Fraser Valley Regional District

Air Quality Planning for the Fraser Valley: a Discussion Paper

Fraser Valley Regional District
Air Quality Management Plan 2021-2030 (draft)

Sept 9, 2020

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INTRODUCTION

"Air pollution causes 1 in 9 deaths. It is the most important environmental health risk of our time"

UN Environment Program

Clean air is something we often take for granted. Poor air quality affects our health, our economy, and our recreational and aesthetic enjoyment of the outdoors. In the Lower Fraser Valley, episodes of poor air quality are still frequent. Multiple health advisories are issued each year and our scenic mountains and beautiful landscapes are often hidden from view due to pollution and haze. While there has been improvements in some air pollutant levels observed over the last few decades, more is needed to be done to ensure this progress continues, especially given the population and economic growth anticipated within the region, and to better address other pollutant levels that appear to be on the rise.

The Fraser Valley Regional District (FVRD) produced its first Air Quality Management Plan (AQMP) in 1998. Since then, new comprehensive air quality data have become available, as has new research on air pollution effects, suggesting time for a revised plan. A draft of this new plan is presented here, in the form of a discussion paper, to seek feedback on air quality issues within the Lower Fraser Valley Airshed and on the proposed directions needed by the FVRD or its multitude of partners to address concerns and enhance our collective understanding of air quality in this region.

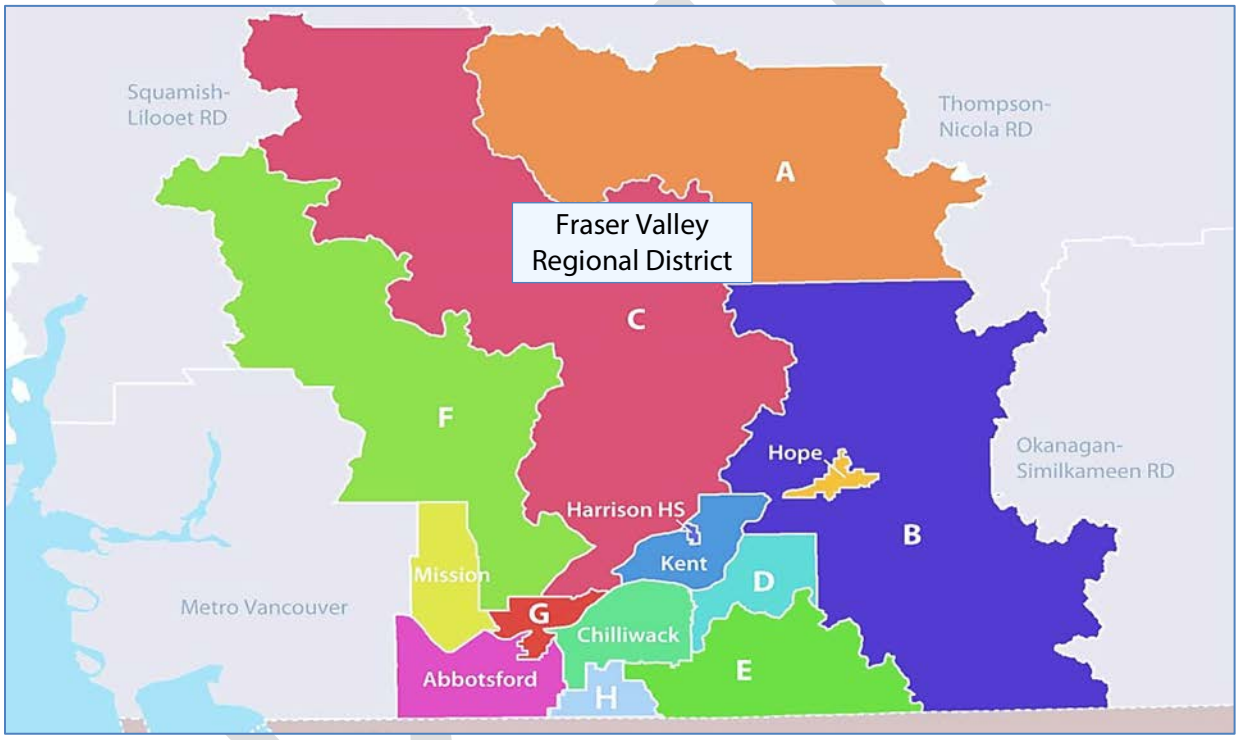
This revised draft AQMP defines key goals and serves as a guiding document to inform, prioritize, and target air quality actions undertaken by the FVRD throughout the next decade. The Fraser Valley Regional District remains committed to protecting air quality within our airshed through monitoring and analysis of air quality data, through research and policy development, and through outreach and public education. By following the roadmap described within this AQMP, the FVRD will do our part to ensure this essential resource remains healthy and clean so that our vibrant vistas will continue to be enjoyed by current and future generations of those who live, work, or play in this beautiful region.

Successful stewardship of our airshed can only be achieved by working collaboratively, for air quality concerns affect us all. Your opinion, knowledge, and experiences matter and we want to hear from you. Please submit feedback to environment@fvrd.ca by November 15th, 2020.

What is the Fraser Valley Regional District?

The Fraser Valley Regional District (FVRD) is a federation of six municipalities (Abbotsford, Chilliwack, Harrison, Hope, Kent, and Mission) and eight Electoral Areas (A through H). It is located in southwest British Columbia between Thompson-Nicola and Okanagan-Similkameen Regional Districts to the east, Squamish-Lillooet Regional District and Metro Vancouver to the west, and the US border to the south.

The region has a population of approximately 280,000 residents, making it the third most populous regional district in BC. The FVRD is governed by a 23 member board made up of appointed local municipal mayors, councillors, and electoral area directors and they provide over 100 separate services to residents within the region, including sewer and water, fire protection, street lighting, solid waste management, regional parks, emergency services, animal control, community planning, and air quality.

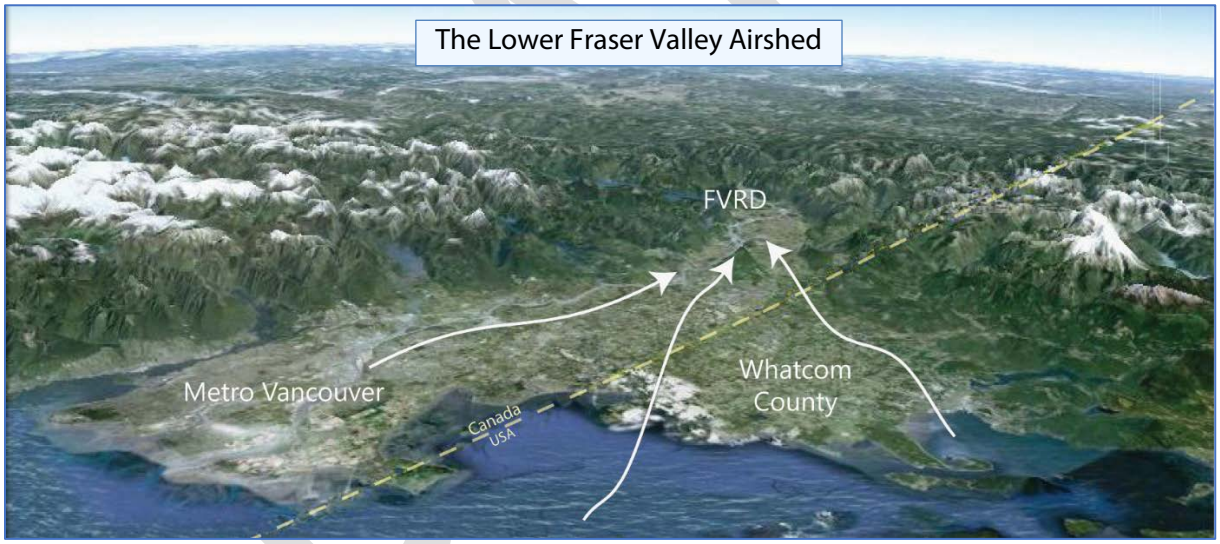


What is the Lower Fraser Valley Airshed?

The FVRD comprises the eastern portion of the Lower Fraser Valley (LFV) airshed. This airshed is situated between the Cascades and the Coast Mountains, in western North America where it overlaps both the southwestern portion of British Columbia and the northwestern portion of Washington State. It is shared by three regions: the Fraser Valley Regional District, Metro Vancouver, and Whatcom County.

The LFV is shaped like a funnel, with the wide end opening up from the Pacific Ocean and narrowing as it continues eastward, bound by mountains that confine and channel the air. Prevailing winds push air pollutants towards the eastern, narrower portion of the airshed. The result is often an accumulation of pollutants from densely populated and industrialized areas of Metro Vancouver and Whatcom County in Washington State, combining with pollutants emitted locally, creating air quality health and visibility concerns concentrated within the FVRD. The airshed is considered 'sensitive' due to its abilities to contain and concentrate air pollutants, resulting in increased health risks for its residents.

The FVRD boundaries extend beyond the Lower Fraser Valley airshed, including up into the Fraser Canyon. While focus is most often placed on the LFV airshed, the breadth and application of efforts to improve air quality described within the AQMP must extend throughout the entire regional district.



WHY IS AIR QUALITY IMPORTANT?

"You know it as Mt. Cheam but our name for it is Lhilheqey… she was supposed to be watching over the river and watching over the people and watching over the salmon and yet she's way up there and all the smog that's impairing her vision to watch over people"

Sonny McHalsie, Stó:lō Nation[i]

Poor air quality affects public health, economic development, agricultural production, local ecosystems, and our overall quality of life. As such, air quality is recognized as one of the most important environmental issues in the FVRD.

Health

Poor air quality can cause adverse health effects on all ages, from pre-birth development deficiencies to premature mortality. Air pollution represents a measurable health risk commonly characterized by the large scale population exposure and strong impacts on vulnerable groups, including children, seniors, and people with pre-existing conditions[ii]. Air quality is ubiquitously recognized by the public health professionals as one of the major modifiable risk factors in disease prevention and management. In the Fraser Valley, long-term exposure to traffic-related air contaminants has been linked to the adverse cardiovascular outcomes in nearby residents[iii]. Regional episodes of poor air quality often see increases in hospital admissions and dispensation of asthma medications, with asthma and COPD rates in the FVRD municipalities reported above BC average (Appendix A). Studies also reveal close association between toxic air pollutants and a greater risk of cancer, with the recent focus on diesel soot from engine exhaust as a primary driver for lung cancer in the region. Air toxins may also contribute to leukemia and other types of cancers.

Ground-level ozone (O_3) and fine particulate mater ($PM_{2.5}$) are the most harmful air contaminants in the LFV, contributing to a broad range of illnesses. Regulatory standards and objectives for these contaminants do not imply that 'safe levels' are found below these thresholds, but in fact these contaminants are considered harmful at any level of exposure. Ozone is a powerful oxidant that can cause inflammation to lung tissue and permanent damage or loss of lung function after repeated long-term exposure. $PM_{2.5}$ penetrates deep into the respiratory tract causing irritation and inflammation to the tissues. Due to their small sizes, fine particulates are falsely recognized and attacked by the immune

[i] Personal interview from 'Mountains that see, and that need to be seen: aboriginal perspectives on degraded visibility associated with air pollution in the BC Lower Mainland and Fraser Valley.' A traditional knowledge study, Government of Canada, 2009

[ii] Costs of Pollution in Canada. Report of International Institute for Sustainable Development, 2017

[iii] The Georgia Basin – Puget Sound Airshed Characterization Report, 2014

system as biological invaders, e.g., viruses and bacteria. However, the particulates cannot be killed by the immune system, and the inflammation is sustained.

Other air contaminants are also associated with significant risks, especially for respiratory and cardiovascular health. Their direct effect might be less pronounced in the LFV due to decreasing trends and improved regional air quality. However, those air pollutants even at the low levels may act as precursors and contribute to the formation of either secondary $PM_{2.5}$ or O_3.

Air quality in the Fraser Valley might be perceived as generally 'good' when compared with many other places in the world, but substantial health benefits can still be achieved by reducing and preventing air emissions and by making continual improvements in air quality.

Visual Air Quality

In the Lower Fraser Valley, air pollution often appears as white or brown haze that obscures views of mountains and scenic vistas within the region. 'Visual Air Quality' (VAQ) or 'visibility' is the term that describes the effect of air pollution and weather conditions on the views of distant landscapes. Recent research has shown that $PM_{2.5}$ of mixed chemical composition (nitrates, sulfates, and organic matter[i]) is the greatest contributor to local haze. The direct effect of $PM_{2.5}$ on visibility is however hard to quantify. Currently VAQ monitoring in the LFV is performed using camera-based instrumentation with automated cameras taking a photograph of the same site a few times a day. Airshed partners use an observation-based scale from 'Poor' to 'Excellent' to report VAQ on a daily basis.

Visual Air Quality is important for many residents and users within the Fraser Valley. It affects the ability of local First Nations to see the mountains, to see from the mountains, and to be seen by the mountain mother - essential for maintaining cultural traditions and meeting spiritual needs. Businesses, like real estate, recreation and tourism, also stand to benefit from a better VAQ. To improve VAQ, the emissions of PM and other pollutants forming secondary PM have to be reduced, so that residents and visitors can enjoy unobstructed views of natural landscapes.

Economy

Economic effects of air pollution are felt by a broad range of institutions, industries, and businesses. Those directly impacted by air quality include public health, agriculture, forestry, real estate, tourism and recreation, to name just a few.

Substantial costs to our health care system are attributed to health impacts from poor air quality. Health Canada estimates the number of annual mortalities in Canada attributed to air pollution to be 14,600 deaths per year. This estimate represents an increase of 1.4% as compared with the 2017 estimate[ii]. The total economic cost of all health impacts attributable to air pollution is $114B per year (in 2015 currency).

[i] Working to clear the air in BC. 2015–2017 Report of the British Columbia Visibility Coordinating Committee, August 2017

[ii] Health Impacts of Air Pollution in Canada. Estimates of morbidity and premature mortality outcomes, 2019

Regionally, a 2014 report produced by Environmental Canada and the United States Environmental Protection Agency[i] estimates that a 10% decrease in ground level ozone and fine particulate matter from a 5-year average baseline (1999-2003) could generate annual health benefits of an estimated C$28 million and $300 million, respectively. The report also identifies losses in revenue from tourism, recreation, and real estate associated with reduced visibility. They estimate that a single poor visibility event in the Fraser Valley during the peak tourist season could result losses be as high as C$1.3 million in regional tourism revenue.

For agricultural and forestry operations, air pollution can result in reduced crop and timber yields and related economic activities. Elevated concentration of ground level ozone is the most significant air quality issue affecting growing crops. Ozone exposure may generate visible foliar damage, reduce plant and tree growth and productivity, and increase their vulnerability to drought, pests, and diseases.

Ecosystems

Ecosystem health is susceptible to air pollution. Atmospheric nitrogen and sulfur oxides (NOx and SOx) are strong acidifying compounds. When deposited on vegetation, they are known to damage plant tissue. This 'acid rain' effect can seriously damage plants and crops and eventually cause loss of sensitive species. Acid deposition on soils and water could cause significant changes in soil and surface water chemistry and reduce nutrient uptake by the roots.

Atmospheric deposition of those nutrients also leads to eutrophication of aquatic ecosystems and overgrowth of algae in water bodies damaging aquatic wildlife. Nitrogen-containing air pollutants contribute to nitrogen eutrophication and this has been identified as an important issue in British Columbia. For instance, up to 8.7 tonnes/yr. or 19% of total nitrogen loading to Cultus Lake in the FVRD was from direct wet and dry atmospheric deposition[ii].

High concentrations of O_3 can cause visible injury to native vegetation, while the long-term exposure may result in decreased plant health. It also contributes to forest decline, such as reduced yields, growth of tree seedlings, and an increased susceptibility to disease and pests. Particulate matter deposited on plant surfaces can inhibit the normal respiration and block photosynthesis within the leaf. Air pollution can lead to the overall decline in habitat and food supply availability for ecosystem wildlife.

[i] Environment Canada and U.S. Environmental Protection Agency. 2014. Georgia Basin - Puget Sound Airshed Characterization Report, 2014. Vingarzan R., So R., Kotchenruther R., editors. Environment Canada, Pacific and Yukon Region, Vancouver (BC). U.S. Environmental Protection Agency, Region 10, Seattle (WA). ISBN 978-1-100 22695-8. Cat. No.: En84-3/2013E-PDF. EPA 910-R-14-002.

[ii] Putt, A. E. 2014. Spatiotemporal nutrient loading to Cultus Lake: Context for eutrophication and implications for integrated watershed-lake management. Master's Thesis, School of Resource and Environmental Management, Simon Fraser University.

Odours

Odours are caused by one or more volatilized chemical compounds that are generally found in low concentrations. They can be unavoidable consequences of certain commercial and business operations, such as wastewater treatment, livestock and manure management, mushroom composting, and various industrial operations. Odours can be offensive to some people even at air concentrations below instrumental detection limits. Understanding the sources of odours, monitoring options, and responsible authorities are critical components that help to reduce the nuisance of odours negatively affecting the health and quality of life for residents.

Climate Change

Air pollution and climate change are directly linked. Greenhouse gases (GHG) and major air contaminants often come from the same sources and activities. On-road transportation, off-road machinery, residential and commercial heating, and livestock farming are amongst the largest emitters of both GHGs and air pollutants in the FVRD. Certain pollutants themselves, such as ground-level ozone (O_3) or particle-formed aerosols, act as short-lived GHGs adding to the greenhouse effect and climate change.

The consequences of climate change, which at times can be quite severe, are already being felt within the Fraser Valley. The recent trends are towards more extreme weather patterns with drier and hotter summers and warmer and wetter winters. With that comes a greater risk of natural disasters. The region is increasingly experiencing intense precipitation, storms and flooding, as well as droughts and forest wildfires, causing major disruptions to communities, and impacts on the economy and the environment.

Recent emission data projected a steady increase for GHG emissions in the FVRD up until 2030. To reverse this trend, consistent mitigation actions are needed. Targeting emissions from common sources therefore provides practical co-benefits addressing both GHGs and air pollution.

While this is not a climate plan per se, by addressing causes of air pollution that also contribute to climate change, the actions identified in this plan have the co-benefits of addressing both air pollution and GHG emissions. It is recognized however that additional GHG planning and management remains an important component of regional sustainability that still needs to be undertaken.

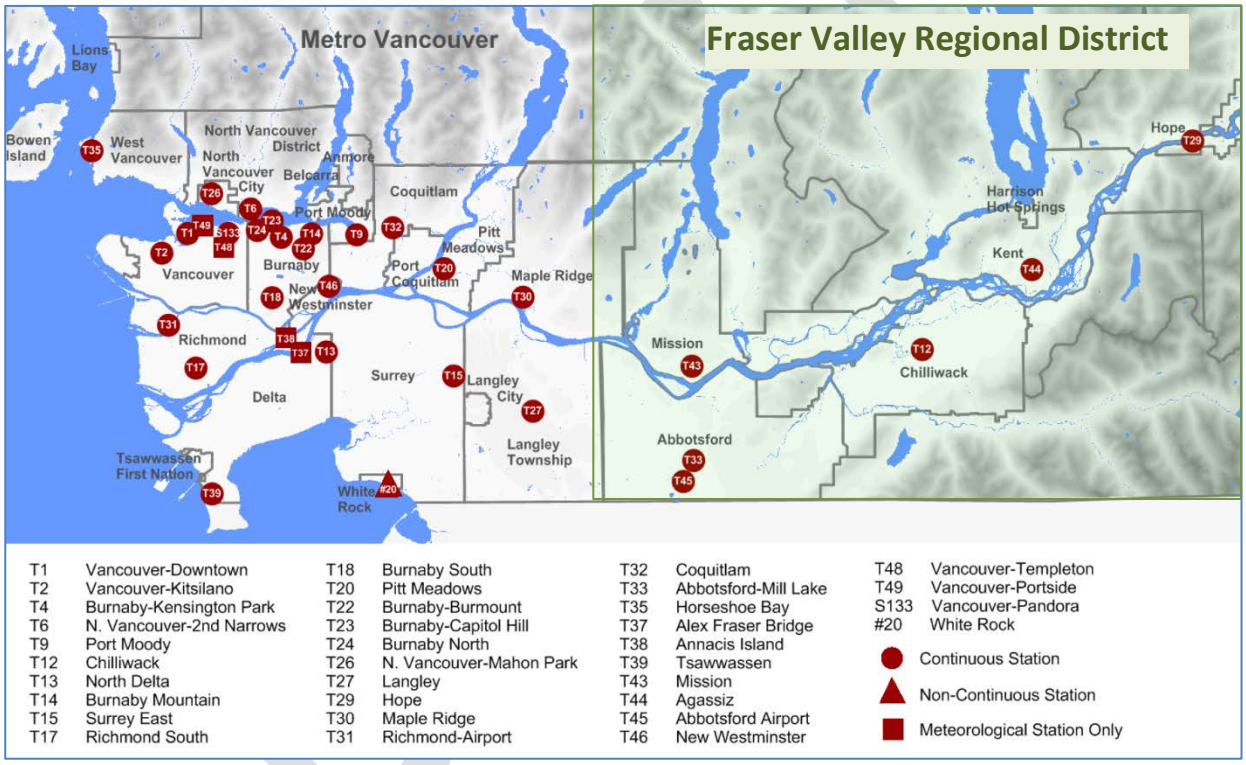
AIR QUALITY IN THE FVRD

"Understanding the source, location and types of emissions in an area is valuable and allows communities to develop targeted actions that can improve air quality in a region"

BC Ministry of Environment and Climate Change Strategy

Monitoring Air Quality

The Lower Fraser Valley Air Quality Monitoring Network is an integrated system of monitoring stations that measure air contaminant concentrations in ambient air throughout the region. These stations cover the entire Lower Fraser Valley airshed from Horseshoe Bay to Hope. The FVRD hosts the six eastern-most stations: Abbotsford (2 stations), Mission, Chilliwack, Agassiz, and Hope. All stations also collect meteorological and weather data.



Source: 2016 Lower Fraser Valley Air Quality Monitoring Report (Metro Vancouver)

Automated air quality sensors take a reading of each parameter every minute of the hour generating high-frequency real-time continuous data. Non-continuous air testing is also conducted periodically for certain contaminants when continuous monitoring is not available. All data points undergo thorough data quality checks. After averaging over certain time periods (hourly, 8-hour, 24-hour, or annual), the data is reported to the public through online web resources (e.g., https://www2.gov.bc.ca/gov/content/environment/air-land-water/air/air-quality/current-air-quality-data). Real-time continuous data from the Network also serve as a basis for air quality advisories, Air Quality Health Index (AQHI) calculations, and various reports and assessments.

Due to high complexity and diversity of emission sources, it is not always possible to measure emissions from all the different source types. Therefore, an emission inventory can assist policy makers in estimating emissions from within a geographic region or jurisdiction.

Metro Vancouver, in partnership with the FVRD, updates the LFV Emission Inventory every 5 years.

Air Quality Health Index (AQHI) is a scale (1 to 10+) designed to help understand what the quality of the air around us means to our health. It is a tool developed by health and environmental professionals to communicate the health risk posed by air pollution.

Trends and Pollutants of Concern

Consistent measures on reducing air emissions since the late 1990s have resulted in significant air quality improvements in the Lower Fraser Valley airshed and the FVRD. As the region faces growing populations and industrial usages, maintaining this progress becomes more difficult and collaborative efforts on air quality protection should continue.

While the downward trends in some pollutants is encouraging, several concerns remain for regional air quality. Unfortunately, these emission trends are projected to level off or slowly increase after 2020. The release of ammonia (NH_3), another important air contaminant, has been increasing since 2010. Steady increases are also projected for the principal greenhouse gases: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

The most concerning air contaminants for local air quality are fine particular matter ($PM_{2.5}$) and ground-level ozone (O_3). Smoke from wood and biomass burning is the main source of $PM_{2.5}$ in the FVRD. Episodes of elevated $PM_{2.5}$ occur during all seasons. Burning for residential heating, yard waste disposal and land clearing generate much smoke in colder months. An emerging source for high levels $PM_{2.5}$ is wildfire activity typically occurring under hot and dry summer conditions.

Ground-level ozone (O_3) is not emitted directly but forms in the atmosphere from other air pollutants in the presence of sunlight. Summertime O_3 episodes were frequent in the LFV in the past. The alarming tendency for O_3 is that even though the occurrences of summertime peak episodes are decreasing, its non-peak averages are on the rise, affected by transboundary imports and new local sources.

Air quality trends, emissions, and forecasts in the FVRD are provided in Appendix B.

Sources of Emissions

Air emissions within the Lower Fraser Valley originate from a multitude of sources, most of which can be considered non-point sources. Degraded air quality is a result of the cumulative affect of all these emissions occurring within our confined, sensitive, airshed. The sources of emissions can be broadly characterized as originating from one of the following five categories:

1) On-Road Transportation
2) Non-Road Equipment
3) Indoor and Outdoor Wood Burning
4) Commercial, Industrial, and Agricultural Operations
5) Natural Sources

These categories, and the emissions they are responsible for, are summarized in the following table.

Category	Key Sources	Pollutants of Concern [1]	Significance in FVRD
1. On-Road Transportation	Light-, medium- and heavy-duty gasoline & diesel vehicles	CO, NOx, SOx, VOCs, $PM_{2.5}$, TAPs, GHGs	Accounts for: ➢ 24% of total air emissions ➢ 37% of NOx emissions ➢ 43% of total GHG emissions
2. Non-Road Equipment	Construction equipment Agriculture machinery Lawn and garden equip. Rec. vehicles & watercraft Aircraft Rail yard and locomotives Marine vessels	CO, NOx, SOx, VOCs, $PM_{2.5}$, TAPs, GHGs	Accounts for: ➢ 27% of total air emissions ➢ 58% of NOx emissions ➢ 21% of total GHG emissions
3. Indoor or Outdoor Wood Burning	Land clearing burning Prescribed forest burning Residential yard waste burning Agricultural debris burning Woodstoves and fireplaces Commercial boilers & heaters	PM_{10}, $PM_{2.5}$, CO, VOCs, TAPs	Accounts for: ➢ 4% of total air emissions ➢ 25% of $PM_{2.5}$ emissions
4. Commercial, Industrial, and Agric. Operations	Composting Facilities Soil tillage Fuel distribution stations Forest harvesting Aggregate extraction Construction and excavation Waste landfills and incinerators Livestock and poultry farms Pulp mills & wood processing Miscellaneous facilities	$PM_{2.5}$, PM_{10}, NH_3, VOCs, NOx, TAPs, GHGs, odours	Accounts for: ➢ 20% of total air emissions ➢ 49% of $PM_{2.5}$ emissions ➢ 35% of GHG emissions
5. Natural Sources	Wildfires Radon Sources Vegetation	CO, Ground-level ozone, BVOC, PM_{10}, $PM_{2.5}$, TAPs, Radon	Accounts for: ➢ 25% of total air emissions ➢ 73% total VOC emissions

[1] Acronyms used within the table include the following:

- CO = Carbon Monoxide
- NOx = Nitrogen Oxides
- SOx = Sulfur Oxides
- $PM_{2.5}$ = Fine Particulate Matter
- PM_{10} = Inhalable Particulate Matter
- VOCs = Volatile Organic Compounds
- BVOC = Biogenic Volatile Organic Compounds
- TAPs = Toxic Air Pollutants
- GHGs = Greenhouse Gases
- NH_3 = Ammonia

These categories of emission sources are utilized later in the report to present the various actions suggested as part of the Air Quality Management Plan.

AIR QUALITY PLANNING AND MANAGEMENT

"Air pollution does not recognize borders. Improving air quality demands sustained and coordinated government action at all levels"

World Health Organization

Airshed Authority

The primary authority for air quality regulation in British Columbia outside of the Metro Vancouver lies with the BC Ministry of the Environment and Climate Change Strategy. It does so through the *Environmental Management Act* by establishing air quality standards and guidelines and regulating point sources of emissions. BC builds its air quality policies and actions upon programs already in place at the national level. The federal government plays a pivotal role in addressing air quality issues, and is involved in monitoring, providing public health information, and regulating many industries or sectors that have an impact on air quality such as motor vehicles and fuels, railways, and marine vessels.

The FVRD received air quality planning authority by a Provincial Order in Council in 1992. Although air emissions regulatory authority remains with the Province, the FVRD, as a local government, has numerous ways to influence air quality in the region. Tools, such as air quality monitoring and research, education and outreach, regional planning and development, advocacy, and incentives, can play an important role in reducing regional air pollution and its associated risks for public health.

Tools

In order to be effective and efficient, the FVRD uses numerous tools available within their air quality toolbox. These tools include reliance on partnerships, air quality monitoring and comparing data with standards, supporting educational initiatives, conducting scientific research, generating policies and programs, advocating for the region to senior governments, leading by example, and pursuing co-benefits. These tools are explained below.

1) Partnerships and Collaboration

   Air pollution cannot be stopped by geographic boundaries. It can travel long distances and affect large population groups. Management of airshed air quality is a complex, non-trivial undertaking that can only be successful with coordinated, long-term effort from all levels of government, health authorities, science experts, and environmental advocates.

   Many regional agencies and organizations share a common mission for continuous improvements in air quality in the Lower Fraser Valley that can only be realized by working together. To coordinate that effort, air quality experts and regulators from relevant agencies in the LFV work in cooperation on a network of regional committees and working groups (Appendix C). Such cooperation includes but is not limited to ambient air quality monitoring, compilation of periodic emission inventories, provision of air quality data to the public, initiatives and incentives on emission reduction, and public outreach and education. As an active member of the LFV air quality management network,

the FVRD regularly contributes to continuous improvement of local air quality, both individually and in collaboration with airshed partners.

2) Measuring and Monitoring Air Quality

Information on ambient levels of air contaminants is gathered to assess health exposure, evaluate the performance of programs and actions aimed at reducing emissions, and provide support for the development of new initiatives. To obtain this information, the FVRD participates in several undertakings including monitoring ambient air quality and estimating using emissions inventories.

The emissions of atmospheric pollutants could be natural or anthropogenic. Natural sources of air pollution may include forest fires, volcanoes and VOC emissions from vegetation. Anthropogenic emissions are caused by human activities and come from point, area, and mobile sources.

> ***Point sources*** are stationary, fixed sources from which air pollutants can be released into the atmosphere continuously or instantaneously, for example, factory or power plant smokestacks.
>
> ***Area sources*** release pollutants to the atmosphere from larger areas, for example, agricultural fields or forest wildfires.
>
> ***Mobile sources*** generally refer to the emissions from sources that can move around, for example, road transportation, non-road machinery, railways, marine vessels, or aviation.

3) Air Quality Standards and Objectives

Air quality standards and objectives are thresholds on the acceptable presence of contaminants in the atmosphere established by the regulatory authorities at the federal, provincial and regional level. They are useful tools to help protect human health and the environment, assess current or historical air quality status, and guide decision-making for all levels of government.

For many air pollutants, however, there are no "safe" levels and exposure can affect peoples' health even at low concentrations. Air quality objectives should not be viewed as limits to "pollute up to" but as targets for guiding decision-making and policies.

Air quality standards and objectives for contaminant concentrations in ambient air have been established at the national, provincial, and regional levels (Appendix D).

The Canadian Ambient Air Quality Standards (CAAQS) have been developed as federal standards for certain Criteria Air Contaminants. CAAQS are an important part of the national Air Quality Management System (AQMS) in Canada. The purpose of the AQMS is to protect human health and the environment from detrimental effects of air pollution. It does so through maintaining the ambient air quality standards, such as CAAQS, limiting industrial and transportation emissions, supporting actions to improve air quality and encouraging collaboration between jurisdictions

Criteria Air Contaminants (CACs) are the most common air pollutants for which threshold levels are set to protect public health and to guide airshed-planning activities. In Canada, they include fine particulate matter ($PM_{2.5}$), nitrogen oxide (NO_2), sulfur oxide (SO_2), and ground-level ozone (O_3).

on air quality initiatives. Appendix E provides a summary of key air contaminants, their sources, and their impact on human health or the environment.

4) Education and Awareness

Understanding air quality and making informed and responsible decisions relies on environmental education. Knowledge and awareness of air quality sources, exposure risks, and personal choices that can be taken are critical for ongoing air stewardship and relies on a collaborative approach to reach as many as possible.

> *In 2017, the FVRD launched a well-received school program called "Love Our Air". This program consists of custom workshops designed for Grades 5 and 10 classrooms and a teacher resource package. The program focuses on developing students' respect for our sensitive airshed and understanding of how to reduce pollution through their everyday actions.*

5) Research and Studies

Scientific knowledge is essential for creating guidance or policies on complicated environmental topics such as air quality and climate change. Effective dialogue between science and policy helps policymakers, industry, and the public to make decisions that protect our health, our ecosystems, and our air.

The FVRD engages in high-quality problem-oriented air quality research to identify emerging topics, to prioritise, and to communicate and measure impact. Conducted either independently or in collaboration with other partners, these studies help to address the broad range of factors contributing to air quality. Examples of recent studies administered by the FVRD include reviews of air emissions from on-road and off-road engines, smoke from open burning, and emissions of ammonia. Those studies provided important insight essential for decision making on those issues.

6) Policies and Programs

Environmental policies and programs are practical measures for preventing or reducing the harmful effects of air quality on environmental and public health. Developed either as single or linked policies, they also can be useful to facilitate positive relations with regional counterparts, stakeholders, businesses, and communities. At the corporate level, they demonstrate commitment to environmental sustainability and continuous improvement.

7) Advocating for the Region

Advocating to higher levels of government for stronger regulations and enforcement is a valuable tool for protecting regional air quality. It might include raising concerns and awareness about the adequacy of existing rules, lobbying for legislation that is more robust, or supporting best industry standards.

8) Integration in Other Planning Processes

To be successful, air quality policies need to be fully integrated into federal, provincial, regional, municipal and electoral area plans and strategies. An AQMP cannot be effective in isolation. Many local governments within the FVRD already have air quality policies within their Official Community Plans. Incorporating these linkages will assist with prioritization and implementation (Appendix F).

9) Leading by Example

Through leading by example, the FVRD is fully committed to demonstrate and promote responsible behaviour aimed at reducing air emissions, using sustainable energy sources, and minimizing environmental footprints from day-to-day operations.

> *The FVRD has been actively promoting low or zero emission initiatives by adding a number of electric vehicles to its fleet, installing new chargers on the FVRD parking lots, organizing Bike-to-Work and Walk-to-Work campaigns, and reducing corporate energy consumption.*

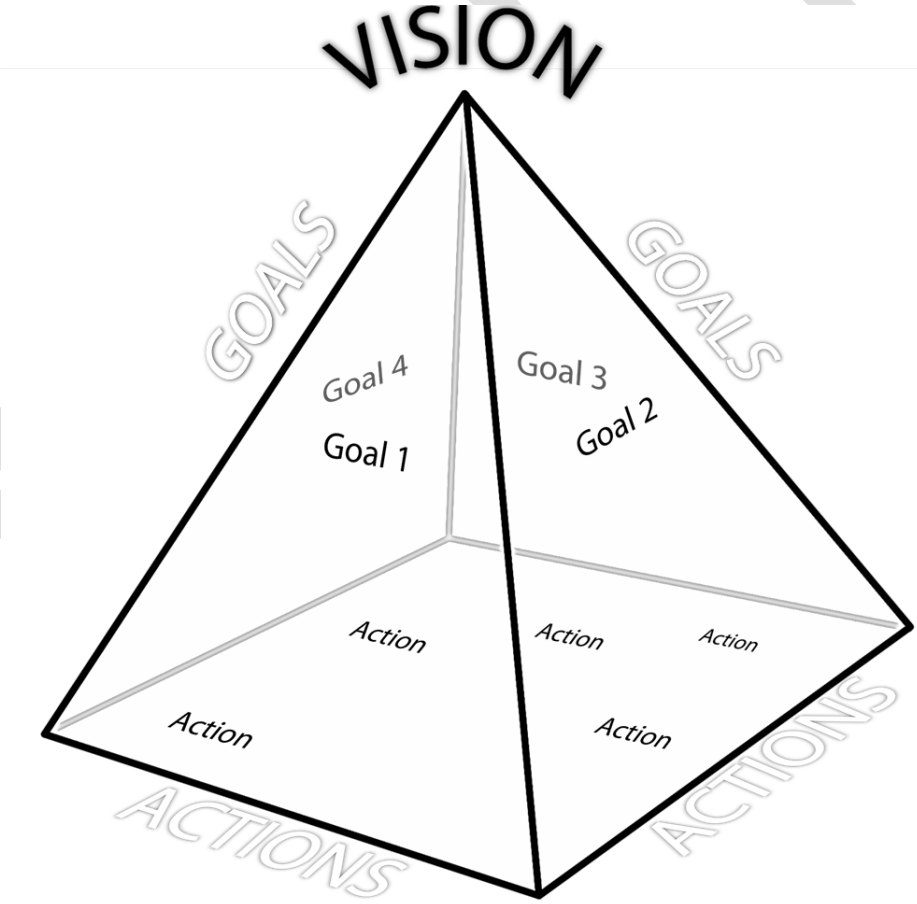
10) Pursuit of Co-Benefits

The focus of the FVRD's air quality management is on improving air quality, but helping to address sources of pollution can have multiple co-benefits beyond the health of the air. Reducing greenhouse gases emissions from fossil fuels and the accompanying climate impacts is the most obvious co-benefit. Other areas where positive impacts could be expected might include resource and energy efficiency, economic development, ecosystem sustainability and biodiversity.

VISION AND GOALS

Many plans use a simple linear framework where each goal is followed by a series of actions designed to help achieve that particular goal. Such a linear model does not fully reflect the intricacy of air quality, a cross-jurisdictional issue affected by diverse emission sources, convoluted nature of pollutants, and complex atmospheric chemistry.

This AQMP is designed to make the Actions be dynamic and interactive, as each Action may contribute to various Goals. The strong focus is therefore on pursuit of co-benefits and alignment with collective airshed responsibility without duplication of efforts. The Actions are formally attributed to the six Focus Areas of emission sources broadly defined based on the emission inventory data. However, since sources often overlap across categories, this categorization is flexible and unrestrictive. The conceptual diagram below demonstrates the AQMP structure with Actions as the basis of the plan contributing to all four Goals, which support the overarching Vision for regional air quality.



The FVRD AQMP Vision statement is formulated as our overarching objective and long-term aspiration for the region, a destination where we would like to be. To set the path for it and to make the Vision turn into a reality, four Goals have been identified. Goals are specific desired outcomes in line with the Vision. Goals define steps towards the Vision and continuously helps to test our abilities, skills and perseverance in reaching it.

VISION

"Healthy air and clear vistas that support a vibrant region"

The Goals of this AQMP address four primary concerns in the airshed related to air quality: health, visibility, odour, and climate change.

Goal 1: To improve community and environmental health impacted by exposure to air contaminants

This Goal will be reached through emission reduction of criteria and toxic air contaminants harmful for humans and the environment. The focus is on key sources of fine particulate matter (PM2.5) and ground-level ozone and its precursors from the LFV.

Goal 2: To attain a consistently excellent visibility rating that allows visitors and residents to fully enjoy the region's scenic beauty

This Goal will be reached through emission reduction of air pollutants contributing to poor visual air quality (visibility), which has negative effects on various economic and cultural aspects and quality of life in the LFV.

Goal 3: To effectively prevent or mitigate nuisance odour conditions

This Goal will be reached through emission reduction of air pollutants contributing to noxious odours, which can have negative impacts on residents and visitors of the FVRD.

Goal 4: To achieve continual reductions in emissions which contribute to climate change

This Goal will be reached through improvements in energy management in the FVRD, maximizing use of renewable energy sources and minimizing energy consumption overall. It also entails reducing greenhouse gas emissions from all major sources in the FVRD.

ACTIONS

Actions outlined in the document are meant to serve as a roadmap only. New initiatives that require resources beyond normal operating budgets will be brought forward to the FVRD Board for their consideration to determine if they align within with organization's capacity and policy directions. The following actions are not intended to be exhaustive but should provide a foundation for the FVRD's Air Quality Program to follow to continue addressing air quality matters within the LFV for the next decade.

Actions are categorized based on the sources of emissions presented previously. The following actions are tentative only and are included here for the purposes of discussion, refinement, and the identification of gaps or action items still needed for inclusion.

I. On-Road Transportation

Light-duty automobile emissions

1. The FVRD will continue to improve public awareness and knowledge of zero-emission vehicles (ZEV) including plug-in hybrid, battery electric and hydrogen fuel cell vehicles by:
    a. Providing information and education materials on purchasing, driving, and charging of ZEVs to organizations, businesses, and residents;
    b. Collaborating with regional campaigns and organizers (e.g., Emotive BC) to showcase and promote ZEVs at community events.
2. The FVRD will advocate for maintaining and expanding government programs and financial incentives for replacing old polluting vehicles with ZEVs (e.g., BC SCRAP-IT program, Clean Energy Vehicles for BC, etc.).
3. The FVRD will help develop public, residential, and commercial ZEV charging infrastructure by:
    a. Maintaining existing and installing new public charging stations in the FVRD, using available grants and financial support;
    b. Evaluating need and identifying locations for new public charging stations within the region for travelers (e.g., rest areas, campgrounds, tourist destinations), daily commuters (e.g., park n ride/carpool lots, transit hubs), and residents (e.g., schools, hospitals, parks);
    c. Supporting local municipalities, neighbouring jurisdictions, BC Hydro, and the Province in their efforts to build and operate new charging stations (e.g., providing host locations);
    d. Supporting development of government guidelines and/or sample bylaws that would assist with the installation of ZEV charging infrastructure in new developments (multifamily, mixed use, employment center developments, and new homes) where appropriate and as permitted under the BC Building Code;
    e. Assisting homeowners with identifying potential funding sources and incentives for home EV charger installation.

4. The FVRD will consider adopting a ZEV policy for the FVRD corporate fleet by:
    a. Continuing to replace old corporate fleet vehicles with ZEVs, or cleaner alternatives with lower emission and carbon outputs;
    b. Developing a corporate driving policy for FVRD staff prioritizing use of ZEVs, when appropriate;
    c. Continuing to provide education for staff on the use of ZEVs and on fuel-efficient driving behaviours.
5. The FVRD will promote optimizations of local fleets and improve driving behaviour by:
    a. Supporting regional fleet management programs that reduce emissions from private and public vehicle fleets by maintaining appropriate fleet size and composition;
    b. Promoting driver education programs (including for FVRD staff) that increase fuel efficiency and reduce emissions;
    c. Supporting the installation of low-emission re-fueling infrastructure within the region;
    d. Supporting efforts to reduce idling;
    e. Advocating to the Province of BC to prevent tampering of emission control devices from vehicles, particularly when the tampering results in higher emissions of harmful diesel engine exhaust ("coal rolling").
6. The FVRD will encourage transit ridership within the region.
7. The FVRD will consider the promotion of car-pooling and ride-sharing within the region by:
    a. Supporting infrastructure upgrades and expansions for safe and affordable park-and-ride and park-and-carpool parking options;
    b. Facilitating information exchange for drivers and riders to schedule rides and routes;
    c. Promoting car-sharing co-ops to reduce residents' need for owning a car.
8. The FVRD will promote active transportation, such as biking and walking by:
    a. Actively participating in community events such as Bike to Work Week, Walk to Work Day, etc.;
    b. Supporting the development of pedestrian-friendly and bike-friendly communities and infrastructure (sidewalks, crosswalks, overpasses, road signage, trails, etc.).
9. The FVRD will collaborate with the Provincial Government, municipalities, and health and transportation authorities on land use planning and urban development practices that considers health implications associated with siting residential developments near heavy traffic areas.

Heavy-duty on-road transportation

10. The FVRD will encourage and support electrification infrastructure for truck stops within the Fraser Valley to reduce idling of commercial trucks.
11. The FVRD will encourage and support the Province of BC and regional partners to develop a heavy-duty diesel vehicle retirement program that replaces or retrofits old polluting vehicles with cleaner models.
12. The FVRD will advocate for a new, thorough, vehicle emission inspection program for heavy-duty vehicles.
13. The FVRD will promote and advocate for the use of cleaner alternative fuels (e.g., natural gas, propane, renewable fuels) for heavy-duty vehicles by:
    a. Providing in-kind assistance and technical expertise for municipal, public, and private fleet managers in their efforts to replace heavy-duty diesel vehicles with cleaner alternative fuel vehicles;
    b. Supporting the establishment of programs or infrastructure that increases the availability of increased access to sources of clean re-fueling technology or stations.

II. Non-Road Equipment

Non-road diesel equipment and machinery

14. The FVRD will advocate to the Province to address spill-over emissions from old diesel engines being relocated to the Fraser Valley as a result of Metro Vancouver's Non-Road Diesel Engine Emission Regulation and their non-road diesel engine registration system.
15. The FVRD will encourage and promote opportunities for residents and businesses to replace or retrofit older diesel equipment with newer low-emission models by:
    a. Investigating the feasibility of providing an incentive program to encourage residents to replace older lawn and garden equipment;
    b. Advocating to the Province of BC and agricultural agencies to pilot a 'SCRAP-IT' type of financial incentive program for replacing old diesel-fueled agricultural equipment.
16. The FVRD will support and promote the development and use of Best Management Practices (BMPs) for construction and agricultural non-road diesel equipment that would reduce emissions of harmful emissions (e.g., avoiding unnecessary idling, preventative engine maintenance, prevention of fuel spills, using electric grid power when available, using alternative fuels where feasible, etc.).
17. The FVRD will ensure that adequate air quality provisions are considered in the new industrial proposals associated with non-road equipment use within the region.

Rail, Airplanes, and Boat Emissions

18. The FVRD will advocate for emission monitoring and enforcement of new railway emission regulations to reduce emissions from diesel locomotives and rail yard support machinery.
19. The FVRD will consider a study of river traffic (both industrial and pleasure craft) used on the regional waterways and, if warranted, investigate potential options to reduce exposure from nearby users or residents.
20. The FVRD will provide in-kind assistance, where feasible, to municipal and local airport staff to help in their efforts to reduce emissions associated with airport ground support machinery.

III. Indoor and Outdoor Wood Burning

Residential woodstoves and fireplaces

21. The FVRD will continue to administer the BC Wood Stove Exchange Program that provides financial incentives that support the upgrade of older wood burning appliances with newer, emission-certified woodstoves or fireplaces.
22. The FVRD will continue to promote education and awareness for reducing emissions from the operation of residential wood burning appliances.
23. The FVRD will encourage and promote new energy-efficient developments built less reliant on woodstoves.

Commercial boilers and heaters

24. The FVRD will continue to advocate for more stringent emission standards for commercial boilers and heaters and for improved compliance with provincial and regional regulations and policies.
25. The FVRD will promote and encourage use of cleaner or retrofitted greenhouse boilers that optimize efficiencies and reduce emissions.

Residential and agricultural debris burning

26. The FVRD will explore potential alternatives to residential and agricultural open burning.
27. The FVRD will provide education and awareness on best management practices for open burning.

Land clearing burning for development purposes

28. The FVRD will investigate the potential effect of smoke from current, planned, and potential land clearing burning for development purposes on nearby communities through modeling and monitoring studies.
29. The FVRD will work with municipal and electoral area planning and firefighting staff on developing more effective and consistent use of “burning windows” across the region.

IV. Commercial, Industrial, and Agricultural Emissions

Sources of dust and wind erosion of soils

30. The FVRD will support and advocate for the development and implementation of industry-specific soil stabilization and dust control BMPs, such as wind barriers, cover crops, reduced tillage, sprinkler/irrigation systems.
31. The FVRD will support and advocate for the implementation of provincial, regional, and municipal regulations and other tools (e.g., Mines Permits by the BC Ministry of Energy and Mines) related to dust emissions or dust suppression requirements.

Sources of gaseous ammonia

32. The FVRD will promote applicable research and information exchange within regional air quality and agriculture networks, government agencies, and research institutions, in order to gain further knowledge of ammonia emissions.
33. The FVRD will optimize and advance the ambient ammonia monitoring network and air pollution data collection, through:
    a. Continuously expanding and improving the stationary ammonia monitoring network in the region in collaboration with Metro Vancouver, BC Ministry of Environment and Climate Change Strategy, and Environment and Climate Change Canada.
    b. Exploring short-term mobile air pollution monitoring of ambient ammonia for near-farm communities to better understand localized ammonia emissions and exposure risks.
34. The FVRD will encourage and promote the use of new technologies and practices that clean ammonia from ventilation air, such as gas-phase bio-filtration at livestock or poultry facilities.

Municipal Solid Waste

35. The FVRD will continue to advocate against the incineration of municipal solid waste from within the Lower Fraser Valley airshed and for strong emission control requirements and transparency.
36. The FVRD will support emission reduction from landfills.
37. The FVRD will increase awareness and enforcement of the FVRD's Source Separation Bylaw, which, through diversion of organic waste, will reduce methane emissions from regional landfills.

New industrial developments

38. The FVRD will protect the airshed from new industrial developments potentially contributing to air pollution by working with regulatory agencies (BC Ministry of Environment and Climate Change Strategy, USA Northwest Clean Air Agency, USA Puget Sound Clean Air Agency, local municipalities) to collect information on air discharges, permits, modeling and monitoring data.
39. The FVRD will encourage and provide in-kind assistance for local businesses to develop, adopt, and implement pollution prevention plans to reduce air pollution from their operations.

Sources of odour emissions

40. The FVRD will encourage local producers to increase the use of new technologies and employ BMPs to manage nuisance impacts of odour, such as bio-filtration systems, anaerobic digesters, forced or fan-driven ventilation, sealed or covered storage of odorous materials, and maintaining good housekeeping and spill cleanup procedures**.**
41. The FVRD will support and mediate when appropriate, the development of constructive relationships and mutual understanding for both producers and neighbouring residential communities to deal effectively with odours.
42. The FVRD will support the Province of BC to develop odour complaint logging processes, response protocols, and guidelines for odour impact assessment.
43. The FVRD will advocate for and participate in the development of a regional policy framework to address noxious odours from cannabis growing through monitoring and reporting the odour-causing emissions, as well as identifying and supporting best practices for emission reductions.

V. Natural Sources

Smoke from forest wildfires

44. The FVRD will continue to provide updated air quality information to communities and businesses when wildfire smoke air quality advisories are in effect for the region, including updates and associated messaging on the Air Quality Health Index (AQHI).

Radon Sources

45. The FVRD will promote residential indoor radon awareness, testing and mitigation, in collaboration with health authorities and regional partners.

Biogenic VOC Sources

46. The FVRD will coordinate with regional partners to develop an updated emission inventory of local biogenic sources of Volatile Organic Compounds.
47. The FVRD will support and promote planting of low BVOC emitting tree species in the region that would include:
    a. Coordinating with the FVRD municipalities to develop and support a low-BVOC species guidance document in the municipal tree planting programs.
    b. Advocating to the Province of BC to include BVOC emission rates as a selection criterion in a Tree Species Selection Tool.
48. The FVRD will participate and contribute to regional studies of potential impacts of BVOC emissions from commercial cannabis cultivation and processing.

VI. General/Other

All Sources

49. The FVRD will continue to study and monitor air quality throughout the region in collaboration with provincial and regional partners through both the regular regional air quality monitoring network and short-time mobile monitoring campaigns.
50. The FVRD will investigate the need for additional air quality monitoring within the region and expand the monitoring network as required, including within small, remote and rural communities underserved by the existing network.
51. The FVRD will investigate and employ new evolving technologies for air quality testing, such as small and portable sensors, to amend and complement its existing air quality monitoring network.
52. The FVRD will continue working in partnership with other agencies and health authorities as part of an air quality advisory network that creates and delivers consistent and timely health messaging to the public about poor air quality conditions.
53. The FVRD will continue conducting emission assessments and forecast studies for all sources of emissions to enhance understanding of emission areas that might require further controls.
54. The FVRD will continue to support or deliver air quality education programs developed by the FVRD for schools in the Fraser Valley.
55. The FVRD will communicate information on air quality issues in the FVRD through community centers, public forums, regional events, internet and mass media resources, education and extension centers, and signage at parks, playgrounds, and scenic viewpoints, as appropriate.
56. The FVRD will design a public engagement program to empower the community and identify action items they can do at the individual or community level to protect air quality and help the FVRD achieve the vision and goals of this plan.
57. The FVRD will continue to assist regional stakeholders with air quality expertise and air monitoring data and outreach.
58. The FVRD will continue to participate in the BC Visibility Coordinating Committee (BCVCC) on managing visual air quality through activities such as:
    a. Developing visual air quality goals, metrics, indices, and rating tools;
    b. Helping to maintain a visual air quality monitoring network at the FVRD air quality monitoring stations to collect and analyze visibility data;
    c. Raising public awareness of air quality impacts on visibility through communications, outreach, published materials, interpretive signage, and community workshops.
59. The FVRD will continue to work with regional stakeholders directly affected by poor visual quality, such as health, tourism, and real estate sectors, to receive feedback, collect information, and implement measures on reducing haze and the number of poor visibility days.
60. The FVRD will identify further opportunities for information exchange and collaboration with local First Nation communities on air quality.

61. The FVRD will continue supporting stewardship group such as the Fraser Valley Watersheds Coalition to replant degraded habitat sites with native trees and shrubs.

It is anticipated this list of actions will expand as new air quality or technology emerges and as we continue to discuss projects and ideas with airshed stakeholders. Our hope is that through this AQMP process, we will be able to discover initiatives proposed or being undertaken by others that also align with the vision and goals of this plan. Supporting those projects and helping to coordinate and develop synergies between actions underway within the airshed will allow the greatest chance for success in collective stewardship of our shared airshed.

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NEXT STEPS

The FVRD Air Quality Management Plan 2021-2030 represents our consistent commitment to the improvement of regional Air Quality. Through its Vision, Goals, and Actions, the Plan identifies strategic directions and practical mechanisms required for reducing emissions, changing behaviours, and promoting sustainability, so residents and visitors will enjoy clean air, beautiful vistas, and healthy living.

Following the inclusion of feedback or suggestions, subsequent steps include the prioritization of actions, identifying associated timelines, determining suitable performance indicators and benchmarks, and defining a schedule for progress reporting that evaluates implementation.

The AQMP is intended to be a living dynamic and will likely require updates and amendments as new data, technologies, ideas, funding opportunities, or policy directions emerge over time. Much can change within a ten-year period, and remaining adaptable and flexible will allow the plan to remain relevant over the next decade.

Continual improvements in air quality remains a top priority for the Fraser Valley Regional District, and this draft AQMP provides a roadmap for moving forward towards a vision of *healthy air and clear vistas that support a vibrant region*.

APPENDICES

Appendix A: Lung disease prevalence in the FVRD

Appendix B: Air quality trends and emission data for the FVRD

Appendix C: List of Air Quality Committees and Working Groups in the LFV

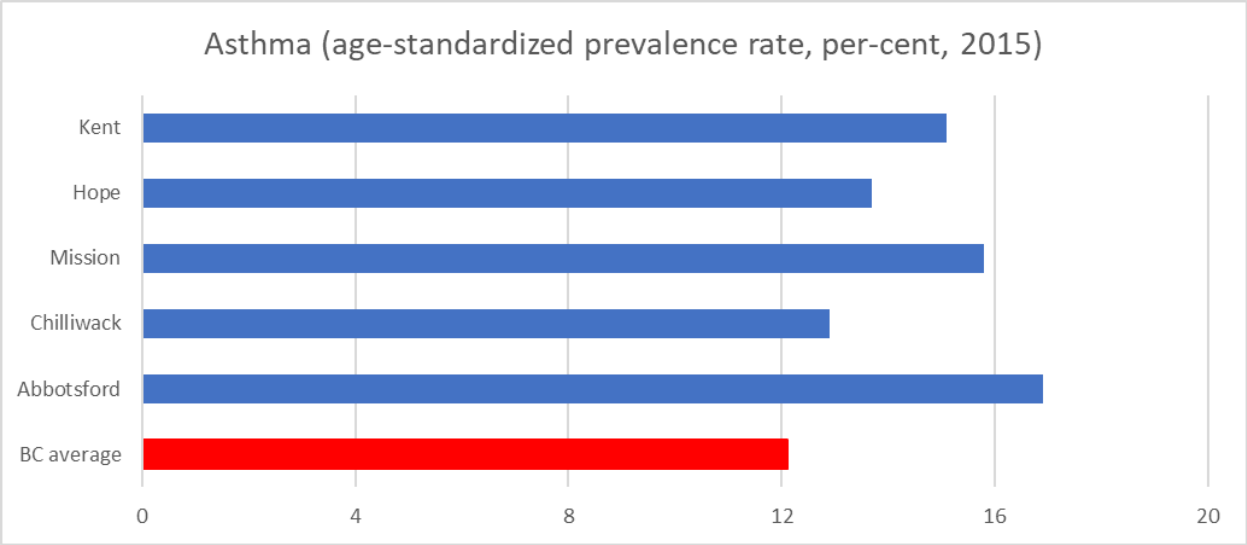
Appendix D: Ambient Air Quality Objectives in Canada, BC, and the Lower Fraser Valley

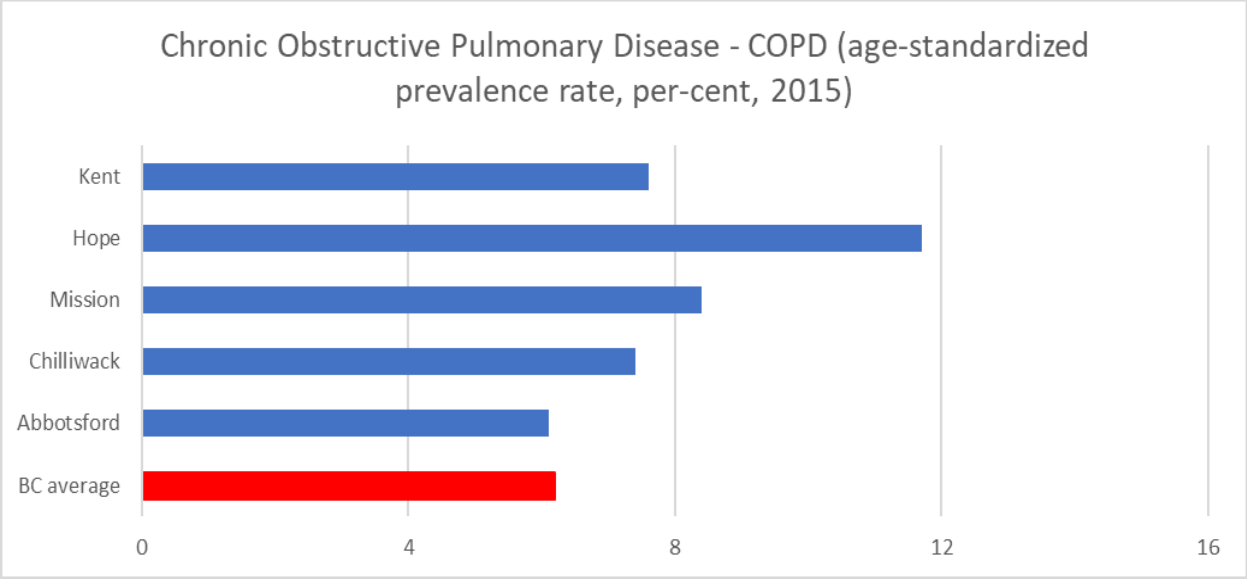
Appendix E: Criteria Air Contaminants and their sources and effects

Appendix F: Linkages to the existing local plans and policies

Appendix G: List of Acronyms

Appendix A: Asthma and COPD prevalence rates in the FVRD municipalities

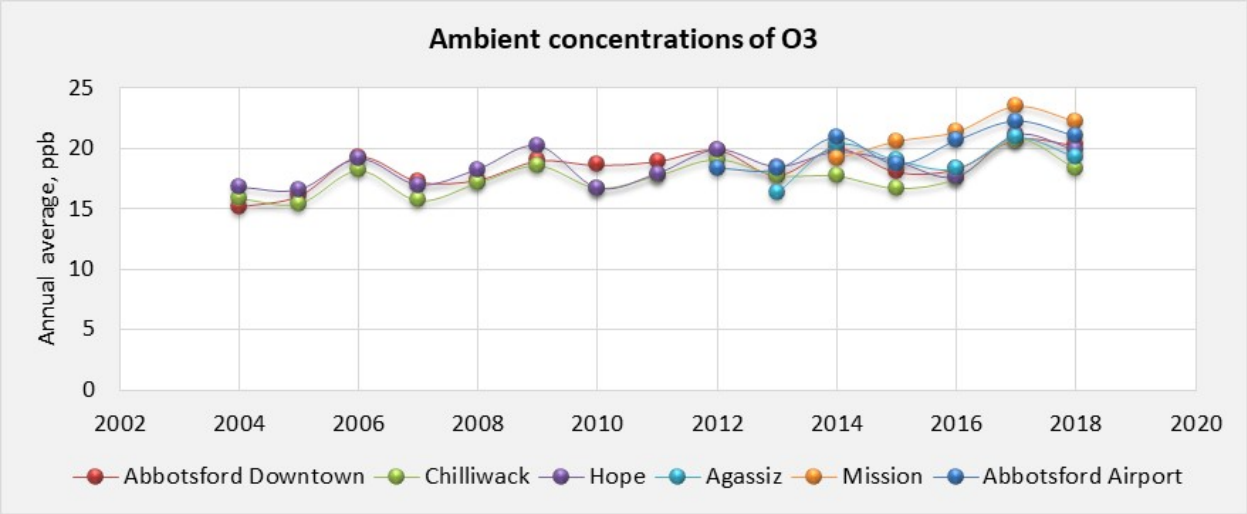


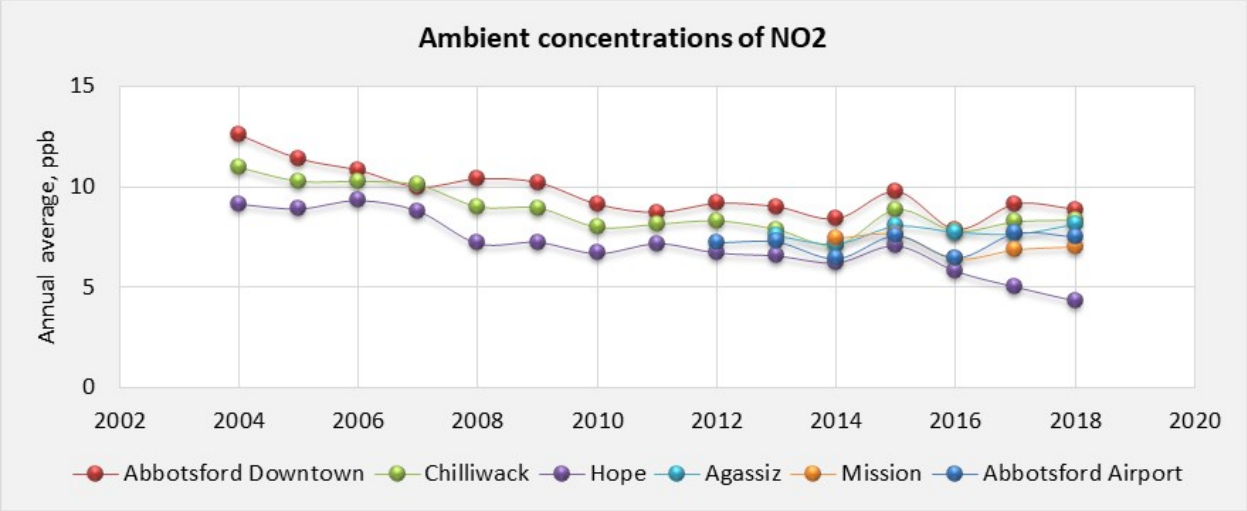


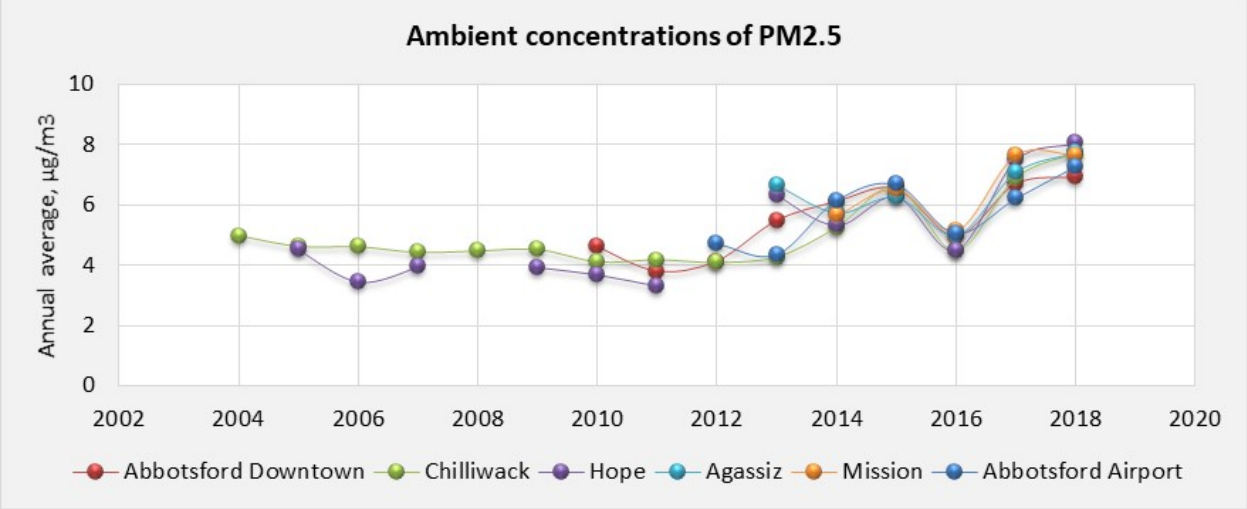
(from BC Community Health Profiles. Municipality Health Profiles, 2019. http://communityhealth.phsa.ca/HealthProfiles)

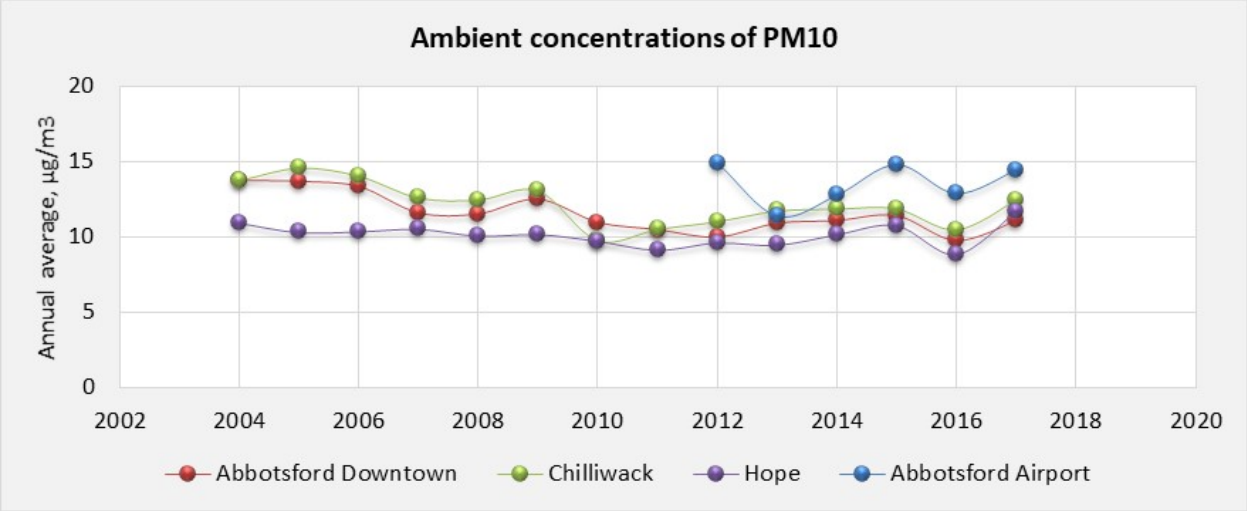
Appendix B: Air quality trends and emission data for the FVRD

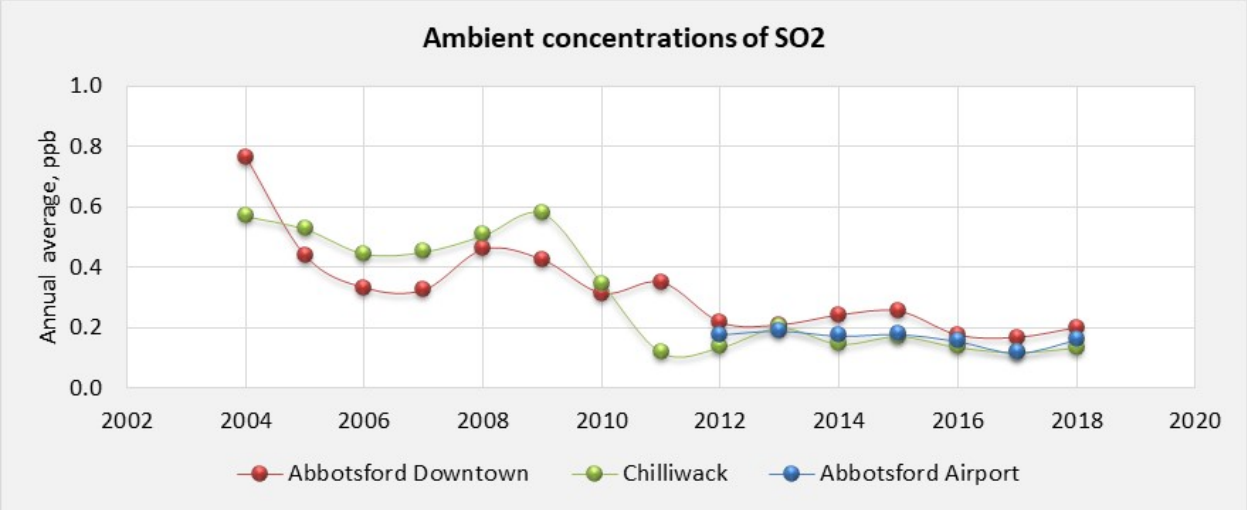
Air Quality Trends:

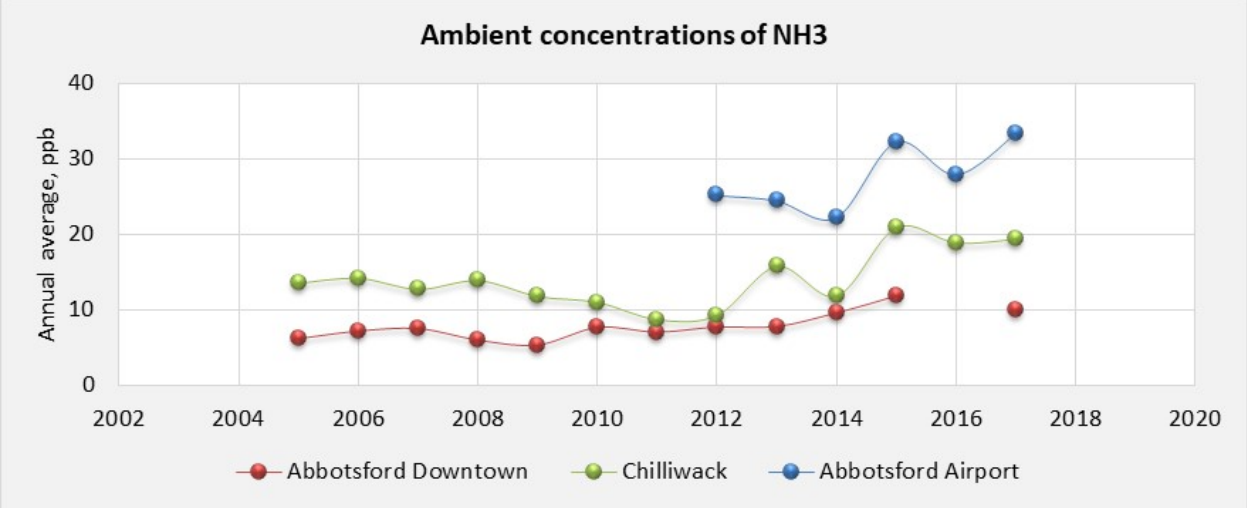


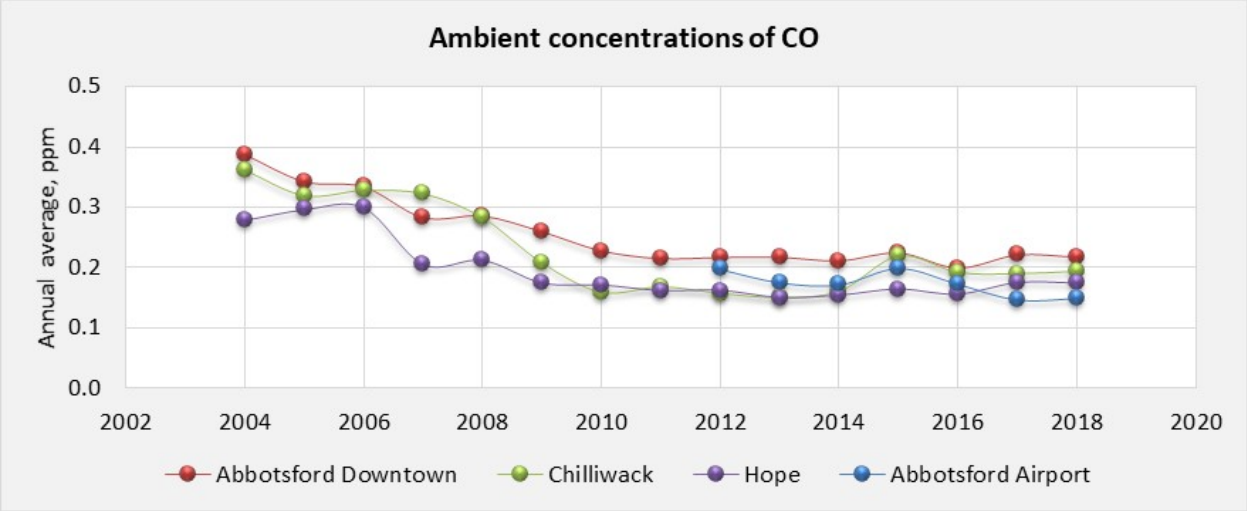




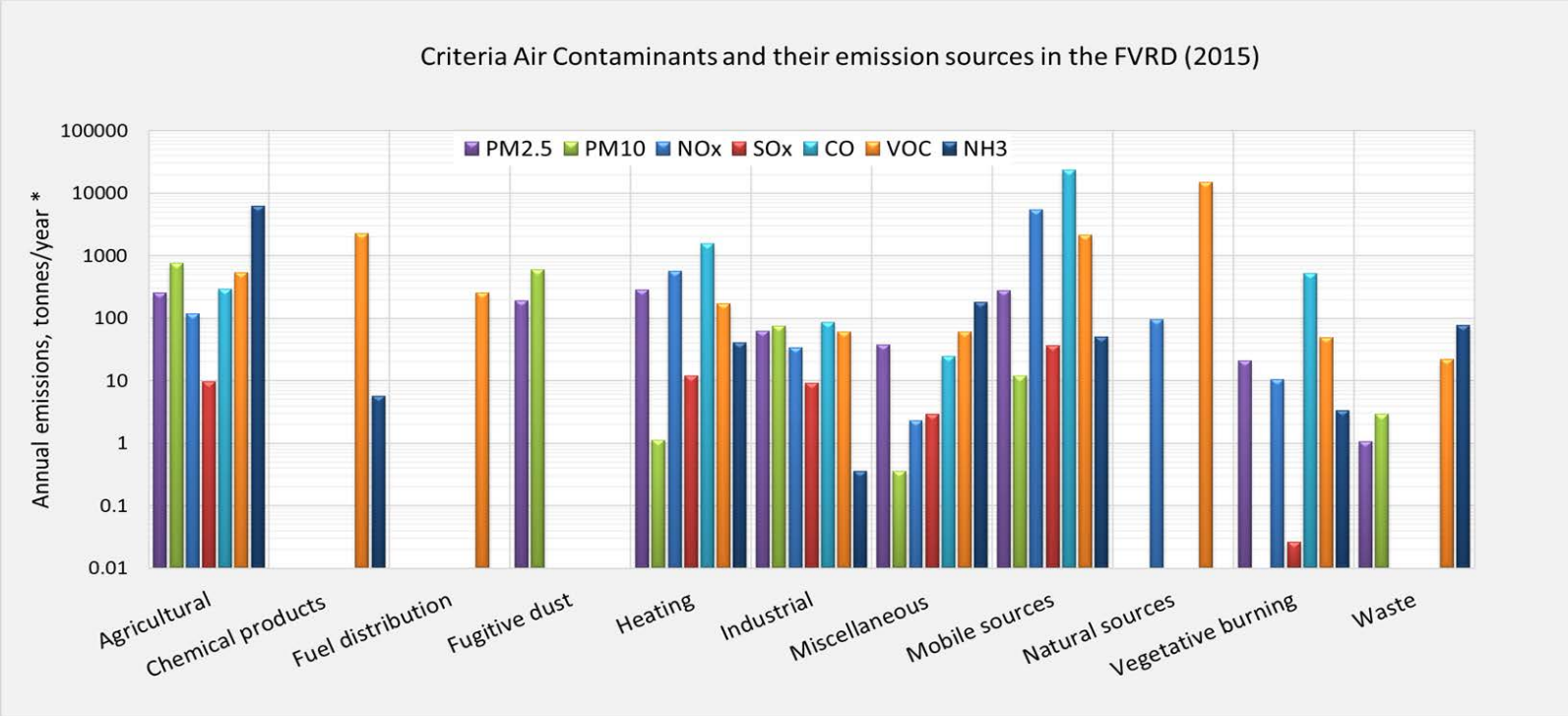

Ambient concentrations of PM10
Annual average, µg/m3
20
15
10
5
0
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Abbotsford Downtown
Chilliwack
Hope
Abbotsford Airport


Ambient concentrations of SO2
Annual average, ppb
1.0
0.8
0.6
0.4
0.2
0.0
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Abbotsford Downtown
Chilliwack
Abbotsford Airport

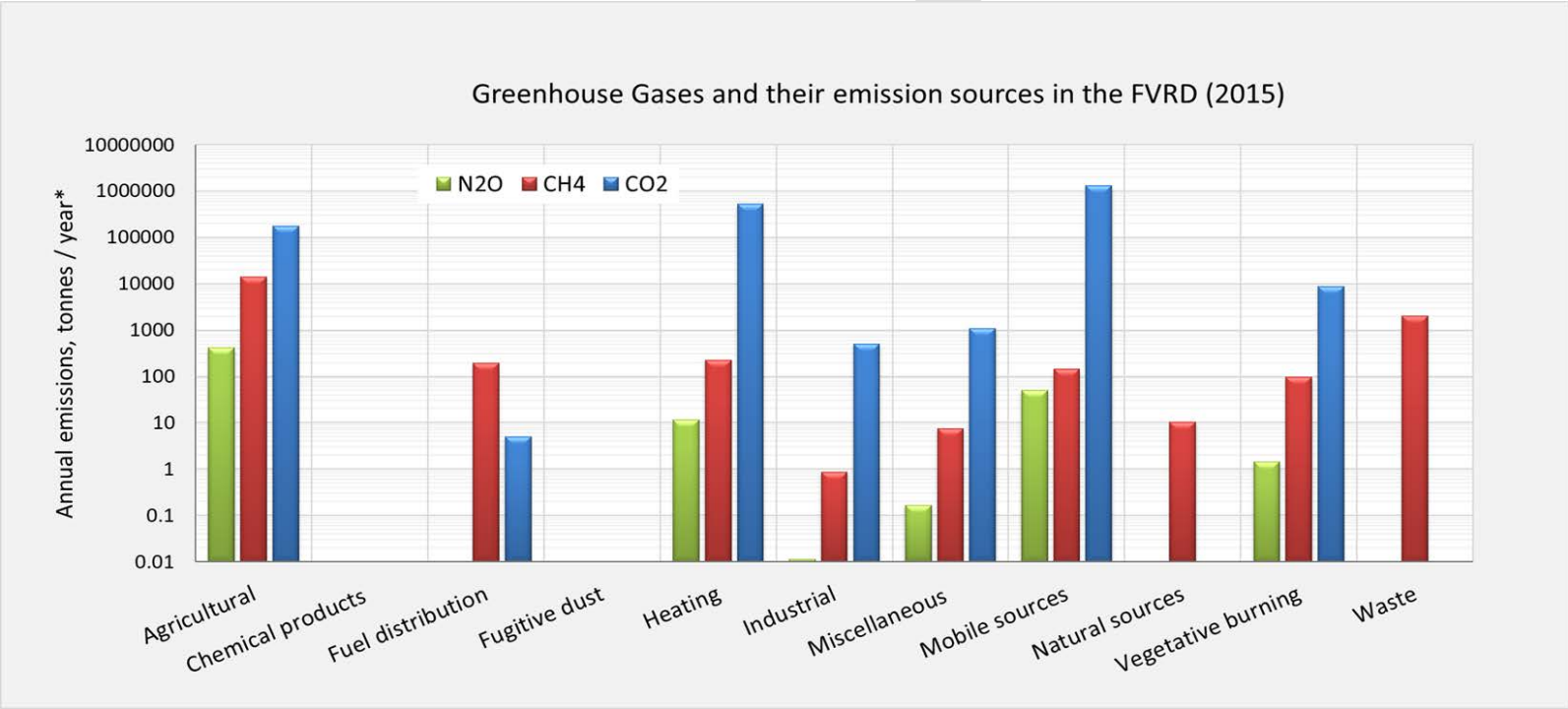

Ambient concentrations of NH3
Annual average, ppb
40
30
20
10
0
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Abbotsford Downtown
Chilliwack
Abbotsford Airport


Ambient concentrations of CO
Annual average, ppm
0.5
0.4
0.3
0.2
0.1
0.0
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Abbotsford Downtown
Chilliwack
Hope
Abbotsford Airport

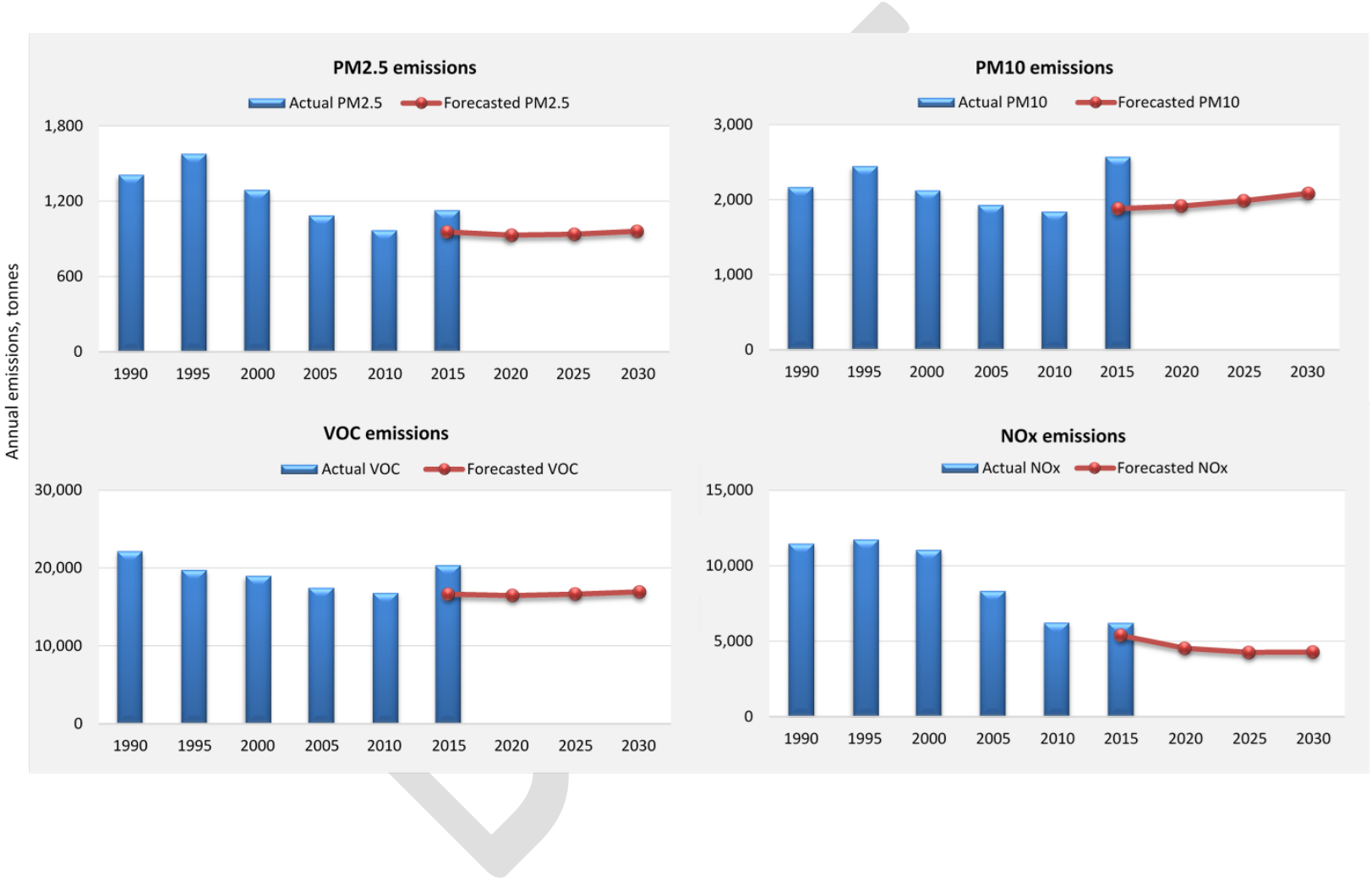
Air Emissions in the FVRD:

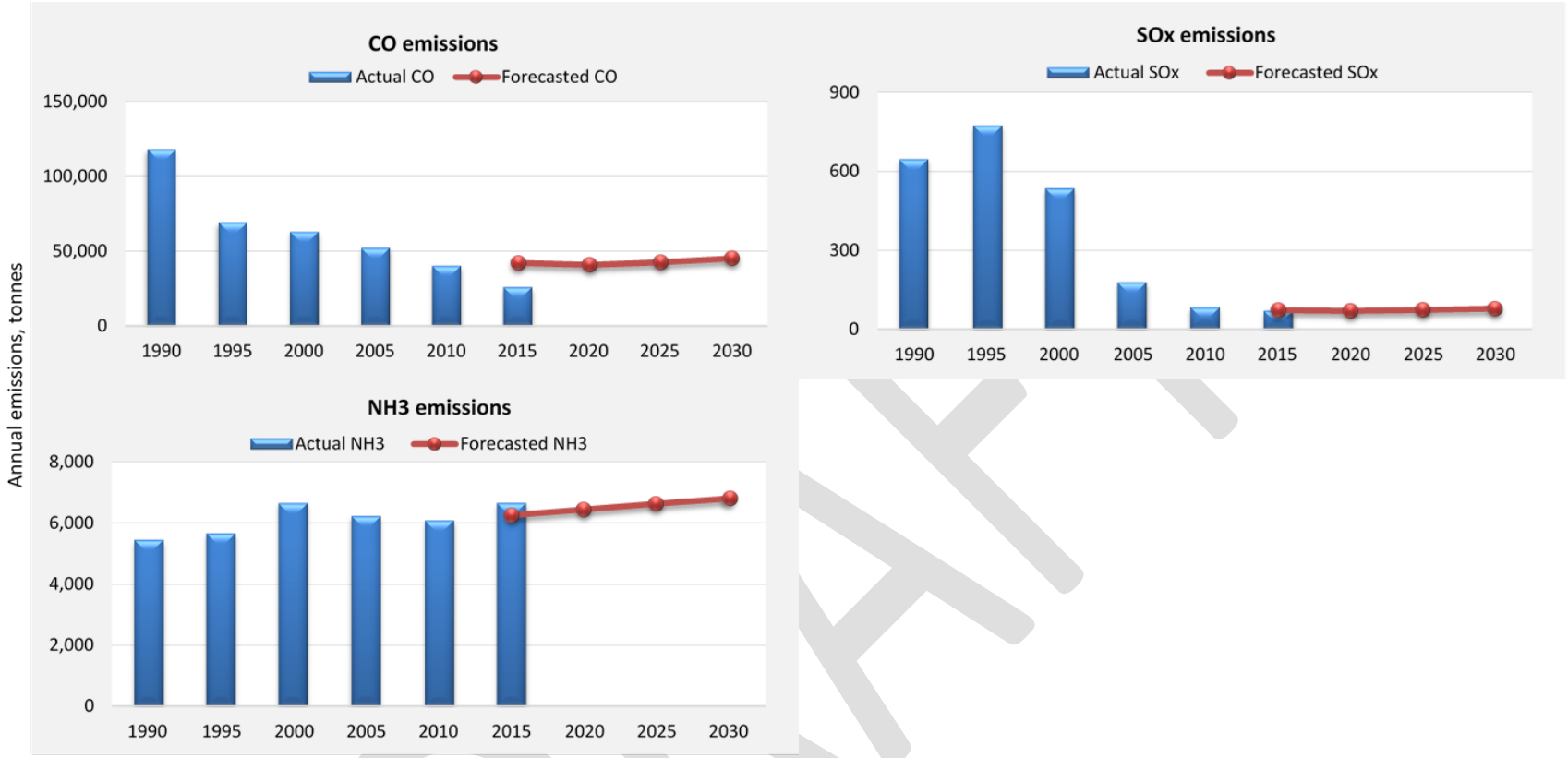


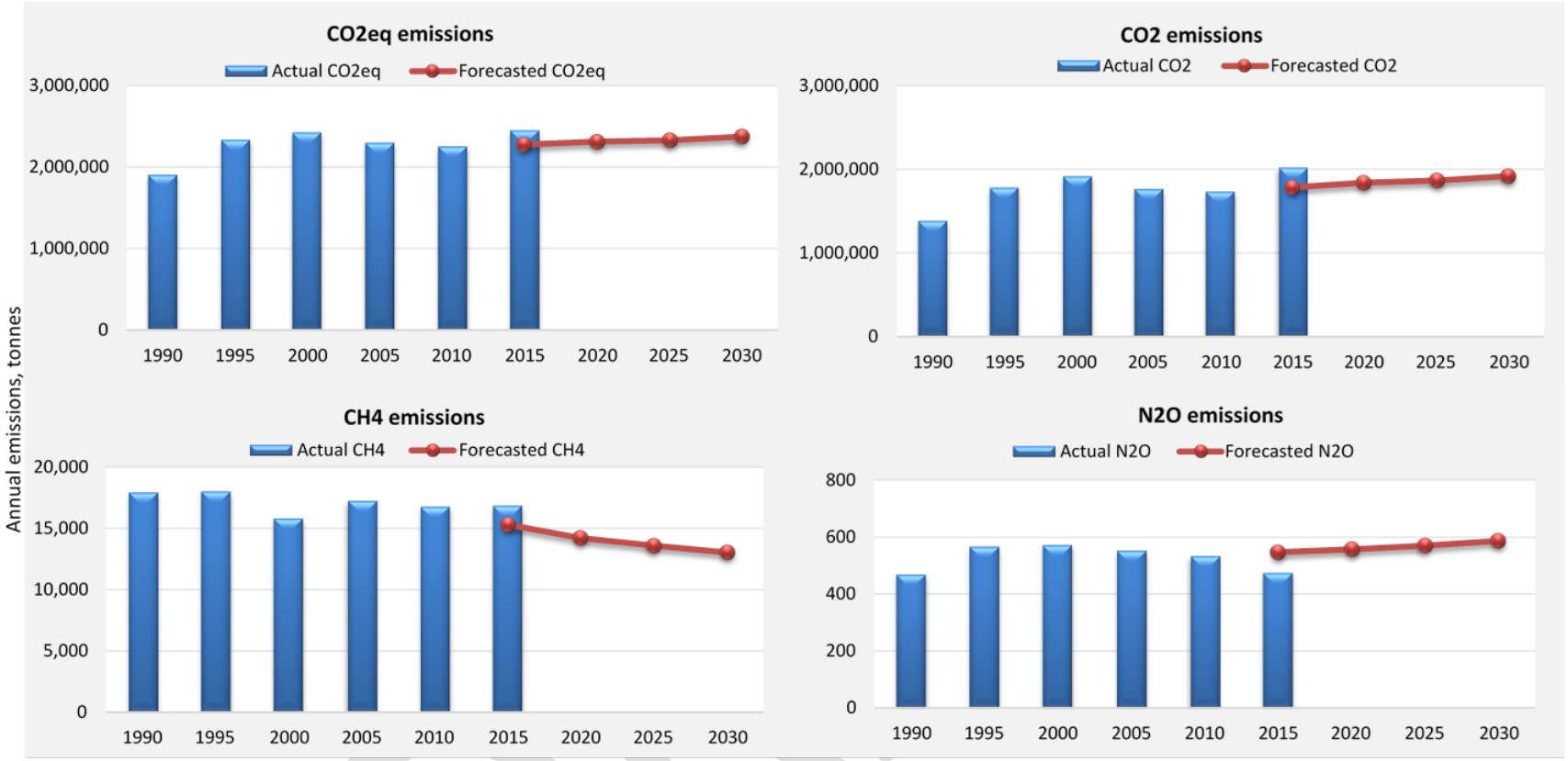
GHG emissions in the FVRD:



Emission trends and forecast in the FVRD:




CO emissions
Actual CO
Forecasted CO
150,000
100,000
50,000
0
1990
1995
2000
2005
2010
2015
2020
2025
2030
SOx emissions
Actual SOx
Forecasted SOx
900
600
300
0
NH3 emissions
Actual NH3
Forecasted NH3
8,000
6,000
4,000
2,000
Annual emissions, tonnes


CO2eq emissions
Actual CO2eq
Forecasted CO2eq
3,000,000
2,000,000
1,000,000
0
1990 1995 2000 2005 2010 2015 2020 2025 2030
CO2 emissions
Actual CO2
Forecasted CO2
3,000,000
2,000,000
1,000,000
0
1990 1995 2000 2005 2010 2015 2020 2025 2030
Annual emissions, tonnes
CH4 emissions
Actual CH4
Forecasted CH4
20,000
15,000
10,000
5,000
0
1990 1995 2000 2005 2010 2015 2020 2025 2030
N2O emissions
Actual N2O
Forecasted N2O
800
600
400
200
0
1990 1995 2000 2005 2010 2015 2020 2025 2030

Appendix C: List of Air Quality Committees and Working Groups in the LFV

Committee	Region/ country	Goals and objectives	Activity status	FVRD involvement
Agricultural Nutrient and Air Working Group (ANAWG) - a joint industry-government working group	LFV	Provides a forum for exchange of information on agricultural nutrient management and air quality, as well as to review projects and research being done.	Dormant since 2018	Member
Air Quality & Health Steering Committee (AQ&HC) - a multi-agency regional committee	LFV	Promotes understanding of the effects or air pollution on health, environment, and economy through research, education, and public awareness campaigns. Aims to develop tools and inform policies that will reduce the impact of air pollution on human health, ecosystems, and visibility.	Active, meets semi-annually	Member
BC Air Quality Meteorologists (AQ Met) – a provincial air quality experts group	BC	Discusses provincial air quality issues and organizes training sessions and workshops.	Active, meets monthly by tele-conference	Member
BC Visibility Coordinating Committee (BCVCC)	LFV	Studies and communicates the impact of air pollutants on visual air quality in the LFV	Dormant since 2019	Member
eMotive (Electric Vehicle Experience) Campaign	LFV	Develops and implements electric vehicle communications strategy. Raises awareness and promotes electric vehicles in the LFV.	Active, meets monthly by tele-conference	Member
Georgia Basin/Puget Sound International Airshed Strategy Group (IAS)	LFV and WA (USA)	Works collaboratively to address present and future cross-border air quality issues and to resolve pressing international air quality issues in the region in a timely manner.	Active, meets semi-annually	Member
IAS Subcommittee - Residential Wood Smoke Workgroup	LFV and WA (USA)	Exchanges information on wood burning appliances regulations and studies across the USA and Canada.	Active, meets semi-annually	Member

Committee	Region/ country	Goals and objectives	Activity status	FVRD involvement
Lower Fraser Valley Air Quality Coordinating Committee (LFV AQCC)	LFV	Works toward coordinated policies and programs for air quality management in the LFV. Guides intergovernmental actions to address the issues, encourage efforts to understand and manage air quality and foster the stewardship. Facilitates cooperation and information exchange between agencies responsible for air quality management in the LFV airshed.	Active, meets quarterly	Member, Co-chair
Regional Ground Level Ozone Strategy Steering Committee (RGLOSSC)	LFV	Develops and implements the regional Ground Level ozone Strategy in the LFV	Active	Chair
Mobile Source Emissions Forum (MSEF, formerly Air Care Steering Committee)	LFV	Oversees the inspection and maintenance program for light-duty vehicles in the LFV	Dormant since 2015	Member
Regional Clean Air Communications Team (RCACT)	LFV	Focuses on air quality communications	Dormant since 2018	Member
Regional Engineers Advisory Committee (REAC, Metro Vancouver Committee)	MV	Discusses climate change and greenhouse emissions reductions	Active, meets monthly	Adjunct member

Appendix D: Ambient Air Quality Objectives in Canada, BC, and the LFV

Canadian Ambient Air Quality Standards[i]

Pollutant	Averaging Time	Numerical Value		
		2015	2020	2025
Fine Particulate Matter ($PM_{2.5}$)	24-hour	28 µg/m^3	27 µg/m^3	
	Annual	10 µg/m^3	8.8 µg/m^3	
Ozone (O_3)	8-hour	63 ppb	62 ppb	
Sulphur Dioxide (SO_2)	1-hour	-	70 ppb	65 ppb
	Annual	-	5 ppb	4 ppb
Nitrogen Dioxide (NO_2)	1-hour	-	60 ppb	42 ppb
	Annual	-	17 ppb	12 ppb

Ambient Air Quality Objectives in British Columbia[ii]

Contaminant	Avg. Period	Air Quality Objective		Source	Date Adopted
		µg/m^3	ppb		
Formaldehyde (HCHO)	1 hour	60	50	Provincial AQO	1995
Nitrogen Dioxide (NO_2)	1-hour	188	100	Interim Provincial AQO	2014
	Annual	60	32		
Ozone (O_3)	1-hour	160	82	NAAQO8	1989
	8 hour	123	63	CAAQS	2013
Particulate Matter <2.5 µm ($PM_{2.5}$)	24 hour	25	-	Provincial AQO	2009
		28	-	CAAQS	2013
	Annual	8	-	Provincial AQO	2009
		10		CAAQS	2013
Particulate Matter <10 µm (PM_{10})	24 hour	50	-	Provincial AQO	1995
Sulphur Dioxide (SO_2)	1-hour	196	75	Interim Provincial AQO	2016
	1-hour	183	70	CAAQS	2016
	Annual	13	5	CAAQS	2016
Total Suspended Particulate (TSP)	24- hour	120	-	NAAQO	1974
	Annual	60	-	NAAQO	1974

[i] Adopted from the Canadian Council of Ministers of the Environment website. More details available at http://airquality-qualitedelair.ccme.ca/en/

[ii] Adopted from the BC Air Quality website. More details available at https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/aqotable.pdf

Metro Vancouver's Current Ambient Air Quality Objectives[i]

Air Contaminant	Averaging Time	Ambient Air Quality Objective Levels	
		µg/m³	ppb
Carbon monoxide (CO)	1-hour	30,000	26,200
	8-hour	10,000	8,700
Nitrogen dioxide (NO_2)	1-hour	200	106
	Annual	40	21
Sulphur dioxide (SO_2)	1-hour	196*	75*
	24-hour	125	48
	Annual	30	11
Ozone (O_3)	1-hour	161	82
	8-hour	128	65
Inhalable particulate matter (PM_{10})	24-hour	50	-
	Annual	20	-
Fine particulate matter ($PM_{2.5}$)	24-hour	25	-
	Annual	8 (6)	-
Total reduced sulphur (TRS)	1-hour (acceptable)	14	10
	1-hour (desirable)	7	5

Air Zone management framework for ground-level ozone and PM2.5[ii]

Management Level	O_3 (ppb)		$PM_{2.5}$ – Annual (µg/m³)		$PM_{2.5}$ - 24h (µg/m³)	
	2015	2020	2015	2020	2015	2020
Red	Actions for Achieving Air Zone CAAQS					
Threshold (CAAQS)	63	62	10	8.8	28	27
Orange	Actions for Preventing CAAQS Exceedance					
Threshold	56		6.4		19	
Yellow	Actions for Preventing Air Quality Deterioration					
Threshold	50		4		10	
Green	Actions for Keeping Clean Areas Clean					

- "Red" - Communities are expected to work towards a goal of achieving the CAAQS through advanced air zone management actions. The CAAQS define the upper threshold separating the "red" and "orange" management levels.
- "Orange" - Communities are expected to improve air quality through active management.
- "Yellow" – Communities are expected to utilize early intervention and ongoing actions to continuously improve air quality.
- "Green" zones are expected to keep clean areas clean and to proactively manage air quality.

[i] Adopted from the Metro Vancouver website. More details available at http://www.metrovancouver.org/services/air-quality/AirQualityPublications/CurrentAmbientAirQualityObjectives.pdf

[ii] Adopted from the Report on Air Zone Management Response for British Columbia, September 2017

Appendix E: Criteria Air Contaminants and their sources and effects

Air Contaminant	What is it?	Where does it come from?	What does it do for health and the environment?
Particulate Matter (PM)			
Coarse or inhalable Particulate Matter (PM_{10})	Solid or liquid airborne particles smaller than 10 micrometers (µm) in diameter (1/10 of a human hair thickness)	Motor vehicles Wood burning stoves and fireplaces Wildfires Open burning and incineration of waste Dust from construction, roads, and agriculture Industrial sources Windblown dust from open lands Atmospheric chemical reaction between other pollutants	*Health:* Penetrates the deeper part of human lungs, such bronchi (PM_{10}) and alveoli ($PM_{2.5}$) causing irritation and inflammation to airways. Causes negative health effects, such as lung cancer, respiratory and cardiopulmonary diseases, adverse pregnancy outcomes, birth defects, and dementia. Increases mortality and a number of hospital visits. Has no safe levels for human exposure *Environment:* Contributes to haze and smog; reduces visibility Clogs stomatal openings of plants, leading to slower growth or mortality in some plant species
Fine Particulate Matter ($PM_{2.5}$)	Solid or liquid airborne particles smaller than 2.5 micrometers (µm) in diameter (1/40 of a human hair thickness)		
Ozone (O_3)			
Ground-level ozone (O_3)	Light-blue gas with a pungent smell Highly reactive and hazardous substance Powerful oxidizing agent Major component of toxic photochemical smog	Photochemical (sun-driven) atmospheric reaction between nitrogen oxides (NOx) and volatile organic compound (VOC)	*Health:* Aggravates chronic lung diseases and causes permanent lung damage, particularly for children and the elderly. Increases risk of premature death Has no safe levels for human exposure *Environment:* Damages sensitive vegetation and decreases productivity of some crops Damages synthetic materials and rubber

Air Contaminant	What is it?	Where does it come from?	What does it do for health and the environment?
Nitrogen Oxides (NOx)			
Nitrogen dioxide (NO_2)	Reddish-brown gas with pungent and irritating smell Highly reactive and hazardous substance	Motor vehicles Industrial sources	Causes airway irritation and inflammation in healthy people Increases respiratory symptoms in people with asthma Main component of ground-level ozone formation cycle Major component of acid rain
Nitric oxide (NO)	Colorless gas, a free radical Highly reactive and hazardous substance	Motor vehicles Industrial sources	Rapidly oxidizes to hazardous NO_2 in presence of air
Volatile Organic Compounds (VOC)			
Volatile organic compounds (VOC)	Organic substances which easily evaporate or sublimate from their liquid or solid form	Motor vehicles Various hydrocarbons in fossil fuels Chemical products, such as solvents, paints and coatings	Participate in ground-level ozone formation cycle Vary from highly toxic to those with no known health effects Might cause eye and respiratory irritation, headaches, dizziness, visual disorders, and memory impairment
Biogenic volatile organic compounds (BVOC)	VOCs produced by plants	Certain plant/tree species	
Greenhouse gases (GHG)			
Carbon dioxide (CO_2)	Atmospheric gases that absorb and re-emit thermal energy and cause the greenhouse effect on Earth	Motor vehicles (CO_2, N_2O) Deforestation and land use changes (CO_2) Livestock and manure management (CH_4, N_2O)	Contribute to global warming and climate change
Methane (CH_4)			
Nitrous oxide (N_2O)			
Other Criteria Air Contaminants			
Ammonia (NH_3)	Colourless gas with a pungent and irritating smell Extremely hazardous and toxic in high concentrations	Livestock and manure management Sewage treatment	Causes airway irritation and inflammation in healthy people Contributes to formation of secondary $PM_{2.5}$
Sulfur oxides (SOx)	Colorless gas with a pungent and irritating smell Extremely hazardous and toxic in high concentrations	Motor vehicles Marine vessels Coal burning Industrial sources	Causes airway irritation and inflammation in healthy people Increases respiratory symptoms in people with asthma

Air Contaminant	What is it?	Where does it come from?	What does it do for health and the environment?
			Increases risk of premature death Contributes to formation of secondary $PM_{2.5}$ Major component of acid rain
Carbon monoxide (CO)	Colorless, odorless, and tasteless gas Extremely hazardous and toxic in high concentrations	Motor vehicles Gas burning stoves and fireplaces (if improperly vented) Coal burning Industrial sources	Causes significant damage to the heart and central nervous system May result in seizure, coma, and fatality May have severe adverse effects on the fetus of a pregnant woman

Appendix F: Linkages to the existing local plans and policies

Initiative	Air Quality Content
FVRD Regional Growth Strategy (2020, working draft)	Strategy 5.1: Monitor, study, protect and improve air quality. Strategy 6.1: Create a region-wide network of affordable and convenient transportation options that safely and efficiently facilitates the movement of people and goods. Strategy 6.2: Promote active and alternative forms of transportation that prioritize pedestrians and cyclists. Strategy 8.1: Promote energy efficiency and the reduction of greenhouse gas emissions. Strategy 8.2: Reduce the region's impact on climate change and develop capacity to adapt to and mitigate climate change.
FVRD Solid Waste Management Plan Update (2016-2026) [i]	The FVRD is not supportive of incineration as a method of 'recovery' for reasons that include its emissions of harmful air emissions and its production of greenhouse gases. The FVRD supports organic diversion from landfills to reduce production of methane and other volatile organic compounds. Strategy 7.3.4: Reduce operations-related GHG emissions.
Strategic Review of Transit in the Fraser Valley (2010)[ii]	Includes a 20-year vision for transit in the Fraser Valley involving significant increases in local services, new regional services between communities, and new inter-regional services, and outlines numerous transit-related strategies to achieve this Vision.
FVRD Climate Change Adaptation Strategy (2015)[iii]	As part of the BC Agriculture & Food Climate Action Initiative, this strategy identified priority actions for the agricultural sector to adapt to impacts from climate change. It also included a detailed analysis of climate projections for the Fraser Valley through the 2050s. The report discusses the anticipated impacts of climate change on the region some of which (e.g., increased opportunities for production of ground level ozone in the atmosphere, increased dust, etc.) affect air quality.
FVRD Greenhouse Gas Reduction Strategy (2009)	Stantec prepared a baseline inventory of corporate greenhouse gas emissions that result from FVRD operations and identified a number of corporate actions that could be taken to reduce energy consumption. The total energy consumption for the FVRD operations in 2008 was estimated at 563 tonnes of CO_2e, primarily emanating from recreational facilities and the fleet. Although not part of the strategy, the report estimates community emissions for the FVRD as 67,685 tonnes of CO_2e.

[i] Available: http://www.fvrd.ca/assets/Services/Documents/Garbage/SWMP.pdf
[ii] Available: http://www.fvrd.ca/assets/Government/Documents/Transit%20Strategic%20Review.pdf
[iii] Available: http://www.fvrd.ca/assets/Government/Documents/RegionalStrategies-FraserValley.pdf

City of Abbotsford Official Community Plan (2016)	Sets city-wide GHG Reduction Targets for 2025 (20%) and 2040 (40%; per capita, below 2007 levels) and establishes policies pertaining to alternative forms of transportation and improved air quality, including: Policy 3.2: "Develop ambitious but realistic city wide and neighbourhood specific mode targets that emphasize walking, biking, and transit use year-round, reflecting a multi-modal city. A suggested starting target is 25% of all trips being made without a vehicle in the life of this Plan, an increase from 7% today." Policy 5.6: "Protect viewscapes to natural features such as Mt. Baker, north shore, and Fraser Valley mountains, and minimize the visual impact of development on the hillside from the lowlands." Policy 5.12: "Promote strategies that reduce local air pollution, including measures to protect the Fraser Valley airshed from additional point pollution sources such as energy plants."
City of Abbotsford Green Energy Plan (2013)	This plan outlines strategies that can be taken to support and promote green house gas and energy use reduction in the City of Abbotsford. Carbon emissions related to the energy used in buildings (29% of community emissions), transportation (69% of community emissions) and solid waste decomposition (2% of community emissions). Activities in Abbotsford generate 6%-9% of the emissions of carbon monoxide (CO), nitrogen oxide (NOx) and particulate matter (PM 2.5) in the Lower Fraser Valley.
Chilliwack's Integrated Air Quality, Energy and Greenhouse Gas Community Action Plan (2011)	Stantec prepared an action plan for to help address community and corporate air quality and greenhouse gas emissions for the City of Chilliwack. Based on 2007 levels, 45% of GHG emissions within the City were from on-road transportation. Buildings (29%), agriculture (17%), and solid waste (9%) were responsible for the remainder. Around 3-6% of all emissions in the Lower Fraser Valley originate from within Chilliwack, with key parameters of concern including ammonia, particulate matter, and nitrogen oxides and volatile organic compounds (which react with sunlight to produce ozone). This plan will be updated in 2020
District of Mission OCP (2017)	The District is striving to achieve the greenhouse gas emissions reduction targets adopted in the 2008 OCP - 20% below 2007 levels by December 31, 2020 and by 80% below 2007 levels by December 31, 2050. The District's Policies to achieve these goals include: 4.2.3-4.2.8. Promote sustainable and active transportation, establishing an idling reduction policy, and developing infrastructure for electric vehicles. 4.2.9-4.2.27 Programs and incentives for home energy retrofits, sustainable development practices, building alternative energy systems, promote energy efficiency for commercial and residential buildings, reduce commercial fleet vehicle emissions 4.2.30 Reduce methane gas generation from the landfill 6.5.1-6.5.12 Improve transit service and amenities
District of Kent OCP (2014)	According to the Community Energy and Emissions Inventory for Kent (2010), on-road transportation accounts for approximately 54% of emissions in Kent. Buildings account for 36% of emissions and solid waste for 10%. The district already has air quality initiatives such as no-idling policy for municipal fleet vehicles and the operation of a new air quality monitoring station. Further GHG and Energy Reduction Policies include the following: Reduce District GHG's by 10% of 2006 levels by 2025; this target is in line with the District's unique small town and rural characteristics.

	Raise awareness respecting climate change and GHG emission reduction initiatives through leadership and community sustainability programs incorporate climate change, its potential impact, and mitigation measures when reviewing new development applications and undertaking long-term planning projects and initiatives. Continue to pursue opportunities to reduce GHG emissions in District operations including the use of fuel-efficient municipal vehicles. Continue to support improvements to alternative and active transportation amenities. Explore options for encouraging and developing infrastructure for "electric plug-in-vehicles". Support provincial efforts and work with other agencies, stakeholders, and the community to achieve emission reduction targets and energy conservation goals.
District of Hope OCP (2018)	Objective 6.6 To improve air quality. Policy 6.6.1 Discourage vehicle idling within the District. Policy 6.6.2 Collaborate with the FVRD, other Fraser Valley municipalities, and major employers to address issues that affect air quality. Policy 6.6.3 Encourage large employers and government agencies with air quality monitoring data to share this information publicly. Policy 6.6.4 Continue to support the wood stove exchange program. In 2014, Hope set its community target of reducing GHG emissions to 23% per capita below 2009 levels by the year 2030. Develop a sustainability checklist for buildings to improve energy efficiency in new and existing developments. Policy 15.1.2 Encourage active transportation through infrastructure development and education. Policy 15.1.3 Work with BC Transit to provide local public transit options that are affordable and convenient. Policy 15.1.4 Promote energy demand-side management programs Policy 15.1.5 Incorporate energy efficient standards into purchase agreements, enforced through a Section 219 covenant, when selling District lands for development. Policy 15.1.6 Investigate the implementation of LED street lighting, solar pathway lighting and lighting retrofits in municipal buildings, where appropriate.
Harrison Hot Springs OCP (2018)	Goal 5: Protect and maintain air and water quality and biodiversity. The strategy to achieve this goal involves upgrading wastewater management systems, managing stormwater drainage and runoff, limiting campfires and protecting important natural habitats and ecosystem functions.
Area A Official Community Plan (1994)	It is the Regional Board's policy that: 10.3.1 The Regional board will encourage the ongoing monitoring and analysis of ambient air quality and air contaminant discharges in the Plan area.
Area D Official Community Plan (Draft)	7.6.4 Residents are encouraged to avoid the burning of wood wastes and debris, which results in reduced air quality and emissions of fine particulates that may pose a health hazard, and instead employ alternatives such as composting or mulching. 7.6.5 The Regional District will work with Provincial ministries and other appropriate organizations to combat the illegal burning of household garbage and other prohibited materials.

Area E and H Official Community Plans (2011)	6.1.4 The farming community is strongly encouraged to follow best management practices associated with the spreading of manure on fields and the burning of wastes to minimize air quality impacts, particularly fine particulates in the air. Farms are encouraged to review the Ministry of Agriculture's Beneficial Management Practices for crop types grown in Columbia Valley. 8.4.5 Residents are encouraged to avoid the burning of garbage and wastes which results in reduced air quality and emissions of fine particulates which may pose a health hazard.
Area F Official Community Plan (2010)	The Plan states that support from the FVRD board for any new transportation/utility corridor proposals will be contingent on the proposals meeting the air quality policies outlined in the AQMP
Area G Official Community Plan (2009)	The Plan states that support from the FVRD board for any new transportation/utility corridor proposals will be contingent on the proposals meeting the air quality policies outlined in the AQMP
Hemlock Valley OCP (Draft)	Sets a community-wide plan to reduce GHG and other air pollutants originating from the Hemlock Valley Community. This Plan strives to protect sensitive ecosystems with high biodiversity values through legal and policy tools including the following; 4.7.7 Encourage residents to avoid the burning of garbage and waste which results in reduced air quality and hazardous fine particulate matter emissions. 6.3.3 Take actions to reduce particulates and other emissions from transportation, industry, building heating and other sources. 6.3.4 Continue to study and monitor air quality throughout the Hemlock Valley and expand the monitoring network as needed. 6.3.5 Support land use development, initiatives, and programs across all sectors that reduce Greenhouse Gas Emissions, protect air quality, and promote energy efficiency and conservation. 6.3.6 Update and implement the regional Air Quality Management Plan. 6.3.7 Educate Hemlock Valley residents on the causes and impacts of degraded air quality, and what they can do to improve air quality.

Appendix G: List of Acronyms

AQ	Air Quality
AQHI	Air Quality Health Index
BC MOECCS	BC Ministry of Environment and Climate Change Strategy
BVOC	Biogenic Volatile Organic Compounds
CAAQS	Canada-wide Ambient Air Quality Standards
CAC	Criteria Air Contaminants
CH4	Methane
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide
COPD	Chronic Obstructive Pulmonary Disease
ECCC	Environment and Climate Change Canada
EV	Electric Vehicles
GHG	Greenhouse Gases
H2S	Hydrogen Sulfide
FVRD	Fraser Valley Regional District
LFV	Lower Fraser Valley
LNG	Liquefied Natural Gas
MV	Metro Vancouver
NAAQS	National Ambient Air Quality Standards (USA)
NH3	Ammonia
N2O	Dinitrogen Monoxide or Nitrous Oxide
NO2	Nitrogen Dioxide
NO	Nitrogen Monoxide or Nitric Oxide
NOx	Nitrogen Oxides
O3	Ozone
PM	Particulate Matter
PM2.5	Fine Particulate Matter (with particle diameter ≤ 2.5µm)
PM10	Coarse or Inhalable Particulate Matter (with particle diameter ≤ 10µm)
ppb	Particles Per Billion
ppm	Particles Per Million
SO2	Sulfur Dioxide
SOx	Sulfur Oxides
TAP	Toxic Air Pollutants
TRS	Total Reduced Sulfur
TSP	Total Suspended Particulates
US EPA	US Environmental Protection Agency
VAQR	Visual Air Quality Rating
VI	Ventilation Index
VOC	Volatile Organic Compounds
ZEV	Zero-Emission Vehicles