

CLIMATE, WATER & GLACIERS

Questions and Answers

CLIMATE CHANGE

- Climate Change is real, even though we don't know how severe it will be. It is a compelling reason to build Jumbo Glacier Resort (JGR). If the worst predictions regarding climate change are true, many existing low-elevation ski resorts in B.C. will not be able to operate, including Panorama. **Because of its high elevations, JGR will continue to receive natural snow and operate.**
 - *Question:* the resort planners say that ski resorts need to be located at higher elevations because of global warming. Do you believe that over the next fifty to a hundred years we will get to the point where it won't snow at the 3,000-metre mark in the Purcells?
 - *Answer:* No, the UN's Intergovernmental Panel on Climate Change (IPCC) estimates that "temperatures will rise by between 1.4 degrees C and 5.8 degrees C by 2100 unless action is taken to significantly reduce emissions."¹ Even in the worst-case scenario, the Purcells will continue to receive snow at higher elevations. Dr. Ralf Bürki notes that as a result of climate change the reliable snow line may rise to 1,500 metres (year 2030 – 2050), and possibly up to 1,800 meters after that². JGR's base elevation is 1,700 m and its top is 3,400 m – well above the reliable snow line.
- JGR is a compact, pedestrian-oriented resort incorporating comprehensive environmental management plans and a "green" design. It will be smaller than Panorama, and significantly smaller than Whistler or Banff. JGR is the **only tourism project in the Kootenays to have received certification** under B.C.'s comprehensive Environmental Assessment Act.
 - *Question:* Tourism is an important contributor to the Columbia Valley's economy. In your opinion, are centrally planned resorts that utilize strict environmental management plans, conservation-oriented design, and that discourage the use of motor vehicles the way to go in the future?
 - *Answer:* Yes, all new destination resorts should be held to the same high sustainability standards as JGR. JGR is the only resort in the Kootenays to have received certification under B.C.'s comprehensive Environmental Assessment Act.

¹ <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=363&ArticleID=4313&l=en>

² Rolf Bürki, Hans Elsasser, Bruno Abegg; Climate Change and Winter Sports: Environmental and Economic Threats presented at the 5th World Conference on Sport and Environment, Turin 2-3 December 2003 (IOC/UNEP)

- In B.C., the consensus is that **climate change will result in increased precipitation**. It is estimated that precipitation will increase by 10 to 20 percent by 2090.³ Precipitation has already increased over the past 70 years – including in the Columbia Valley. It has increased by 3 percent per decade in the Southern Interior and 4 percent per decade in the Kootenays.⁴ At lower elevations, B.C. will see more rain as the climate changes. At higher elevations, especially in the interior, B.C. will see more snow. Warmer air can hold more water vapour and pick up moisture faster from the ocean. “In B.C., prevailing winds carry moisture inland from the Pacific Ocean. As the air rises over coastal mountains, it cools, releasing moisture.”⁵ It is therefore likely that the coastal ranges will see more rainfall, while the interior ranges such as the Purcells will see significantly more snowfall.
 - *Question:* If B.C. is expected to get more precipitation, why is Alberta expected to be drier?
 - *Answer:* Alberta is subject to different weather patterns than most of B.C. It is already much drier and sunnier than B.C. and has experienced severe drought. Precipitation in Alberta is not expected to be sufficient to compensate for increased evaporation and smaller snowpacks due to climate change. The Rocky Mountains are a formidable barrier to Pacific weather systems. Lake Louise, for example, sees much less snow than Kicking Horse or Whitewater. Alberta’s major rivers drain from the “dry” side of the Rockies and are more vulnerable.
- “Low-elevation ski resorts may experience a shorter ski season or no snow at all, due to warmer winter temperatures,”⁶ but “where winter precipitation falls as snow – in the interior of B.C, for example – an increase in precipitation may help local economies based on skiing and other winter recreation activities.”⁷

WATER

- Water Source – the resort will get all its water from ground wells. **No surface water of any kind will be utilized** and all riparian areas will be protected by minimum 30 metre setbacks.
 - *Question:* The resort’s Master Plan says that all of its water will come from drilled wells. I know that a lot of other resorts and communities get their water from surface sources. Is getting water from the ground a better option and if so, why?

³ BC Ministry of Water, Land and Air Protection, Indicators of Climate Change for British Columbia 2002; page 16.

⁴ Ibid, page 14 and Bill Green, Canadian Columbia River Inter-Tribal Fisheries Commission, in “A forecasting fool’s game”, presented at the *Columbia Mountains Institute - Climate Change in the Columbia Basin* conference (<http://www.cmiae.org/climatechange2003/summaryTOC.htm>)

⁵ BC Ministry of Water, Land and Air Protection, *ibid*, page 16.

⁶ BC Ministry of Water, Land and Air Protection, Weather, Climate and The Future: B.C.’s Plan; (December, 2004) page 7

⁷ BC Ministry of Water, Land and Air Protection, Indicators of Climate Change for British Columbia 2002; page 15

- *Answer:* Yes, groundwater is plentiful and is quickly recharged in mountainous areas that see major precipitation such as the upper Jumbo Valley.⁸ The upper Jumbo Valley is expected to see increased precipitation in the coming century. Retrieving water from the ground greatly reduces impacts on wildlife that are dependent on surface water. The resort will also utilize a tertiary treatment plant that will return potable, treated water to the ground thereby providing an equilibrium to what is taken out of the ground.
- Snowmaking – JGR is one of the very few resorts in BC (planned or existing) that will **not require any snowmaking** – this results in huge savings in the amount of water the resort will require. Many snowmaking systems can pump a million litres of water/hour. Panorama’s system can pump 10,600 litres/minute or 638,000 litres/hour. The fact that JGR receives plentiful natural snow means that **no salt or fertilizers will be used** to “firm” up a scant snow base.
 - *Question:* since ski resorts that are located at lower elevations use millions of litres of water for snowmaking on a daily basis, do you see merit in planning ski resorts at higher elevations, in areas that don’t require snowmaking?
 - *Answer:* **Yes, it is logical to plan ski resorts in locations where there is snow – now and for the foreseeable future.**
 - *Question:* Since the reality of global warming is upon us, do you think that skiing and ski resorts in general should be allowed to die, period?
 - *Answer:* No. Ski resorts are important to the livelihood and recreation of millions of people around the world, including people in Invermere. Skiing forms the basis for tourism in mountain areas and constitutes an essential factor in the economic survival of the people who live there. In effect, tourism provides the basis for social security and economic wealth in many mountainous regions and plays a role in reducing migration towards cities. With proper planning and proper placement of resorts such as JGR, there is no reason for skiing to disappear.
- Water Conservation – the resort is the **only tourism project in the Kootenays with a comprehensive Water Conservation Plan** that will significantly reduce its water usage and needs.
 - *Question:* JGR is the only project in the Kootenays with a comprehensive Water Conservation Plan. Why is this important?
 - *Answer:* Water conservation is an important goal – Canadians are amongst the greatest consumers of water in the world. JGR’s water conservation plan is intended to rectify this and is one of the most comprehensive in Canada. It will greatly reduce water consumption at the resort. This is an important benefit that will also have a small, but positive impact on overall water usage. Since the resort will not “create” new people, but will simply host visitors from what are likely to be much less conservation-oriented jurisdictions, the resort will help contribute to a net reduction of the overall usage of water.

⁸ Project engineers will calculate recharge rates for each well(Golder Associates).

- Invermere's Water Supply: Invermere's water supply system has been described as being "antiquated." This has nothing to do with the amount of meltwater or runoff coming off the nearby mountains. According to Mayor Shmigelsky, Invermere's water reservoir was full this summer⁹. The town, however, has seen significant growth in the past decade with no improvements to its water supply infrastructure. The recently approved Castle Rock subdivision in Invermere will be **almost exactly as large** (5,100 bed units¹⁰ vs. 5,500 bed units) as Jumbo Glacier Resort at buildout. Castle Rock's water supply will be from the District of Invermere while JGR will supply its own water. JGR will not affect Invermere's water or wastewater issues.
- Invermere will reportedly receive about \$1.4 million funding from the Canada-BC Infrastructure Program for groundwater well development, construction of a 500,000 imperial gallon water reservoir, installation of about 1,000 metres transmission mains and a booster pump station.¹¹ **JGR will not require tax dollars for its water supply or any other part of its infrastructure.** The resort will provide its own water and will not impact Invermere's water supply.
 - *Question:* Invermere's water supply is at risk in the future and water shortages have already been experienced. The new Castle Rock subdivision will be almost the same size as JGR at buildout. Invermere is planning to drill new wells and build a new reservoir. JGR's water will come from its own wells – it is a planned and contained ski resort that will provide its own water along with strict water conservation measures, isn't this a better planning solution than continued sprawl in the valley?
 - *Answer:* Yes, well-planned "nodes" of development such as JGR that are held to high environmental standards are the preferred planning solution. The regional district's land use plan specifically recommends against continued sprawl.

WASTEWATER

- The resort will use a **tertiary treatment plant** to treat sewer and will return treated water to the ground in areas (identified by engineers and scientists) where groundwater or surface water contamination will be impossible. Tertiary treatment plants are the most advanced sewer treatment systems available and the treated water that they output is potable.
 - *Question:* JGR is the only tourism project in the Kootenays that will use a tertiary treatment plant with return to ground. What are your thoughts on this kind of system – is it better than other systems such as those in Invermere or Radium?

⁹ http://www.watertiger.net/articles/water_shortage.htm

¹⁰ Based on projected 550 single family homes (3,300 bed-units) and 450 townhomes/condos (1,800 bed-units).

¹¹ Blair Ells, *Water Use Efficiency and Conservation in the Kootenay Region of the Canadian Columbia River Basin*; *Canadian Columbia River Intertribal Fisheries Commission*; (2005); page 45 – (http://www.ires.ubc.ca/projects/cbt/links/CCRIFC_wateruse.pdf) see also: http://www.infrastructure.gc.ca/icp/publication/new_release/bc/2003/20030522vancouver_e.shtml

- *Answer:* Yes, tertiary treatment is the most advanced form of wastewater treatment available today. According to the BC Ministry of Water, Land and Air Protection, “Preliminary treatment removes solid material using screens. Primary treatment removes material through settling chambers. After primary, secondary treatment removes suspended material and organic matter, while tertiary goes beyond this to remove target substances such as nutrients.” The majority of wastewater treatment systems in B.C. are primary or secondary.¹² In fact, in a letter to the *Invermere Valley Echo* newspaper, Martin Cullen, Area “F” Director made reference to “Invermere's sewage lagoons that flood into Lake Windermere and the Columbia River with untreated raw sewage every spring when Toby Creek overflows.”¹³

GLACIERS

- Glaciers are formed in locations where heavy snowfalls occur and where the snow never melts. Snowfalls accumulate year-over-year for centuries, to the point where they become compacted into ice.

The upper part of a glacier that receives most of the snowfall is called the *accumulation zone*. As a rule of thumb, the accumulation zone accounts for 60-70% of the glacier's surface area. The depth of ice in the accumulation zone exerts a downward force sufficient to cause deep erosion of the rock in this area.

On the lower end -- the foot of the glacier, is the *ablation zone*, where more ice is lost through melting than gained from snowfall and sediment is deposited.

The "health" of a glacier is defined by the area of the accumulation zone compared to the ablation zone. Healthy glaciers have large accumulation zones. In summer, skiers ski on the snow that is on top of the accumulation zone of a glacier, not the ablation zone.

Jumbo Glacier, for example, is almost entirely an “accumulation zone”. It has almost no ablation zone because it flows (calves) over a huge cliff into the Lake of the Hanging Glacier. Jumbo is the “hanging glacier”.

A major reduction in size, or **the complete disappearance of the collection area of major high-elevation glaciers in B.C. would entail a cataclysm that is currently not foreseeable and is not forecasted by scientists**, including Dr. Michael Maxwell, the glaciologist who has reviewed JGR's glaciers. Such a cataclysm would likely render every other existing ski resort inoperable.

- **Not all glaciers behave the same way.** Worldwide, while the majority of glaciers are retracting, around 30% of them are advancing. Glaciers have been advancing recently in Norway, New Zealand and South America. This is often attributed to increased precipitation in specific microclimates. For example, the biggest glacier of South America, Chile's Pio XI glacier, has been growing at an unprecedented rate. Only 50 kms away, however, some glaciers are shrinking.

¹² BC Ministry of Water, Land and Air Protection, Environmental Trends in British Columbia 2002; page 38

¹³ Letter to the Editor, *Invermere Valley Echo*, August 03, 2005

- In New Zealand, the famous Franz Josef glacier has been **advancing rapidly** since 1984. The glacier is 12 km long and stretches down to a mere 200 meters above sea level. Its expansion is due to increasing precipitation falling as snow at higher elevations. Climate change is expected to result in increased precipitation on Jumbo Glacier as well.
- **The glaciers at JGR are high.** They stretch from a height of 3,400 metres (top of Jumbo) to a low of 2,450 metres (bottom of Farnham). By comparison, Athabasca Glacier, the (well-studied glacier in the Columbia Icefields) stretches from a height of 2,800 metres to a low of 1,900 metres. Jumbo Glacier itself stretches from 3,400 metres to 2,700 metres. **Almost all of Jumbo Glacier is higher than Athabasca Glacier.**
- The toe of Athabasca Glacier is receding relatively rapidly; Jumbo Glacier is not.
- “In BC, whether glaciers advance, remain stable, or retreat will depend on their geographic location and elevation. Most glaciers in southern BC are likely to continue to retreat. **Glaciers with a high proportion of their surface area at high elevations are likely to remain stable.** In northwestern BC, increases in precipitation associated with climate change may offset higher temperatures and contribute to the ongoing advance of glaciers.”¹⁴
 - *Question:* According to the BC Ministry of WLAP, “In BC, whether glaciers advance, remain stable, or retreat will depend on their geographic location and elevation... Glaciers with a high proportion of their surface area at high elevations are likely to remain stable.” Do you agree that higher elevation glaciers are more likely to remain stable?
- Chemicals on the glacier: **No chemicals or fertilizers will be used by the resort** – fertilizers are sometimes used in skiing to “firm up” ski runs, especially at lower elevations. At JGR, fertilizers will not be necessary, nor desired.
- **Skiers ski on snow that is on top of a glacier. They don’t ski on glacier ice.** No part of the resort will be “built” on a glacier. T-bars will “float” on the snow that is on top of the glacier. They never touch the glacier.
 - *Question:* Considering that skiers don’t actually ski on glaciers, but on metres of snow that is on the top of a glacier, what do you think the impact of a skier is on a huge glacier?
 - *Answer:* Negligible. The impact of a skier skiing on snow on top of a glacier is like that of a swimmer in the ocean.
- There are an estimated **100,000 glaciers in Canada.** Only one of them (a very small one) is lift-accessible for skiing (Blackcomb Glacier).
 - *Question:* Seeing as there are an estimated 100,000 glaciers in Canada, doesn’t it seem reasonable to provide lift access for the general public to ONE

¹⁴ BC Ministry of Water, Land and Air Protection, Indicators of Climate Change for British Columbia 2002; page 21

high elevation glacier? In other parts of the world, high elevation glaciers are readily accessible to the public via ski lifts, gondolas and trains.

- Glaciers hold “most of the world’s fresh water”, however 90% of the world’s glacier mass is locked up in the world’s ice caps and is not where we get our fresh water from. We do not get most of our freshwater from glacier melt. We get it from snowmelt and rainwater that feeds our rivers, lakes and aquifers.
- Even if Jumbo’s glaciers were to completely disappear, the moraines that the glaciers leave behind are perfect for skiing when it snows in winter.
 - *Question:* What will happen if the JGR’s glaciers completely disappear?
 - *Answer:* First of all, the consensus is that high elevation mid-latitude glaciers such as Jumbo and Commander will not disappear. In fact, due to increased precipitation, they might even grow. If they do disappear, it would mean that climate change is severe and will be a disaster for everyone. JGR, however, will still be skiable as it will continue to receive snow in winter. It will likely be one of the last places in B.C. to continue to offer skiing. In addition, the moraines that the glaciers leave behind create perfect natural ski runs.

MELTWATER

- Glacier Dome, Jumbo Glacier, Commander Glacier and Farnham Glacier (JGR’s glaciers) all drain into the Horsethief Creek drainage. NONE of the project’s glaciers actually drain into the Jumbo/Toby Creek drainages.
- Jumbo Creek is primarily fed by snowmelt. The resort will not affect snowfall or snowmelt in any way. No water will be taken, and none will be added by the resort.
- Glacier meltwater (melting ice) is only a very small percentage of water that comes from our glaciers and feeds our major rivers. Most of the meltwater comes from snow.

Background Facts

- The resort will average a maximum of 2,000 to 3,000 visitors at one time during high season. This is about the same as Panorama. It is much smaller than Banff or Whistler. Whistler, for example can see 20,000 – 30,000 visitors during peak periods.
- A “bed-unit” is a measurement of development size. It is not a person count. JGR will have 5,500 tourist bed-units at buildout. Panorama will have 7,000 bed-units at buildout, Sun Peaks will have 26,000 and Whistler has 52,000. Castle Rock estates in Invermere will have approximately 5,100 bed-units.
- The access road is a dead end road that will see roughly 900 vehicles per day during peak periods at buildout. It is one of the easiest mountain access roads in Canada. It will not connect to the West Kootenays.