

# Working to Clear the Air in BC



**British Columbia Visibility Coordinating Committee**

**2013 – 2015 Report**

**July 2015**

*"The ability to clearly see our natural environment is an important part of the Canadian experience, thus the BC Visibility Coordinating Committee (BCVCC) is committed to achieving clean air and pristine visibility for the health and enjoyment of present and future generations."*

## Summary

### Visual Air Quality in the Lower Fraser Valley

Clear views of the scenic vistas in and around Metro Vancouver and the Lower Fraser Valley (LFV) are highly prized by residents and visitors alike. However as the levels of air pollutants increase, the views of these vistas can become degraded or even obscured. This effect is known as visual air quality impairment.

Projects to protect and improve visual air quality<sup>1</sup> in the LFV have been explored since the early 1990s. Under the 1991 Canada/US Air Quality Agreement commitments were made to prevent significant deterioration of air quality and protect visibility “with respect to sources that could cause significant transboundary air pollution”. In 2006 the BC Visibility Coordinating Committee (BCVCC) was established as a collaborative initiative between Metro Vancouver, BC Ministry of Environment, the Fraser Valley Regional District (FVRD), Environment Canada, Health Canada and the City of Kelowna to take action on impaired visual air quality in BC. This report describes the activities and accomplishments of the BCVCC from April 2013 to March 2015.

### Project Background

A pilot project was initiated by the BCVCC in 2010 to create a visual air quality management program in the LFV. In addition to the program in the LFV, the project will produce a visual air quality management framework that may provide a model for developing visual air quality management programs in other parts of BC and Canada.

Task-focussed interagency workgroups have been conducting different elements of the pilot project. In addition to a steering group, the three workgroups active in 2013-2015 were Science, Goal and Index, and Strategic Outreach.

### 2013-2015 Highlights

#### **Modelling**

Our scientific understanding of visual air quality in British Columbia was further strengthened by continued air quality modelling work. Model scenarios are investigating the impact of reducing pollutant emissions on visual air quality. The air emissions reductions are based on a range of existing, proposed, and potential emission reduction policies.

A statistical visual air quality model was developed and published in a peer-reviewed journal. The model predicts hourly visibility from common air quality measurements and has applications for testing visual air quality improvement scenarios and developing a visual air quality goal.

#### Visual air quality workgroups

Three workgroups were active in the Lower Fraser Valley visual air quality pilot project during 2013-2015.

- The **Science workgroup** has been studying the causes of poor visual air quality and characterizing the current state of visual air quality. The results of the science work can inform the development of policies that can help improve visual air quality.
- The **Goal and Index workgroup** is developing a visual air quality rating tool and defining a visual air quality goal.
- An engagement strategy is being devised by the **Strategic Outreach workgroup**.

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<sup>1</sup> The terms “visual air quality” and “visibility” are used interchangeably in this report. The term “visibility” is widely used internationally and in the scientific literature. The BCVCC is primarily using the term “visual air quality” as that term has been found to be more informative for stakeholders and the public.

### ***Monitoring***

Further strides were made in visual air quality monitoring capabilities in the 2013-2015 period with the installation of equipment to monitor views of the North Shore Mountains, and the installation of additional instrumentation to collect data to measure visual air quality at the Pitt Meadows station.



**In 2014 visual air quality monitoring equipment was added at Metro Vancouver’s Pitt Meadows air quality monitoring station. The new measurements in Pitt Meadows complement an existing visual air quality camera there. The camera view looks north up the valley of Pitt Lake. The above image was captured by the Pitt Meadows camera at 11:30 am, April 5<sup>th</sup>, 2015.**

### ***Index Development***

Following in-house testing of a perception-based index dubbed the Visual Air Quality Rating (VAQR), the index was publicly tested for the BCVCC by a well-known survey firm. In addition preparations were made for the public launch of the VAQR.

### ***Outreach and Engagement***

Another priority issue for the BCVCC is communicating effectively to stakeholders and the public. In 2013 a meeting was held with local government stakeholders to better understand their visual air quality information needs and to learn from public outreach successes on similar topics. In addition a series of fact sheets explaining the visual air quality issue have been developed by the BCVCC.

**The following sections describe the activities and achievements of the British Columbia Visibility Coordinating Committee (BCVCC) between April 1<sup>st</sup>, 2013 and March 31<sup>st</sup>, 2015. The goals of the BCVCC for 2015-2016 are also outlined.**

## **BCVCC Activities**

Air quality agencies and other partners are collaborating through the BCVCC to protect and improve visual air quality. During the first several years of its existence, BCVCC activity focussed on developing an understanding of current visual air quality conditions in the LFV, visual air quality management strategies in other jurisdictions, appropriate visibility monitoring technology, and effective metrics for tracking visual air quality. As a result of this foundation work, in 2010 the BCVCC adopted a visibility protection framework for BC that describes in general terms the visual air quality management actions required to achieve the vision of *“achieving clean air and pristine visibility for the health and enjoyment of present and future generations”*.

The BCVCC has been implementing a pilot project in recent years to develop a visual air quality management program for the LFV. The core activities of the BCVCC are to coordinate activity among the collaborating agencies and provide direction on visual air quality management in British Columbia. It is currently co-chaired by one representative from the BC Ministry of Environment and one from Metro Vancouver.

The full committee meets once or twice each year to discuss progress on projects, share information and determine future steps. During the period covered by this report, the BCVCC met in September 2013 and in October 2014.

Several aspects of the BCVCC's work were presented to peers at the 2013 PNWIS conference held in Victoria, BC. In addition, the work of the BCVCC was described in the 2014 Progress Report on the Canada – United States Air Quality Agreement as one component of Canada's work to protect visibility and prevent air quality deterioration.

Metro Vancouver's Integrated Air Quality and Greenhouse Gas Management Plan was adopted in 2011. The plan includes the goal of **“Improving visual air quality”**. This goal is to be achieved by reducing emissions of visibility degrading pollutants and by developing a visual air quality management program.

The Fraser Valley Regional District included visual air quality monitoring studies in its 1998 Air Quality Management Plan and is presently revisiting its AQMP which is expected to include action related to visual air quality.

## **Workgroups**

During 2013-2015, eighteen people from five agencies were actively contributing to the work of one or more of the following BCVCC groups.

### ***Steering Group***

The BCVCC steering group is comprised of management representatives from air quality agencies (Metro Vancouver, BC Ministry of Environment, the Fraser Valley Regional District, Environment Canada), representatives from each workgroup and the BCVCC co-chairs. It coordinates BCVCC activities and plans overlapping activities between workgroups as well as providing a conduit for communication between BCVCC agencies and workgroups. Steering group meetings occurred at approximately two month intervals during 2013-2015.



**A new visual air quality camera was installed in Richmond with views north across the City of Vancouver towards the Lions and Cypress Provincial Park. The Richmond camera complements existing visual air quality measurements made at Vancouver airport (YVR). The above image was captured by the Richmond camera at 10:30 am, April 5<sup>th</sup>, 2015.**

### ***Science Workgroup***

The Science workgroup is tasked with developing the project's visual air quality monitoring network, investigating the causes of episodes of degraded visual air quality, and identifying key emission sources that may need to be addressed to achieve visual air quality goals. Significant progress has been made over the course of the LFV pilot project in expanding visual air quality monitoring capacity, improving our understanding of how to measure visual air quality and determining which air contaminants contribute to degraded visual air quality. Modelling studies have focussed on understanding the effects of targeted emission reductions on visual air quality and establishing a relationship between visual air quality and health.

### **Accomplishments**

#### **Monitoring**

- All visual air quality cameras in the monitoring network were upgraded to new technology as part of an end-of-life equipment replacement process.
- A new visual air quality camera site was installed in Richmond and a new nephelometer and aethalometer were added to an existing monitoring station in Pitt Meadows. This brings the total number of monitoring sites having both camera and

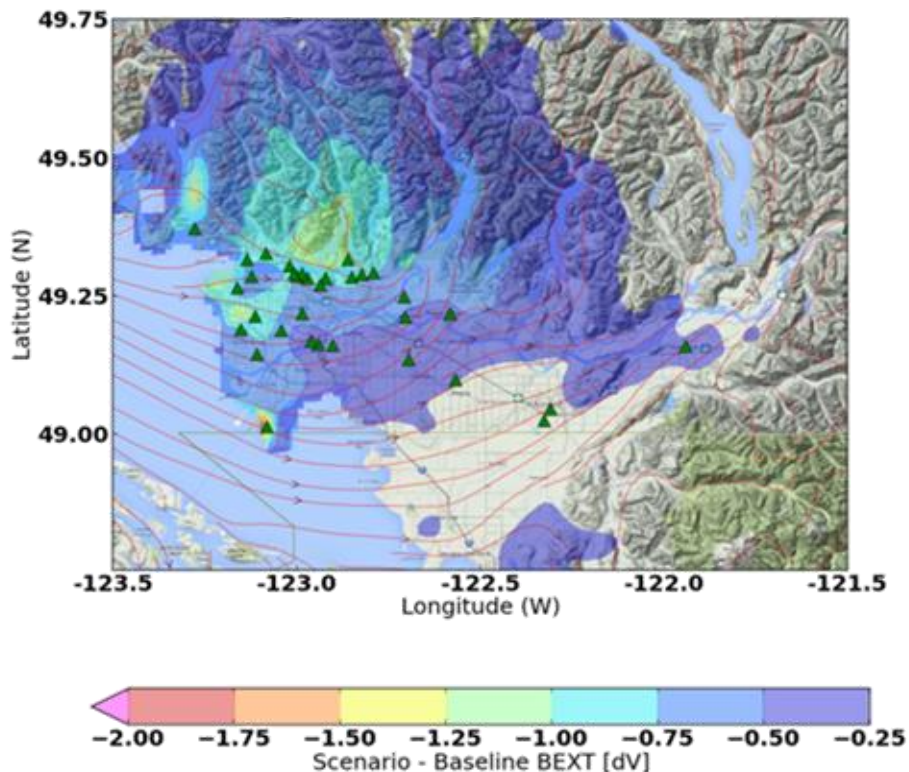
visual air quality monitoring instrumentation to five: Richmond, Burnaby, Pitt Meadows, Abbotsford and Chilliwack.

#### Data Analysis and Reporting and Publication

- A statistical visual air quality model that uses standard air quality monitoring data (fine particulate matter (PM<sub>2.5</sub>), nitrogen dioxide (NO<sub>2</sub>), relative humidity, and particulate matter (PM) speciation profiles) to provide near real-time estimates of time-resolved extinction was developed and published in the [Journal of the Air & Waste Management Association in February 2015](#). The model was applied to a number of policy-related scenarios to inform visual air quality management development in the Lower Fraser Valley.
- A characterization of visibility across the country, including sites in the LFV, using PM speciation monitoring data was completed and presented at the Canadian Chemical Conference in June 2014.

#### Photochemical Modeling

- To test the potential impacts of possible future emission changes on local visibility, a numerical modeling exercise, using Environment Canada's photochemical model (AURAMS) was undertaken. This involved a comprehensive model evaluation, whereby the model was exercised over a number of historical summertime smog events with model results being compared to observations. The model evaluation showed AURAMS was generally responsive to the large scale changes in emissions that have occurred within the region over the last 25 years, but it did have problems reproducing observed particulate nitrate concentrations. Work is being undertaken to determine the cause of this problem and to assess the impact of the particulate nitrate errors on the model's prediction of light extinction (visibility) changes. Initial analysis suggests that only the model's sensitivity of extinction to changes in nitrogen oxides (NO<sub>x</sub>) emissions will be affected by the particulate nitrate errors.



**Modelled change in average daytime (1200-1900 PST) extinction (in dV) under a 50% reduction in VOC emission scenario. Regions where the modelled relative humidity is greater than 75% have not been contoured. Also shown are the average daytime surface wind streamlines (thin red lines).**

- Notwithstanding the model uncertainties with respect to particulate nitrate, the AURAMS model was used to examine the impacts on local visibility due to LFV-wide changes in NO<sub>x</sub>, volatile organic compounds (VOC), PM<sub>2.5</sub>, and sulphur dioxide (SO<sub>2</sub>) emissions reductions. Visibility impacts were also modelled due to large scale emissions reductions in several key sectors including: on-road vehicles, marine vessels, agriculture and industrial point sources. All model impacts were calculated over four different meteorological conditions typical of LFV summertime weather. Visibility impacts due to trans-boundary (e.g. Canada/US) transport were also investigated.

### **Goal and Index Workgroup**

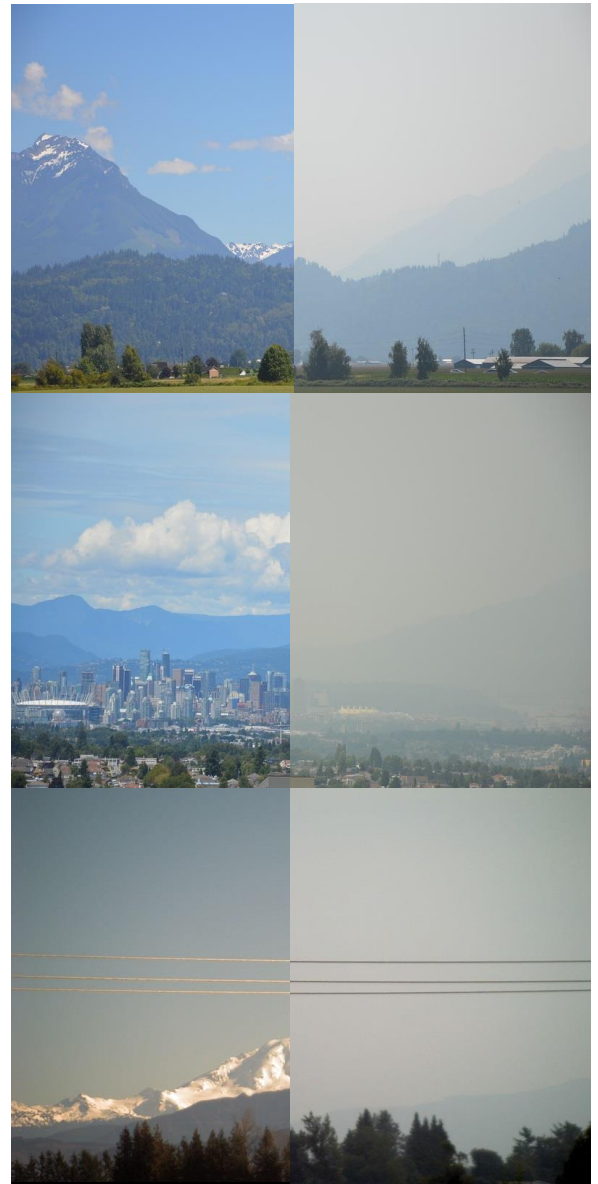
The Goal and Index workgroup is tasked with developing and piloting a perception-based visual air quality index that may serve as a metric for a future visual air quality goal. In addition, the group is charged with making recommendations to the BCVCC with respect to developing a visual air quality goal for the LFV.

### Accomplishments

- Following the development and preliminary testing of the VAQR, Environics Inc., a well-known Canadian polling and survey firm, was contracted to test the VAQR with the public in 2013. Residents of Metro Vancouver and the FVRD were surveyed for this test.
- Results from the VAQR test were analyzed by the BCVCC resulting in a proposal for minor changes to the VAQR, upgrades to the camera at the Burnaby station, and the suggestion to undertake further testing prior to the public launch of the VAQR
- Preparations for public launch of the VAQR.

### **The VAQR Test – What We Found**

The 2013 VAQR test compared the public’s perception of visual air quality with the ratings of the VAQR calculated from air quality measurements. The survey found that overall the public was slightly more negative in their ratings of visual air quality than the VAQR. This bias was quite small at Chilliwack, but larger at Burnaby. Additional information from the survey indicated that a large majority of residents found the VAQR easy to understand and supported making it publically available.



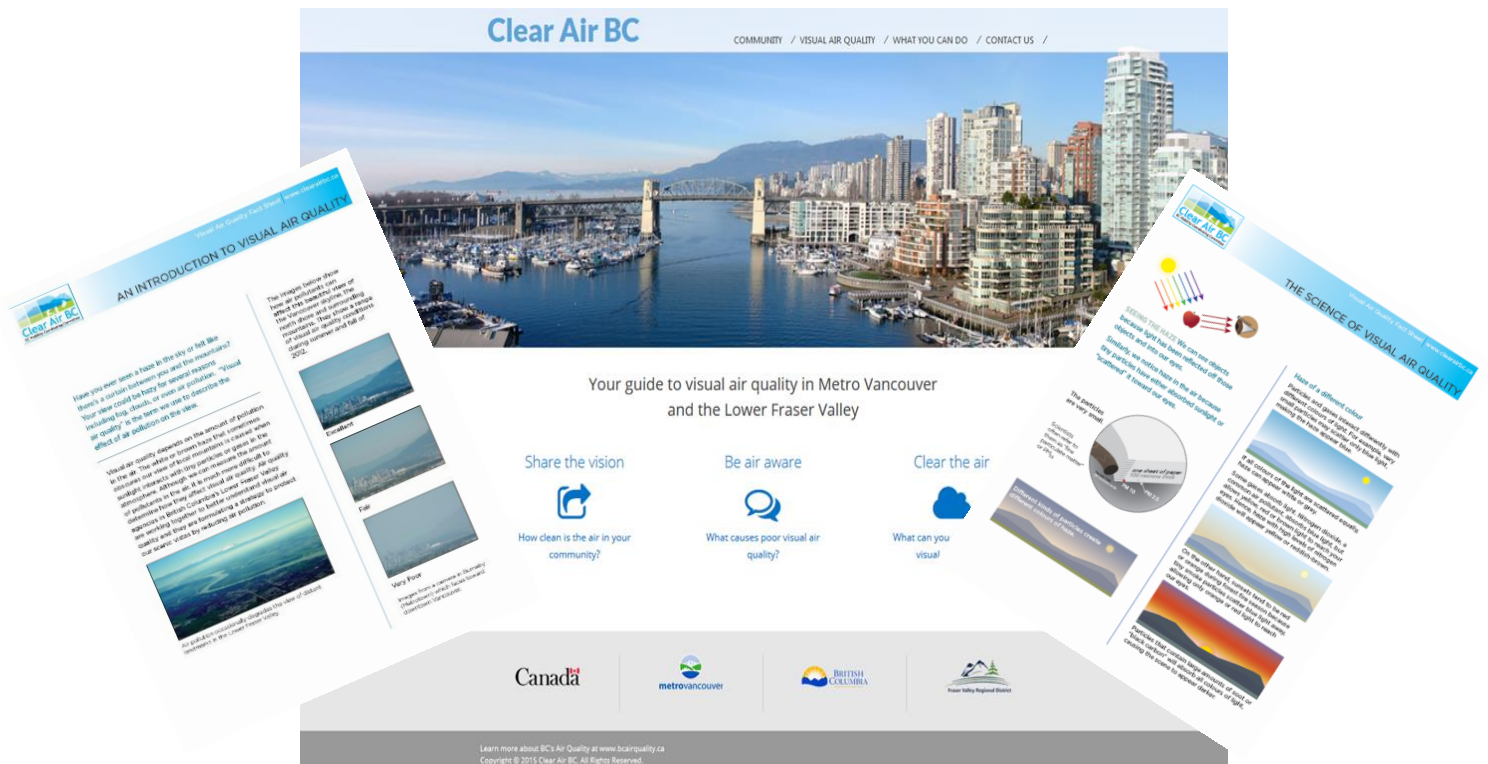
**Images from the visibility cameras in the Lower Fraser Valley showing a range of visual air quality conditions observed during 2015**

## Strategic Outreach Workgroup

The Strategic Outreach workgroup was created in 2011 to identify and establish engagement mechanisms to reach potential partners and stakeholder groups, to determine the appropriate timing of visual air quality outreach and communication activities, and to develop proactive communication strategies specific to different groups of stakeholders and the public.

### Accomplishments

- A stakeholder workshop was held at the end of 2013 targeting representatives from local governments in the Lower Fraser Valley and surrounding regions.
- The BCVCC website was recoded, incorporating responsive design to enhance the viewing experience and usability of the site for mobile device users.
- The creation of a web interface to publicly show the VAQR in near real-time was completed.
- Fact sheets providing background information about visual air quality were finalized.
- An introduction to the VAQR was included in Metro Vancouver's plain language Caring for the Air report.
- The use of social media public engagement tools was explored.
- In conjunction with the Goal and Index workgroup, supporting information materials were prepared for the launch of the VAQR.
- Health and economic benefits analysis was completed and public summary report was prepared.





## **BCVCC Targets for Fiscal Year 2015-2016**

In 2015-2016 the BCVCC will continue advancing the pilot visual air quality management program for the LFV. A major target in 2015-2016 is the public launch of the VAQR on the ClearAirBC.ca website. The BCVCC will also enhance communication to the public and stakeholders by making more of the committee output such as studies, documentation and presentations available. These materials will be available through the ClearAirBC.ca website, at science meetings and conferences, and in the peer-reviewed literature.

Specific targets for the workgroups are:

### Science

- Continue to support reliable near real-time data reporting for display of the VAQR.
- Continue to analyse photochemical modelling output, specifically to assess the impact of the particulate nitrate errors on the model's prediction of light extinction (visibility) changes.
- Develop a visibility forecasting tool using Environment Canada's air quality forecasting model combined with statistical post-processing.

### Goal and Index

- Launch the VAQR on the ClearAirBC website.
- Complete and make available technical documentation of the VAQR derivation.
- Provide options to the BCVCC on a visibility goal.

### Strategic Outreach

- Support VAQR launch.
- Host a stakeholder workshop.
- Initiate public outreach projects through regional parks.
- Create communication products, e.g. scan on visual air quality for Environmental Assessment Office.
- Integrate fact sheet information into the ClearAirBC.ca website.

Goals for the whole BCVCC are to:

- Meet in the fall of 2015 to share progress on the pilot project and assess feasibility and needs for transition from pilot to program;
- Begin identifying key emissions sources that contribute to visual air quality impairment; and to
- Keep respective agencies informed of developments on the visibility file.



A view recorded by the Chilliwack visibility camera on November 10<sup>th</sup>, 2014. The camera is located at the Chilliwack ambient air quality monitoring station, situated at Chilliwack airport. The camera looks southeast across the Trans-Canada Highway into the Cascade Mountains and the valley of Tamihi Creek, a tributary of the Chilliwack River. The prominent peak on the left is Mt. McGuire (2008 m), located 18 km from the camera. Just visible near the centre of the skyline is the peak of Mt. Shuksan (2783 m), located 44 kilometres away in Washington State. This view combining farms, forested hills and snow-capped mountains exemplifies the scenery of the Lower Fraser Valley.

The Visual Air Quality Rating (VAQR) at the time the picture was taken was rated excellent based on measurements taken at the same location as the camera. Visual air quality measurements have been taken at Chilliwack since 2009. This is the longest continuous series of such measurements in the Lower Fraser Valley and will be helpful to establish trends in visual air quality.

