

PROGRESS REPORT 2007

Climate and Feasibility Assessment of Growing Wine Grapes in the Lillooet-Lytton Area



Prepared by:



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PROJECT BACKGROUND

Grapes have been produced in the Lillooet-Lytton area for a long time. Discussions to initiate a project that would assess the feasibility of producing grapes commercially in the area began amongst local landowners in the early 1960s'. Grape varieties representing the varieties important to the British Columbia grape industry at that time were planted at Riverland Irrigated Farm in Lillooet. This experimental planting was discontinued when the farm was sold in 1972. A small wine grape vineyard planted to Foch (with a mixture of Okanagan Riesling, Chancellor and DeChaunac) by Robert Roshard at his home property in Lillooet (Roshard Acres) has produced grapes since it came into production around 1974.



Robert Roshard in Foch – May 30, 2005

In 2003, local landowners felt that it was time to assess the new wine grape selections and requested the assistance of Alida Boyd of Okanagan University College Penticton, to arrange for a viticulture short course in Lytton. A course titled “Introduction to Grape Growing” was presented on November 23, 2003. Presentations focused on soil (Dr. Susan Ames, P.Ag., Specialist in Soil Science), wine growing-opportunity analysis (Mr. Lee Cartier, P.Ag., Okanagan University College), and Introduction to Grape Growing (Mr. John Vielvoye, P.Ag., Specialist in Grape Production).

Subsequent to this workshop Barry Wilson representing Ruddock Ranch, Mayor Chris O'Connor of Lytton, Fred Vickery of Lytton and Christ'l Roshard (representing Roshard Acres) of Lillooet requested assistance from John Vielvoye to establish a grape evaluation project at three grape test sites in the area. Funding would be the responsibility of the landowners. Fred Vickery, Barry Wilson and Christ'l Roshard traveled to Oliver to meet John Vielvoye December 14-15, 2004 to cut propagation wood in several vineyards. (Mrs. Sam Baptiste, Richard Cleave, and Robert Goltz provided sources of wood). Mr. Vickery, Vince Machel, Christ'l Roshard and John Vielvoye met in Oliver again January 5-6, 2005 to cut more propagation wood. All the wood was transported to Ruddock Ranch by Mr. Vickery and was stored in a cabin on the Ruddock Ranch. Plans to propagate the vines in the spring of 2005 using an old-fashioned “pit” method changed when funding was secured through the former BC Ministry of Sustainable Resource Management. This infusion of

funds significantly advanced the project. The funding was delivered through FORREX and their representative Mr. Don Gayton negotiated a propagation agreement with Bylands Nursery in Westbank to produce enough vines to plant four test plantings with the same varieties and number of vines. Mr. Doug Robson and Christ'l Roshard transported propagation wood from Ruddock Ranch to Bylands Nursery for greenhouse propagation on March 1, 2005.

Fred Vickery, Doug Robson, Christ'l Roshard, Don Gayton, Herb Luttmerding P.Ag. (Specialist in Land Inventory, Interpretation and Use) and John Vielvoye evaluated three proposed planting sites on March 23, 2005 (a fourth site had not yet been identified). Mr. Vickery withdrew from the project in mid-April stating that a seven-year commitment of time, labour, money, and land was too great a responsibility given other personal and public responsibilities and commitments to the Village of Lytton.

Bylands Nursery delivered all of the rooted cuttings to Roshard Acres on June 1, 2005. Volunteer labour by Joanne & Terry Drake, Trevor Chandler, Barry Wilson, Don Gayton, John Vielvoye, Graham Strachan and two of his summer students, Doug Robson, Christ'l Roshard, and Robert Roshard planted the vines at the Roshard Acres on June 1, 2005. Vines were planted at Ruddock Ranch on June 2, 2005.

Fifty vines each of eighteen wine grape selections (9 red and 9 white) are planted at the two sites represented more than 80% of the 2004 grape crush by commercial BC wineries. A few experimental wine grape selections are added to the plantings. Fresh market grapes were not added to these plantings due to limited resources and interests.

Table 1 Wine Grape Selections Planted at Roshard Acres and Ruddock Ranch	
Red Wine selections	White wine selections
Cabernet Sauvignon (clone 169))	Chardonnay (clone 95)
Cabernet Franc (clone 331)	Gewürztraminer (clone Washington)
Chancellor	Göcseji Zamos
Limberger	Johannisberg Riesling (clone 239)
Merlot (clone 339)	Muscat Riesling
Pinot Noir (clone 115)	Pinot Blanc (clone 54)
Syrah (clone 7)	Pinot Gris (clone 53)
Tinta Madeira	Riesling Muscat
Zweigeltrebe	Sauvignon Blanc (clone 276)

Fifty vines each of Petite Verdot (red) and Viognier (white) propagated at Bylands Nursery were planted at Roshard Acres on June 1, 2006.

Roshard Acres is located on a bench above the Fraser River at an elevation of approximately 210m (ASL) on deep, well-drained gravelly sandy loam to gravelly silty loam soil. The Ruddock Ranch is located between Lytton and Lillooet at an elevation of approximately 400m (ASL) on west sloping, coarse and moderately coarse textured colluvium very stony and gravelly soil.

Three solar-powered WeatherHawk weather stations were purchased in May 2005 to monitor climate at the grape test sites. One was established at Ruddock Ranch and another at Roshard Acres. It was decided to keep the third station in reserve until such time as

technical difficulties as a result of improperly-sized batteries supplied by the manufacturer that resulted in missing data (particularly during shorter winter days) during 2005 and 2006 were resolved and/or a third site was found.

Vines surplus to the project in 2005 were planted in nursery rows in the vineyard at Roshard Acres with intent to make these available to anyone in February or March of 2006. The availability of vines was advertised in the local newspaper. Exposure of the project in the local newspaper and by word of mouth encouraged Eileen and Bill Pietila of East Lillooet and Tim Jones and Alice Brown of Wonderland Farm near Fountain to express interest in participating in the project. In May 2006, Eileen Pietila planted 50 vines each of 11 varieties while Tim Jones and Alice Brown planted 50 vines each of 17 varieties. Vines had leafed out and were growing by this time.

The Pietila site consists of man-made terraces, facing west, and consists of loamy sand soil and is located at an elevation approximately 349m (ASL). Wonderland Farms (Tim Jones & Alice Brown) is located approximately 12 km east of Lillooet along the Lillooet-Cache Creek Highway above Fountain Siding. Soil at this site consists of moderately coarse and moderately textured colluvial fan deposit with a thin capping of sandy material and is moderately stony with a hard layer that had to be broken prior to planting. The site has a slight northern aspect and is at an elevation of approximately 340m (ASL).

Other people obtained vines but are not participants of the test program. Approximately 400 plants were given to Mr. William Hayward located on the west side of the Fraser River near Lytton. Approximately 250 vines were given to Celine Dayon and Bruce McClellan of D'Arcy on May 24, 2006.

Table 2 Wine Grape Selections at Pietila Vineyard and Wonderland Farm

Pietila Vineyard	Wonderland Farm
Cabernet Sauvignon	Cabernet Franc
Chardonnay	Cabernet Sauvignon
Cosceji Zamos	Chancellor
Gewürztraminer	Göcseji Zamos
Johannisberg Riesling	Gewürztraminer
Merlot	Johannisberg Riesling
Pinot Blanc	Merlot
Pinot Gris	Muscat Ottonel
Sauvignon Blanc	Pinot Blanc
Tinta Madeira	Pinot Gris
	Pinot Noir
	Riesling Muscat
	Sauvignon Blanc
	Syrah
	Tinta Madeira

Trellis construction, irrigation installation, and routine maintenance of the plantings (weeding, spraying, and pruning) and fencing to exclude deer, occurred at Ruddock Ranch and Roshard Acres in 2005 and 2006. Vineyard installation occurred at the Pietila and Wonderland Farm in 2006 and 2007. Vines at the Ruddock Ranch generally had low vigour during 2005 and 2006. Vines did not mature well in 2006 and weed control was a major problem.

Vines grew vigorously at the Roshard site in 2005 and 2006. A small crop of grapes was produced at Roshard Acres one year after planting and this showed that early production is possible. Grape canes matured well on some but not all selections in 2006. Vines suffered transplanting shock and did not grow well at the Pietila and Wonderland Farms sites in 2006.

Funding to continue and expand the project to gather climate data using iButtons (temperature data loggers), upgrade existing weather stations, add two more weather stations and hire Mr. Norm Vernon as project technician was possible because a successful application for funds by Association of BC Grape Growers to Investment Agriculture Foundation of British Columbia and the commitment of funds and in-kind contributions from other agencies and individuals acknowledged in this report. Landowners who participate in the project continue to volunteer their time, labour and absorb all the costs associated with vineyard establishment and maintenance. Advice concerning grape production is provided. Information about the vineyard progress, specific dates for bud break, bloom, the start of fruit maturity (called veraison), fruit quality and detailed climate records is collected and analysed and is used to determine the suitability of these wine grapes for the area. Existing soil survey information provides general descriptive soil information for the study area (G. Young, M.A. Fenger and H.A. Luttmerding. 1992. Soils of the Ashcroft Map Area. MOE Technical Report 23. Ashcroft map area 92I/NW, Lytton Map area 92I/SW. Scale 1:100,000)

KEY ACTIVITIES IN PERIOD APRIL 2007 TO APRIL 2008

1. PROJECT DESCRIPTION

a) Project Timing

Planned Start Date: March 1, 2007 Planned Completion Date: December 31, 2009

The project will operate for 3 years. However, the project partners are committed to the long-term nature of the demonstration/research project and will continue with information gathering, tours and/or other industry building activities beyond the term of the Investment Agriculture Funding wherever possible.

b) Concept / Goal

To provide production and climatic information to better assess the feasibility and suitability of commercial wine grape production in the Lillooet-Lytton area.

c) Objectives

1) To test the suitability and performance of wine grape varieties in the Lillooet-Lytton region.

Mechanism: Measure, compile and compare information relating to grape phenology and vineyard management, production, and fruit quality from 4 wine grape plantings that were established in 2005 and 2006.

Grape phenology includes the date that grapes begin to grow, bloom, veraison (start to ripen) and reach ripeness. Vineyard management such as irrigation, the use of fertilizers, cover crops, and leaf management may influence some of these events. Fruit quality and quantity of grapes produces is important when considering the economics of grape production. Fruit quality for wine production is determined by measuring the amount of sugar, acid and pH of the grape juice. The amount of sugar is expressed as Brix, which is the percent of dissolved sugar in the grape juice (21% sugar or more is required). Total acid determines the sharpness of the juice. The amount of acid is expressed as total acid equivalents as tartaric acid and should be between 6 to 8 grams per litre for most varieties.

PH is a measure of the grape ripeness, how the wine tastes and lasts, influences the growth of yeast, stability of the colour and influences the resistance to bacteria. The juice pH should be between 3.2 and 3.5 at harvest. These units of measurement should also be in harmony.

It was not possible to make detailed observations to record specific phenological events at each vineyard in 2007 because Mr. Vernon was not available until August of 2007 and only Roshard Acres produced fruit. General phenology comments pertaining to the Foch variety are made in section 3 of this report. Information concerning the quality of the grapes is monitored during the ripening season in a lab facility provided by Roshard Acres. Grapes are sent to participants at PARC Summerland for final quality determination. Information concerning the quality of grapes produced in 2007 is provided in tables 16 and 17 appended to this report.

2) To develop a detailed climatic profile of the area.

Mechanism: Compile climate data via weather stations and supplemental temperature data loggers (iButtons).

Calculate agro-climatic events that help determine the suitability of an area for commercial grape production such as last spring and first fall frost dates, growing degree-days, extreme minimum temperatures, rainfall, etc.

Climate information needed to determine the suitability of the area to commercial grape production includes the length of the frost-free season, the amount of heat accumulated during the growing season, the minimum winter temperature, and rainfall. The minimum number of frost free days needed to grow and mature the earliest wine grape varieties produced in BC is about 130 days but 160 days or more are required to mature mid-season selections and later ripening selections require more than 170 frost free days. The average amount of heat above 10 degrees each day is accumulated through the period April 1 to October 31 and is expressed as growing degree-days (GDD) or heat units (HU). The number of growing degree-days accumulated is indicative of the ripening potential of an area for a range of grape selections. A minimum of 850 grape growing degree-days are needed to mature very early grape selections in British Columbia. More than 1000 GDD are needed to ripen mid season selections and more than 1400 are needed to mature late wine grape selections. The wine grapes demanded by the wine industry today are not as hardy as the wine grapes produced 30 years ago. Minimum winter temperatures of - 25°C may severely damage most wine grapes grown today. There are cultural methods that encourage maximum hardiness of vines. Rainfall information is important to determine the need for an irrigation system, the amount of rain that may occur at specific times of the year such as bloom and harvest and to develop disease and pest control strategies. A compilation of climate data taken from Environment Canada Atmospheric Environment Service (AES) weather stations at Lytton and Lillooet in tables 5 to 14 is appended to this report. Climate data from the project weather stations is collected and transmitted to participants at the Pacific Agri-Food Research Centre (PARC) Summerland. Here the data is stored and summaries prepared. This data together with information from Environment Canada stations will be used to develop a detailed climatic profile of the area. There is limited data available from project weather stations this year. Some available information is appended to this report in Tables 19 and 20 and Charts 1 and 2.

2. COMMUNICATIONS

Communication about this project to create awareness and provide the project progress occurs through the participation of the British Columbia Grapegrowers' Association, interest by several larger wineries in the Okanagan, tour of two participating vineyards and a weather station, participation by various levels of government, interest by local individuals as well as people outside the Lillooet-Lytton area and by placing this progress report on the Lytton and Lillooet community Internet sites. Project participants have appointed Christ'l Roshard as media contact.

Articles concerning the project have appeared in local and other newspapers and various magazines. A listing of articles and notices of field days is provided in Tables 3 and 4 appended to this report.

Direct contact is maintained with the landowners. John Vielvoye provides pro bono consulting services and records observations.

The project technician Norm Vernon maintains contact with landowners when he records observations and attends to the temperature data loggers (iButtons). Doug Robson and Christ'l Roshard also maintain contact with other landowners.

a) Field Day 2007

A tour of the Ruddock Ranch vineyard, Halfway Ranch and Roshard Acres was held on September 23, 2007 including the Hon. Pat Bell, Minister of Agriculture and Lands, his guest Harry McWatters (well known in the winery and grape growing communities), Minister's EA T.J. Palmer, Gordon & Barrie DiCatri (Ruddock Ranch), Graham Strachan (Ministry of Agriculture & Lands), Myles Bruns (Regional Project Manager, Ministry of Economic Development), project technician Norm Vernon, Christ'l Roshard & Doug Robson (Roshard Acres), and John Vielvoye. The tour was joined at Halfway Ranch by Astrid and Winfried Reuter (owners of Half Way Ranch) and Mr. Phil Hallinan (Fraser Basin Council, which donated the Davis Vantage Pro 2 weather station located at Half Way Ranch) and Eileen Pietila (vineyard test site participant).

3. PROJECT OUTPUTS DURING PAST 12 MONTHS

Project outputs include:

- Awareness of the project created through word of mouth, articles in the print media and the use of Roshard Acres for a student project by Sarah O'Connor.
- Improved battery capacity and weather-proof battery boxes for the WeatherHawk weather stations purchased in 2005 located at Ruddock Ranch, Roshard Acres and Grossler Farm such that all three are now fully operational.
- Installation of two Davis Vantage Pro 2 weather stations (donated and installed by the Fraser Basin Council). One at Diamond S Ranch and one at Halfway Ranch.
- These five weather stations in the Lillooet-Lytton area are collecting year-round temperature data as well as wind speed and direction, relative humidity, solar radiation, and precipitation.
- On-line accessibility to the weather records for the two Davis weather stations are available to growers, industry and the public is via the Farmwest website www.Farmwest.com. These are accessed by following the link to climate, southwest interior, and selecting Diamond S or Halfway Ranch.
- Mr. Norm Vernon hired as project technician late July, 2007.
- Tensiometers installed at all vineyards at 30 and 60 cm depth to aid in irrigation management.

- Installation of the 87 temperature data loggers (iButtons) at 59 properties during August to December (since Mr. Vernon was hired). These data loggers are in locations to augment collection of temperature data and will contribute to the development of a climate profile for the region. Most iButtons are protected from livestock and wildlife.
- Regular collection of weather data from all WeatherHawk and Davis stations and iButtons and transmission of data to project participants at PARC-Summerland where the data is stored and put into a usable format. Over a three-year period, the amount of data that this climate network will produce will be voluminous.
- Assessment of the effect of early low winter temperatures of November 28-29, 2006.
- Observations at the four participating test sites on February 10, 2007 showed winter damage to buds and some trunks and canes of the vines that had not matured well in 2006 resulting in some winter die back and a need to retrain some vines but there was little damage to those vines that were well matured.
- Winter damage assessment at Ruddock Ranch showed that the low temperatures plus variable cane maturity produced trunk and bud damage to Cabernet Sauvignon, Pinot Blanc, Merlot, Muscat Ottonel, Syrah, and Tinta Madeira. Bud damage only occurred to Pinot Gris.
- Winter damage assessment at Roshard Acres showed that low temperatures combined with variable wood maturity injured trunks of Cocseji Zamos, Petit Verdot, Sauvignon Blanc and Viognier, and these would need retraining. Less damaged but requiring some retraining were Cabernet Franc, Cabernet Sauvignon, Gewürztraminer, Merlot, Syrah, and Tinta Madeira. Some bud damage was present in Gewürztraminer, Pinot Blanc and Muscat Ottonel.
- Vines examined at the Pietila vineyard had little trunk damage but all showed bud damage.
- Vines at Wonderland farms had little trunk damage but the selections Cocseji Zamos, Limberger, Merlot, Muscat Ottonel, Pinot Blanc, Pinot Gris, Pinot Noir, Sauvignon Blanc, Syrah and Tinta Madeira had damaged buds. These participants reported that the minimum temperature at Wonderland Farms reached -27° C in November 2006.
- Anecdotal temperature data obtained from Okanagan and Similkameen valley grape growers suggests that the minimum temperature during November 2006 in Similkameen valley and Kelowna area vineyards reached -23°C. A temperature of -20°C is reported from vineyard areas of the upper benches in Oliver. An evaluation of vines in the Okanagan and Similkameen grape growing areas in 2007 showed damage to some vines and buds because of low November 2006 temperatures. Late harvest of some varieties may also have contributed to vine damage.



Phil Hallinan explains the recording and transmission of Davis Vantage Pro 2 at Halfway Ranch – Sept. 23, 2007

- Weather data for November 2006 has not been available from the project weather stations but is available from local AES climate stations. This data is compared to other AES stations in Tables 11 and 12.
- Monitor of detailed phenology events by variety was limited to assessment of fruit quality at Roshard Acres. (Tables 16 and 17). General phenology events of Foch at Roshard Acres are as follows: bud break began on April 10, 50% bloom by June 18. Veraison on test site vines had started by August 17. (see Table 15)
- Field day held on September 23, 2007 to show the Hon. Pat Bell and his guests the test planting at Ruddock ranch, explain the features of the Davis Vantage Pro 2 weather station at Halfway Ranch, and review the test planting at Roshard Acres.
- Harvest of the first meaningful crop from 18 varieties at Roshard Acres in 2007.
- Results of final field measurements of fruit quality of the 2007 harvest at the Roshard site is provided in Table 17.
- Weather data for December 2007 and January 2008 that might affect test plantings is provided in Tables 13 and 14.
- On-going assessment and recording of the effects of low winter temperatures on dormant vines, advisement and recording of vineyard performance and condition, consultations with vineyard owners, regarding irrigation, spray programs, canopy management, cover crops, nutrition, and pruning .

4. PROGRESS THUS FAR TOWARDS ACHIEVING THE OBJECTIVES AND BENEFITS

Objectives

- 1) **To test the suitability and performance of wine grape varieties in the Lillooet-Lytton region.**
 - Participating vineyards have a range of soil and climate conditions.
 - Vineyards are visited before pruning is started, during the growing season, and in the autumn to record observations and to provide consultations because none of the vineyard participants has previous viticulture experience.

- Observations are recorded. (e.g. February 2007 assessment of winter damage to vines, phenology at Roshard Acres), grape maturity was monitored on a weekly basis and was tabulated (Tables 15 and 16), harvest of a crop from 18 varieties at Roshard Acres (Tables 16 and 17), and wood maturity of vines up to October 17, 2007 was noted and recorded (Table 18). A comparison of wood maturity up to October 17, 2007 provides information regarding disease control, fertility and irrigation management, potential for vine survival during the coming winter and the potential for vineyard growth and production in 2008.
- Observations made of varieties at the Roshard Acres include varieties established in a separate planting in 1972 plus those established in 2005 and 2006.
- All except the Ruddock vineyard are drip irrigated. The Ruddock vineyard has been sprinkler irrigated.
- Participants have identified irrigation management and the control of vine vigour through irrigation as a challenge to learning to grow a collection of different grape varieties successfully.
- All vineyards have a permanent cover crop.
- All of the vineyards are treated to prevent the development of powdery mildew. Other diseases have not yet been observed although one cluster infected with botrytis was found in Gewürztraminer and some leaves infested with Erineum mite were found at Roshard Acres. Weed control methods vary.
- Growth of vines at Ruddock Ranch vineyard improved in 2007 because of significantly improved weed control and increased irrigation. High vine vigour for the varieties Cocseji Zamatos, Gewürztraminer, Johannisberg Riesling, Pinot Blanc, Pinot Gris, Riesling Muscat and Sauvignon Blanc should result in some crop from these selections in 2008. A small crop is also expected from remaining selections, despite numerous missing vines.
- Observations at the Ruddock Ranch test planting February 27, 2008 showed 50% or greater winter damage to primary buds in the varieties Cabernet Sauvignon, Cabernet Franc, Limberger, Merlot, Muscat Ottonel, Pinot Blanc, Syrah and less damage to primary buds in the varieties Chardonnay, Pinot Noir, Tinta Madeira. Cane damage of 50% or more was observed in varieties Cabernet Franc, Merlot, Syrah and Tinta Madeira. There are sufficient healthy buds and canes to produce a small crop in 2008.
- Zinc deficiency has been identified at the Ruddock Ranch vineyard. The vineyard is planted on a former overwintering site for fallow deer and it is likely that the zinc deficiency is related to the historical use of the area. Nutrition sprays to correct the zinc deficiency will be needed in 2008.

- There was a response to the use of fertilizer at Wonderland Farm in 2007. The use of fertilizer and increased irrigation are planned for 2008 and should produce sufficient vine growth so that a crop can be expected in 2009.
- There was no winter damage observed to buds or canes at this vineyard on February 25, 2008. Some fruit is expected from some vines in this vineyard in 2008.
- Vine vigour at the Pietila Vineyard in 2007 was generally low. Irrigation water from this vineyard was tested in 2007 and was found to be extremely hard, and contained salts. Terracing of the vineyard area may have disturbed the soil sufficiently to interfere with vine vigour. Increased irrigation to offset any negative effects of the salts in the irrigation water plus use of farm manure or other fertilizer will be used in 2008 to stimulate better vine growth.
- Observations at this test vineyard February 27, 2008 revealed 50% winter damage to primary buds of Cosceji Zamatos and 25% damage to primary buds of the varieties Gewürztraminer and Pinot Blanc. Damage to canes was not observed.
- Pinot Blanc at Pietila vineyard planted at the base of the terraces grew better than other selections. A small crop is expected on the Pinot Blanc in 2008.
- Retraining of some Cocseji Zamatos, Limberger, Merlot, Petite Verdot, Sauvignon Blanc, Syrah and Viognier was required at Roshard Acres in 2007. All varieties except Petit Verdot and Viognier produced a small crop. All remaining varieties produced a small crop because of crop control through thinning and severe deficit irrigation management. All vines matured well. A full crop should be produced on 18 varieties and a part crop on 2 new varieties in 2008.



*Pinot Gris at Roshard Acres
– Sept. 23, 2007*

- Drought conditions at bloom and during set at Roshard Acres resulted in small and light clusters and reduced set in the varieties Merlot, Cabernet Sauvignon, Cabernet Franc, Cocseji Zamos, and Syrah.
- The last grapes at Roshard Acres were ready for harvest by October 6, 2007. Fruit from Roshard Acres was brought to the research station at PARC Summerland for chemical analysis (see Table 17)
- Observations at Roshard Acres test vineyard on February 26, 2008 revealed 50% or greater winter damage to primary buds and canes of the variety Viognier and 25% damage to primary buds of the varieties Petite Verdot and Tinta Madeira. There was no damage observed to buds or canes of other varieties. A full crop should be produced on 18 varieties in 2008 and some crop on the two new varieties.
- Comparisons of vineyards based on phenology (bud burst, bloom dates, veraison, harvest dates) are not possible for 2007.

2) To develop a climate profile of the area.

- Environment Canada (AES) has climate stations located above the Village of Lytton and another located in the District of Lillooet. Information from these two stations is a component of ongoing data collection and determination if grape production is feasible in the area. (Tables 5 to 14) The two stations are located approximately 64 km apart in a narrow canyon in mountainous terrain. The Fraser River flows through the canyon and passes the two communities. Potential vineyard areas are located on both sides of the river.
- Project weather stations and iButtons are located on private property including Reserve Land and range in location from just south of Lytton to east of Lillooet along the Lillooet-Cache Creek highway to West Pavillion.
- Installation of supplementary temperature data loggers (iButtons) began in early August and was completed in early December 2007. Sometimes they were installed at the end of a month or the data was downloaded at the beginning of a month resulting in truncated data. Direct comparison of monthly minimum temperatures is not possible unless every location's first and last month is stripped from the table because some months have partial data.
- The three WeatherHawk stations were brought to full operating capacity during the spring of 2007 and the two Davis Vantage Pro 2 stations were installed and brought into service late in the summer of 2007.
- The project climate network consists of five stations capable of recording a wide range of climate parameters hourly plus 87 supplementary temperature data loggers (iButtons) capable of recording hourly temperature.

- Some data was collected from the WeatherHawk stations in 2006 and 2007, but the data was incomplete due to the aforementioned technical difficulties. Those technical difficulties have been corrected by increasing the battery capacity by Myles Bruns.
- Mr. Bruns has created a set of 1:20,000 maps for the Lillooet-Lytton area with topographical details showing general land ownership (crown land, private land, and First Nations reserves) and existing soil survey information, which is not site specific but provides a description of soils in the study area. These maps will be used to indicate the locations of weather stations and iButtons and will form the basis for plotting the climatic profile and will provide 1:100,000 scale soil survey data of the area.
- Complete weather data from the WeatherHawk and Davis weather stations is downloaded onto a computer every three months and then transmitted to PARC. Data from the iButtons is downloaded every five months and is transmitted to PARC.



Myles Bruns downloads data from Davis Vantage Pro 2 weather station – Jan. 24, 2008

- Climate data for periods of low winter temperatures December 2007 and January 2008 is provided in Tables 13 and 14.
- Assessment of vine condition after the 2007/08 winter at participants test plantings.
- A complete year of data for 2007 is not available from any of the stations. A listing of selected station locations is provided in Table 19.
- Available data for the stations listed in Table 19 is provided in Table 20.

- Chart 1 and Chart 2 illustrate the variation in temperature at selected ibutton and full weather station sites.

5. BENEFITS

- This project is providing data and operational experience to individuals and businesses that will assist to determine whether commercial grape and wine production is feasible from a climatic, agronomic and financial perspective.
- This project is providing technology transfer in grape production skills to the participants. One participant is learning how to propagate grape plants from cuttings.
- The project will determine if any wine grape varieties planted in the test plantings or others not part of the testing program are suited to the area.
- This project will provide detailed weather and viticulture data. It is advisable to continue gathering and analyzing weather records to establish a relationship between the five project weather stations and the iButtons and local AES climate stations. It is advisable to continue to gather and analyze viticulture data and relate it to levels of potential climate related injury to vines (e.g. spring, fall, winter damage), phenological and growing season conditions (e.g. frost free period, growing degree days) and to rainfall.
- The application of a climate profile generated by this project for use as an assessment tool by producers for other crops including both traditional commodities and specialty crops.
- The Davis Vantage Pro 2 weather stations have the capability of providing soil moisture data used to determine evapotranspiration (ET). This added feature will be used by irrigators to improve the efficiency of water use with their existing systems.

6. ANNUAL WORK PLAN FOR THE NEXT 12 MONTHS

The project partners now enter an on-going process to collect and evaluate information from the climate network and established vines. Information will be collected in the same manner as in 2007.

Appendix

Table 3 Communications 2005 and 2006

- 1) Gayton, Don. Innovations and elbow grease bring viticulture project alive. Link. Summer 2005. Volume 7 Issue 1. Available on line at www.forrex.org.
- 2) Fraser, Wendy. Small grape cuttings represent big hope for the future. The Bridge River Lillooet News. May 18, 2005. Page 2.
- 3) Gair, Bain. A brighter future needs hard work and some help. Lillooet News, May 25, 2005. Page 4.
- 4) Fortems, Cam. Heat's on for wine. Lytton, Lillooet to build industry around grapes. The Daily News. June 11, 2005.
- 5) Gayton, Don. The Lillooet-Lytton Grape Project. 2005. (A flyer providing project background for an Open House held September 18, 2005 at the Ruddock Ranch and Roshard Acres).
- 6) Visit the Vineyards at Roshard & Ruddock's Ranch. Field Day. The Bridge River Lillooet News, September 14, 2005. Page 10. Field Day was held September 18, 2005.
- 7) O'Connor, Sarah. The Grapes of Math. An investigation into the growing of 18 varietals of Grapes at Roshard Acres in Lillooet, BC. Ashcroft Secondary School. May 13, 2006. Canada Wide Science Fair. (Sarah won the local and provincial competitions with her project and the right to represent British Columbia in the Canada Wide Science fair. She received a silver medal for her work and presentation. She was subsequently asked to present her project at the Taiwanese International Science Fair).
- 8) Young Scientist O'Connor earns trip to national Science fair. The Bridge River Lillooet News. May 24, 2006 Page 16.
- 9) Dickinson, Paul. Grape project a growing concern. The Bridge River Lillooet News. July 5, 2006.
- 10) Interested in the Grape Industry. Open House. Lillooet Grape Project - 768 Roshard Road. Everyone welcome. The Bridge River Lillooet News. September 16, 2006

Table 4 Communications 2007

- 1) Constantineau, Bruce. Global warming could boost wine industry, experts say. The Vancouver Sun. April 10, 2007. Page D3
- 2) The Great Grape project of Two River Valleys. The Bridge River Lillooet News. April 11, 2007. Page 3
- 3) Fong, Petti. Global warming fine by B.C. Grapegrowers. Toronto Star. April 14, 2007.
- 4) British Columbia Ministry of Agriculture and Lands. LYTTON-LILLOOET TO REALIZE ITS GRAPE POTENTIAL. News Release. April 11, 2007.
- 5) Fletcher, Tom. Getting British Columbia back to the land. Penticton Western News. April 18, 2007. Page A6
- 6) Hooper, Mike. B.C. gov't getting back to the land. Nanaimo News Bulletin. April 19, 2007.
- 7) Monco, Shannon. Grapes tested in unlikely location. The Western Producer. May 3, 2007.
- 8) Edwards, Terry. Lillooet: the new gold rush. Orchard & Vine. Summer 2007.
- 9) Nybo, Darcy. Grape growing from Lytton to Lillooet. The Growers' Journal. Summer 2007. Page 6
- 10) Norm Vernon comes home to Lillooet to work for Hot spot Grape Project. The Bridge River Lillooet News. August 15, 2007.
- 11) Roshard, Christ'l. Mayor Roshard and Councillor Lampman meet Premier, 7 ministers at UBCM. The Bridge River Lillooet News. October 10, 2007. Page 6

Table 5 Location of Environment Canada weather stations at Lytton and Lillooet

Lytton Station	Latitude 50° 13.200'N	Longitude 121° 34.800'W	Elevation 225m
Lytton RCS	Latitude 50° 13.200'N	Longitude 121° 34.800'W	Elevation 225m
Lillooet Station	Latitude 50° 40.800'N	Longitude 121° 55.800'W	Elevation 235m

Table 6 Lytton Frost Free Season and Extreme Minimum Temperature					
Year	Frost Free Period			Extreme Minimum Temperature	
	Last Spring Frost Temp. (°C)	First fall Frost Temp. (°C)	Frost Free Period in Days	Extreme Low Temp.(°C)	
1941-70	April 24	Oct. 24	Average 187	Jan (-31.7)	26 years of records
1951-80	April 20	Oct. 24	Average 188	Jan (-31.7)	26 years of records
1961-90	Not available	(n/a)		Dec 31 1984 (-27.1) Nov 27 1985 (-27.7)	> 20 year record > 20 year record
1971-2000	n/a	n/a		Nov 27, 1985 (-27.7) Dec 31, 1984 (-27.1)	
1995	April 20 (-1.3)	Oct. 29 (-0.9)	192	Dec 8 (-18.6)	
1996	April 4 (-0.4)	Oct 20 (-1.4)	199	Jan 30 (-22.8)	
1997	April 11 (-2.0)	Oct 20 (-0.6)	192	Jan 26 (-22.0)	
1998	April 15 (-1.5)	Nov 10 (-0.6)	209	Jan 12 (-22.9)	
1999	April 15 (-1.3)	Oct 27 (-1.1)	195	Jan 24 (-11.0)	
2000	April 14 (-0.4)	Nov 6 (-0.8)	206	Jan 20(-14.3)	
2001	April 15 (-0.8)	Oct 28 (-1.1)	196	Feb 7 (-10.0)	
2002	April 25 (-0.8)	Oct 24 (-2.3)	182	Jan 28 (-17.1)	
2003	April 6 (-0.6)	Oct 31 (-4.1)	208	Mar 8 (-12.7)	
2004	April 2 (-2.0)	Oct 27 (-1.3)	208	Jan 5 (-20.4)	
2005	April 9 (-0.2)	Nov.14 (-1.1)	219	Jan 15 (-22.3)	
2006	May 3 (-0.2)	Oct. 26 (-3.7)	176	Nov. 29 (-20.0)	
2007	April 11 (-0.8)	Nov. 2 (-0.4)	205	Jan 12 (-16.0)	
Average	Apr. 14	Oct. 30	199		

Table 7 Lillooet Frost Free Season and Extreme Minimum Temperature				
Year	Frost Free Period		Extreme Minimum Temperature	
	Last Spring Frost Temp. (°C)	First Fall Frost Temp. (°C)	Frost Free Period in Days	Extreme Low Temp.(°C)
1941-1970	Long term temperature information not found for this location			
1951-1980	Long term temperature information not found for this location			
1961-1990	Long term temperature information not found for this location			
1971-2000	Long term temperature information not found for this location			
1998	April 15 (-1.1)	Oct 24 (-0.2)	192	Jan 12 (-25.1)
1999	May 10 (-0.1)	Oct 23 (-0.3)	166	Jan 20 (-11.2)
2000	April 17 (-0.1)	Oct 16 (-0.8)	182	Jan 20(-15.5)
2001	April 12(-3.3)	Oct 25 (-1.2)	196	Feb 7 (-10.4)
2002	April 23 (-2.2)	Oct 12 (-1.5)	172	Jan 28 (-17.7)
2003	April 6 (-2.2)	Oct 15 (-0.1)	192	Mar 8 (-14.4)
2004	April 2 (-2.0)	Oct 27 (-1.3)	208	Jan 6 (-22.7)
2005	April 14 (-0.1)	Oct. 27 (-1.5)	196	Jan 15 (-25.4)
2006	April 17 (-0.2)	Oct. 30 (-0.3)	196	Nov. 29 (-20.0)
2007	n/a	Oct. 26 (-0.2)		Dec 8 (-17.5)
Average	Apr-14	Oct. 22	188.88	

Table 8 Lytton and Lillooet Calculated Growing Degree Days		
Estimated Growing Degree Days (base 10° C)		April 1 to Oct. 31
Year	Lytton	Lillooet
1951-1980	1,368.2	n/a
1961-1990	n/a	n/a
1971-2000	1,361.3	n/a
1998-2003	1,387.7	1426
2000	1,256.2	1262
2001	1,407.2	1379
2002	1,373.7	1405.5
2003	1,580.0	1562
2004	1,617.7	Monthly & daily data report not available for August & September
2005	1,449.6	Monthly & daily data report not available.
2006	1,578.1	Monthly & daily data report not available.
2007	1,334.9	Daily data report resumes Aug. 3
Average		
2000-03		1345.7
2000-07	1,449.7	

Table 9 Lytton Estimated Precipitation & Hours of Bright Sunshine									
Year	Total Precipitation in mm							Total Annual Precipitation In mm	Hrs. Bright Sunshine
	May	June	July	Aug	Sept	Oct	Total		
1941-1970	14.7	20.6	12.2	18.8	23.4	49.5	139.2	334.5	n/a
1951-1980	14.7	17.6	11.7	23.4	24.9	44.5	136.8	326.8	1987.4 hr.
1961-1990	17.6	18.0	14.2	17.1	26.2	35.2	128.3	324.2	1923.3 hr.
1971-2000	18.2	18.8	14.4	22.9	27.3	36.4	138.0	338.7	1915.3 hr.
1997	18.4	14.5	3.2	10.9	16.6	59.8	123.4	297.0	
1998	41.1	30.9	9.9	0.5	2.1	40.0	124.5	401.4	
1999	13.5	10.0	57.5	26.5	20.0	40.0	167.5	645.5	
2000	57.5	67.5	335.5	M	M	47.5	M	more than 673.0	
2001	16.5	M	M	2.0	22.5	24.5	M	more than 301.5	
2002	27.5	15.5	20.5	32.5	17.5	3.5	117.0	277.5	
2003	6.0	20.0	M	12.5	7.5	137.0	M	500.0	
2004	32.0	18.5	36.0	24.0	46.0	35.5	192.0	357.4	
2005	30.5	46.0	16.5	30.0	Missing data			More than 434.5	
2006	25.5	33.0	4.5	8.0	17.5	20.0	108.5	596.5	
2007	18.5	28.0	15.5	19.5	32.0	29.5	143.0	501.5	
Average 1997-07	26.1	28.4	55.5	16.6	20.2	43.7	139.4	445.7	
Note: M Means missing data									

Table 10 Lillooet Estimated Precipitation									
Year	Rainfall in mm						Monthly Total	Total Annual Precipitation in mm	
	May	June	July	Aug	Sept	Oct			
1941-1970	21.1	28.4	25.4	25.9	32.8	46.0	179.6	341.5	Russell Street
1951-1980	Long term temperature information not found for this location								
1961-1990	Long term temperature information not found for this location								
1971-2000	Long term temperature information not found for this location								
1998	15.0	29.4	44.0	3.6	24.4	29.6	146.0	334.4	
1999	7.2	13.0	81.4	14.8	13.8	3.2	133.4	more than 297.0	
2000	51.8	14.0	37.2	20.6	16.2	52.0	191.8	more than 265.4	
2001	6.2	34.6	40.2	7.8	9.2	30.6	128.6	298.4	
2002	32.4	9.4	13.8	18.6	M	0.8	M	more than 178.4	
2003	16.0	24.0	0.6	8.6	22.4	57.8	129.4	more than 319.2	
2004	23.6	22.2	32.4	Missing data			78.2		
2005	Missing data						?		
2006	Missing data						?		
2007	Missing data				17.6	44.0	M	?	
M means missing data									
Average	21.7	20.9	35.7	13.1	21.7	29.0	134.6		

Table 11 Location of Selected AES Climate Stations in Table 12				
Name	Latitude	Longitude	Elevation (m)	Elevation (feet)
Kamloops A	50° 42.000' N	120° 26.400' W	345	1133
Kelowna AWOS	49° 57.600' N	119° 22.800' W	429	1409
Kelowna MWSO	49° 57.000' N	119° 24.000' W	456	1496
Lillooet	50° 40.800' N	121° 55.800' W	235	771
Lytton	50° 13.200' N	121° 34.800' W	225	738
Lytton RCS	50° 13.200' N	121° 34.800' W	225	738
Penticton A	49° 27.600' N	119° 36.000' W	334	1129
Summerland CS	49° 33.600' N	119° 38.400' W	454	1490
Osoyoos CS	49° 1.8000' N	119° 26.400' W	282	928

Table 12 Minimum Temperatures (°C) November 2006 at Selected AES Stations in Table 11								
Station	Date							
	Nov. 1	Nov. 26	Nov. 27	Nov. 28	Nov. 29	Nov. 30	Dec. 1	Dec. 2
Kamloops	-6.0	-15.6	-17.2	-23.9	-24.9	-16.6	-10.3	-10.2
Kelowna AWOS	-12.0	-7.8	-15.4	-25.0	-26.6	-14.8	-9.5	-6.1
Kelowna MWSO	-8.7	-5.8	-14.5	-17.4	-24.1	-15.0	-10.5	M
Lillooet	-6.3	-13.6	-14.9	-19.7	-20.1	-13.9	-10.1	-9.8
Lytton	M	-13.4	-14.7	-18.7	-20.1	-13.3	-12.5	-9.1
Lytton RCS	-4.7	-13.5	-14.5	-18.2	-19.9	-12.9	-13.7	-9.0
Penticton	-9.1	-4.3	-14.3	-16.2	-17.5	-8.6	M	-6.4
Summerland CS	-6.8	-5.9	-15.4	-20.1	-19.7	-12.9	-12.9	-7.1
Osoyoos CS	-7.4	-2.6	-12.2	-13.7	-16.9	-13.0	-11.6	-12.6

Table 13 Minimum temperatures (°C) December 2007					
Date					
Station	Dec. 7	Dec. 8	Dec. 9	Dec. 10	Dec. 11
Kamloops A	-8.9	-13.8	-12.9	-13.8	-8.5
Kelowna AWOS	-4.0	-11.7	-12.0	-11.1	-8.5
Kelowna MWSO	-3.1	-7.7	-10.1	-6.7	-7.5
Lillooet	-14.7	-18.2	-16.7	-10.8	-6.9
Lytton	-12.9	-15.4	-15.0	-11.6	-7.0
Lytton RCS	-13.0	-15.3	-15.0	-11.6	-7.0
Penticton	2.2	-7.2	-7.3	-7.3	-6.0
Summerland CS	-3.8	-8.3	-9.3	-7.4	-5.7
Osoyoos CS	-1.0	-5.0	-6.9	-5.0	-8.5

Table 14 Minimum Temperatures (°C) January 2008											
Station	January										
	21	22	23	24	25	26	27	28	29	30	31
Kamloops A	-15.1	-16.5	-16.2	-13.2	-13.3	-10.7	-10.3	-20.6	-19.2	-20.4	-12.6
Kelowna AWOS	-20.8	-19.4	-18.6	-19.8	-17.9	-11.9	-11.3	-15.7	-15.6	-12.3	-8.6
Kelowna MWSO	-16.2	-15.8	-10.0	-15.8	-13.6	-8.1	-4.2	-13.6	M	-13.9	-6.0
Lillooet	-12.4	-14.0	-15.0	-13.6	-15.1	-8.8	-8.9	-18.0	-18.5	-17.9	-10.8
Lytton	-11.1	-12.5	-12.8	-11.1	-13.7	-8.7	-6.9	-16.5	-16.3	-16.7	-10.0
Lytton RCS	-11.1	-12.5	-12.8	-11.0	-13.7	-8.8	-7.0	-16.5	-16.2	-16.9	-9.9
Penticton	-12.3	-14.1	-13.6	-15.7	-15.5	-7.9	-9.2	-11.2	-12.3	-10.8	-5.1
Summerland CS	-11.6	-12.4	-1.1	-15.1	-13.9	-10.1	-8.8	-12.4	-13.4	-12.5	-6.0
Osoyoos CS	-9.5	-13.4	-15.6	-16.0	-16.6	-10.9	-7.9	-11.6	-10.9	-8.0	-6.6

Table 15 Brix (sugar content) of Grapes at Roshard Acres Aug. 17, 2007

Grape Variety	Brix	Observations
Cabernet Sauvignon	5.2	berries mostly green & hard. seeds hard & green
Cabernet Frank	5.5	berries mostly green & hard. seed hard & green
Chancellor	8.2	berries mostly green, some blue. Seeds turning brown, hard.
Chardonnay	9.0	berries green, few softening. seeds green turning brown, hard
Cocseji Zamatos	13.2	many berries softening. seeds green, some turning brown, hard
de Chaunac (S-9549)	10.0	many berries blue, some softening. seeds turning brown, hard
Foch	10.2	many blue berries. seeds hard, turning brown
Gewürztraminer	12.0	some berries softening. seeds hard & green
Johannisberg Riesling	6.0	berries green & hard. seeds green & hard
Limberger	9.4	some coloured berries. seeds hard turning brown
Merlot	6.0	a few coloured berries. seeds hard turning brown
Muscat Ottonel	8.0	some soft berries. seeds turning brown
Petite Verdot	no crop	planted 2006
Pinot Blanc	7.8	mostly hard green berries. seeds hard & green
Pinot Gris	9.2	some berries colouring. seeds hard & turning brown
Pinot Noir	8.5	some berries colouring. seeds hard & green
Okanagan Riesling	7.4	berries mostly hard & green. seeds hard and turning brown
Riesling Muscat	12.0	some soft berries. seeds hard & turning brown
Sauvignon Blanc	9.0	few vines with crop. berries green & hard. Seeds green & hard
Syrah	6.0	berries green & hard. seeds hard & green
Tinta Madeira	6.0	berries mostly green & hard. seeds green & hardening
Viognier	no crop	planted 2006
Zweigeltrebe	11.0	many coloured berries. seeds hard & turning brown

Table 16 Lillooet-Lytton Grape Project Analytical Results Roshard Acres 2007

Variety	Harvest date	Last field analysis prior to harvest			Total yield (lbs)	Average cluster wt. (ounces)
		Brix	Total Acid	pH		
Cabernet Franc	Oct. 6	21.9	6.75	3.24	22.75	3.20
Cabernet Sauvignon	Oct. 6	22.0	7.12	3.28	12.50	2.40
Chancellor	Oct. 6	22.2	8.62	3.26	10.00	3.20
Chardonnay	Sept. 22	22.1	6.45	3.28	130.00	3.47
Cocseji Zamatos	Sept. 28	19.5	7.95	3.19	61.00	3.52
Foch	Oct. 6	22.3	11.70	3.16	1581.00	
Gewürztraminer	Sept. 22	22.1	6.67	3.34	154.00	3.17
Johannisberg Riesling	Oct. 6	19.3	10.42	3.01	125.00	3.16
Limberger	Oct. 6	22.1	6.30	3.13	90.00	7.20
Merlot	Oct. 6	24.0	6.52	3.30	23.00	2.67
Muscat Ottonel	Sept. 22	21.1	6.15	3.29	105.00	6.40
Okanagan Riesling	Oct. 6	16.1	9.82	3.08	180.00	
Pinot Blanc	Sept. 28	19.6	5.55	3.21	218.00	2.88
Pinot Gris	Sept. 22	21.1	7.27	3.20	177.00	5.76
Pinot Noir	Sept. 28	21.4	6.22	3.21	116.00	2.88
Riesling Muscat	Sept. 22	20.3	4.50	3.56	144.00	4.21
Sauvignon Blanc	Oct. 6	23.2	9.67	3.10	16.50	4.40
Siebel (DeChaunac)	Oct. 6	21.0	13.27	3.10		
Syrah	Oct. 6	21.1	9.37	3.21	8.50	
Tinta Madeira	Oct. 6	22.0	7.20	3.20	81.00	7.20
Zweigeltrebe	Oct. 6	20.5	5.85	3.17	153.00	7.20

Table 17 Analyses of Grape Samples from Roshard Acres Conducted at the Pacific Agri-Food Research Centre (PARC) Summerland 30-Oct-07
Contact: Carl Bogdanoff

Sample ID	Variety	Harvest Date	Brix	pH	TA
F	Cabernet Sauvignon	06-Oct-07	22.2	3.5	5.7
K	Chancellor (Roshard)	06-Oct-07	21.2	3.44	8
D	Chardonnay	22-Sep-07	21.7	3.57	4.8
P	Cocseji Zamos	27-Sep-07	20.6	3.33	6.5
G	Gewürztraminer	22-Sep-07	21.7	3.55	4.6
N	Johannisberg Riesling	07-Oct-07	19.1	3.14	7.7
I	Limberger	06-Oct-07	22.8	3.3	6
B	Merlot (Roshard)	06-Oct-07	24.5	3.27	6.8
C	Muscat Ottonel	22-Sep-07	21.2	3.58	3.9
E	Pinot blanc	26-Sep-07	18.4	3.4	5.4
O	Pinot gris	22-Sep-07	20.5	3.41	5.8
L	Pinot noir	27-Sep-07	20.3	3.39	4.7
Q	Riesling Muscat	22-Sep-07	21.3	3.65	3.9
M	Sauvignon blanc	06-Oct-07	22.1	3.54	4.9
J	Syrah (Roshard)	06-Oct-07	21.7	3.41	5.9
H	Tinta Madeira	06-Oct-07	21.1	3.37	6.9
A	Zweigeltrebe	06-Oct-07	19.5	3.22	5.1

Table 18 Percent Wood Maturity at Participating Vineyards October 17, 2007				
Grape Variety	Vineyard			
	Roshard Acres	Ruddock Ranch	Pietila Vineyard	Wonderland Farms
Cabernet Franc	90	80		85
Cabernet Sauvignon	85	60	95	90
Chancellor	95	85		85
Chardonnay	90	50	95	90
Cocseji Zamos	90	45	95	90
Foch	80			
Gewürztraminer	95	40	95	80
Johannisberg Riesling	95	50	95	90
Limberger	95	65		90
Merlot	95	60	95	90
Muscat Ottonel	95	60		90
Petit Verdot	70			
Pinot Blanc	95	55	95	90
pinot Gris	90	55		90
Pinot Noir	95	60	95	90
Riesling Muscat	95	80		85
Sauvignon Blanc	80	85	95	85
Syrah	85	40	95	80
Tinta Madeira	95		95	80
Viognier	70			
Zweigeltrebe	95	60		

Table 19 Elevation and Type of Weather Station at Selected Project Locations		
Property Name	Station Elevation (m)	Type of weather station
Diamond S	445	Davis Vantage Pro 2 & iButton
Grossler Farm	304	WeatherHawk & iButton
Halfway Ranch	308	Davis Vantage Pro 2 & iButton
Wonderland Farm	348	iButton
Pietila Farm	349	iButton
Roshard Acres	210	WeatherHawk & iButton
Ruddock Ranch	400	WeatherHawk & iButton

Table 20 2007 Monthly Minimum Temperatures at Some iButton Locations and 7 Complete Weather Stations (see bullet 7 page 13 before reading this table)					
ID	August	September	October	November	December
1	8.63	2.98	-1.61	-5.52	
2	8.21	3.19	-0.96	-5.18	
3	7.80	3.27	-1.76	-6.10	
4	7.36	2.77	-1.95	-6.42	
5	7.53	1.75	-3.10	-6.94	
6	6.16	1.95	-2.89	-6.86	
7	9.19	4.48	-1.88	-9.76	
8	5.91	2.21	-4.70	-12.00	
9	8.97	3.70	-1.14	-9.00	
10	7.29	3.59	-3.20	-9.95	
11	7.75	3.61	-1.22	-9.45	
12	8.34	3.62	-2.55	-9.24	
13	7.47	2.44	-2.66	-9.54	
14	8.43	3.03	-0.93	-8.85	-11.43
15	9.37	3.27	-1.07	-9.39	-11.60
27	8.69	2.85	-1.80	-9.99	-12.26
28	6.87	1.53	-3.44	-11.56	
29	6.24	1.16	-3.75	-11.62	-19.51
31	7.09	3.69	-2.09	-10.47	
32	7.58	3.62	-2.04	-9.85	
33	8.72	2.43	-1.42	-8.99	-16.58
34	9.66	2.64	-1.37	-8.22	-16.26
35	9.31	2.78	-1.50	-8.43	-16.33
36	8.29	2.44	-2.29	-8.53	
37	9.04	2.99	-1.55	-8.43	
38	8.91	3.19	-0.91	-7.29	-10.07
39	8.90	3.20	-1.26	-7.87	-10.26
40	8.78	4.13	-0.02	-7.70	
41	9.31	4.10	-0.81	-7.16	-10.37
42	8.60	2.38	-0.90	-8.20	-10.28
47	12.02	4.29	-0.74	-8.12	
48	11.56	4.22	-0.61	-7.97	
49	11.00	3.85	-0.87	-8.16	
51	10.32	1.46	-1.57	-8.37	-16.14
52	10.89	1.90	-1.49	-8.11	-16.25
64		3.25	-1.10	-8.04	-16.26
72		3.62	-1.60	-10.29	-19.75
73		1.71	-2.14	-10.67	-20.17
76		5.43	-1.72	-11.71	-20.33
77		2.88	-3.41	-13.56	-22.60
78		4.95	-1.65	-12.29	-20.81

ID	August	September	October	November	December
79		5.47	-1.76	-11.27	-21.69
82			-3.55	-11.27	-17.05
83				-9.94	-19.39
84				-5.65	-17.97
85				-7.87	-16.41
86				-6.31	-19.17
87				-6.66	-16.72
Complete weather stations					
Grossler	6.73	2.08	-3.94	-11.32	-19.67
Roshard	6.72	2.04	-2.91	-9.96	-18.28
Ruddock	7.80	2.02	-2.93	-9.32	-18.00
Halfway		1.94	1.89		
Diamond		3.39	2.94		
Lillooet EC	8.6	4.1	-1.3	-9.8	-18.2
Lytton EC	3.90	3.30	-0.90	-7.80	-15.30



