufacturer's specifications were used for emission estimates when available. Industry-specific emissions factors were used to calculate emission rates if the manufacturer had not yet been selected by Tyhee NWT Corp. Emission factors are representative values that relate the quantity of a contaminant released into the atmosphere based on the type of activities associated with the release of contaminants. In this assessment, emission factors from the United States Environmental Protection Agency's (US EPA) compilation of Air Pollutant Emission Factors, known as AP-42, were employed in most cases.

3.3.1 Ventilation Raises

To estimate emissions from the underground mine ventilation raises, it was assumed that the quality of the ambient air underground will be maintained to meet the Mine Health and Safety Standards in NWT. The Mine Health and Safety Regulations R-125-95 for NWT states that threshold limit values (TLV) set out in the handbook Threshold Limit Values for Chemical Substances and Physical Agents issued by American Conference of Governmental Industrial Hygienists (ACGIH[1]) are to be followed (ACGIH, 1997).

Since the ambient air underground will meet standards outlined in the Mine Health and Safety Regulations, emission rates through the ventilation raises were conservatively estimated using the design air flow rate and the appropriate TLVs. ACGIH standards were obtained for NO_2, SO_2, CO and TSP, shown in Table 3.3. Emissions of $PM_{2.5}$ were assumed to be 7.5% of TSP according to Particulate Matter Speciation Profile by California Emission Inventory and Reporting System (CEIDAR, 2009) for mineral crushing, screening, and handling. There will be two ventilation raises at each mine site. The ventilation rate of 85 m^3/s per mine was assumed to be distributed evenly between the two raises.

---

[1] ACGIH is a professional organization of industrial hygienists and practitioners of related professions.

Table 3.2 Emissions Sources in the LSA

Source	Type of Emissions	Rank	Comments
Underground mining activities and processing	CACs and GHGs	Major	CAC, GHG and fugitive dust emissions from all mining activities will be concentrated through two ventilation raises
Open pit mining activities	CACs and fugitive dust	Major	Open pit mining activities include drilling, excavator loading onto truck and blasting. Note that blasting is assessed qualitatively because both frequency and affected area are unknown.
Exhaust from diesel generator stacks	CACs and GHGs	Major	Four diesel generators will be used at the Ormsby site and one diesel generator will be used at the Nicholas Lake site to support all power to the mine and mill activities.
Surface equipment	GHGs	Major	Fuel combustion in equipment is a large source of CACs and GHGs
Transfer and handling of ore	CACs	Moderate	Ore transfer and handling is a moderate source of PM emissions
Crushing of ore	CACs	Major	Crushing of ore is a large source of PM emissions
Wind Erosion from Run-of-mine (ROM) and crushed ore stockpiles	CACs	Minor	Stockpiles at the Ormsby site will be enclosed and therefore there will be no wind erosion. Wind speed at the Nicholas Lake site is low and the ore particle size is sufficiently large that wind erosion is very unlikely.
ANFO explosive	GHGs	Moderate	ANFO explosives are a moderate source of CO_2 emissions
Fuel combustion in vehicles	CACs and GHGs	Minor	CAC emissions from fuel combustion in vehicles will be intermittent and localized. GHG emissions were estimated.
Fugitive dust emissions from haul trucks and roads	Fugitive dust	Minor	Fugitive dust emissions from trucks and roads will be short-term and localized
Fuel consumption in aircraft	CACs and GHGs	Minor	Limited effect on ground-level ambient concentrations with infrequent operating hours
Waste incineration	CACs	Minor	Incineration of waste produced on site will be a small, intermittent source

Table 3.3 Threshold Limit Values for Mine Health and Safety Standards in NWT

	NO_2	SO_2	CO	TSP	$PM_{2.5}$
ACGIH TLV (mg/m^3)	5.6	5.2	29	10	0.75

3.3.2 Open Pit Activities

Open pit activities include drilling, excavator loading to haul trucks, and blasting. Because the frequency and the blast area are both unknown, blasting is assessed qualitatively. Drilling was assumed to occur once per hour. Emission factors for drilling were obtained from AP-42 Chapter 11 and speciation of $PM_{2.5}$ from TSP was from CEIDAR, 2009. Emissions associated with the transfer of material to haul trucks using excavators will be a function of the wind speed and were calculated using the methodology described in AP-42 Chapter 13.

3.3.3 Diesel Generators

Four EMD 16-710GC 2985 kW (tier 2) diesel generators at the Ormsby site and one at the Nicholas Lake site are required to operate continuously to meet the power demand. Additional diesel generators will be available for emergency standby but are not included in the assessment. The US EPA NONROAD2005 model was used to estimate emissions from the diesel generators. The manufacturer's specifications indicate a load factor of 90%.

3.3.4 Transfer and Handling

There will be several transfer points of dry ore. At Ormsby, there will be three enclosed transfer points: transfer from underground or open pit mine to ROM stockpile, transfer from tertiary cone crusher to crushed ore stockpile, and loading onto conveyor from crushed ore stockpile to the mill. Emissions from enclosed transfers of ore were estimated using AP-42 Chapter 11. Transfer from the underground mine to ROM stockpile at Nicholas Lake site, and the transfer to the waste dumps at Ormsby and Nicholas Lake will occur outdoors. Emissions from these sources were estimated using the methodology outlined in AP-42 Chapter 13.

At the Ormsby site, stockpiles and equipment will be enclosed in a large building with four rooms. The ROM stockpile will be in one room, the three crushers in another, crushed stockpiles in the third room, and the mill in another room. The milling processes are wet and therefore no emission is expected. Each of the other rooms will be equipped with a baghouse. A control efficiency of 99% was assumed for the baghouses.

Table 3.4 summarizes the total annual emissions from Ormsby and Nicholas Lake sites. At both sites, the largest sources of TSP, CO and SO_2 are the ventilation raises. The largest source of NO_x and $PM_{2.5}$ is the set of diesel generators.

Table 3.4 Summary of Annual CAC Emissions

Source	CAC Emissions (tonnes/y)				
	NO_X	SO_2	CO	TSP	$PM_{2.5}$
Ormsby Site					
Generators (four)	517	0.62	96	17	16
Ventilation (two raises)	30	28	155	54	4
Crushing of Ore	-	-	-	31	2
Open Pit	-	-	-	32	2
Transfer and Handling of Ore	-	-	-	28	2
Subtotal	*547*	*28*	*252*	*134*	*25*
Nicholas Lake Site					
Generator (one)	129	0.2	24	4	4
Ventilation (two raises)	30	28	155	54	4
Transfer and Handling of Ore	-	-	-	0.4	0.03
Subtotal	*159*	*28*	*180*	*58*	*8*
Total	**707**	**57**	**431**	**192**	**33**

3.4 Dispersion Modelling

Dispersion modelling was conducted using the US EPA CALPUFF dispersion model. CALPUFF is a multi-layer, multi-species, non-steady-state puff dispersion model. It simulates the effect of time- and space-varying meteorological conditions on pollutant transfer, transformation and deposition. CALPUFF can use three-dimensional meteorological fields developed by the CALMET model or simple, single-station winds in a format consistent with the meteorological files used to drive the ISCST3 steady-state Gaussian model. For this study, using meteorology from a single station was deemed sufficient.

Since the GNWT does not have dispersion model guidelines, CALPUFF modelling for the Project was performed in accordance with the Guidelines for Air Quality Dispersion Modelling in BC. Table 3.5 summarizes the CALPUFF model switch settings that were used in this assessment and Table 3.6 summarizes the emission source types.

NO_x emissions are comprised of NO_2 and NO. The primary emission is in the form of NO with reactions in the stack and atmosphere resulting in the conversion of NO to NO_2. There are two methods outlined in the Guidelines for Air Quality Dispersion Modelling in BC for converting NO_x to NO_2: ambient ratio and ozone limiting. The ozone limiting method was selected. Ozone observed in Norman Wells in 2006 (Environment Canada, 2008) were used in the calculation. The maximum one-hour and 24-hour concentrations were 51 and 44 ppb, respectively, and the annual average was 22 ppb.

Table 3.5 CALPUFF Model Switch Settings

Parameter	Default	Project	Comments
MGAUSS	1	1	Gaussian distribution used in near field
MCTADJ	3	3	Partial plume path terrain adjustment
MCTSG	0	0	Scale-scale complex terrain not modelled
MSLUG	0	0	Near-field puffs not modelled as elongated
MTRANS	1	0	Transitional plume rise modelled
MTIP	1	1	Stack tip downwash used
MBDW	2	1	ISC type building downwash used
MSHEAR	0	0	Vertical wind shear not modelled
MSPLIT	0	0	Puffs are not split
MCHEM	1	0	Chemical transformation not modelled
MAQCHEM	0	0	Aqueous phase transformation not modelled
MWET	1	0	Wet removal modelled for fugitive dust sources
MDRY	1	0 or 1	Dry deposition modelled for fugitive dust sources
MDISP	2 or 3	2	Near-field dispersion coefficients internally calculated from sigma-v, sigma-w using micrometeorological variables
MTURBVW	3	3	This variable is not used for MDISP = 2
MDISP2	3	2	This variable is not used for MDISP = 2
MROUGH	0	0	PG σ_y and σ_z not adjusted for roughness
MPARTL	1	0	No partial plume penetration of elevated inversion
MTINV	0	0	Strength of temperature inversion computed from default gradients
MPDF	0	1	PDF used for dispersion under convective conditions as recommended for MDISP = 2
MSGTIBL	0	0	Sub-grid TIBL module not used for shoreline
MBCON	0	0	Boundary concentration conditions not modelled
MFOG	0	0	Do not configure for FOG model output
MREG	1	0	Do not test options specified to see if they conform to regulatory values

Table 3.6 CALPUFF Emission Source Types

<table>
<tr><th colspan="2">Emission Source</th><th>CALPUFF source type (Point, Area, or Volume)</th><th>Nature of Emissions (Constant or Variable)</th></tr>
<tr><td colspan="2">Underground Mining Activities</td><td>Point</td><td>Constant</td></tr>
<tr><td colspan="2">Ormsby Open Pit</td><td>Volume</td><td>Variable</td></tr>
<tr><td colspan="2">Diesel Generators</td><td>Point</td><td>Constant</td></tr>
<tr><td rowspan="2">Crushing, Transfer and Handling of Ore</td><td>Enclosed sources (Crusher and indoor stockpiles)</td><td>Point</td><td>Constant</td></tr>
<tr><td>Outdoor sources (outside stockpile and waste dump)</td><td>Volume</td><td>Variable</td></tr>
</table>

For this assessment, four years of site-specific surface meteorological data were used (2006 to 2009). Upper air data from Fort Smith were employed to determine mixing heights. These data were processed with CPrammet, the meteorological pre-processor for CALPUFF, to create an ISC-type meteorological file.

Figure 3.1 shows the joint frequency distribution of wind direction and wind speed in a polar histogram format based on the pre-processed meteorological data. The orientation of each bar indicates the direction from which the wind is blowing, with direction being shown for the 16 compass points. The length of each bar indicates the frequency of occurrence. The most frequent wind directions are from the east and east-northeast. The maximum wind speed from 2006 to 2009 was 10.3 m/s.

To assess the potential effect of emissions from a facility on ambient air quality, concentrations are predicted beyond the facility boundaries, where ambient air quality standards apply. Within the facility boundaries, occupational health and safety guidelines apply; therefore, receptors inside the boundaries are excluded from the modelling. In this LSA, two areas were excluded, one at the Ormsby site and one at the Nicholas Lake site. A Cartesian receptor grid was adopted with the following receptor spacing:

- 20-m spacing along the plant boundaries where no public access is expected at both Ormsby and Nicholas Lake sites;
- 50-m spacing for a 2.3 by 2.3 km area centred on the Ormsby site and a 0.77 by 0.77 km area centred on the Nicholas Lake site;
- 250-m spacing for a 3.8 by 3.8 km area centred on the Ormsby site and a 2.27 by 2.27 km area centred on the Nicholas Lake site;
- 500-m spacing for a 6.8 by 6.8 km area centred on the Ormsby site and a 5.27 by 5.27 km area centred on the Nicholas Lake site;
- 1000-m spacing for the remainder of the 30 km by 30 km LSA.

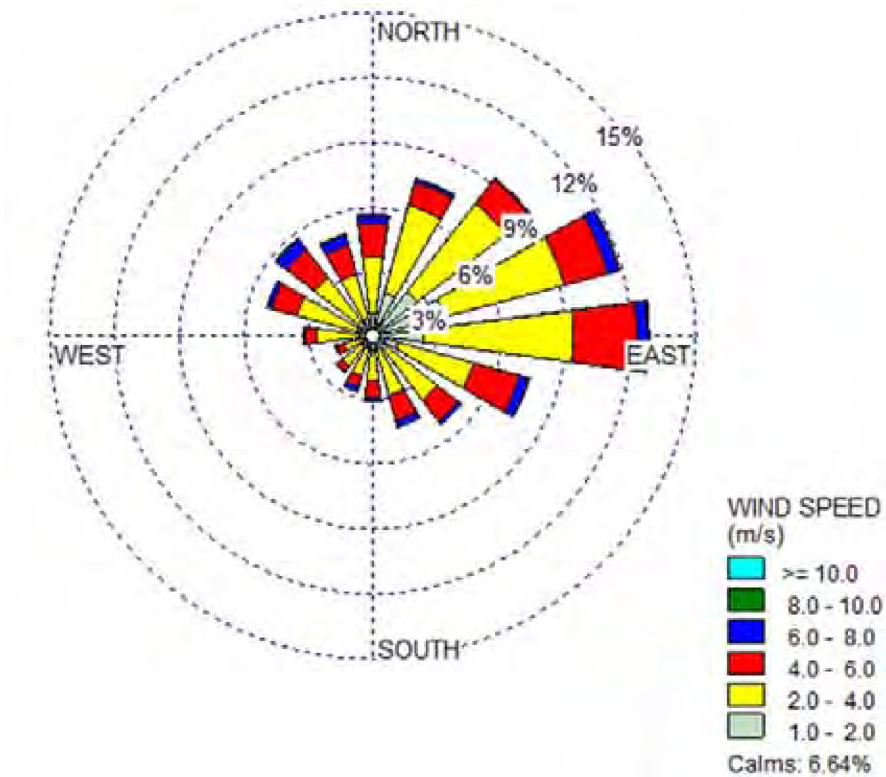

Figure 3.1 Joint Frequency Distribution of Wind Direction and Wind Speed Observed at the Ormsby site from 2006 to 2009

In addition to the Cartesian grid described above, discrete receptors were defined at the camps at Ormsby and Nicholas Lake sites. The terrain elevations for these receptors were extracted from 1: 250,000 scale Canadian Digital Elevation Data. A map of the LSA with the receptors is shown in Figure 3.2

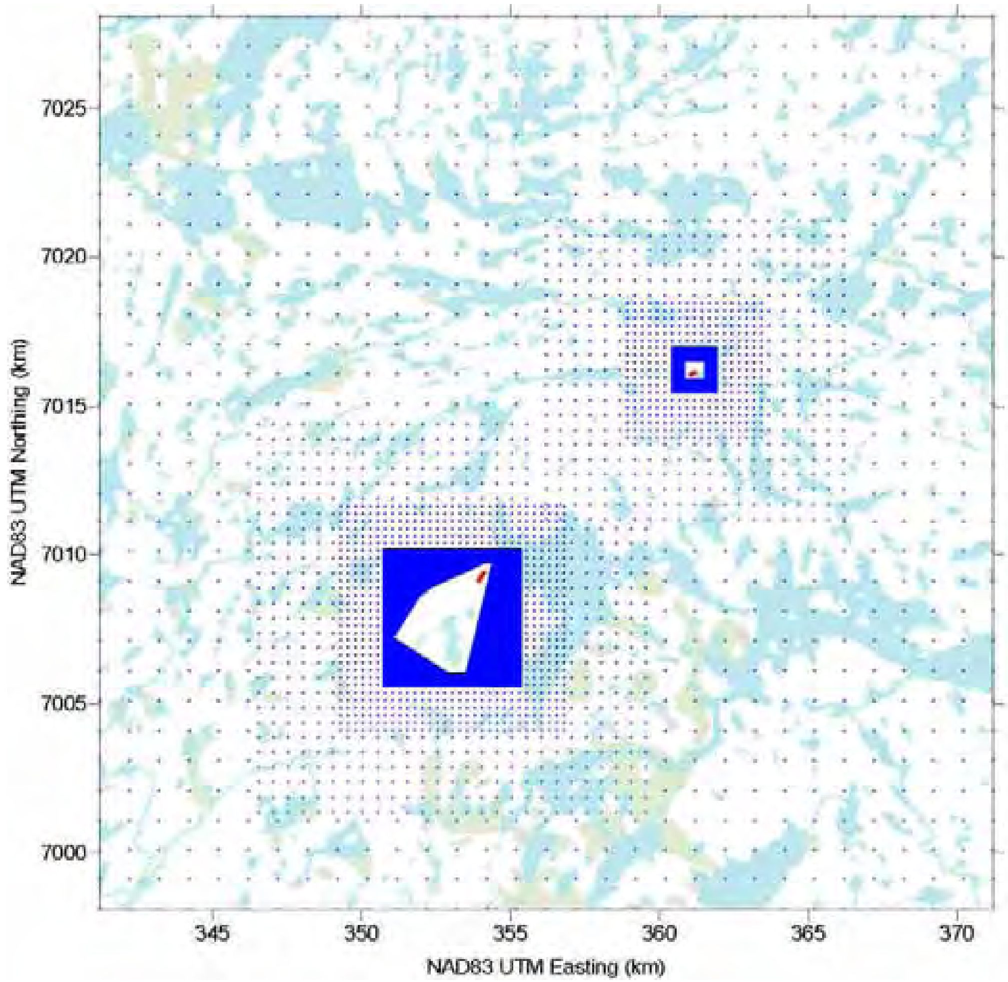

Figure 3.2 Local Study Area Showing Gridded Receptors (Blue Dots) and Discrete Receptors (Red Dots)

4 PROJECT EFFECTS ASSESSMENT

4.1 Construction

Equipment and vehicles used for site preparation and construction of Project infrastructure will emit CACs and GHGs. These activities will also be sources of fugitive dust. Construction will include upgrading an existing road and construction of an access road. Based on previous experience and professional judgment, it is expected that Project construction emissions will be of smaller magnitude and shorter duration than emissions during operation. Therefore, it is assumed that potential effects due to construction are bounded by the potential effects due to Project operations. Thus, residual effects due to construction emissions are assessed qualitatively. Furthermore, emissions during Project construction will be managed using best practices outlined in the Air Quality Management Plan (Section 7).

4.2 Operation

4.2.1 Criteria Air Contaminants

There are four main sources of CAC emissions: underground mining activities; Ormsby open pit mining activities; diesel generators; and crushing, transfer and handling of ore. The ROM stockpile, crushers, and crushed ore stockpile at the Ormsby site are in separate rooms inside the same building. All the crushers are in the same room and each ore stockpile has a dedicated room. Air from each room will be vented through a separate baghouse. The hourly emission rates that were used as inputs to the dispersion model are summarized in Table 4.1. The hourly emissions were calculated using design capacities (maximum obtainable output) where available. For the sources without maximum design capacities, annual production rates were converted to hourly emission rates based on the operation schedule of 365 days per year.

Table 4.1 Emission Rates Used for Dispersion Modelling

Sources	Emissions Rate (g/s)				
	NO_X	SO_2	CO	TSP	$PM_{2.5}$
Ventilation Raises (each, for both Ormsby and Nicholas Lake sites)	0.48	0.44	1.23	0.85	0.06
Ormsby Open Pit	-	-	-	1.07	0.08
Diesel Generator (one)	4.10	0.005	0.76	0.13	0.13
ROM Stockpile at Ormsby Site	-	-	-	0.02	0.002
Crushers at Ormsby Site	-	-	-	0.76	0.06
Crushed Ore Stockpile at Ormsby Site	-	-	-	0.04	0.003
Waste Dump at Ormsby Site	-	-	-	0.85	0.06
ROM Stockpile at Nicholas Lake Site	-	-	-	0.01	0.001
Waste Dump at Nicholas Lake Site	-	-	-	0.001	0.0001

The ventilation raises were assumed to be 3 m above ground with diameter of 2.1 m. The ventilation rate for each underground mine is expected to be 85 m^3/s, with each ventilation raise venting half the flow rate. The Ormsby open pit mining activities, including drilling and excavator loading to haul trucks, were modelled using a release height of 1 m. Diesel generator exhaust parameters were obtained from manufacturer's specifications (Electro-Motive-Diesel, 2009) and personal communication with Waterous Power Systems[2]. The emissions from crushing, adding and removing aggregate material from the ROM and crushed ore stockpiles at Ormsby site were assumed to exit through the baghouse stacks. The flow rates through the baghouses were calculated assuming two building exchanges per hour and that half the space in each room is occupied by either equipment or a stockpile. The transfers to the waste dumps at Ormsby and Nicholas Lake would be outdoors and were assumed to emit at a height of 12 m. The release height of the transfer to the ROM stockpile at Nicholas Lake was assumed to be 5 m. The stack parameters used in the modelling are summarized in Table 4.2 and Table 4.3.

Table 4.2 Stack Parameters Used for Point Source Dispersion Modelling

Sources	Stack (m)	Stack Inner Diameter (m)	Stack Exit Temperature (°C)	Stack Exit Velocity (m/s)
Ventilation Raises	3	2.1	0	12.3
Diesel Generator (one)	4.6	0.6	335	40.1
Baghouse for ROM Stockpile at Ormsby Site	26.9	1.5	10	14.7
Baghouse for Crushers at Ormsby Site	26.9	0.7	10	11.3
Baghouse for Crushed Ore Stockpile at Ormsby Site	26.9	1.5	10	14.7

Table 4.3 Stack Parameters Used for Volume Source Dispersion Modelling

Sources	Release Height (m)	Initial Sigma –Y and –Z (m)
Ormsby Open Pit	1	2
Waste Dump at Ormsby Site	12	2
ROM Stockpile at Nicholas Lake Site	5	2
Waste Dump at Nicholas Lake Site	12	2

As the stacks are relatively short, the associated plumes may be influenced by building downwash. For this reason, building downwash effects were assessed in the dispersion modelling. Table 4.4 and Table 4.5 summarize the building dimensions that were used.

[2] Waterous Power Systems is the new company name for Midwest Power Product.

Table 4.4 Ormsby Site Building Parameters Used for Dispersion Modelling

Description	Unit	Camp	Diesel Storage	Power Generation	Process Plant Building	Truck shop, warehouse, and office
Base Elevation	(m)	309.25	309.25	309.25	309.25	309.25
Height	(m)	3.048	6.096	4.572	25.908	6.096
Number of Vertices		4	4	4	4	4
Vertices:						
Corner1	(mE)	354.09	353.47	353.59	353.63	353.56
	(mN)	7009.43	7008.58	7008.68	7009.03	7008.77
Corner2	(mE)	354.15	353.51	353.63	353.81	353.60
	(mN)	7009.39	7008.53	7008.63	7008.93	7008.73
Corner3	(mE)	353.94	353.36	353.55	353.71	353.41
	(mN)	7009.08	7008.40	7008.56	7008.75	7008.56
Corner4	(mE)	353.89	353.32	353.51	353.53	353.37
	(mN)	7009.12	7008.44	7008.61	7008.85	7008.60

Table 4.5 Nicholas Lake Site Building Parameters Used for Dispersion Modelling

Description	Unit	Camp	Shop	Diesel Storage	Power Generation Plant
Base Elevation	(m)	341.8	341.8	341.8	341.8
Height	(m)	3.048	3.048	6.096	4.572
Number of Vertices		4	4	4	4
Vertices:					
Corner1	(mE)	361.20	361.06	361.14	361.10
	(mN)	7016.17	7016.17	7016.30	7016.34
Corner2	(mE)	361.23	361.17	361.16	361.12
	(mN)	7016.12	7016.23	7016.27	7016.31
Corner3	(mE)	361.06	361.20	361.12	361.10
	(mN)	7016.03	7016.17	7016.23	7016.30
Corner4	(mE)	361.03	361.09	361.09	361.08
	(mN)	7016.08	7016.12	7016.25	7016.32

The maximum ambient concentrations of CACs and dustfall levels predicted using the CALPUFF model are shown in Table 4.6 and

Table 4.7, respectively. The maximum predicted CAC concentrations are less than the corresponding NWT ambient air quality standards for all contaminants. Most of the maximum CAC concentrations were predicted to be less than half of the NWT AQ standards except 24-hour TSP. The maximum 24-hour TSP is 119 μg/m^3 compared to the standard of 120 μg/m^3; however, the maximum 24-hour TSP concentration at the two camps is less than 40 μg/m^3, which is a third of the ambient air quality standard. The maximum predicted dustfall deposition level is much less than the most stringent criteria. The maximum concentrations predicted for all CACs at the camps are less than one third of the corresponding ambient air quality standards.

Table 4.6 Maximum Predicted CAC Concentrations

Pollutant	Averaging Period	Maximum Predicted Concentration ($\mu g/m^3$)	NWT AQ Standard ($\mu g/m^3$)
NO_2	1-hour	152	400
	24-hour	105	200
	Annual	7	60
SO_2	1-hour	146	450
	24-hour	48	150
	Annual	5	30
CO	1-hour	407	15,000
	8-hour	217	6,000
TSP	24-hour	119	120
	Annual	11	60
$PM_{2.5}$	24-hour	13	30

Table 4.7 Maximum Predicted Dustfall Deposition Level

Dustfall	Maximum Predicted Deposition Level ($mg/dm^2/day$)	Most Stringent Criteria ($mg/dm^2/day$)
	0.39	1.75

The spatial distributions of maximum predicted concentrations and dustfall levels are presented in the form of isopleths maps. Since all predicted concentrations are less than the ambient standards, only one plot is shown per contaminant for the shortest relevant averaging period.

The highest one-hour NO_2 concentration was predicted to occur immediately west of the Ormsby camp (Figure 4.1). The highest one-hour SO_2 and CO concentrations (Figure 4.2 and Figure 4.3) were predicted to occur immediately north of the Nicholas Lake camp. The highest TSP (Figure 4.4) and $PM_{2.5}$ (Figure 4.5) concentrations, and dustfall levels (Figure 4.6) were predicted to occur immediately outside the waste dumps at Ormsby and Nicholas Lake sites.

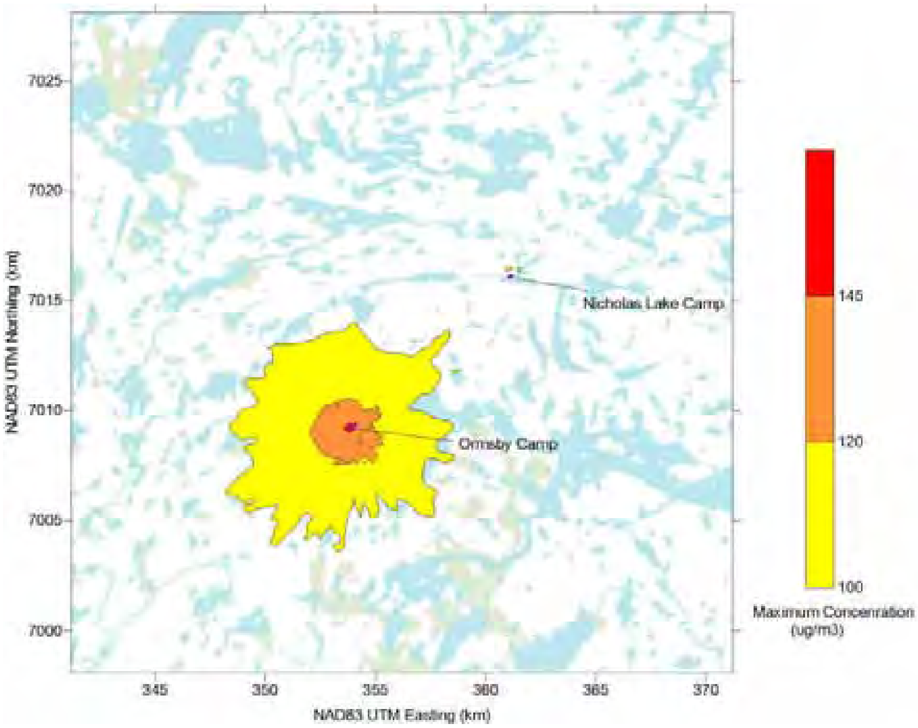

Figure 4.1 Isopleths of Maximum Predicted One-Hour Average NO_2 Concentrations

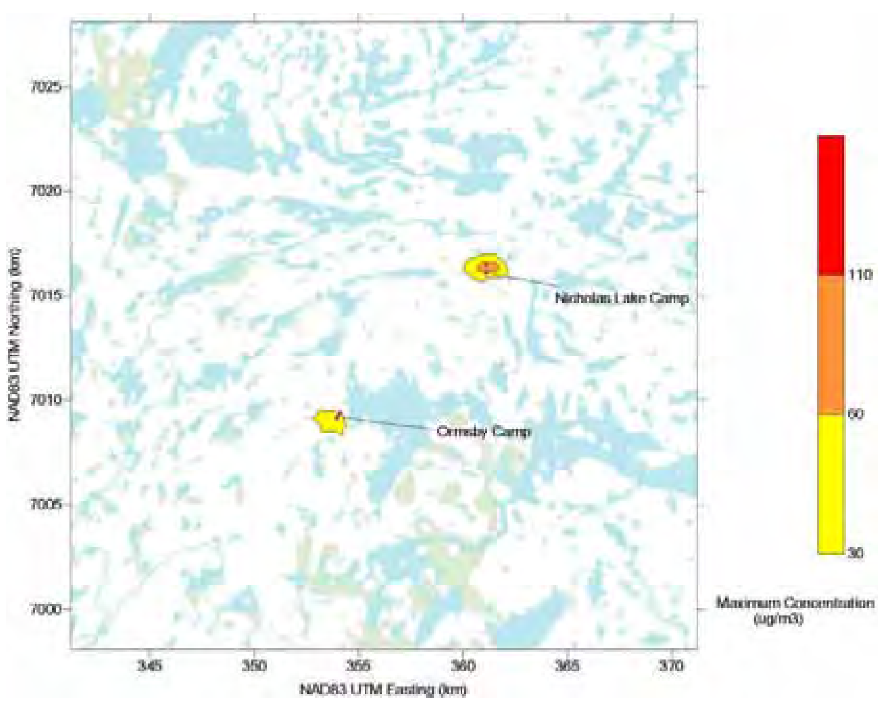

Figure 4.2 Isopleths of Maximum Predicted One-Hour Average SO_2 Concentrations

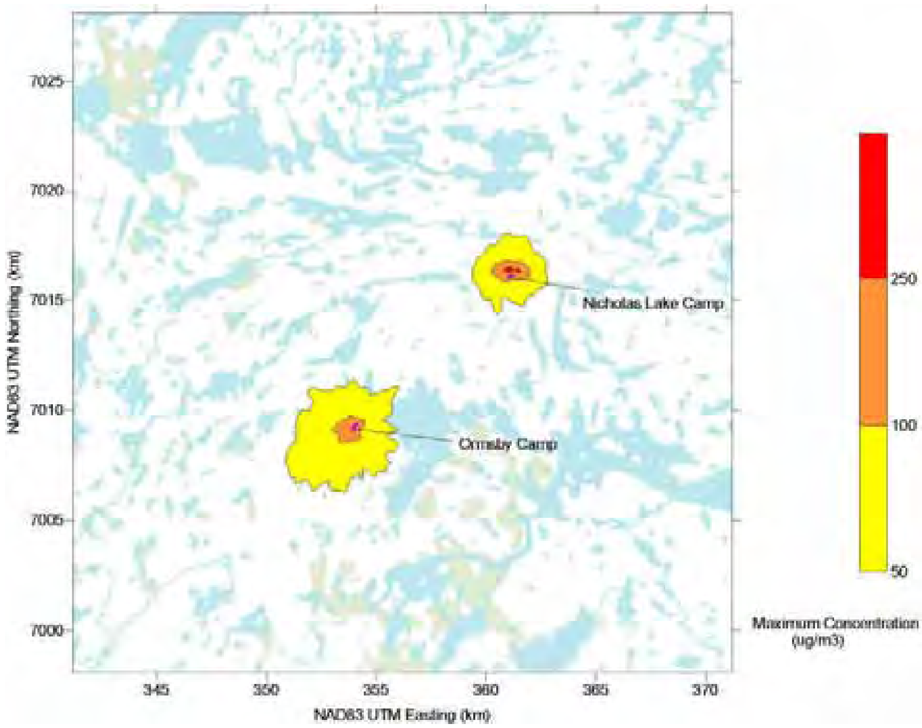

Figure 4.3 Isopleths of Maximum Predicted One-Hour Average CO Concentrations

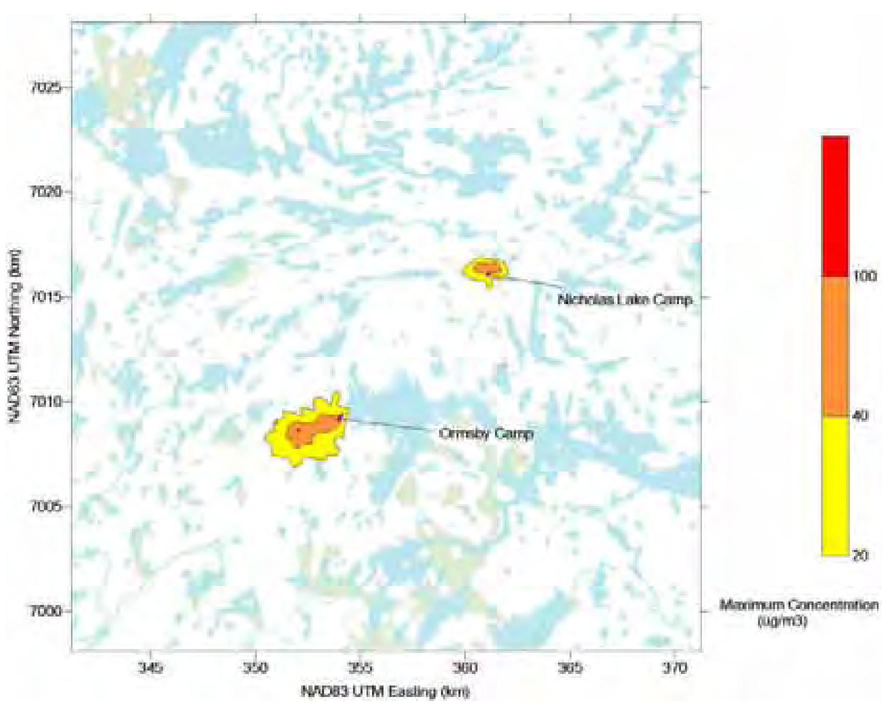

Figure 4.4 Isopleths of Maximum Predicted 24-Hour Average TSP

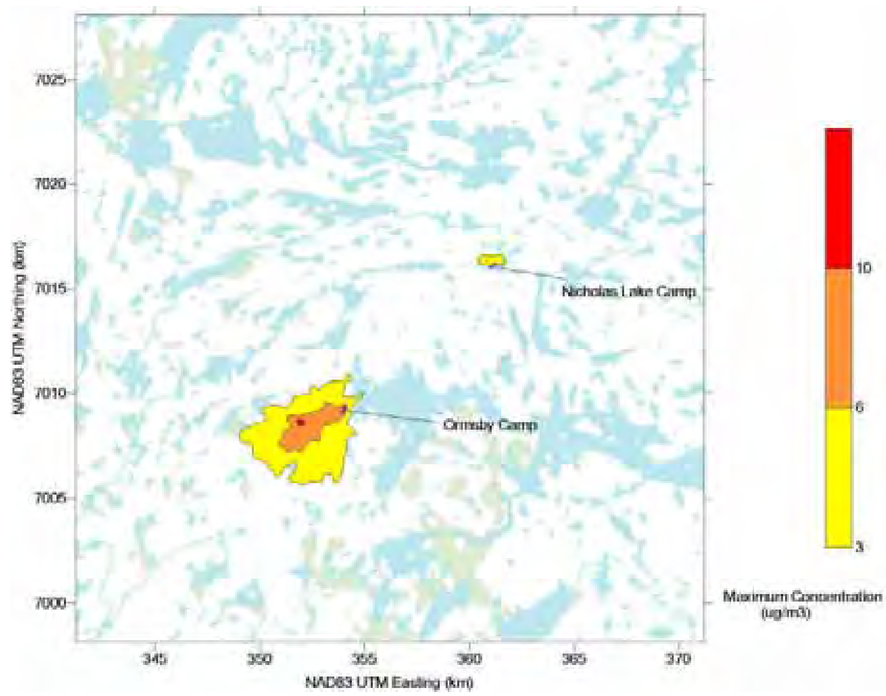

Figure 4.5 Isopleths of Maximum Predicted 24-Hour Average $PM_{2.5}$

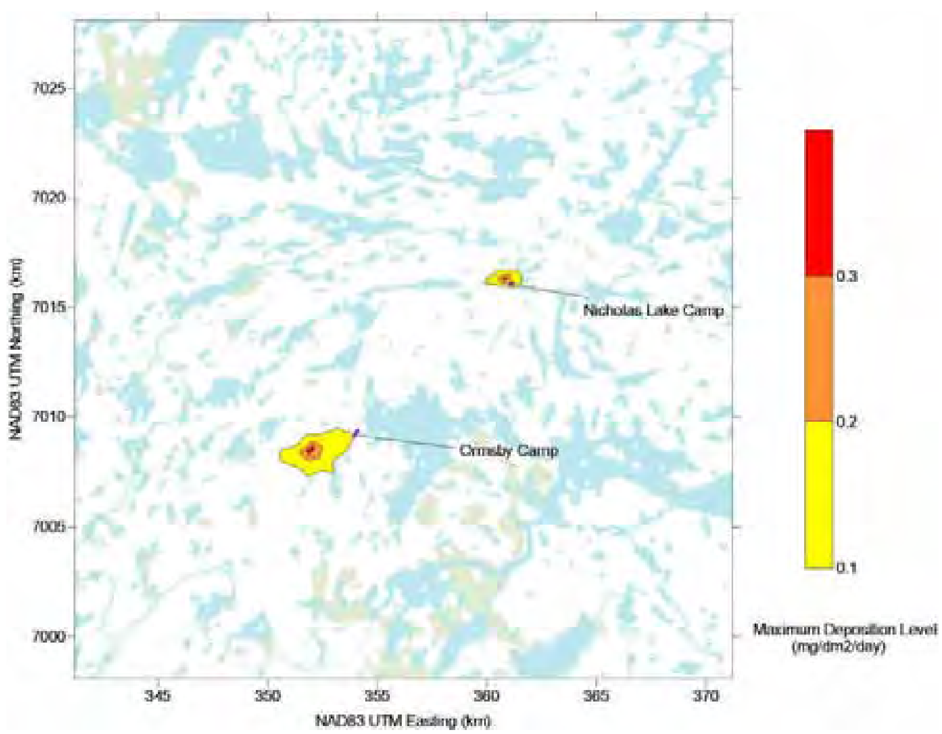

Figure 4.6 Isopleths of Maximum Predicted Dustfall Deposition Levels

4.2.2 Greenhouse Gases

Greenhouse gases are generally aggregated into "CO_2 equivalent" (CO_2e). The equivalency factors are based on the relative global warming potentials (GWP) for each gas sanctioned by the Intergovernmental Panel on Climate Change (IPCC). The IPCC estimates GWPs for a number of GHGs for various time periods related to the effect of a quantity of the gas released on future atmospheric temperature rise. These numbers vary widely from gas to gas, and they also vary from time period to time period for a given gas, depending on physical and chemical properties. The 100-year GWPs are generally used. The most recent estimates of 100-year GWPs used by Environment Canada are sanctioned by the IPCC and are shown in Table 4.8. These numbers indicate that one kilogram of N_2O has 310 times the global warming effect of one kilogram of CO_2 over a period of 100 years.

Table 4.8 IPCC Global Warming Potentials

	CO_2	CH_4	N_2O
Global Warming Potential	1	21	310

The Project will emit GHGs from the following main sources: underground and surface equipment, diesel generators, and ANFO explosives.

The GHG emissions for underground and surface equipment were estimated using fuel consumption and emission factors from National Inventory Report – Greenhouse Gas Sources and Sinks in Canada (Environment Canada, 2010). Annual fuel consumption is expected to vary throughout the mine life. The maximum annual consumption of 10.7 million litres is expected to occur in year three while the average annual consumption is expected to be 7.2 million litres. Year three was selected for the GHG emission estimation.

CO_2 emissions associated with diesel generators were estimated in accordance with the US EPA NONROAD2005 model. Emissions of CH_4 and N_2O were estimated by scaling the CO_2 emissions using Environment Canada emission factors for non-road diesel equipment. The Project requires approximately 5,000 tpa of ANFO explosives.

Explosives are identified as one of the common sources of GHG emissions in the mining sector (The Mining Association of Canada, 2009). The Energy and GHG Emissions Management Guidance Document by the Mining Association of Canada indicates that 0.189 tonne of CO_2 is emitted for each tonne of ANFO explosives used.

Total GHG emissions from the Project are summarized in Table 4.9. The diesel generators at Ormsby site are expected to emit the most GHGs. Total Project-related emissions of 123,954 tonnes per year would represent a 0.02% increase compared to the estimated Canadian total emissions in 2008 and a 7% increase compared to Northwest Territories and Nunavut's total reported GHG emissions in 2008. The expected GHG emissions during operation are greater than the Environment Canada reporting threshold of 50,000 tonnes.

Greenhouse gas emissions from several other potential and existing mines in the NWT are presented in Table 2.3. Total Project GHG emissions during operations are roughly twice the total GHG emissions from Snap Lake Mine (63 kt/y) but less than the GHG emissions from Diavik Diamond Mine (159 kt/y) and Ekati Diamond Mine (210 kt/y).

Table 4.9 Summary of Annual GHG Emissions

Source	CO_2	CH_4	N_2O	CO_2e
Generators (four)- Ormsby	66,921	4	28	75,569
Generator (one) - Nicholas Lake	16,730	1	7	18,892
ANFO explosive	945	-	-	945
Equipment	28,547	2	12	32,236
Total	113,143	6	46	123,954

4.3 Closure

The closure and reclamation plans (CRPs) of the project are integral components of a sound environmental management system for the development, designed to ensure that the development will not leave an adverse footprint on the ecosystem. Activities during the closure and reclamation phase will include reduction or elimination of physical environmental effects and re-establishment of conditions that enable the lands to return to pre-mining land uses. Physical environmental effects will be reduced or eliminated once the mine ceases operation. During the final abandonment phase of closure, infrastructure pads, roads and development site will be re-contoured and scarified to encourage the reestablishment of native vegetation. Equipment and vehicles used for the closure and reclamation activities will emit CACs and GHGs. There will also be fugitive dust emissions from the re-contouring of the roads. However, these emissions will be of smaller magnitude and shorter duration than the emissions during the operation phase. Therefore, it is assumed that potential effects during the closure are bounded by the potential effects during operation. The residual effects due to closure are assessed qualitatively in Section 6.2.

4.4 Post-Closure

The Project is considered to be a temporary land use. Long-term monitoring and maintenance will be eliminated by establishing physical and chemical stability of disturbed areas during the closure phase. Emissions associated with the post-closure phase are expected to be negligible.

5 MITIGATION MEASURES

Various mitigation measures have been incorporated into the Project design.

- Haul roads, dams and tailing storage facilities will be constructed using non-acid-generating waste rock from the site rather than importing construction material from off site. This will reduce the fuel required to transport construction materials.

- At the Ormsby site, the crushers and the stockpiles will be enclosed in a building that will be vented through baghouses, with greater than 99% capture of particulate matter.

- Milling will be a wet process with negligible fugitive dust emissions.

- In the underground mines, there will be sufficient dust control devices on the mining and processing equipment to meet the Mine Health and Safety Regulations.

- Hauling of fuel and other heavy or bulk material from Yellowknife will be by winter roads between Prosperous Lake and the mine sites during February and March, which should minimize fugitive dust emissions from the roads.

6 RESIDUAL EFFECTS ASSESSMENT

The residual effects were assessed using the assessment endpoint and residual effects assessment criteria presented in Sections 2.5 and 2.6, respectively. Based on previous experience on similar projects and professional judgment, the majority of the emissions will occur during the operation phase. Therefore, the effect assessment of operation phase will bound the construction, closure, and post-closure phases. The operation phase is assessed quantitatively while construction, closure, and post-closure phases are assessed qualitatively. The residual effects of the Projects are summarized in Construction Table 6.1.

Since construction of the Project will result in increased emissions of CACs and GHGs, the direction of effect is negative and the likelihood of occurrence is high. Based on previous experience and professional judgment, the magnitude of effect is expected to be low for both CACs and GHGs. The geographical extent of CACs is expected to be limited to the LSA and therefore is rated local while the geographical extent of GHGs is global. Since CACs will only be emitted during the construction phase, duration is rated short term. GHGs have a long atmospheric lifetime and therefore the duration is rated long term. It is expected that CACs and GHGs will be emitted intermittently during construction. The LSA has not been substantially disturbed by human development and therefore the ecological context is rated undisturbed. Since the CAC and GHG emissions from construction activities will cease at the end of construction, the residual effect is rated reversible. Due to the low magnitude, intermittent frequency and reversible nature of the effect, the residual effects on ambient air quality and GHG emissions are considered less than significant. Since the construction phase was assessed qualitatively but is bounded by a quantitative assessment of emissions during operations, the level of confidence is low to moderate for both CACs and GHGs.

6.1 Operation

6.1.1 Criteria Air Contaminants

As shown in Table 4.6, the maximum predicted CAC concentrations due to the major sources of emissions during operations are less than the corresponding NWT AQ standards. Similarly, the maximum predicted dustfall levels are less than the most stringent criteria from other Canadian jurisdictions (

Table 4.7).

There is the potential for wind erosion of ROM stockpile at Nicholas Lake since it will be located outdoors. Ore size distribution for this Project was not available; however, the primary crusher is designed to reduce the ore to less than four inches (10 cm). Based on a sample calculation of ore with aggregate size of 7 mm using methods detailed in the *Control of Open Fugitive Dust Sources* (US EPA, 1986), the minimum wind speed required to generate wind erosion is 13 m/s. Since the maximum wind speed from the site-

Table 6.1Summary of Residual Effects on Ambient Air Quality

Phase	Potential Residual Effect	Direction	Magnitude	Likelihood	Geographical Extent	Temporal Extent: Duration	Temporal Extent: Frequency	Ecological Context	Reversibility	Significance	Level of Confidence
Construction	Change in ambient CAC concentration or deposition	Negative	Low	High	Local	Short term	Intermittent	Undisturbed	Reversible	Less than significant	Low to Moderate
Construction	Change in GHG emissions	Negative	Low	High	Global	Long term	Intermittent	Undisturbed	Reversible	Less than significant	Low to Moderate
Operation	Change in ambient CAC concentration or deposition	Negative	Low to Medium	High	Local to Regional	Medium term	Continuous	Undisturbed	Reversible	Less than significant	Moderate
Operation	Change in GHG emissions	Negative	Medium	High	Global	Long term	Continuous	Undisturbed	Reversible	Less than significant	Moderate
Closure	Change in ambient CAC concentration or deposition	Negative	Low	High	Local	Short term	Isolated	Undisturbed	Reversible	Less than significant	Low to Moderate
Closure	Change in GHG emissions	Negative	Low	High	Global	Long term	Isolated	Undisturbed	Reversible	Less than significant	Low to Moderate
Post-Closure	Change in ambient CAC concentration or deposition	Neutral	Negligible	Low	Local	Long term	Isolated	Undisturbed	Reversible	Less than significant	Low to Moderate
Post-Closure	Change in GHG emissions	Neutral	Negligible	Low	Global	Long term	Isolated	Undisturbed	Reversible	Less than significant	Low to Moderate

specific data for 2006 to 2009 is 10.3 m/s and the aggregate size is unlikely to be smaller than 8 mm, it is assumed that fugitive dust emissions due to wind erosion of the ROM stockpile will be negligible.

Mobile sources, including aircraft and vehicles, will emit CACs. However, the aircraft will emit CACs at high elevation and therefore should have limited effect on the ground-level concentrations. Fuel combustion emissions from mobile sources are expected to be relatively low in magnitude and intermittent. CACs will be emitted during the entire operation phase and therefore the duration for CACs is medium term. Since all aircraft and vehicles travelling to the Project site will normally pass through Yellowknife, the geographic extent is local to regional for CACs.

Fugitive dust emissions from haul roads tend to be deposited within several hundred metres of the road and are not considered transportable particulate matter; therefore the geographical extent is local and the magnitude is low. The frequency is considered intermittent. The potential effect of CACs is short term.

Waste incineration will be a batch process and therefore the duration is short term and frequency is intermittent. Since the incinerator will be relatively small and CCME emission standards will be met, the magnitude is considered low.

Blasting typically does not occur on a daily basis and therefore the duration is short term and frequency is intermittent. Particulate matter and dust emissions from blasting tend to be localized and, thus, the geographical extent is local, magnitude is low and potential effect is short term.

Considering both the quantitative assessment of the major sources and qualitative assessment of the minor sources, the Project has the potential to increase ambient CAC concentrations, the likelihood is high and direction is negative. Most of the maximum ground-level CAC concentrations and maximum dustfall deposition levels are less than half the corresponding NWT AQ standards and criteria from other jurisdiction except 24-hour TSP; therefore, the magnitude is low to medium. Emissions from most of the sources are confined to the LSA except mobile sources, which will extend to the territorial boundary. The geographical extent is rated local to regional. Since the emission sources will be operating continuously throughout the operation phase of the Project, the frequency is continuous and the duration is medium term. The ecological context of the LSA is undisturbed. Since the emissions will cease once operations cease the residual effect is reversible. Since the magnitude is low to medium, the geographic extent is local for most emissions, the duration is medium-term and the effect is reversible, the residual effect is considered to be less than significant. The overall level of confidence is rated moderate since only major sources of emissions were included in the quantitative assessment; emissions were estimated using emission factors; and a considerable degree of professional judgment was exercised.

6.1.2 Greenhouse Gases

Since Project operation will result in an increase in GHG emissions, the direction is negative and the likelihood is high. Since GHG emissions associated with this Project are approximately 7% of total GHG emissions in the Northwest Territories and Nunavut, and 0.02% of total emissions in Canada, the magnitude is rated medium. The potential effect of GHG emissions on climate change is global and long term due to the long lifetime of the individual gases. Since GHGs will be emitted throughout the operation phase and will cease after the operation cease, residual effects are rated continuous and reversible. Due to the medium magnitude and reversible effect, the potential residual effects of Project GHG emissions are considered less than significant. Since the GHG emissions were estimated using a top-down approach based on fuel consumption and emission factors, the overall level of confidence is moderate.

6.2 Closure

Both CACs and GHGs will be emitted during the closure phase; therefore, the direction is negative and likelihood is high. Since the magnitude of emissions during closure is expected to be low. The geographic extent of the effect of emissions during closure is expected to be local for CACs and global for GHGs. The closure phase is expected to be short term and frequency of emission is expected to be isolated. Since the potential residual effects during closure were assessed qualitatively, the level of confidence is rated low to moderate. Due to the low magnitude, isolated frequency and reversible nature of the effect, the potential effects of the closure phase on ambient air quality and GHG emissions are considered to be less than significant.

6.3 Post-Closure

Emissions of CACs and GHGs are expected to be limited to the occasional vehicle trip. Therefore the direction is neutral, magnitude is negligible and likelihood is low. The geographic extent of any emissions is expected to be local for CACs and global for GHGs. The frequency would be isolated and the effect would be reversible. Since the potential residual effects during post-closure were assessed qualitatively, the level of confidence is low to moderate. The residual effect is expected to be less than significant.

7 AIR QUALITY MANAGEMENT PLAN

The air quality management plan for the Project outlines the best management practices and mitigation measures to minimize the potential air quality effects. Mitigation measures already incorporated in the Project design are outlined in Section 5. Additional mitigation measures that could be considered to reduce emissions of CACs, GHGs, fugitive dust, or dioxins and furans are provided in this section.

7.1 CACs and GHGs

The sources of CAC and GHG emissions associated with the Project include diesel generators, mobile equipment, and nonroad equipment. The best management practices for CAC and GHG emissions include:

- Use of higher tier diesel generators instead of Tier 2;
- Restrict unnecessary idling of Project equipment; and
- Inspect and maintain equipment regularly.

7.2 Fugitive Dust

The sources of fugitive dust emissions include blasting, drilling, handling of ore, and haul road dust. The best management practices for fugitive dust include:

- Minimize drop heights for waste rock;
- Equip drilling rigs with dust suppression mechanism;
- Apply wet suppression system to maintain relatively high material moisture;
- Water roads during dry, non-freezing periods;
- Restrict vehicle speed of haul trucks; and
- Cover haul trucks.

7.3 Dioxins and Furans

Waste incinerators can be a source of dioxins and furans. There are Canada-wide standards (CWS), developed by Canadian Council of Ministers of the Environment (CCME), for emissions of dioxins and furans (Table 7.1). Dioxin and furan standards were developed for two types of sources: pulp and paper boilers burning salt-laden wood, and waste incineration. The emission limits are expressed as the toxic equivalent (TEQ) and international toxic equivalent (I-TEQ) concentrations in the exhaust gas exiting the stack of the facility. For this Project, the relevant standard is the one for a new municipal waste incinerator, which is 80 pg/m^3 I-TEQ.

Table 7.1 CWS for Dioxins and Furans

Emission Source			Numerical Targets
Pulp and paper boilers burning salt laden wood		Existing boiler by 2006	500 pg/m^3 TEQ
		New boilers	100 pg/m^3 TEQ
Waste Incineration	Municipal waste	Existing facilities by 2006	80 pg/m^3 I-TEQ
		New facilities	80 pg/m^3 I-TEQ
	Medical waste	Existing facilities by 2006	80 pg/m^3 I-TEQ
		New facilities	80 pg/m^3 I-TEQ
	Hazardous waste	Existing facilities by 2006	80 pg/m^3 I-TEQ
		New facilities	80 pg/m^3 I-TEQ
	Sewage sludge	Existing facilities by 2005	100 pg/m^3 I-TEQ
		New facilities	80 pg/m^3 I-TEQ

The waste incinerator for this Project will be CA50 from Eco Waste Solutions. The exhaust from this incinerator will meet the CCME standards for dioxins and furans, without an additional air pollution control system (Eco Waste Solutions, 2011).

8 AIR QUALITY MONITORING PLAN

The assessment of CAC emissions during operation was based on emission estimates. To confirm the input parameters used in the dispersion modelling, stack testing is recommended for the diesel generators and baghouses. Dispersion modelling results shows that the maximum predicted concentrations are less than half of the NWT ambient air quality standards for all CACs except 24-hour TSP. Therefore it is recommended that TSP be re-modelled once the Project design has been finalized. If elevated TSP is still predicted, it is recommended that an ambient monitoring program for TSP be developed.

9 CONCLUSIONS

The Tyhee Yellowknife Gold Project consists of three major components: Ormsby Open Pit mine, Ormsby Underground mine, and Nicholas Lake Underground mine. These components were assessed using both quantitative and qualitative methods. The valued components were air quality and greenhouse gas emissions. The assessment focused on the Project operation phase since potential air quality effects due to construction, closure, and post-closure are expected to be bounded by air quality effects associated with the operation phase.

Project operation will result in CAC and GHG emissions. The main sources at Ormsby site include four diesel generators, a run-of-mine stockpile, three crushers, a crushed ore stockpile, and a waste rock dump. The main sources at Nicholas Lake site are a diesel generator, a run-of-mine stockpile, and a waste rock dump. CAC emissions were estimated for these sources and modelled using CALPUFF for a 30 km by 30 km local study area centred on the midpoint between Ormsby and Nicholas Lake. Dispersion model results indicate that maximum predicted ground-level concentrations for all CACs are less than the corresponding NWT air quality standards. Annual GHG emissions associated with this Project are expected to be 95.4 kt, which is 5% of the Northwest Territories and Nunavut total and 0.01% of the national total.

For all the phases of the Project (construction, operation, closure, and post-closure), the potential for residual effects was found to be less than significant for both air quality and greenhouse gas emissions.

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