Naramata Bench Sub-Geographic Indication

January 2018

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 Naramata Bench.

Scott Smith, Eterrna Consulting

Pat Bowen, Summerland Research and Development Centre, Agriculture and Agri-Food Canada

Naramata Bench Sub-Geographic Indication

TECHNICAL DESCRIPTION AND GEOGRAPHIC EXTENT

EXECUTIVE SUMMARY

The 'Naramata Bench' brand is firmly established in a regional socioeconomic context and particularly within the BC wine and wine tourism industry. The proposed sub-Geographic Indication (sub-GI) covers an area of just under 3,650 ha along the east side of the Okanagan Valley from Okanagan Mountain Provincial Park in the north to Penticton Creek within the City of Penticton in the south. The area includes approximately 250 ha of vineyards and some 50 wineries.

The proposed sub-GI is composed of two landscape elements – the glaciolacustrine landscape and the mixed sediments landscape. The glaciolacustrine landscape is characterized by a gullied, gently undulating land surface and is the signature landform of the Naramata Bench. The second landscape element is the mixed deposits that lie above the glaciolacustrine landscape. At higher elevations are common outcrops of coarse grained metamorphic rocks (gneiss) which have been altered through geologic faulting and are termed 'mylonite'

The soil used extensively for agriculture on the Naramata Bench sub-GI is the Penticton silt loam. This stone-free soil has a well-developed profile with a distinct organic matter-rich topsoil underlain by a highly favourable rooting zone up to 60 cm thick over the unweathered calcareous parent material. Within the mixed sediment landscape there are several common soils composed of stratified materials that vary in soil texture and the degree and location of stoniness in the profile.

Currently low elevation sites experience a mean annual temperature of approximately 9.5 °C, accumulate around 1400 growing degree days >10°C, and have a growing season of around 195 days, all values well suited to production of many *Vitis vinifera* cultivars. An important climatic consideration is the temperature moderating influence of Okanagan Lake which results in longer frost-free periods on the Naramata Bench than in production regions to the south such as near Oliver and Osoyoos. Spatially, a wide range of temperatures can exist through the day as the result of landscape position. Complex topography influences patterns in daytime convective airflow and nighttime air drainage. The combination of dominant slope, topography, and landscape position creates a range of mesoclimates within the sub-GI.

The principal cultivars grown in the proposed sub-GI, in descending order are Merlot, Pinot Gris, Chardonnay and Pinot Noir. Together these cultivars occupied two thirds of the vineyard acreage in 2017. Careful selection of cultivars suited to vineyard site conditions has enabled production of optimally mature fruit for producing high quality wines. The warmest sites are suitable for producing many long-season red cultivars. In late summer and fall, cooler 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 conditions are also optimal for extending fruit hang time to further enhance flavour and tannin ripening and improve the body and aftertaste of red wines.

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.

BACKGROUND

In July 2017 Scott Smith was commissioned by Hillside Cellars Winery Ltd on behalf of a group of Naramata Bench wineries to define the extent of a proposed Naramata Bench Sub-Geographical Indication (sub-GI) and to compile technical (biophysical) information to describe and define its nature. The section on viticultural characterization was completed in collaboration with Dr. Pat Bowen.

The starting point for the evaluation was the area outlined by the Appellation Task Group conceptual map of contiguous sub-GIs. Several possible sub-GI boundaries were prepared and reviewed by the proponents. Following consideration of climatic, topographic and soil factors, the surficial geology and resultant viticultural properties, a boundary configuration was finalized. The boundary map, technical characterization and rationalization for the delineation are compiled in this report.

The ‘Naramata Bench’ brand is firmly established in a regional socioeconomic context and particularly within the wine and wine tourism industry. 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 extent of this proposed sub-GI covers the area from Okanagan Mountain Provincial Park in the north to Penticton Creek within the City of Penticton in the south (Figure 1). The sub-GI covers an area just under 3,650 ha in which there are estimated to be approximately 250 ha of vineyards based on information within the Summerland Research and Development Centre Wine Grape Research geographic information system (GIS) database. The delineation includes extensive areas of native vegetation and areas of urban residential development primarily within the village of Naramata and the Uplands area of Penticton.

Figure 1. The proposed sub-GI boundary extends from Okanagan Mountain Park in the north, along the eastern valley wall at an elevation of between 650 and 700 m, southward to Campbell Mountain and Penticton Creek.

Boundary Rationalization

The northern boundary segments are shown in Figure 2. The northernmost boundary of the sub-GI (segment 1 – 2) rises from the lake shore along the northern edge of the Sebastian Farms Naramata Ranch vineyards and onto the rocky slope to an elevation of between 660 and 690 m above sea level (asl). The boundary then follows the contour of the valley wall southward where it intersects the KVR trail at the Little Tunnel above the village of Naramata. Segment 2-3 runs south to Naramata Creek. At 685 m elevation adjacent to Naramata Creek lie the highest elevation vineyards within the sub-GI which probably represent the elevation at which current climatic suitability begins to limit production of *Vitis vinifera* cultivars. Other than the landscape immediately adjacent to the creek, there is a limited extent of arable land at this elevation although there are no doubt small pockets of land potentially suitable for future viticultural development within this rocky landscape. These landscape and climate limitations were used as the basis for establishing the upper elevational limit to the sub-GI.

Figure 2. The northern half of the sub-GI from Naramata Ranch vineyards to Naramata Creek.

From Naramata Creek the boundary continues along a contour between 650 and 680 m elevation on the east wall of the valley until it intersects with Spiller Road just above the regional landfill (location 4 on Figure 3). Segment 4-5 continues south, crosses Reservoir Road at 665 m elevation, before traversing the west facing slope of Campbell Mountain above Upper Bench Road and eventually dropping of the south end of Campbell Mountain to a point on the escarpment overlooking Penticton Creek. Segment 5-6 follows the top of the escarpment roughly following the KVR trail across Vancouver Hill Road and northward to the lakeshore just east of the Tennis Club. The western sub-GI boundary runs along the lake shore up to Naramata Ranch vineyards.

Figure 3. The southern portion of the sub-GI from Naramata Creek to Penticton.

PHYSICAL CHARACTERISTICS

Most of the landforms were shaped by events and deposits related to de-glaciation of the Okanagan Valley. The proposed sub-GI is composed of two landscape elements. The boundary between the two is shown in Figure 4.

Figure 4. The two landscape elements of the southern (a) and northern (b) portions of the Naramata Bench sub-GI. The red line delineates the break between the glaciolacustrine landscape and the sloping, gravelly mixed sediments that lie to the east and at higher elevation. The delineation is based on 1:20,00 soil mapping by Wittneben (1986).

Surficial Geology and Landforms

The two landscape elements in the proposed sub-GI are illustrated in Figure 5 and described in detail in the next two sections of the report.

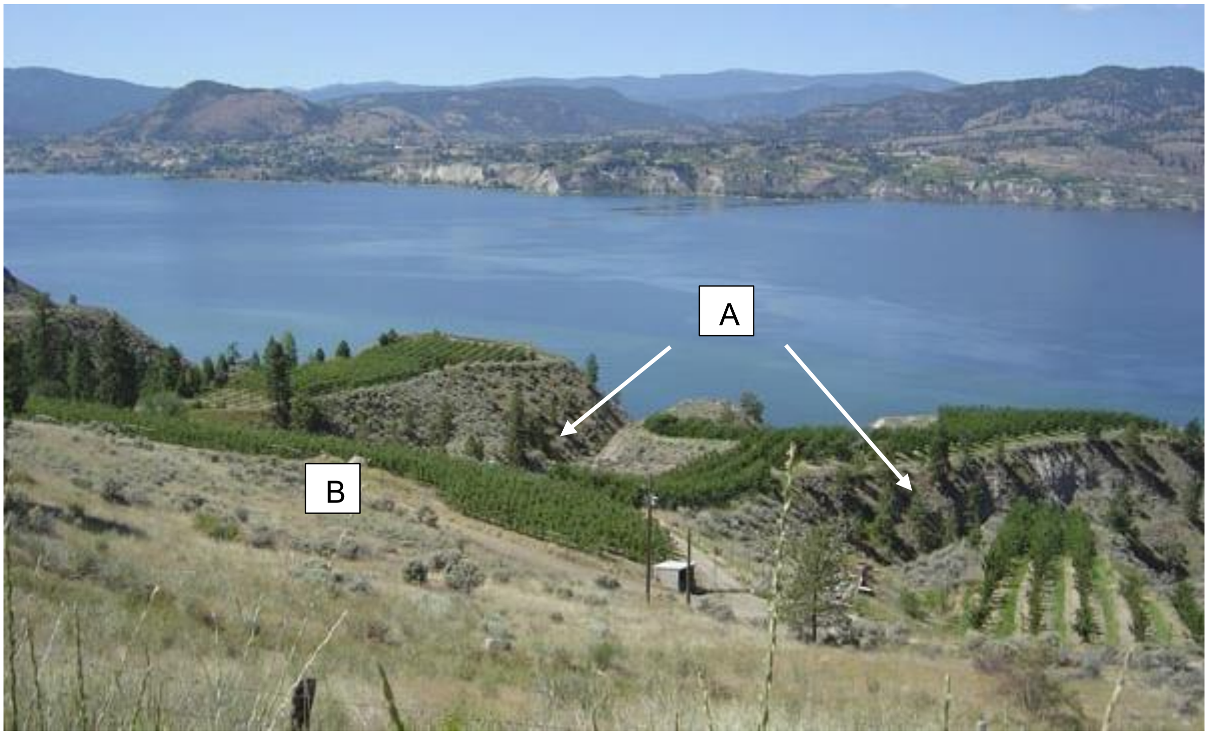

Figure 5. An overview of the two Naramata Bench landscape elements. In the distance (A) is the highly dissected glaciolacustrine landscape with gentle undulating slopes broken by deep gullies (arrows) that lead down to the lakeshore. In the foreground is the sloping mixed sediments landscape element (B).

The Glaciolacustrine Landscape

The glaciolacustrine landscape is characterized by a gullied, gently undulating land surface. This is the signature landform of the proposed Naramata Bench sub-GI. Nasmith (1962) described these sediments as part of the stages of glacial retreat in the following way. *"Extensive proglacial lakes formed as the Okanagan ice lobe melted, and in them thick deposits of sand, silt and clay accumulated. The distribution of the sediments is a result of various factors of sedimentation and of preservation of sediments as the lakes were drained. The extent of the lakes in which the various glacial-lake sediments were deposited is undetermined".* Roed and Fulton (2011) describe beach deposits associated with the presumed highest levels of Lake Penticton on the bedrock slopes above Naramata village some 50 m in elevation above the highest extent of the actual glacial lake sediments in the area.

The glaciolacustrine sediments have unique characteristics. They often form prominent bluffs with near vertical walls in which the bedding structures and sedimentary composition are clearly visible (Figure 6). The materials, which are dominated by silt sized particles (these range from .002 to .050 mm in diameter) but also can include layers of sand and even gravel.

Figure 6. The full thickness of the Glacial Lake Penticton sediments is seen in this vertical exposure along Mill Road (a). Close inspection reveals the horizontal sedimentary layers (called varves) within this material (b).

They are highly susceptible to water erosion. If the sediments become saturated they lose their internal strength and can collapse as large landslides or slope failures. The sediments are notoriously erosive, even small amounts of surface run-off can create large gullies in little time. Evidence of past erosion is present on the landscape which is characterized by large prominent gullies that dissect the land surface (Figure 7a). These very large gully systems likely formed during, and shortly after, the drainage of the glacial-lake about 9,000 years ago.

Figure 7. Much of the glaciolacustrine landscape along the shore of Okanagan Lake is dissected by large gullies creating a patchwork of discontinuous, irregularly-shaped vineyards (a). In addition to gullying, irregularities in depositional processes have led to locally complex sloping and pitted topography (b).

Following de-glaciation, the surface of these sediments weathered under a warm semi-arid climate to produce soils that are well suited to agricultural production. These soil properties are discussed in detail in the section on Soil Development

The Mixed Landscape

The second landscape element is the mixed deposits that lie above the glaciolacustrine landscape and occupy higher elevations of the in the sub-GI. The key distinctions between this mixed landscape element and the glaciolacustrine element is that the topography of the latter is often controlled by the form of the underlying bedrock surface and the surface deposits are highly variable and often stony (Figure 8). These mixed sediments are not as thick as the glaciolacustrine deposits. Viticultural production is most widespread on the lower slopes of this landscape element at or near the interface with the glaciolacustrine landscape. The mixed sediments include gravelly glaciofluvial materials that may overlie bedrock or glaciolacustrine sediments, stony till sediments and fluvial fan deposits from the hillsides above. At higher elevations throughout the landscape there are common outcrops of coarse grained metamorphic rocks (gneiss) which have been altered through geologic faulting and are termed ‘mylonite’ (Roed and Fulton 2011).

Figure 8. Vineyards located on gently sloping till sediments. Shown in the foreground is Albarino, a novel white cultivar for the Naramata Bench noted for crisp acidity. These southwest facing vineyards are about 150 m above the elevation of Okanagan Lake seen in the background. The soils in this landscape are typically stony as shown in the inset photo. Photo credit: Terravista Vineyards.

Soil Development and Soil Properties

In the report *Soils of the Okanagan and Similkameen Valleys,* Wittneben (1986) mapped several common soil series in the glaciolacustrine landscape and another 6 common soils in the mixed sediments landscape element. Soil series are defined by the nature of the soil profile and the type of surficial material within which the soil has formed. Surficial geologic deposits act as what are termed 'soil parent materials'.

Within the glaciolacustrine landscape, all soils share the same parent material. Individual soil series are differentiated based on the thickness of the organic matter-rich topsoil layer (the A horizon), the depth of leaching (the B horizon) and the chemical nature of the subsoil (the C horizon). Each soil type is associated with a particular landscape position(s) and may occur in close proximity to each other (Table 1).

Table 1. The major soil types of the glaciolacustrine landscape. All soils are formed on silt loam to silty clay loam parent material and are largely stone-free.

Soil Series Name	**Landscape position**	**Profile Characteristics**	**Taxonomic class[1]**
Chapman	Steep slopes and bluffs	Little or no A horizon, with calcareous subsoil at or near the surface	Orthic Regosol, calcareous phase
Maynard	Eroded slopes and bluffs	Little or no A horizon, with calcareous and saline subsoil at or near the surface	Orthic Regosol, calcareous and saline phase
Munson	Localized mid and lower slopes	Well developed A horizon underlain by saline subsoil	Rego Brown Chernozem, saline phase
Penticton	Widespread on non-eroded surfaces	Well developed A and B horizons overlying calcareous subsoil	Orthic Brown Chernozem

[1] Taxonomy according to Soil Classification Working Group (1998) as reported in Wittneben (1986)

The soil that best characterizes this landscape element and used extensively for agriculture on the Naramata Bench sub-GI is the Penticton silt loam (Figure 9). This soil has a well-developed profile with a distinct organic matter-rich A horizon underlain by a leached horizon (B horizon) where lime and salts have been removed to generate a highly favourable rooting zone up to 60 cm thick over the unweathered parent material (C horizon).

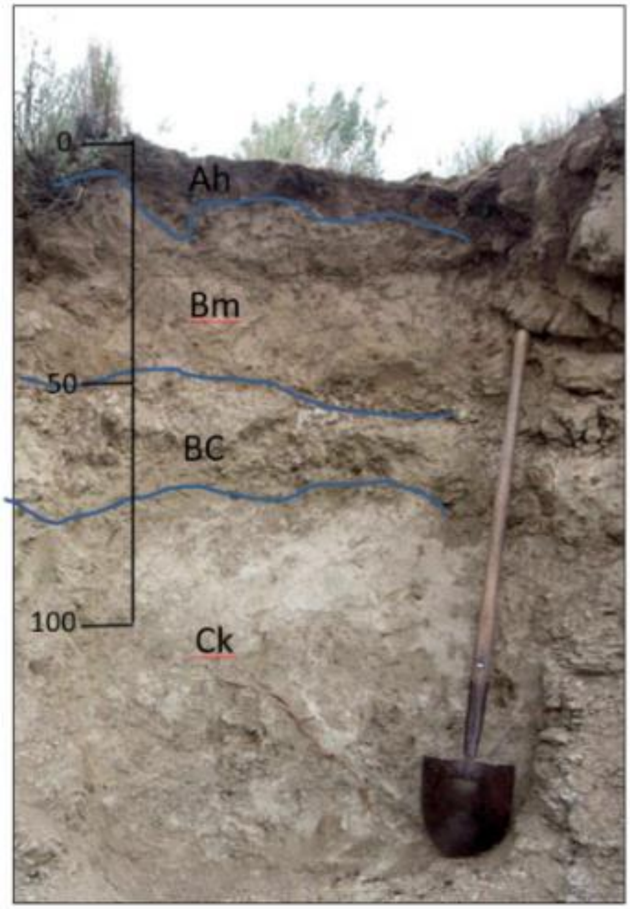

Figure 9. Undisturbed native profile of the Penticton silt loam. The soil horizons are marked on the photo. An Ah horizon is one that is enriched in humus and exhibits a dark colour, the Bm horizon is one that is chemically weathered with soluble materials removed and exhibits a light reddish-brown colour. The BC horizon is a transition zone. The Ck horizon represents unweathered glaciolacustrine parent material that is strongly alkaline and calcareous (contains calcium carbonate). Scale shown is in cm.

Because the glaciolacustrine deposits are thick and without bedrock or stones, land leveling has been a common practice in this landscape. The best practice is to retain A and B horizon materials and then carefully spread these back over the resultant leveled surface.

Within the mixed sediment landscape there is no one dominant soil type. Instead there are several common soils with a range of properties (Table 2). Variable properties include thickness and nature of stratified materials, the soil texture of these materials and the degree and location of stoniness in the profile. These soils can all occur in close proximity to each other and their spatial distribution can be difficult to predict based on topographic characteristics. They all exhibit similar development in that they have a surface A horizon enriched in humus and weathered B horizons such that they are all classified as belonging to the same taxonomic family of Orthic Brown Chernozems.

Table 2. Soils of the mixed sediments landscape. All the soils in this landscape are classified as Orthic Brown Chernozems but have formed on a variety of parent materials.

Soil Series Name	Landscape position	Profile Characteristics
Valley Creek	Interface between landscape elements	Upper 50 cm of profile composed of sandy gravelly material overlying silt loam glaciolacustrine sediment
Skaha	Common throughout lower elevations	Stone-free sandy A and B horizon overlying gravelly C horizon
Osoyoos	Minor soil associated with the Skaha soil	Uniform loamy sand materials throughout the profile
Giant's Head	Upper slopes, associated with bedrock	Sandy A horizon overlying gravelly sandy loam till material

One of the more common soils of the mixed sediment landscape is the Skaha soil series. While the upper soil horizons are formed in sandy loam materials, the subsoils can be very gravelly as illustrated in Figure 10.

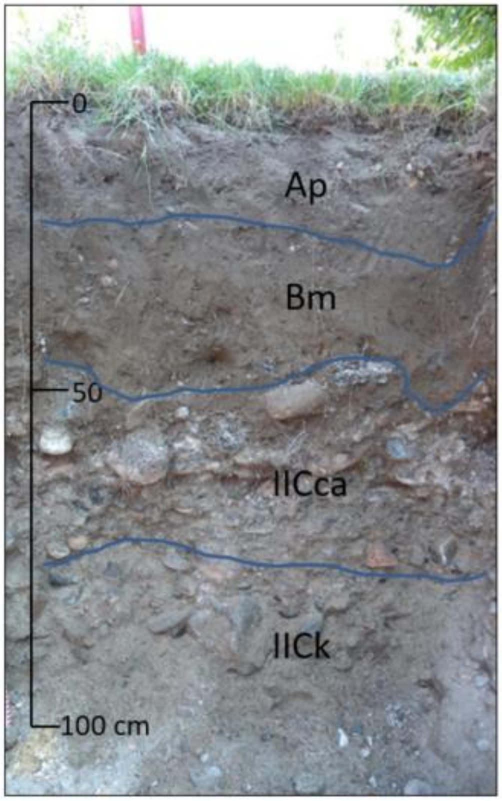

Figure 10. Cultivated profile of the Skaha gravelly sandy loam. The soil horizons are marked on the photo. An Ap horizon is the plow layer which is enriched in humus and exhibits a dark colour, the Bm horizon is one that is chemically weathered with soluble materials removed and exhibits a light reddish-brown colour. The IICca horizon represents gravelly glaciofluvial parent material that is strongly alkaline and has accumulations of calcium carbonate on the underside of stones. The IICk horizon is unweathered parent material.

Observations of vineyards in the sub-GI indicate that in some locations, the original soil profiles have been disturbed over time and soils now supporting viticulture are, at least in part, constructed soils as a result of earth moving, sculpting and burial.

CLIMATE

While there are no long-term climate stations within the sub-GI or in the Naramata townsite, several climate stations have been collecting data in vineyards for the last 5 years. There are long-term climate data available for Penticton airport which lies approximately 6 km from the southernmost portion of the sub-GI and Summerland Research and Development Centre which lies directly across Okanagan Lake from the sub-GI on the western side of the valley (Table 3). Interpolating these data to characterize the climate of the sub-GI has several caveats. Penticton airport is located on the valley floor between two large lakes and does not represent very well the complex topographic and elevated condition of the benches and westerly facing slopes of the sub-GI.

Table 3. Climate normals for the 30-year period 1981 to 2010 for selected south Okanagan climate stations (Environment and Climate Change Canada, 2017).

Station	Elevation m	MAT °C	MAP mm	GDD >10 °C	# of days >20°C	FF Period Days
Penticton A	345	9.5	346	1234	129	160
Summerland CDA	445	8.9	326	1190	112	m
Osoyoos West	297	10.4	323	1448	142	172

MAT = mean annual temperature, MAP = mean annual precipitation, GDD>10°C = growing degree days over 10°C, FF Period = Frost-free period, m=missing record.

The data in the table are averages over a period of 30 years prior to 2010 and illustrate relative differences in climate in the south Okanagan Valley. Recent years have trended warmer than the historic averages, so these long-term values do not reflect the temperature conditions over the last two or three years. For example, between 2011 and 2016 the GDD totals at Summerland averaged 1370, almost 200 GDDs greater than the 30-year average reported on Table 1. The most recent average frost-free period at Summerland is now up to 196 days.

Nonetheless, these stations highlight several climate trends. Elevation, even slight changes in elevation, greatly affect the temperature regime of a site. GDD values tend to decrease at a rate of about 100 GDD for each 100 m elevation gain (PCIC 2014). As the proposed sub-GI extends up to 700 m in elevation, at this elevation the growing degree days are estimated to be on average about 300 less than at the lowest edge of the bench which averages about 400 m in elevation. In a typical year, this would mean a drop in GGD total from approximately 1400 near the bench edge to 1100 GDD at the upper elevation boundary of the sub-GI boundary. In a similar way, the growing season length as defined by the number of frost-free days in the year decreases from approximately 195 at lowest elevation to 160 at the highest elevations in the sub-GI. While these changes may be stated as general elevational trends, actual conditions at any given site will be affected by local slope, aspect and landscape position.

Expressed in general terms, currently low elevation sites, i.e. at the bench edge, in the sub-GI area experience a mean annual temperature of approximately 9.5 °C, accumulate around 1400 growing degree days >10°C, and have a growing season of around 195 days, all values well suited to production of many *Vitis vinifera* cultivars. An important climatic consideration is the temperature moderating influence of Okanagan Lake which results in longer frost-free periods on the Naramata Bench than in production regions to the south such as near Oliver and Osoyoos.

Research monitoring within vineyards has revealed that spatially, a wide range of temperatures can exist through the day 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 Naramata Bench vineyard sites results in excellent air drainage that is assisted by the dissecting gullies and undulating topography that provide pathways through which cold air drains to the valley floor. This drainage strongly influences GDD 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 ample growing-season heat and long frost-free period, coupled with the range climatic conditions among sites within the sub-GI allows for successful production of *Vitis vinifera* cultivars. In 2017, the percentage of total acreage for the top 12 cultivars grown are listed in Table 4.

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

Cultivar	**% of total vineyard area**
Merlot	23
Pinot gris	17
Chardonnay	13
Pinot noir	9
Riesling	5
Cabernet Franc	4
Gewurztraminer	4
Viognier	4
Pinot blanc	3
Sauvignon blanc	3
Syrah	2
Cabernet Sauvignon	2

Careful selection of cultivars suited to vineyard site conditions has enabled production of optimally mature fruit for producing high quality wines. The warmest sites are suitable for producing many long-season red cultivars. The western aspect of most sites provides an additional ability to accelerate fruit maturation of these red cultivars, as fruit clusters have extended exposure to afternoon sunlight. Cooler sites are well suited to production of shorter season reds and many white cultivars. In late summer and fall, cooler 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 conditions are also optimal for extending fruit hang time to further enhance flavour and tannin ripening and improve the body and finish of red wines.

The fine-textured silt loam soils in the glaciolacustrine landscape have a relatively high water holding capacity, but careful control of deficit irrigation can be used to restrain vine vigour and achieve optimum canopy density for producing high quality fruit. Floor vegetation maintenance on these soils requires little or no between-row irrigation. The lower water holding capacity of the coarse textured soils developed in the gravelly mixed sediments require more frequent irrigation. These soils naturally reduce vine vigour, enabling growers to easily manipulate vine growth and canopy function through irrigation management. Maintenance of floor vegetation on these soils may require between-row irrigation.

REFERENCES

Beckwith, R., D. Teibel, and P. Bowen. 2004. Report from the field: Results from an agricultural wireless sensor network. Proc. IEEE International Conference on Local Computer Networks, Tampa, FL.

Environment and Climate Change Canada. 2017. Canadian Climate normals. http://climate.weather.gc.ca/climate_normals/index_e.html Accessed October 15, 2017

Nasmith H. 1962. Late Glacial History and Surficial Deposits of the Okanagan Valley, British Columbia. British Columbia Department of Mines and Petroleum Resources, Victoria, BC. 46 pp. plus plates and maps.

Pacific Climate Impacts Consortium (PCIC) and PRISM Climate Group 2014. *High Resolution Climatology*. Downloaded from https://www.pacificclimate.org/data/high-resolution-prism-climatology.

Roed, M.A. and R. J. Fulton (eds). 2011. Okanagan Geology South. Okanagan Geology Committee, Kelowna BC. 238pp

Wittneben U. 1986. Soils of the Okanagan and Similkameen Valleys, MOE Technical Report 18. BC Ministry of Environment. Victoria, BC. 229pp. plus maps