Skaha Bench Sub-Geographic Indication

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Technical Description and Geographic Extent

Documentation in support of a formal application to the BC Wine Authority for the creation of a new sub-GI named Skaha Bench.

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Skaha Bench Sub-Geographic Indication

TECHNICAL DESCRIPTION AND GEOGRAPHIC EXTENT

EXECUTIVE SUMMARY

The proposed sub-Geographic Indication (sub-GI) is located along the east side of Skaha Lake spanning a total length of approximately 10 km in a north south direction and an area of just under 365 ha. As of 2016, the delineated area contained approximately 75 ha of vineyards, split evenly between the northern and southern portions of the sub-GI. The delineation also encompasses areas of rock outcrop, a large residential area (Heritage Hills estates) and significant areas of orchard lands. The proposed sub-GI is composed of a single landscape element – the Late Pleistocene aged glaciolacustrine terrace (bench). The origin of the glaciolacustrine terrace and the nature of its surface relate to the period at the end of the last ice age during deglaciation when the temporary Glacial Lake Penticton existed some 12,000 to 10,000 years ago on the floor of the Okanagan valley including the area currently along the east side of Skaha Lake.

The unconsolidated materials that underlie the terrace are for the most part comprised of silt and fine sand and without significant stone content. The soils that form on these sediments are very favourable for wine grape production. The most common soil on the Skaha Bench is the Olhausen soil series. The surface of this soil is covered with an eolian (wind-blown) layer some 10 to 50 cm thick overlying the glaciolacustrine silts and clays. While the Olhausen soil series has been mapped throughout the southern Okanagan as a minor soil, along the Skaha Bench, it is the dominant soil. The Olhausen soils are a unique attribute of this sub-GI.

There is only a limited record of climate data for the area. The temperature conditions on the Skaha Bench appear to fall between those for Summerland to the north and Osoyoos to the south. In 2017, growing degree-day accumulations >10°C at Summerland, Osoyoos and the southern portion of the Skaha Bench were 1420, 1600 and 1500 respectively. During the growing season, average daily air temperatures tend to be slightly higher on the Skaha Bench than at Penticton airport largely due to warmer minimum temperatures as the result of the slightly elevated nature of the Bench above the valley floor. The dominantly west-facing slopes of Skaha Bench vineyard sites have excellent air drainage that is assisted by the dissecting gullies and undulating topography that provide pathways through which cold air drains to the lake shore.

The ample growing-season heat, long frost-free period, and range of meso-climatic conditions among sites within the sub-GI allow for successful production of several noble *Vitis vinifera* cultivars. In 2017 the principal cultivars grown in the proposed Skaha Bench sub-GI where chardonnay at 17% of the vineyard area, Merlot and Pinot gris at 12% and Pinot noir and Pinot blanc at 10%. The soils and low rainfall in the sub-GI allow for vigour management through careful control of deficit irrigation to achieve optimum canopy density for producing high quality fruit.

BACKGROUND

In March 2018 Scott Smith was retained by Painted Rock Estate Winery on behalf of a group of neighboring wineries to help define the extent of a proposed Skaha Bench sub-Geographical Indication (sub-GI) in the Okanagan Valley and to compile technical (biophysical) information to describe and define its nature. Dr. Pat Bowen of the Summerland Research and Development Centre agreed to contribute a viticultural characterization section for the technical report.

The starting point for the evaluation was the area outlined by the Appellation Task Group (2015) conceptual map of contiguous sub-GIs. Several iterations of possible sub-GI boundaries were prepared and reviewed by the proponents. Following detailed examination of geological, climatic, topographic and soil factors this rather heterogeneous area was narrowed down to focus on the unique surficial geology and resultant viticultural properties of the landscape on the east side of the Skaha Lake between Ellis Creek in the north and McLean Creek to the south. A boundary map, technical characterization and rationalization for the delineation are compiled in this report.

The intent of this document is to support the submission of an application to the British Columbia Wine Authority seeking formal establishment of this proposed sub-GI.

GEOGRAPHIC EXTENT

The proposed sub-GI is located along the east side of Skaha Lake spanning a total length of approximately 10 km in a north south direction. The sub-GI covers an area just under 365 ha in which there are approximately 75 ha of vineyards, split evenly between the northern and southern portions of the sub-GI (BC Ministry of Agriculture 2016). The delineation also encompasses areas of rock outcrop, a large residential area (Heritage Hills estates) and significant areas of orchard lands.

Figure 1. Overview of the boundary configuration for the proposed Skaha Bench sub-GI. The northern extent is defined as the agricultural land on the bench adjacent to Ellis Creek [1], incorporates all of the glaciolacustrine landscape south to the rocky promontory just north of the Heritage Hills residential area [2], then follows again the terrace (bench) south to where it terminates at McLean Creek in the south [3].

Boundary Rationalization

The details of the boundary placement are shown in Figures 2 and 3. Boundary segments are numbered on the Figures and described.

The primary landform upon which the sub-GI is based is the glaciolacustrine terrace that runs along the east side of Skaha Lake. The northern extent of this terrace is a steep escarpment seen along the southern flank of the Ellis Creek. However, the northern (segment 1 – 2, Figure 2) follows the division between urban development and agricultural land use along the terrace surface

on the south side of the gully in which Green Ave E. is located. The boundary follows the terrace escarpment eastward up to the base of the rock outcrop that marks the start of the valley wall. The eastern boundary of the sub-GI then follows the break between the glaciolacustrine sediments and the bedrock-controlled landscape at the base of the valley wall (segment 2-3 Figure 2). This clear landscape break runs between 440 to 470 m elevation and defines an irregular eastern boundary southward for approximately 6 km at which point a large bedrock outcrop and erosion have removed all remnants of the terrace. This landscape break in this portion of the sub-GI also corresponds closely to the boundary of Skaha Bluffs Provincial Park which is located upslope and to the east of the sub-GI.

Figure 2. The boundary configuration with segment numbers for the northern portion of the sub-GI.

The western boundary is defined by the top of the terrace escarpment (segment 4 with arrow) that runs the length of the landform between 380 and 400 m elevation (about 50 m above lake level). The landscape between the bedrock-controlled slopes of the valley wall and the top of the escarpment represents the 'bench' landform which is central to the concept for the sub-GI.

The central portion of the sub-GI is composed of rocky slopes and mixed sediments in the area of Heritage Hills residential area (shaded area of Figure 3). The boundary placement in this area is based on the typical elevation ranges for the landform break along the bedrock wall elsewhere in the sub-GI and the elevation of the top of the glaciolacustrine terrace. There is little arable land in this section of the sub-GI. However, it connects the northern and the southern portions of the bench to maintain a single continuous unit for the sub-GI.

Figure 3. The southern portion of the sub-GI. The portion shaded in brown is steep, often rocky and has been used primarily for residential development.

South of the Heritage Hills residential area the proper 'bench' reappears and extends some 1.5 km southward to McLean Creek where it terminates (Figure 4). The upper boundary is again clearly defined by the landscape break between bedrock-controlled topography of the valley wall and the relatively gentle slopes of the glaciolacustrine deposit. The lower boundary is again defined as the top of the escarpment except in the area between Matheson and McLean Creeks where the escarpment has been eroded and sediments re-worked into a series of stepped terraces. Here the boundary placed at 360 m (segment 5-6 Figure 3).

Figure 4. The broad expanse of the Skaha Bench south of Heritage Hills residential development is host to some 38 ha (90 acres) of vineyards. The vineyard area continues to expand with new plantings every year.

The proposed sub-GI is composed of a single landscape element – the glaciolacustrine terrace surface (bench) along the east side of Skaha Lake. The unconsolidated materials that underlie the terrace are for the most part comprised of silt and fine sand and generally without significant stone content. The soils that form on these sediments are very favourable for wine grape production. However, this landscape element is not homogeneous. The terrace surface shape is highly variable. In some places the bench is relatively smooth with long uniform slopes while in other areas, highly dissected and punctuated with rock outcrops (Figure 5).

Bedrock is an important component of the landscape. It occurs as either outcrops of large cliff features or as sub-surface bedrock that controls the surface form of the bench. Parts of the bedrock-controlled landscape are very rugged and characterized by rock-walled canyons and steep slopes.

Figure 5. Contrasting surface forms on the glaciolacustrine terrace. There is a large section of relatively smooth, undulating landscape in the southern portion of the sub-GI (a). The northernmost portion of the sub-GI is dissected by gullies and characterized by shorter steep slopes (b), long gentle continuous slopes occur sporadically on the bench (c). Photo credits: Pentâge Winery (b) and Painted Rock Estate Winery (c).

Surficial Geology and Landforms

The origin of the glaciolacustrine terrace and the nature of its surface relate to the Late Pleistocene, the period at the end of the last ice age during deglaciation when Glacial Lake Penticton existed some 12,000 to 10,000 years ago (Roed and Fulton 2011, Nasmith 1962).

It is postulated that Glacial Lake Penticton formed when glacial debris and ice blocked the southward drainage of meltwater from the Okanagan Valley. Glacial Lakes have short and tumultuous histories, with highly fluctuating water levels, periodic drainings and fillings and outflow floods. The lake's highest shoreline was approximately 150 m above the current level of Skaha Lake and above the highest elevations of the proposed Skaha Bench sub-GI.

Earlier glaciation had scoured the valley of most unconsolidated sediment and had rounded bedrock summits and ridges. Of particular note is the sculpting of the granodiorite bedrock that underlies the north end of the sub-GI. During the Pleistocene Epoch (the 'Ice-age') numerous glacial advances scoured out weaker sections of the rock along fault lines leaving the many canyons and near vertical cliffs that today attract rock climbers to the Skaha Bluffs Provincial Park. Below 500 m elevation this incredibly rugged bedrock terrain was buried by sediment carried into Glacial Lake Penticton (Figure 6). The lake bottom sediment or glaciolacustrine sediment is what comprises the current Skaha Bench. Erosion of these sediments after the lake drained has left a varied topography utilized today for a range of horticultural production.

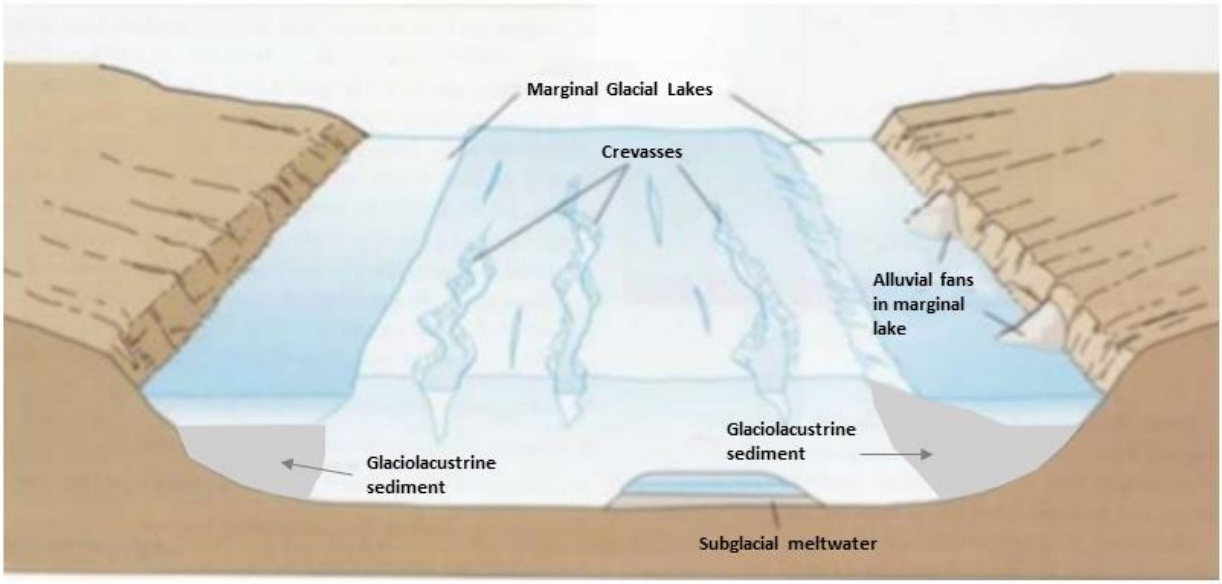

Figure 6. Conceptual illustration of the formation of marginal glacial lakes during de-glaciation. In the south Okanagan Valley these marginal lakes are collectively referred to as Glacial Lake Penticton. Sediment was deposited between the ice margin and the valley wall and in this illustration depicts the formation of the silty bluffs and terraces (i.e. benches) evident today along Skaha and Okanagan Lakes. Adapted from and re-drawn based on Bilton (2012).

South of the Skaha Bluffs Provincial Park the bedrock changes to the older regional Okanagan Complex, a mixture of various metamorphic rock, mainly gneiss, that owe their origin to tectonic activity during the Mesozoic Era over 200 million years (Ouklitch 2013).

Figure 7. The interplay between lake, bedrock and glaciolacustrine deposits is evident in this image of the northern extent of the sub-GI along Skaha Lake. The bedrock in the view is granodiorite, plutonic (igneous) rock that hosts the rock climbing opportunities in Skaha Bluffs Provincial Park. The glaciolacustrine terraces (bench) upon which viticulture is based are indicated by the arrows. The origins of the sediment are shown in Figure 6.

As the Bench is predominantly west facing and receives direct afternoon sun during the growing season, the bedrock outcrops absorb solar radiation during the day and radiate heat at night a process thought by growers to benefit wine grape production. The lake provides a moderating influence on the climate of the outer terrace surfaces, cooling during the heat of the day, providing a degree of warming at night and in the fall through spring season (Figure 7).

Soil Development and Soil Properties

Most of the soils utilized for viticulture on the Skaha Bench are of glaciolacustrine origin. In the report *Soils of the Okanagan and Similkameen Valleys,* Wittneben (1986) mapped a half dozen common soil series on this landscape element. Soil series are soil mapping units defined by the nature of the soil profile and the type of surficial material within which the soil has formed. Unconsolidated surficial geologic deposits act as what are termed ‘soil parent materials’. Within the proposed sub-GI these materials are predominantly of glaciolacustrine and to a lesser extent

glaciofluvial origin (Table 1). Parent materials weather over time to form soil horizons, layers of soil with differing colouration and properties such as amount of organic matter and water holding capacity.

Table 1. The major soil types of the Skaha Bench sub-Geographic Indication. Soils formed on glaciolacustrine parent materials are fine sandy loam to silty clay loam texture and are largely stone-free. Soils formed on glaciofluvial parent tend to be sandy in texture.

Soil Series Name	Landscape position	Profile Characteristics	Viticultural Use
		Soils formed on glaciolacustrine parent materials	
Chapman	Steep slopes and bluffs	Little or no A horizon, with calcareous subsoil at or near the surface	Topographically unsuited
Munson	Localized mid and lower slopes	Well developed A horizon underlain by saline subsoil	Scattered occurrence causes low vigour
Olhausen	Widespread on non-eroded surfaces	Surface veneer 10-50 cm of fine sandy loam wind-blown sediment overlying a calcareous silt loam subsoil	Dominant soil used for viticulture
Penticton	Widespread on non-eroded surfaces	Similar to Olhausen soil but without the sandy loam topsoil	Well suited but with limited distribution
		Soils formed on glaciofluvial parent materials	
Skaha	Upper slopes near/along valley wall	Sandy loam topsoil overlying gravelly sand	Droughty soil, very stony, challenging to manage irrigation and nutrients
Osoyoos	Upper slopes near valley wall	Stone-free loamy sands	Limited distribution but well suited to irrigated viticulture

The most common soil on the Skaha Bench is the Olhausen soil series. This soil has unique properties. The surface is covered with an eolian (wind-blown) layer some 10 to 50 cm thick overlying the glaciolacustrine silts and clays (Figure 8). The topsoil tends to be a little coarser, having a larger proportion of sand than in the subsoil yet still easy to work and is stone free. Eolian sediments were derived when strong winds generated by retreating glaciers swept down the largely unvegetated valley and lifted fine sand silt particles from the surface when under dry conditions. These particles were spread across the landscape covering all soil surfaces. Including the exposed lake bottom sediments. While the Olhausen soil series has been mapped throughout the southern Okanagan as a minor soil, along the Skaha Bench, it is the dominant soil. The Olhausen soils are a unique attribute of this sub-GI.

Along the contact with the bedrock-controlled valley wall is another type of soil parent material, glaciofluvial. These materials are deposited by running water melting from the glaciers and so contain abundant gravels and cobbles that are set in a matrix of sand. They are limited to the highest elevations of the sub-GI. The Osoyoos series is composed of mainly sand and is found in the area of McLean Creek on upper vineyard blocks, Along the upper boundary of the northern portion of the sub-GI are the Valley Creek soils which are a combination of glaciofluvial materials overlying the glaciolacustrine sediment. Such deposition would have occurred along the edges of ponded water against the valley wall during the high-water phases of Glacial Lake Penticton.

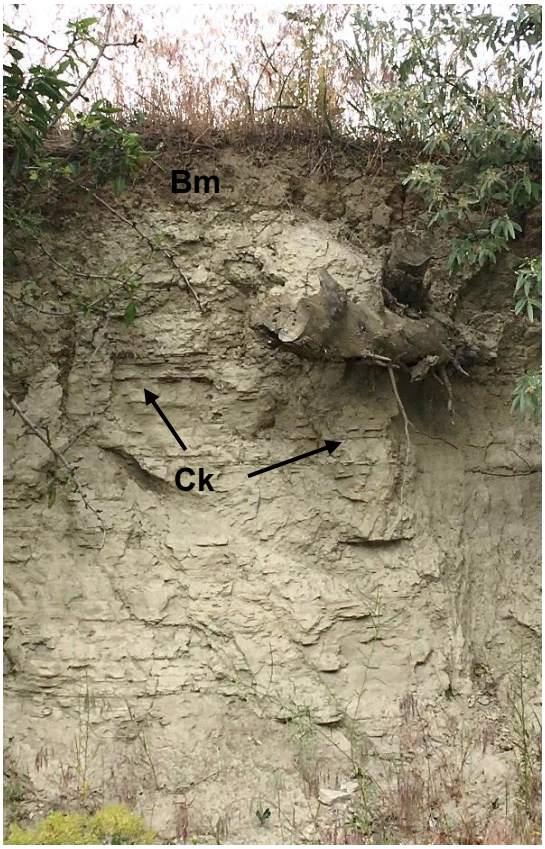

Figure 8. Profile of the Olhausen soil. The topsoil which appears reddish-brown in colour is formed in wind-blown sediment of fine sandy loam texture. The subsoil is composed of glaciolacustrine sediment in which horizontal depositional layers are visible (arrows). The labels refer to the nature of the weathering horizons in the soil profile. The Bm horizon is the topsoil horizon. The colour has formed as the result of oxidation and leaching. The Ck horizon is light gray in colour, largely unweathered and is rich in lime (calcium carbonate).

Figure 9. The Skaha soil series composed of glaciofluvial sands over gravels. The Skaha soils are the only soils in the sub-GI with a gravelly subsoil.

CLIMATE

There are no long-term climate stations within the proposed sub-GI. However, there are long-term climate data available for Penticton airport which lies at the north end of Skaha Lake. Applying these data to characterize the climate of the sub-GI has several drawbacks. Penticton airport is located on the valley floor at 342 m elevation between two large lakes and does not represent very well the complex topographic and elevated conditions of the benches and westerly facing slopes of the sub-GI.

For comparison purposes, we obtained daily temperature data from a weather station in the southern portion of the sub-GI (Table 2). The weather station is located on a neutral landscape position that is neither depressional nor convex (knoll or upper slope) and as such is useful to generalize the temperature regime on the Bench.

Table 2. Comparison of monthly temperatures for Penticton airport and Skaha Bench for the period of May 2017 to January 2018.

Month	Penticton A					Skaha Bench[1]				
	Max	Min	Average	E. Max[2]	E. Min	Max	Min	Average	E. Max	E. Min
May	21.7	6.6	14.2	31.7	-0.4	22.0	8.5	14.7	31.4	3.1
June	25.6	9.4	17.5	33.6	4.6	26.0	11.8	18.7	35.7	8.0
July	31.7	13.4	22.6	36.5	8.5	31.9	16.1	24.2	38.7	11.6
Aug	30.3	12.6	21.4	34.1	7.2	30.6	15.4	22.6	34.6	10.3
Sept	23.6	8.4	16.2	32.8	1.5	23.7	11.1	16.9	34.1	3.4
Oct	14.2	2.0	8.1	19.2	-4.8	14.1	4.3	9.1	20.8	-1.2
Nov	6.4	1.0	4.0	11.9	-9.7	5.3	1.0	3.1	11.3	-6.8
Dec	-0.4	-4.9	-2.6	5	-15.2	0.8	-4.0	-2.3	8.8	-12.4
Jan	2.8	-1.2	0.8	7.6	-13.5	2.4	-0.9	0.7	6.9	-9.4

[1] Skaha Bench data provided by Evan Saunders of Blasted Church Vinyards, Okanagan Falls.

[2] E. Max and E. Min refer to extreme maximum and minimum temperatures recorded during the month

In comparing the daily records of temperatures for Skaha Bench and Penticton airport the period of May 1 to November 30, 2017 the following generalizations are drawn:

- During the growing season, average daily air temperatures tend to be slightly higher on the Skaha Bench than at Penticton airport largely due to warmer minimum temperatures.

- Average daily temperatures are generally one degree warmer on the Bench during the growing season which would equate to about 150 to 200 more accumulated growing degree days over the year.

- Differences throughout the year are most evident in minimum and extreme minimum temperatures where Skaha Bench values are generally 2 to 3°C warmer. This is perhaps most critical during the non-growing and shoulder seasons where frost and winter freeze damage are of concern.

A closer look at growing degree day values is given in Table 3. The temperature conditions on the Skaha Bench would seem to fall between those for Summerland CDA, 20 km to the north, and Osoyoos, 40 km to the south. The growing season experienced in 2017 was warmer than average over the last decade.

Table 3. Growing degree day totals for the year of 2017 and the 10-year period of 2008 to 2017 for three Okanagan locations. A 10-yr average value was not available for Skaha Bench.

Location[2]	Growing Degree Day totals[1]	
	10 yr average	2017
Summerland CDA	1350	1420
Skaha Bench		1500
Osoyoos	1560	1600

[1] Growing Degree Day is calculated on a 10°C base. All values are rounded.

[2] Data for Summerland CDA and Osoyoos prepared by Brad Estergaard, Summerland RDC. Data for Skaha Bench provided by Evan Saunders, Blasted Church Vineyards

It is important to note that considerable variation in temperature can occur on the landscape at any time during the diurnal cycle. Typically, depressional sites experience the coldest air temperatures at night due to cold air pooling, southerly sloping sites experience the warmest temperatures during the day. Additional landscape features also affect air temperatures. Sites adjacent to Skaha Lake will experience moderating temperature effects, cooler during the afternoons, warmer at night and during shoulder seasons.

Air drainage is also very important. Research monitoring within vineyards has revealed that spatially, a wide range of temperatures can exist through the day and night as the result of landscape position and topography (Beckwith et al. 2004). Complex topography influences patterns in daytime convective airflow and nighttime air drainage. The dominantly west-facing slopes of Skaha Bench vineyard sites have excellent air drainage that is assisted by the dissecting gullies and undulating topography that provide pathways through which cold air drains to the lake shore. This drainage strongly influences growing degree-day accumulations and the frost-free period of vineyard sites. Sites with good air drainage have a lower incidence of vine damage by frosts and winter freeze events. The combination of dominant slope, topography, and landscape position creates a range of mesoclimates within the sub-GI.

VITICULTURE CHARACTERISTICS

The proposed Skaha Bench sub-GI has a unique terroir combining climatic, topographic and soil characteristics that influence the development and performance of grapevines including the compositional development of fruit that determines wine quality.

As the sub-GI is located on the east side of the Okanagan Valley, with a dominant western aspect, it intercepts more sunlight in the afternoon than morning. The exposure of grapevines to more afternoon sunlight affects the diurnal temperature patterns of berries and influences developmental processes including the synthesis of key constituents that contribute to the colour, flavour, aroma and mouthfeel of the wines. In addition, cool air originating from adjacent high elevation sites to the east flows into the area at night as katabatic wind which reduces nighttime temperatures, enhancing the development and retention of fruit acids and other constituents including flavor and aroma compounds that further contribute to the sensory quality of the wines.

The ample growing-season heat, long frost-free period, and range of climatic conditions among sites within the sub-GI allow for successful production of several noble *Vitis vinifera* cultivars. In 2017, the percentage of total acreage for the top 10 cultivars grown is listed in Table 4.

Table 4. Principal cultivars grown in the proposed Skaha Bench sub-GI.

Cultivar	% of total acreage (approx.)
Chardonnay	17
Merlot	12
Pinot gris	12
Pinot noir	10
Pinot blanc	10
Syrah	8
Cabernet Sauvignon	6
Cabernet Franc	6
Gewurztraminer	5
Sauvignon blanc	4

Selection of cultivars suited to vineyard site conditions has enabled production of optimally mature fruit for producing high quality wines. The western aspect of most sites provides an ability to accelerate fruit maturation through extended exposure of clusters to afternoon sunlight. These conditions are also optimal for extending fruit hang time to further enhance ripening and improve the flavor, body and aftertaste of red wines. Short-season red wine cultivars and several white wine cultivars are suited to cooler sites in the sub-GI. In late summer and fall, cool temperatures enhance the development and retention of fruit acids and aromatic compounds that further contribute to the sensory quality of wines produced in the sub-GI.

The soils and low rainfall in the sub-GI allow for vigour management through careful control of deficit irrigation to achieve optimum canopy density for producing high quality fruit. Floor vegetation maintenance on these soils requires little between-row irrigation.

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