NEWPRO

Northern Engineered Wood Products (2007) Inc.

Public Presentation and Tour

Plant Conversion Project

July 9-11, 2015

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SLR global environmental solutions

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Northern Engineered Wood Products

- Small privately owned BC based business with 30-40 employees
- Official facility shutdown January 6, 2014
- Historically a manufacturer of particle board (also called panelboard) for international and domestic use in the construction industry
- Permit 06099 still in effect and can resume operations as and when NEWPRO desires
- Asset is still tied to the valid discharge permit.
- Will begin operations as a particle board plant again, if the amendment is not granted

Proposed Project Description

- Re-purposed facility will manufacture wood pellets
- Uses wood waste from cut blocks, lumber shavings, and sawdust that might be otherwise burned in open burning piles or wood boilers
- Older, wood-burning rotary dryers will be replaced with natural-gas heated belt dryer
- Brings the source into compliance with all Best Achievable Technology guidelines

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Wood Pellet Industry

- A refined, carbon neutral renewable fuel source
- Biomass – 100% wood fibre, containing no additives or binding agents
- Approximately 50% of the world's electricity comes from burning of fossil fuels, wood pellets can be used to co-fire and off-set the use of coal in the generation of electricity
- Considered a renewable energy alternative and carbon-neutral

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NEWPRO's Pellet Plant

- 30 Full-time jobs and 10 contract jobs
- $1.5 - 2,000,000 direct economic payment plus secondary and tertiary benefits
- $100,000 in annual tax revenue for Smithers
- 91% reduction in $PM_{2.5}$ emissions
- Additional emission reductions from taking forestry debris
- Implement Best Achievable Technology
- Lowest industrial emitter in the BVLD airshed

Air Quality

- The BC MOE and Environment Canada controls discharge of certain air contaminants of importance to public health and the environment
- Criteria Air Contaminants (CAC), in particular, refer to a group of pollutants that include:
  - Sulphur Oxides (SOx);
  - Nitrogen Oxides (NOx);
  - Particulate Matter (PM);
    - Particulate Matter <10 microns in diameter (PM_{10})
    - Particulate Matter <2.5 microns in diameter ($PM_{2.5}$)
  - Volatile Organic Compounds (VOC);
  - Carbon Monoxide (CO); and
  - Ammonia (NH_3)
- Air quality is evaluated through comparison to national and provincial air quality objectives
- $PM_{2.5}$ is based on the 98^{th} percentile concentration in one year (8^{th} highest daily value)

Air Quality Factors

- Local air quality is the result of:
  - Distant emissions
  - Local emissions
  - Topography
  - Meteorology

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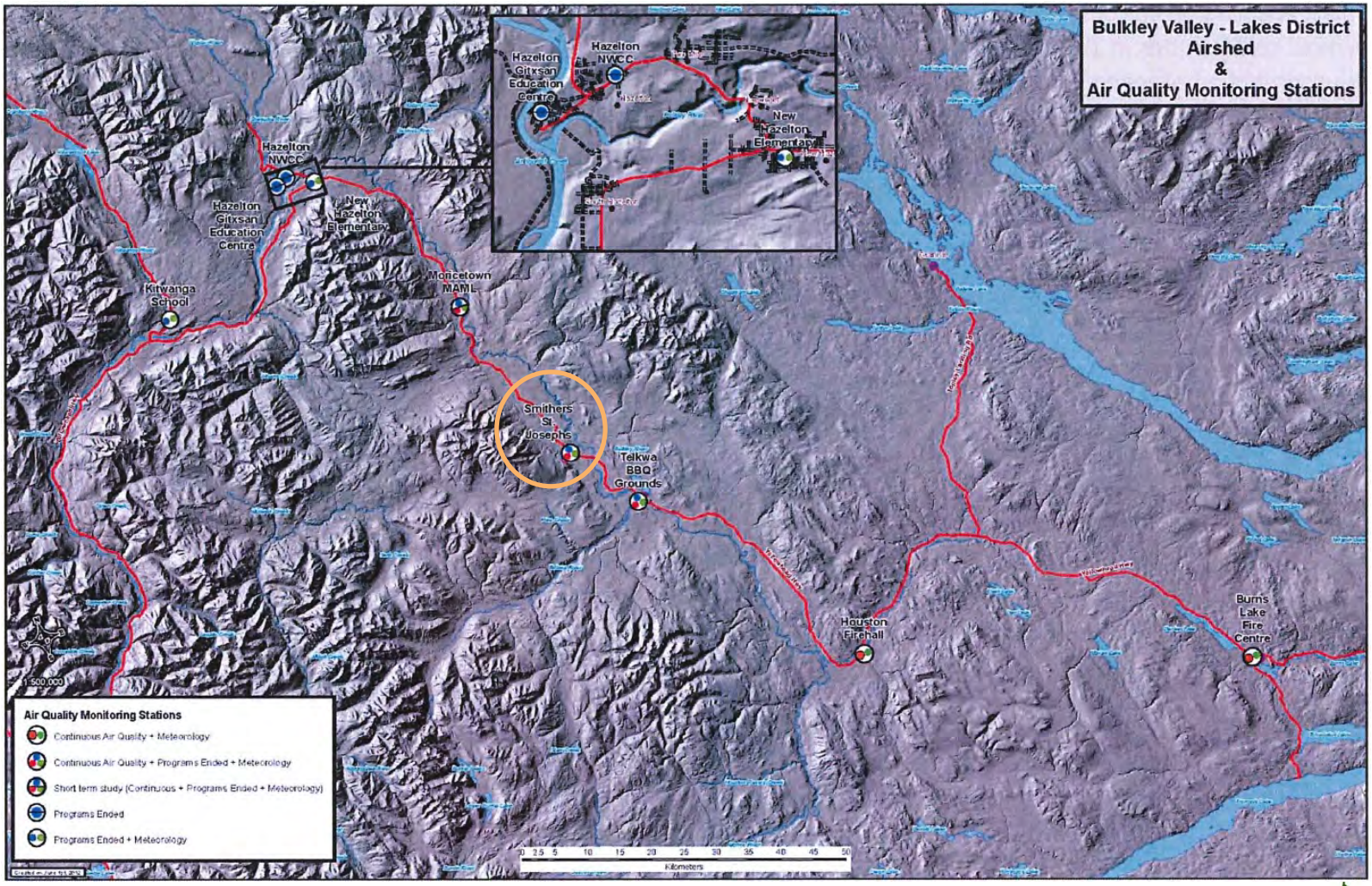
Bulkley Valley Lakes District Airshed

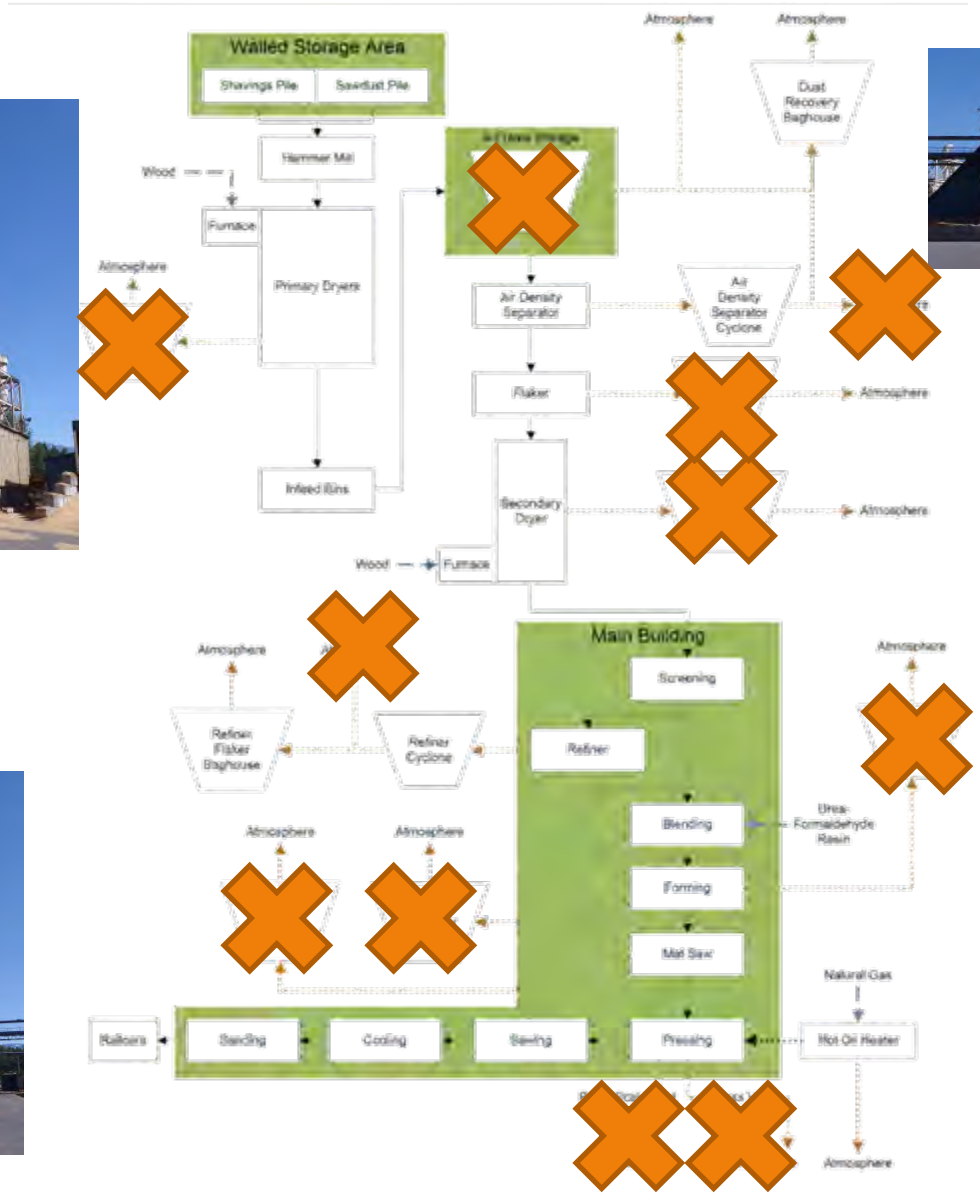


Maintaining the Status Quo

- Permit 06099 still in effect and panelboard operations can resume whenever NEWPRO desires
- Vegetative debris from logging and forest industry is burned in open burning piles
  - 20,000 dried tonnes (~59,000 m^3 of wood; ≈ 1,200 piles*) taken by NEWPRO.
  - 217 tonnes $PM_{2.5}$*
    - ≈ 3,700 wood stoves in BVLD
  - 57 tonnes VOC*
    - ≈ 670 wood stoves in BVLD

*Using factors from *CAC Emission Inventory for the Province outside of the Lower Fraser Valley for 2010*, MOE 2015

Permitted Panelboard Facility



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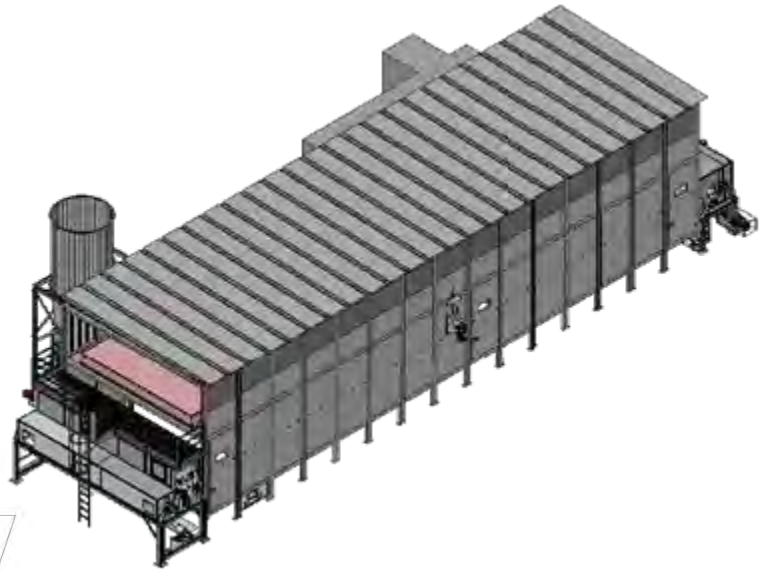
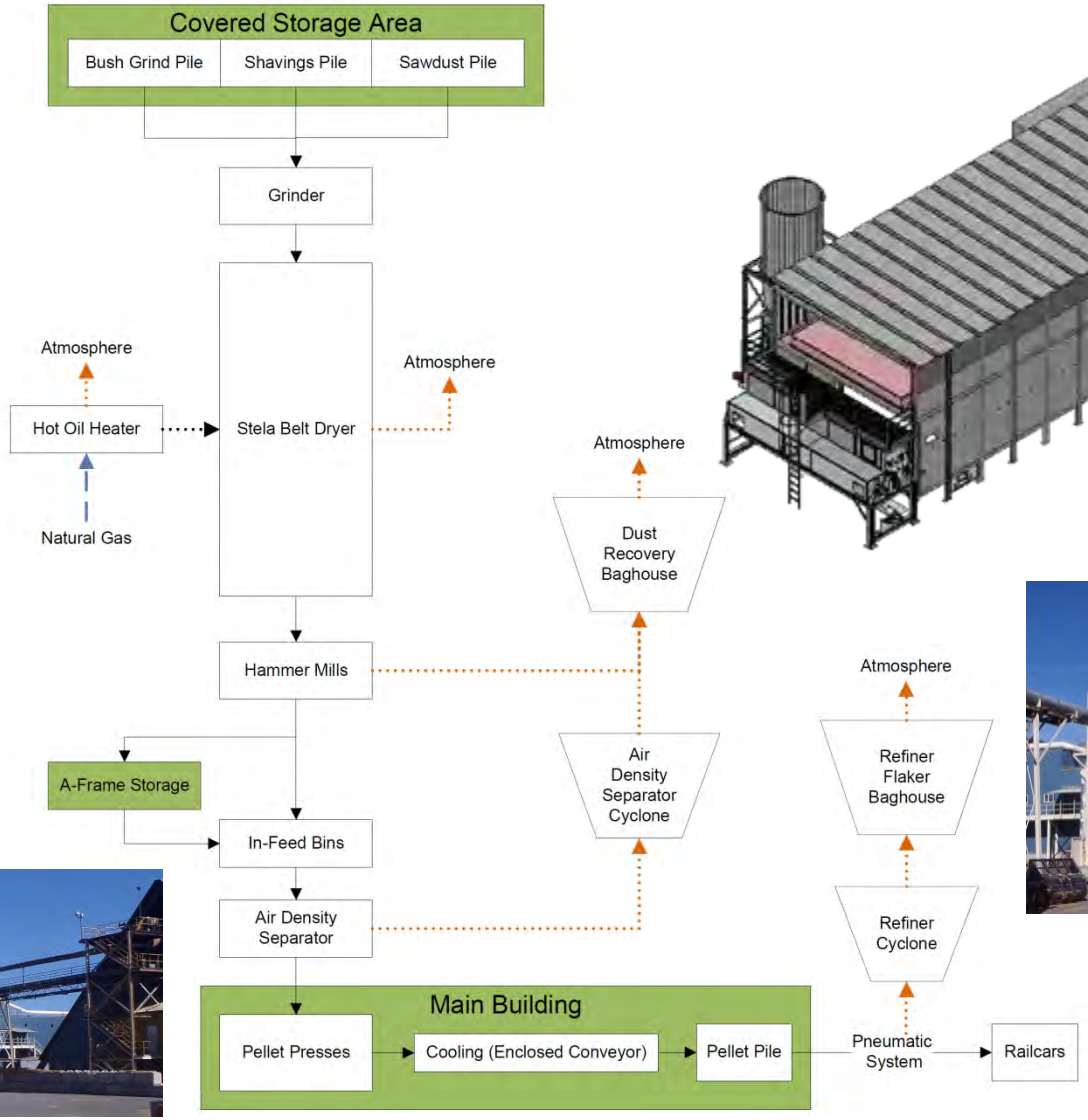
Proposed Pellet Plant





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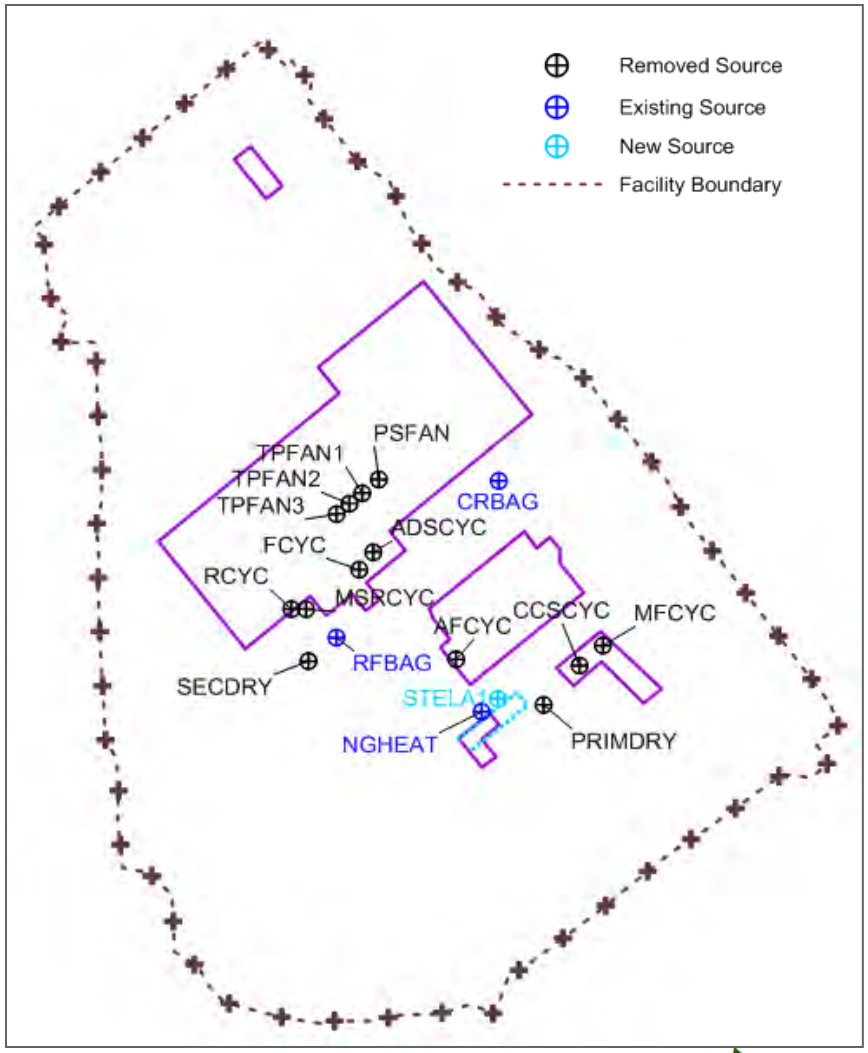
Facility Layout

- 11 cyclones removed
- 2 cyclones re-routed to a baghouse
- Old rotary dryers with wood-fired furnace removed
- New Stela belt dryer installed
- Best Achievable Technology implemented



Emission Sources

- Point Sources: Evaluated through dispersion modelling
  - Cyclones
  - Baghouses
  - Dryer
  - Natural Gas Heater
- Fugitive Sources: Evaluated through best management practices
  - Material Handling (covered storage, enclosed conveyors)
  - Road Dust (paved surfaces, sweeping, dust suppression)
  - Piles (covered storage)

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Best Achievable Technology

- Best Achievable Technology (BAT) is the technology which can achieve the best discharge standards that has demonstrated economic feasibility through commercial application.
- The MOE outlined BAT requirements for the pellet manufacturing industry in the “Emissions and Air Pollution Controls for the Biomass Pellet Manufacturing Industry"

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Best Achievable Technology - Point Sources

Emission Sources	Achievable TPM Emissions Level* (mg/m^3)	Proposed for NEWPRO
Rotary Dryer Exhaust	60/100	16.7 (Belt Dryer)
Pellet Cooler Exhaust	115	None (Enclosed Conveyor)
Other Plant Processes (pelletizers, hammermills, storage, screening, and conveyor)	20 (Baghouse)	20 (Baghouse and Enclosed Conveyors)

* Source: “Emissions and Air Pollution Controls for the Biomass Pellet Manufacturing Industry", May 12, 2010

Best Achievable Technology - Fugitives

Emission Sources	Best Achievable Technology*	Proposed for NEWPRO
Sawdust and Wet Material	Visual monitoring with controls as required including: Limit pile height limit exposed pile faces to high win (e.g. wind breaks vegetative or screens)	
Planer Shavings and Dry Material	As above plus three sided and covered containment. Prevent vehic traffic from grinding material finer	
On-site Haul Roads	Dust suppression in dry season or paving.	Paved and Dust Suppression

* Source: “Emissions and Air Pollution Controls for the Biomass Pellet Manufacturing Industry", May 12, 2010

Factors Affecting Dryer VOC Emissions

- Beginning and ending moisture content of the dried material
- Wood species
- Dryer temperature
- Size of the dried material

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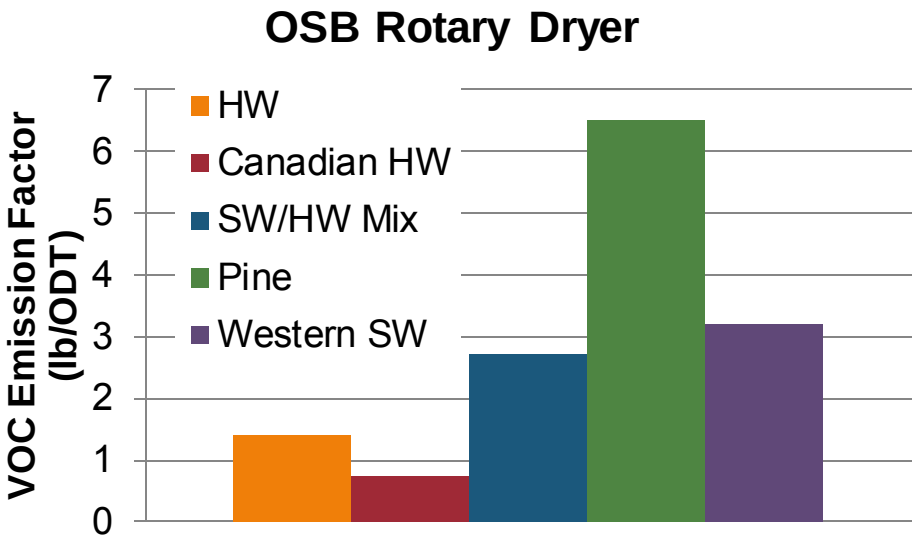
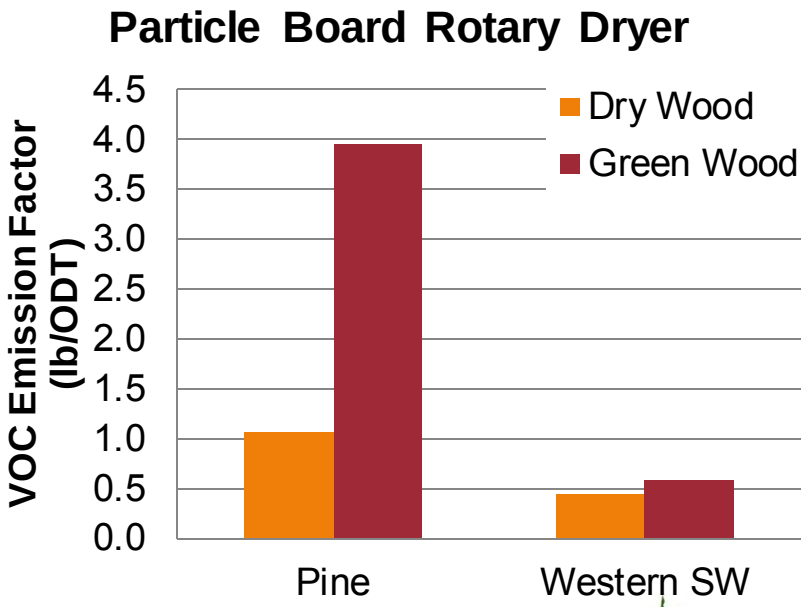
VOC Emissions by Wood Type

- Softwoods (SW) give off more VOC than hardwoods (HW)
- Green, moist wood has higher emissions than dry wood





ODT = Oven Dried Ton
OSB = Oriented Strandboard
Source: NCASI Air Emissions Database for Wood Products, February 2013

Belt Dryers vs Rotary Drum Dryers

Characteristic	Belt Dryer	Rotary Drum Dryer
Electrical energy consumption	Starting from 22 kWh/t water evaporation	Starting from 24 kWh/t water evaporation incl. auxiliaries
Thermal energy consumption (values at 10°C ambient)	Around 1.0 kWh/t water evaporation (110-120°C)	Around 1.15 kWh/t water evaporation (250-871°C)
Ash content at final customer	<0.5%	<0.8% (according to French long-term study from ITEBE)
Risk of fires and explosion	Low temperatures and high air flow rates guarantee very low fire danger	High temperatures and direct firing cause high fire danger
PM emissions	Belt works as filter	Dryer not usable without auxiliary filter equipment
VOC emissions	Low evaporation of VOC due to low drying temperatures	High evaporation of VOC due to high drying temperatures
Blue haze emissions	No	Yes
Additional controls needed? e.g. WESP	No	Yes

Source: STELA Laxhuber GmbH

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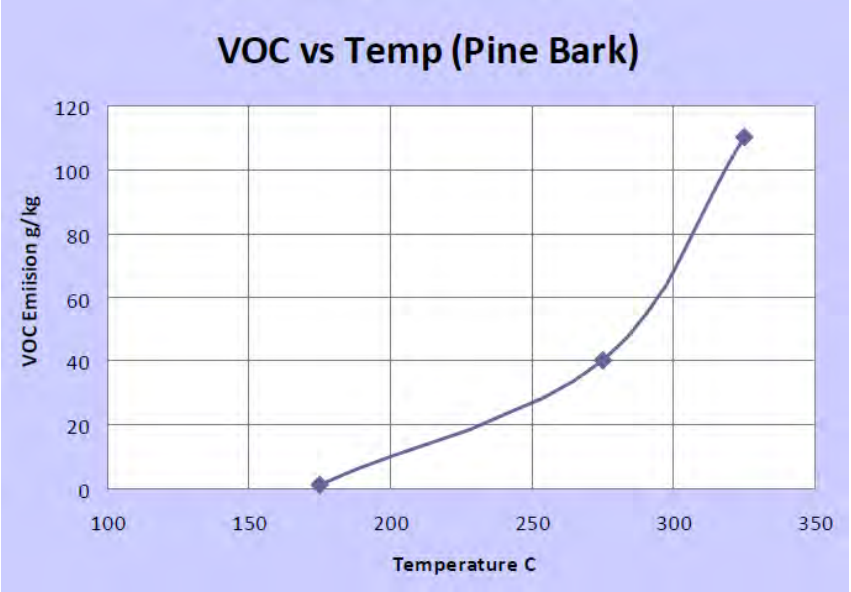
VOC Emissions vs Dryer Temperature

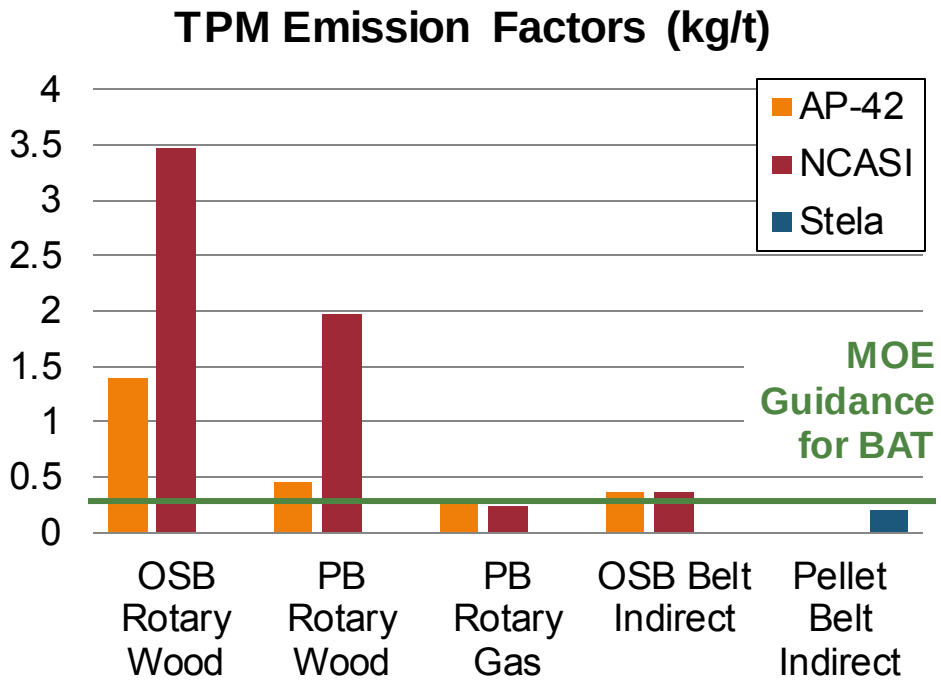
- Data is limited, but data from pine bark drying illustrates the effect of dryer temperature on VOC.
- As wood temperatures rise, emissions of VOC and Condensible PM (CPM) increase

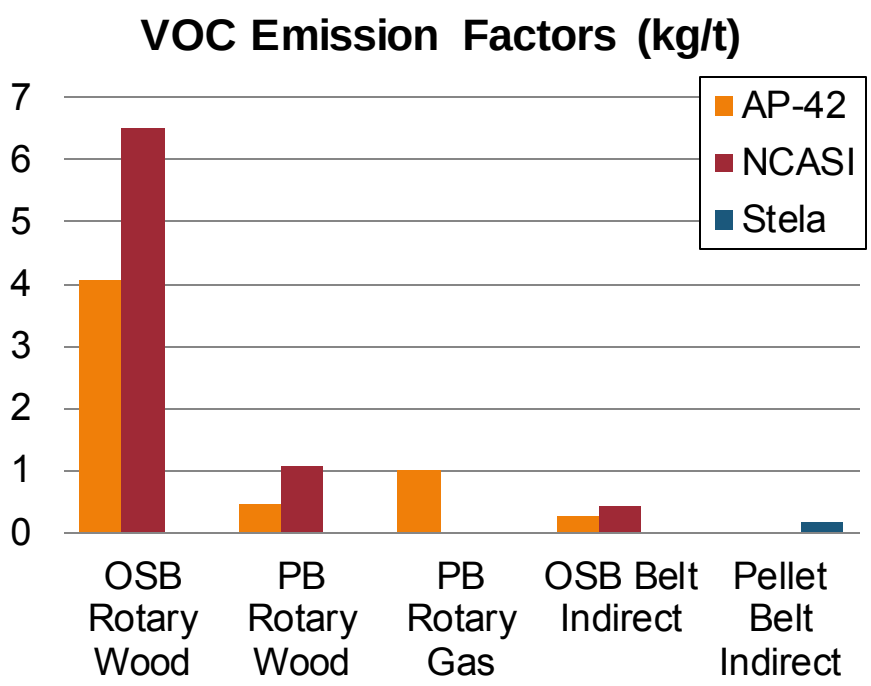


* Source: “Emissions and Air Pollution Controls for the Biomass Pellet Manufacturing Industry", May 12, 2010

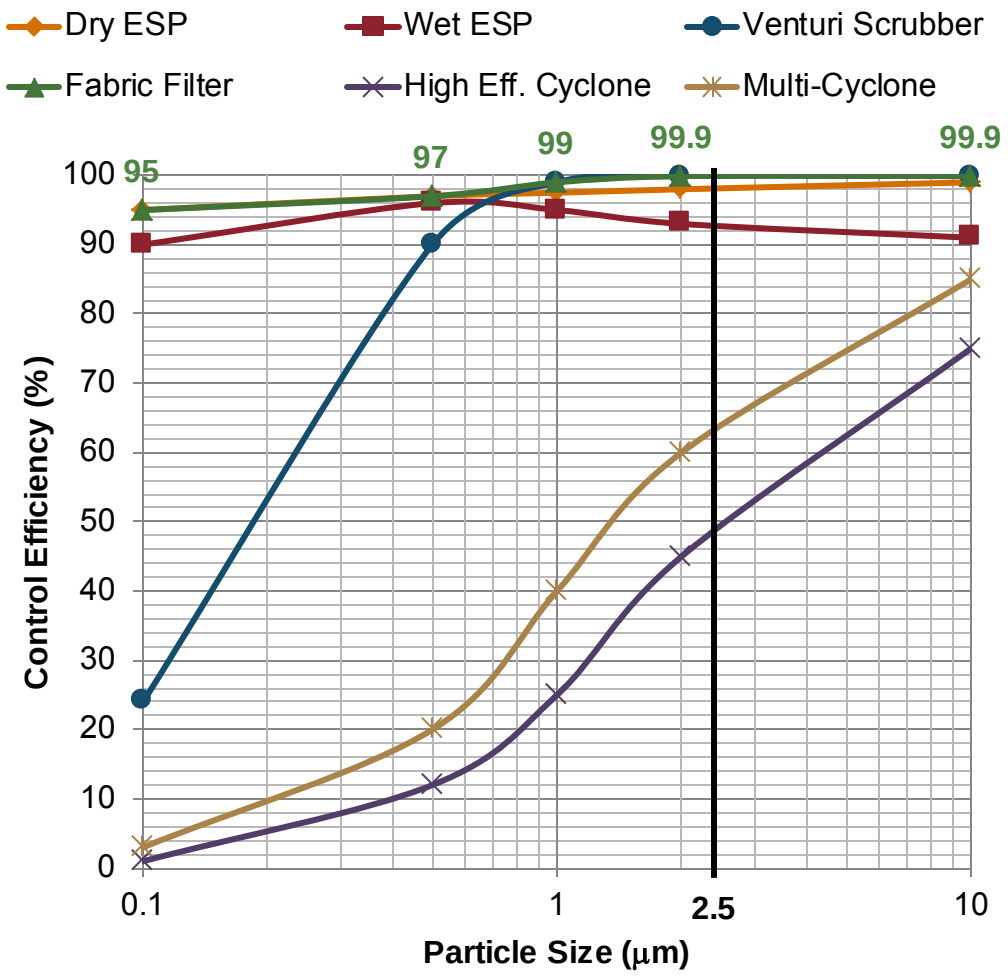
Emissions by Dryer Type

- Limited and highly variable data makes emissions by type difficult to assess
- Averages from several sources show belt dryers are the lowest in the wood drying industry





PM Control Efficiency vs Particle Size



* Source: “Emissions and Air Pollution Controls for the Biomass Pellet Manufacturing Industry", May 12, 2010

- Baghouses are very efficient at even the smallest particle sizes
- Emission estimates overstate actual emissions when based on flow rate instead of product throughput

Direct Emissions Reduction

Scenario	TSP	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Permitted Facility	432	380	255	43	47	130
Proposed Pellet Plant	26	25	24	8	7	36
Emissions Reduction	**-406 (94%)**	**-355 (93%)**	**-231 (91%)**	**-35 (82%)**	**-41 (86%)**	**-93 (72%)**

Units: tonnes per year

- The plant's $PM_{2.5}$ emissions are equivalent to emissions from ~300 households with wood stoves (~2% of BVLD households, ~4% of BVLD wood stoves)
- VOC emissions are equivalent to biogenic emissions from 0.7 hectares of forest

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Direct Emissions Reduction

- $PM_{2.5}$ reduction is equivalent to emissions from ~2,900 households with wood stoves (~21% of BVLD households, 43% of BVLD wood stoves) and ~1,300 open burning piles
- VOC reductions equivalent to the biogenic emissions of 1.9 hectares of forest, ~2,000 open burning piles, ~800 households with wood stoves

Wood stove estimate based on data for the BVLD regional emissions from "Residential Wood-Burning Emissions in British Columbia", April 1, 2004.

Combined Emissions Reduction

- Direct emissions from the facility and associated emissions from the reduction in open burning
- $PM_{2.5}$ reduction is equivalent to emissions from ~5,600 households with wood stoves (~41% of BVLD households, ~84% of BVLD wood stoves)

Emissions	TSP	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Direct Reduction	-406	-355	-231	-35	-41	-93
Associated Reduction	-377	-267	-233	-69	-901	-62
Total Reduction	**-783**	**-622**	**-464**	**-104**	**-942**	**-155**

Demonstrating Initial Compliance

- Stack testing
  - Using specific test methods in the BC Field Sampling Manual, approved by the BC MOE
  - Concurrently measure operating parameters to develop relationship to emissions
  - Conducted after achieving the maximum production rate, but within a reasonable time after startup
  - Provide MOE prior notice of any performance test to afford MOE the opportunity to have an observer present
- Visual monitoring
  - Perform dust surveys during delivery of material
  - Observe opacity during operation

Demonstrating Continuous Compliance

- Adhere to best work practices
- Continuous monitoring of operating parameters measured during the initial and subsequent stack testing
- Environmental Management Plan (EMP)
  - Parameters to be monitored
  - Monitoring methods
    - equipment and locations
    - frequency
  - Performance criteria based on correlation with tests
  - Operation and maintenance procedures
  - Recordkeeping and quarterly reporting
  - Training
- Random inspections by MOE

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Episode Management Plan

- During a poor air quality episode, the plant will reduce emissions
  - For example, if the St. Joseph's monitor has X consecutive hours of measured values above X level, plant will implement reduced emission operating scenario
  - "X" determined based on appropriate trigger level and predicted impact of the facility

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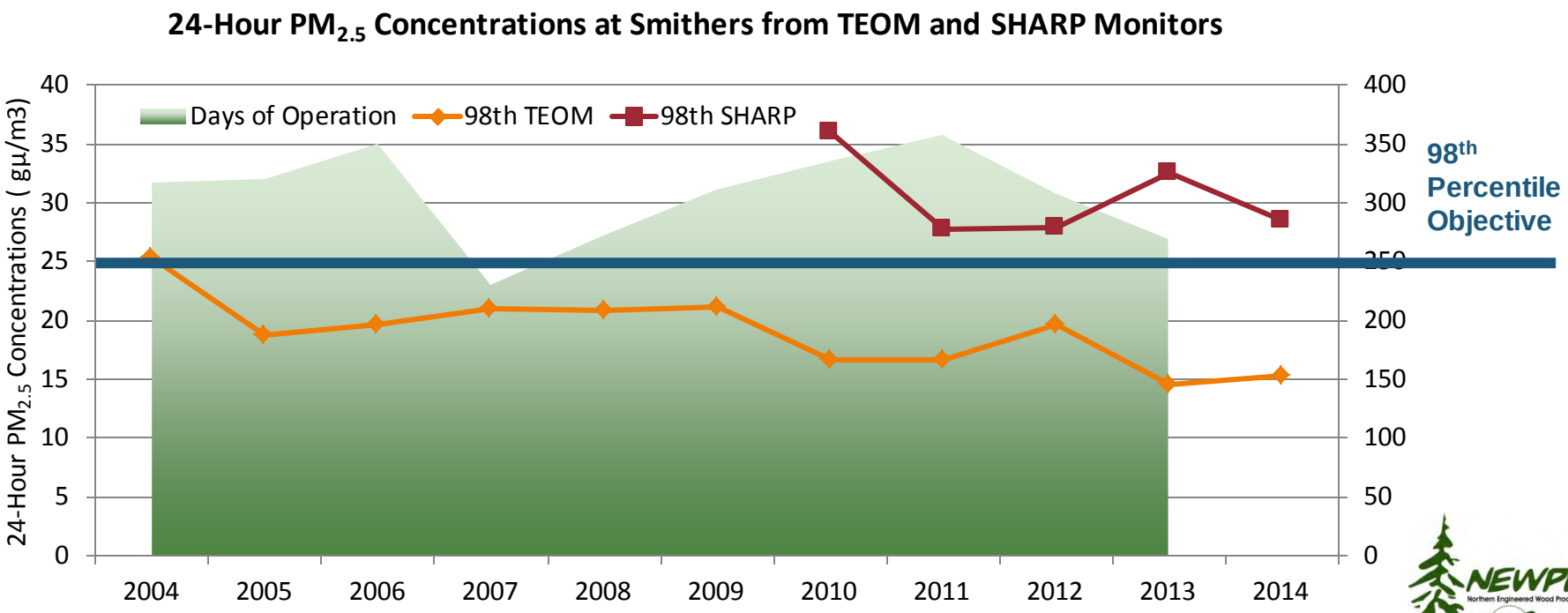
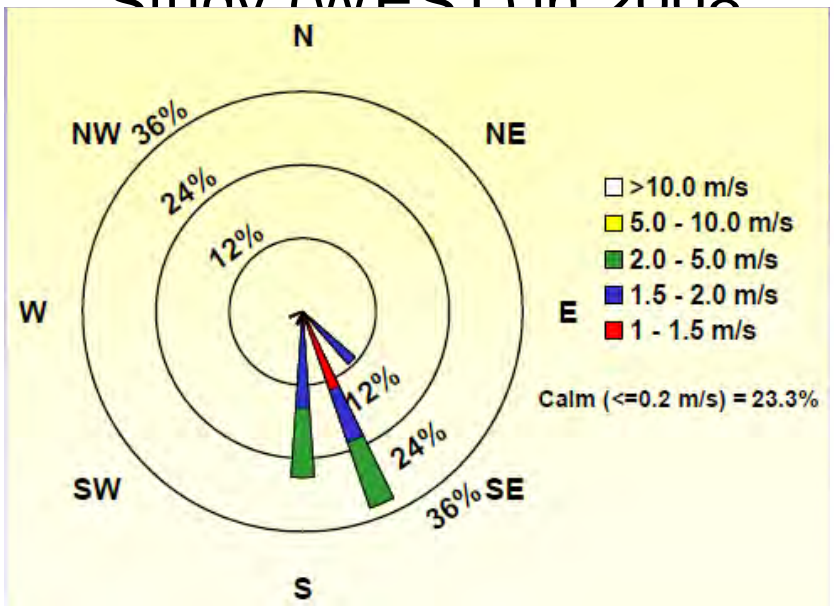
$PM_{2.5}$ Concentrations in the Airshed

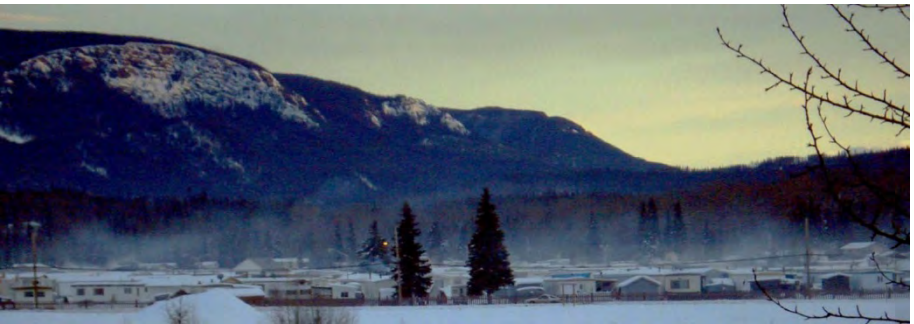
- New monitoring methods and equipment (SHARP/FEM) have shown much higher $PM_{2.5}$
- The objective level was exceeded 16 times in 2014 (8 exceedances are "allowed")

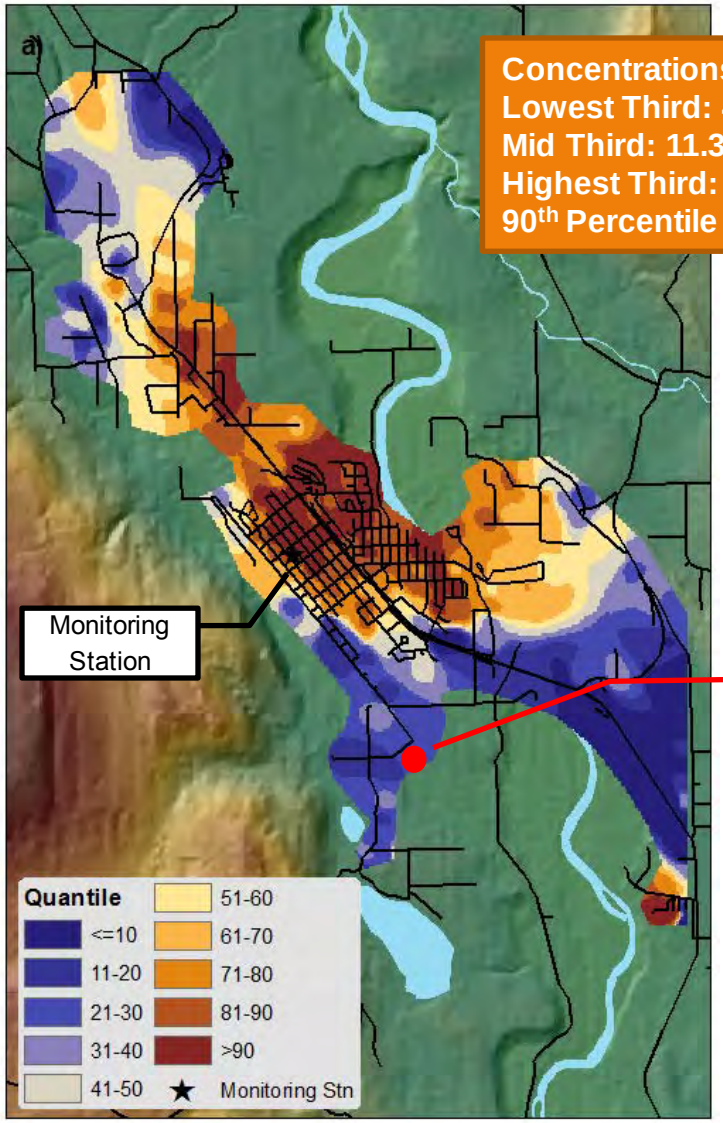


Spatial Distribution of $PM_{2.5}$

- Mobile monitoring done by Woodstove Exchange Study (WEST) in 2008

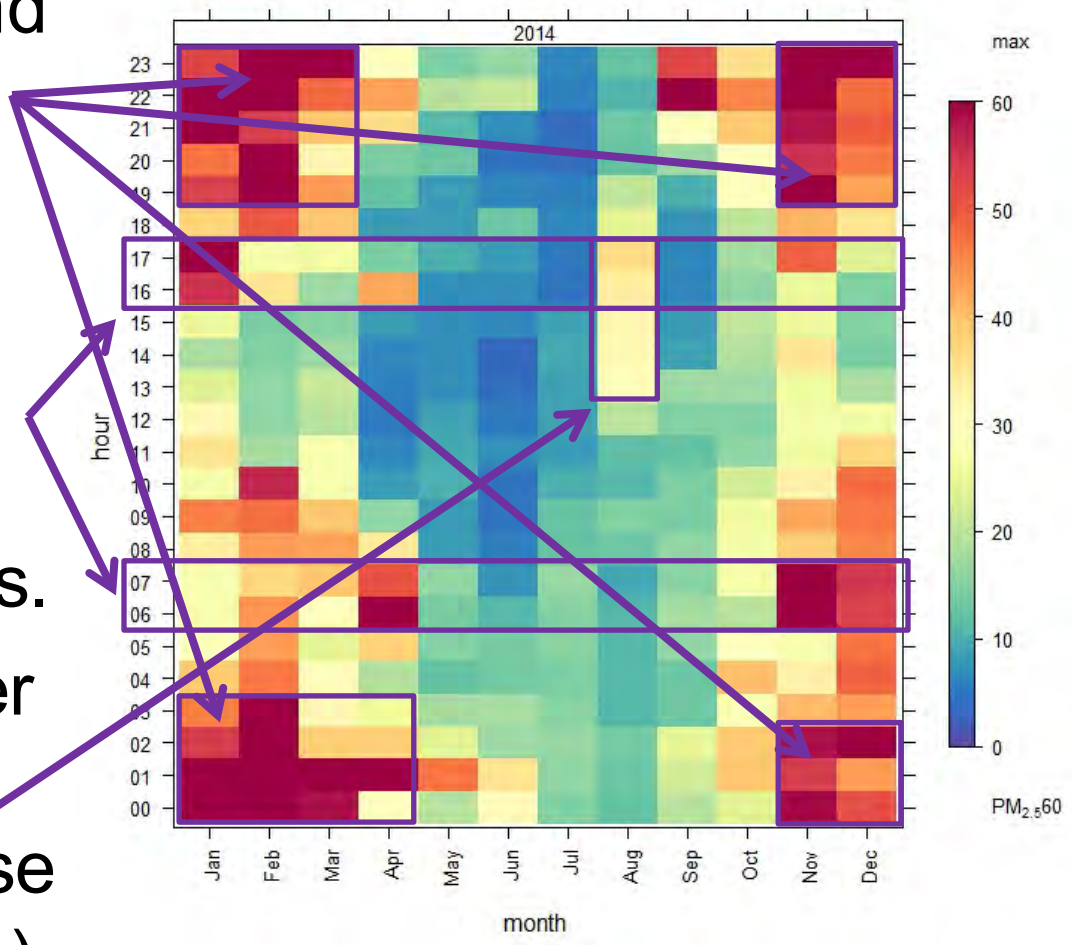






Temporal Distribution of $PM_{2.5}$

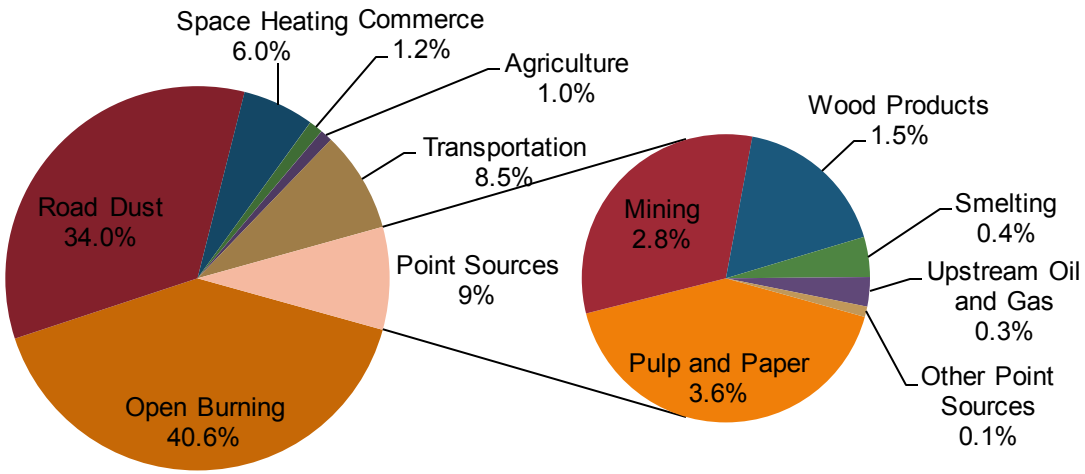
- Highest in winter and at night.
- Peaks on heating days and holidays.
- Small spikes during morning and afternoon commutes.
- Highs in the summer most likely due to wildfires (China Nose Fire, started Aug 11)



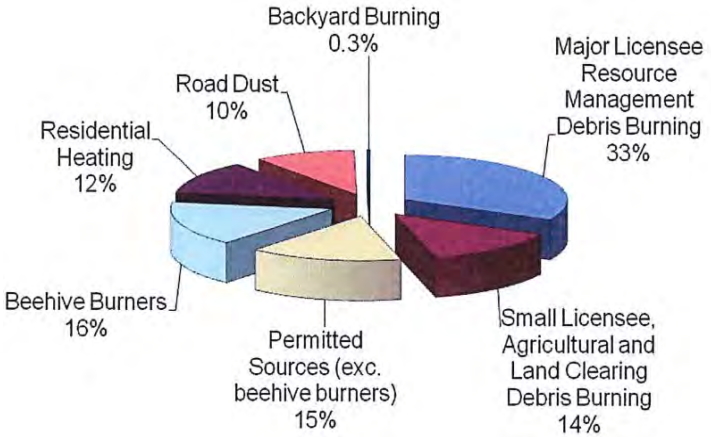
$PM_{2.5}$ Sources in the Airshed

- Point Sources, represented only 15% of $PM_{2.5}$ emissions to the BVLD Airshed in 2002 and 9% to BC in 2010
- The pellet mill will help reduce debris burning, the largest contributor of the emissions to the airshed

BC Outside Lower Fraser Valley for 2010

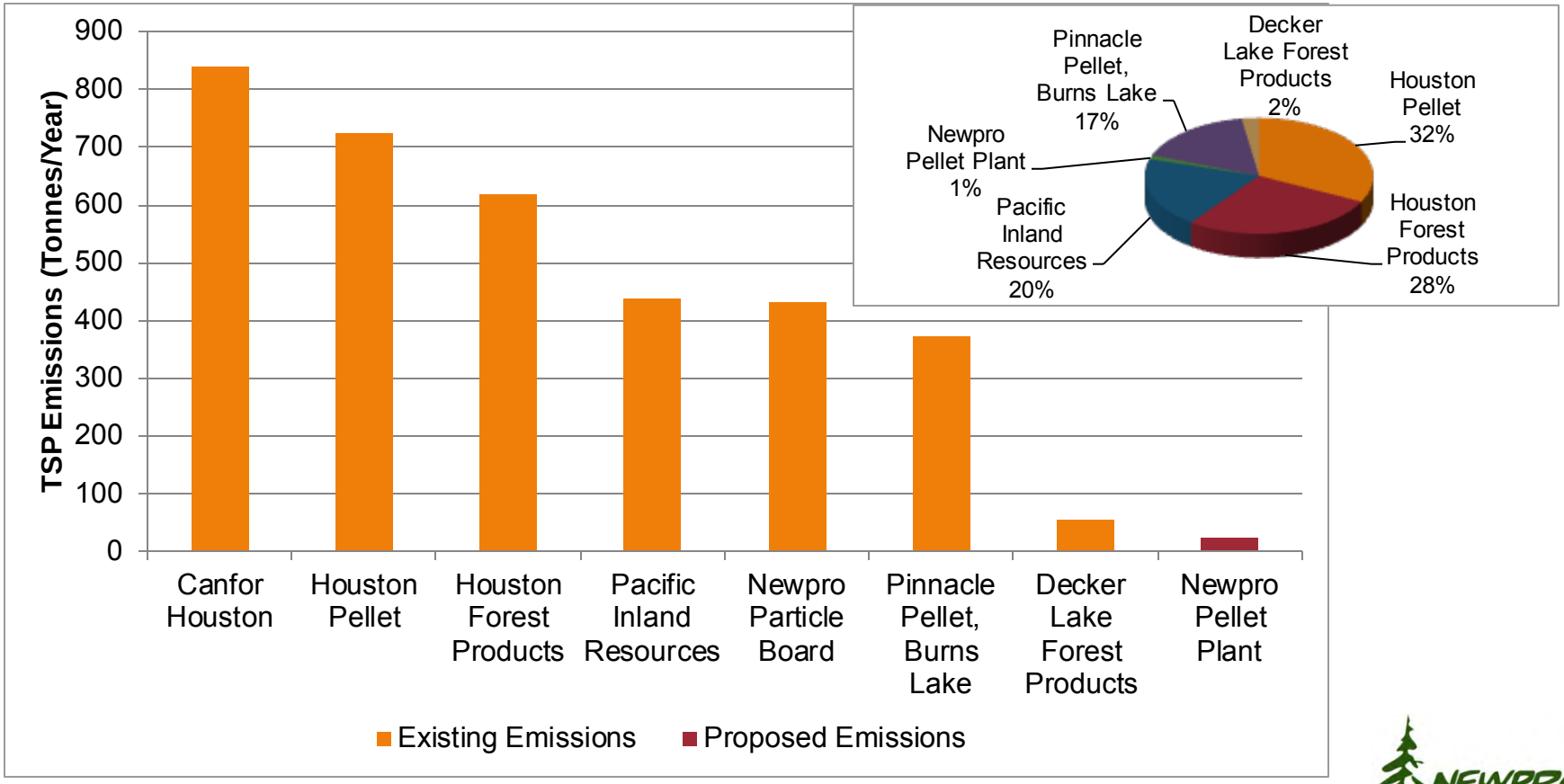


BVLD Airshed for 2002



Permitted Sources in the Airshed

- NEWPRO's emissions will be lower than any other permitted TSP source in the region (2012)



Air Quality Modelling

- Attempt to replicate local terrain and meteorology to quantify potential source impacts
  - Models are idealization of reality
  - Designed to predict worst-case concentrations
- The highest level modelling system was chosen due to the complex terrain and weather patterns
  - CALMET meteorological model
  - CALPUFF dispersion model
- The modelling adhered to all current MOE guidance

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Topography and Meteorology

- Complex, but understood in Bulkley Valley:
  - Increased atmospheric stability at night and during winter
  - Decreased mixing heights at night and during winter.
  - Temperature inversions due to radiational cooling, cold air drainage, terrain blocking and reduced wind speeds
  - High pressure systems in winter can cause prolonged periods of high concentrations due to the above factors

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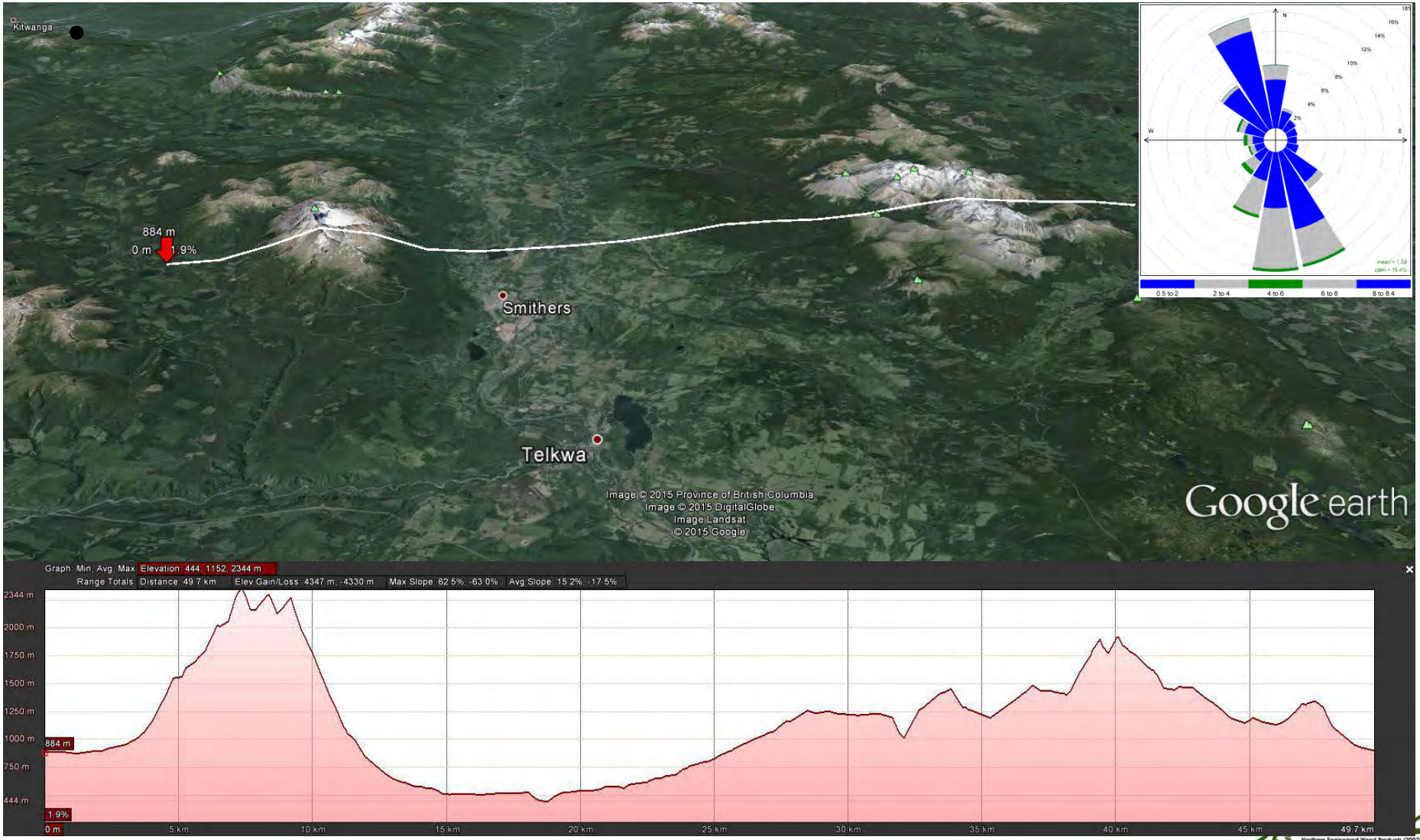
Bulkley Valley Terrain Profile and St. Joseph's Windrose



CALMET Meteorological Modelling

- Simulates meteorological parameters important to air quality
- 3 year database (2011-2013)
- Inputs:
  - 1:50,000 resolution digital terrain data
  - Baseline Thematic Mapping (BTM) landuse data
  - 4-km MM5 prognostic wind fields data
  - Local surface observations
    - St Joseph's School
    - Smithers Airport
    - Telkwa

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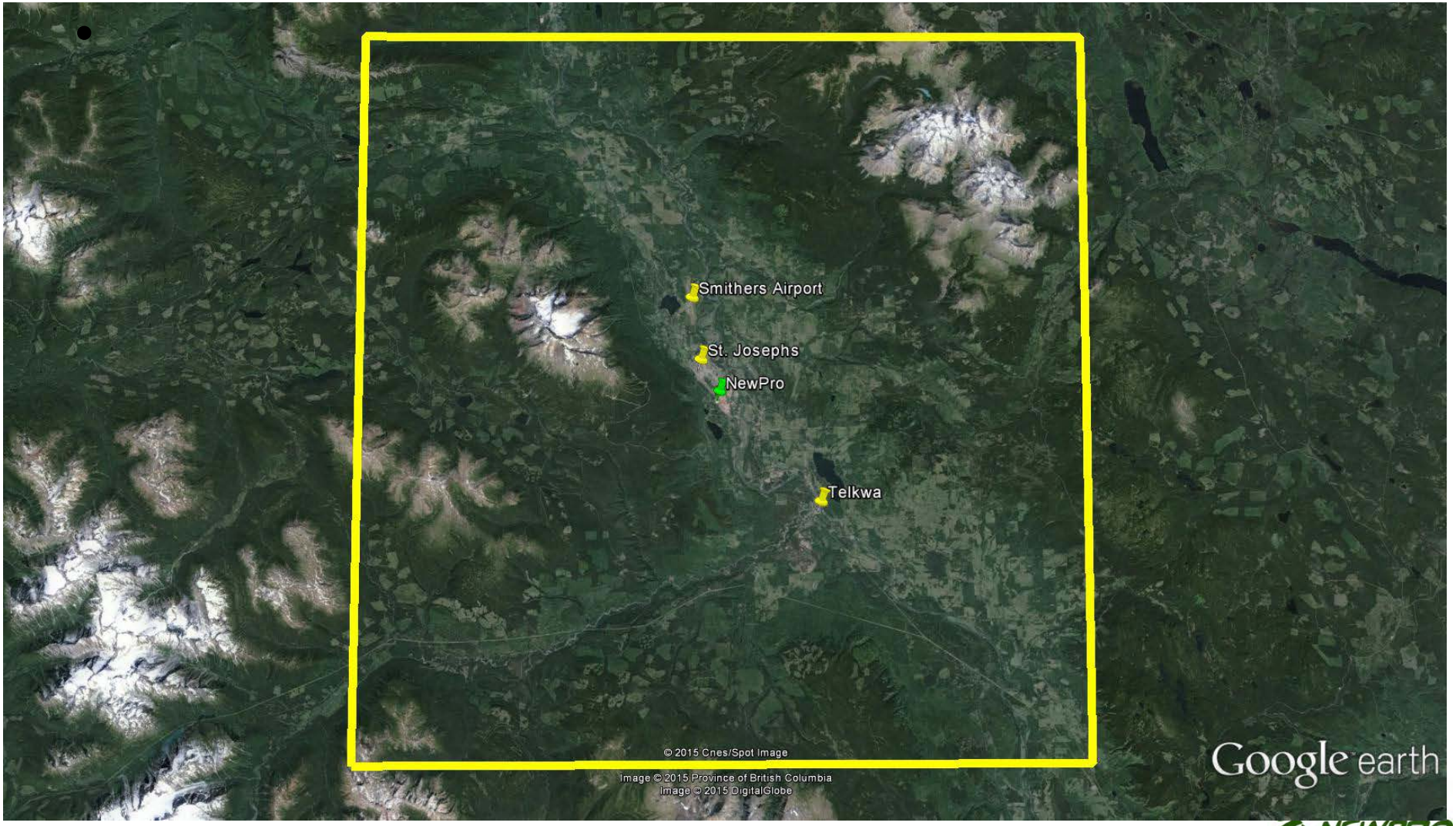
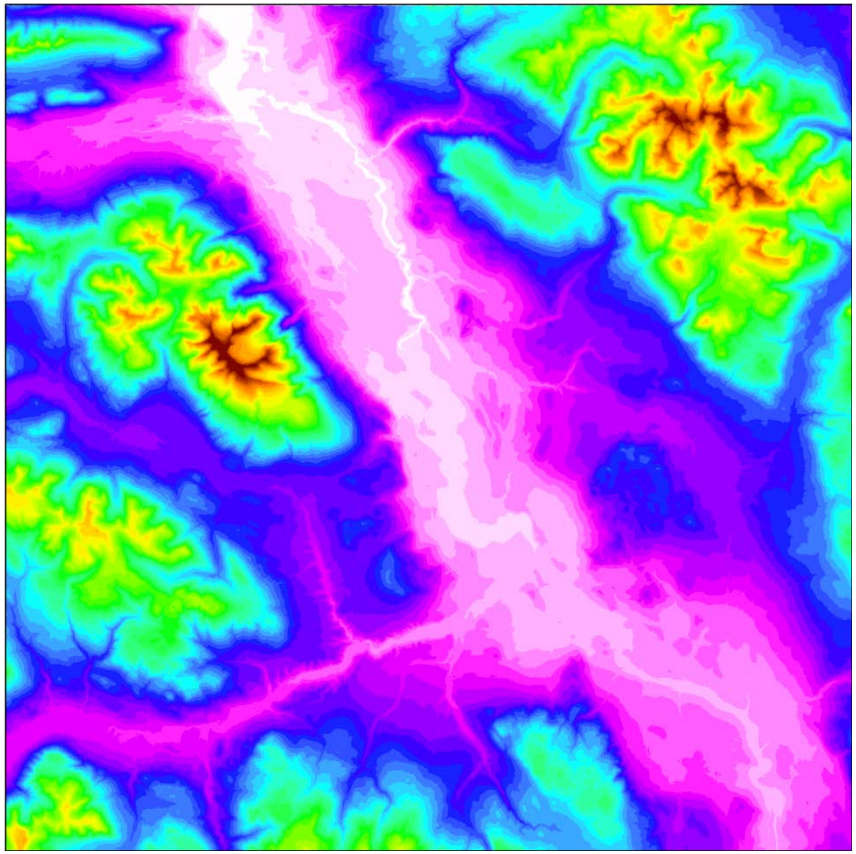
Modelling Domain

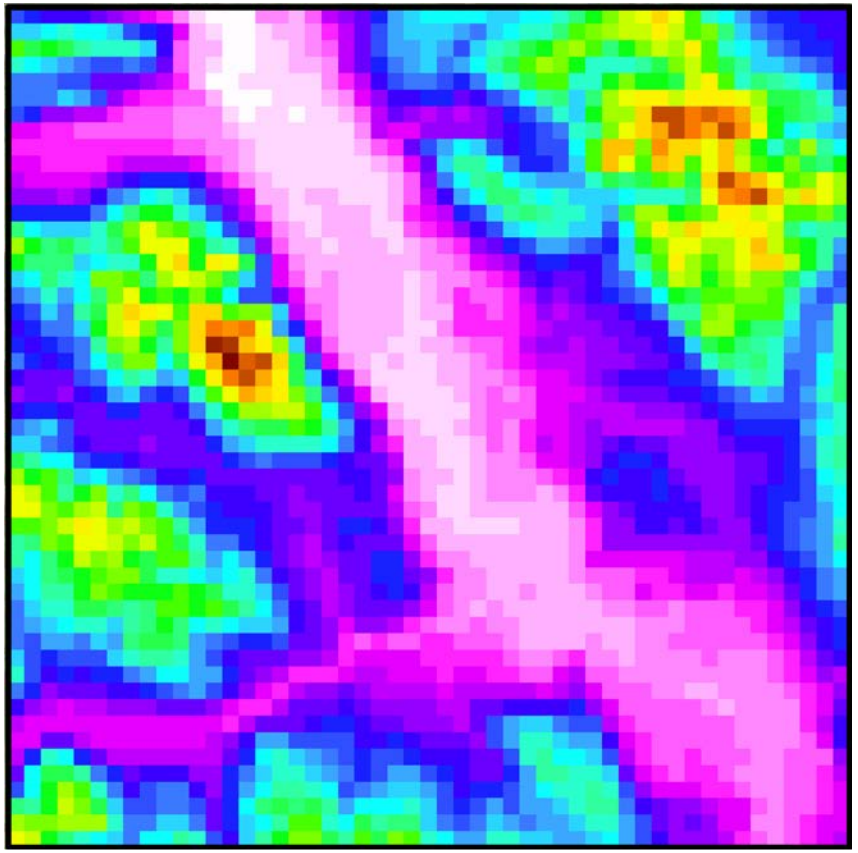


Terrain Data

Input



Modelled



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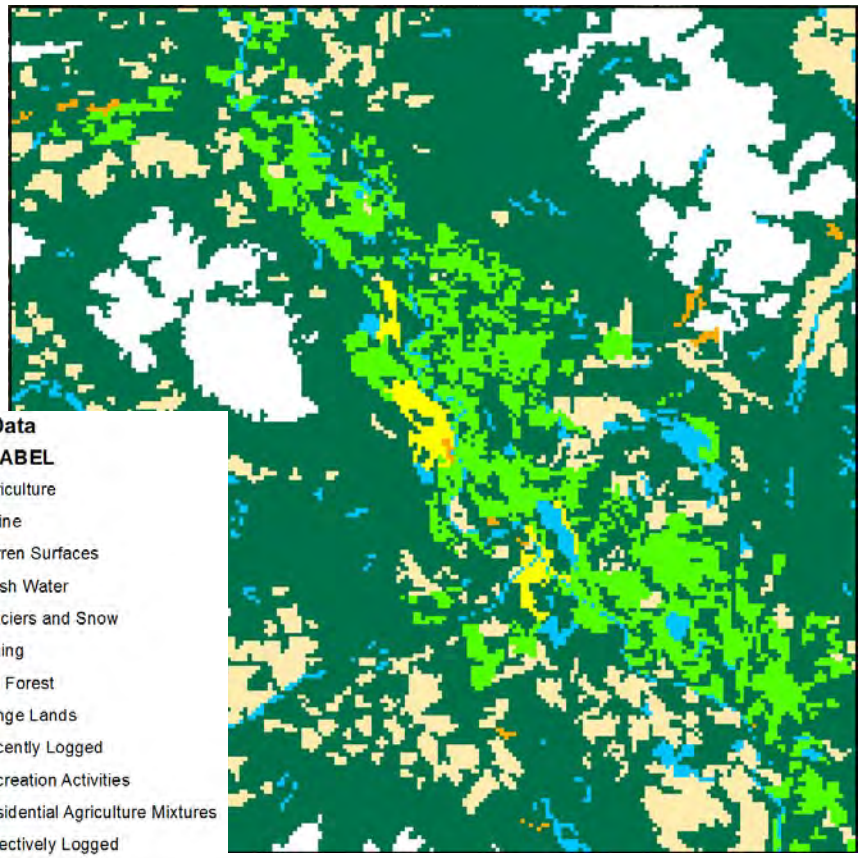
Landuse Data

Input



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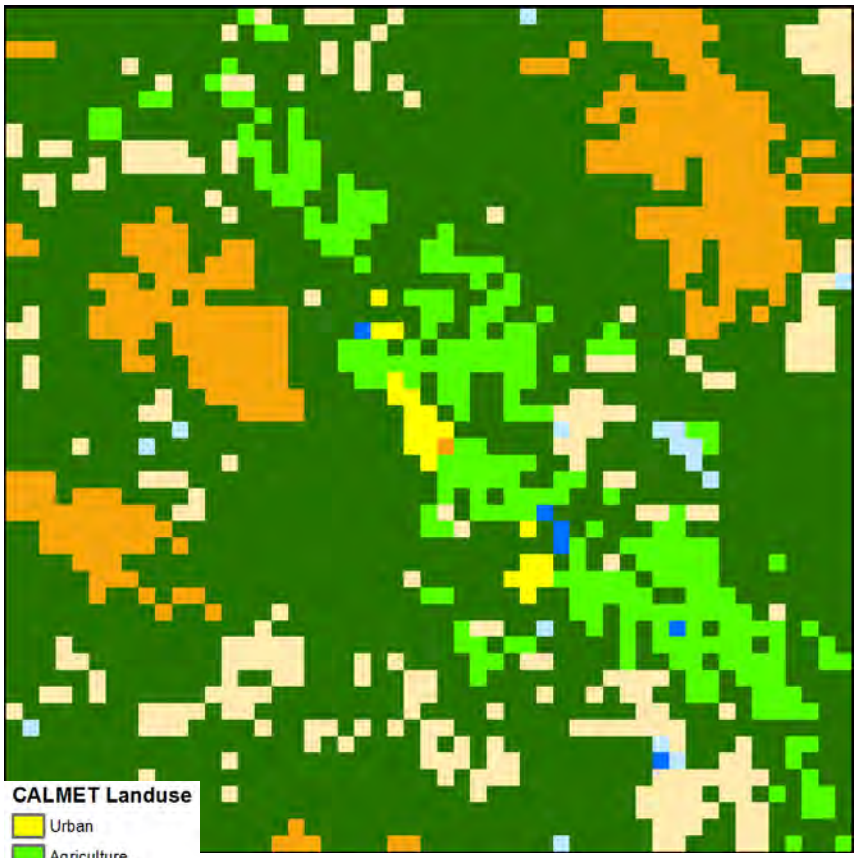

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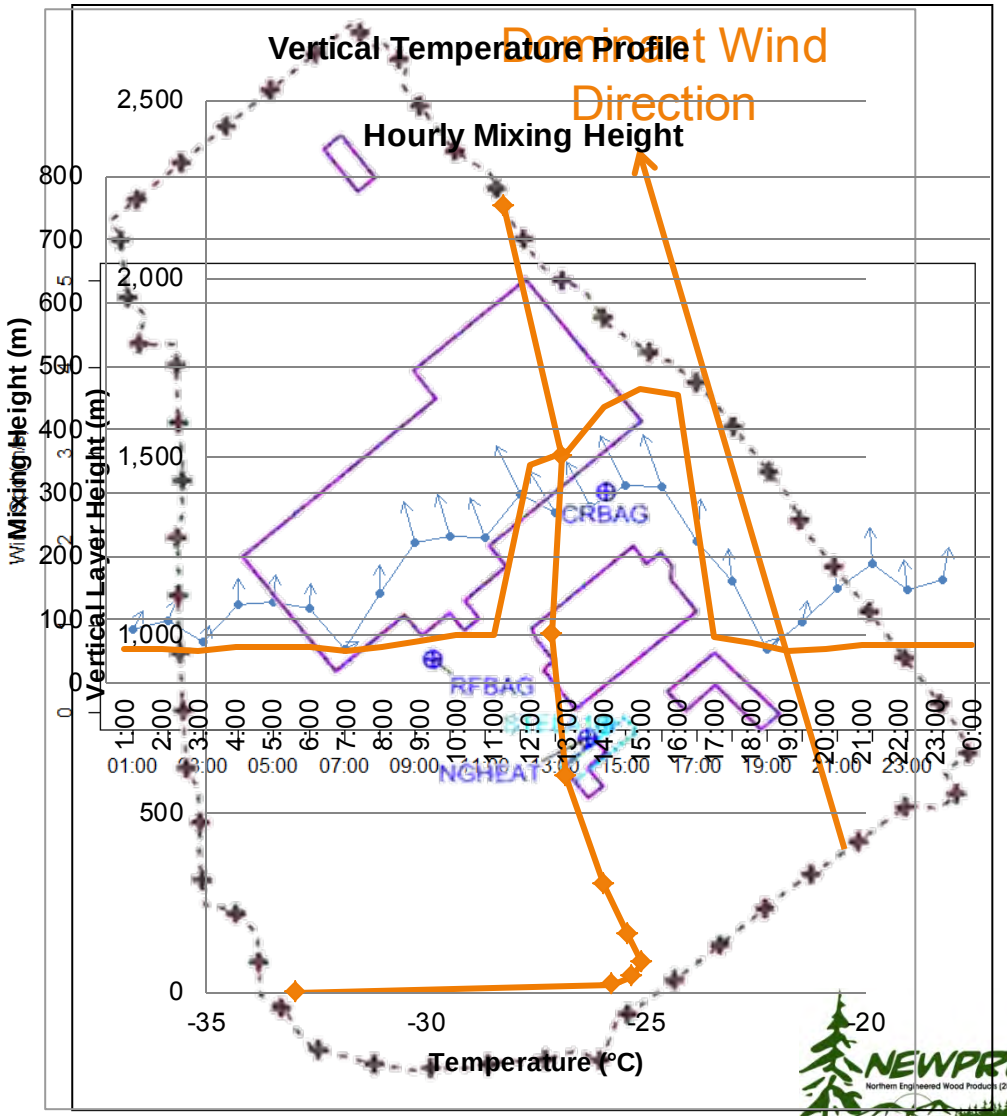
CALMET Meteorological Output

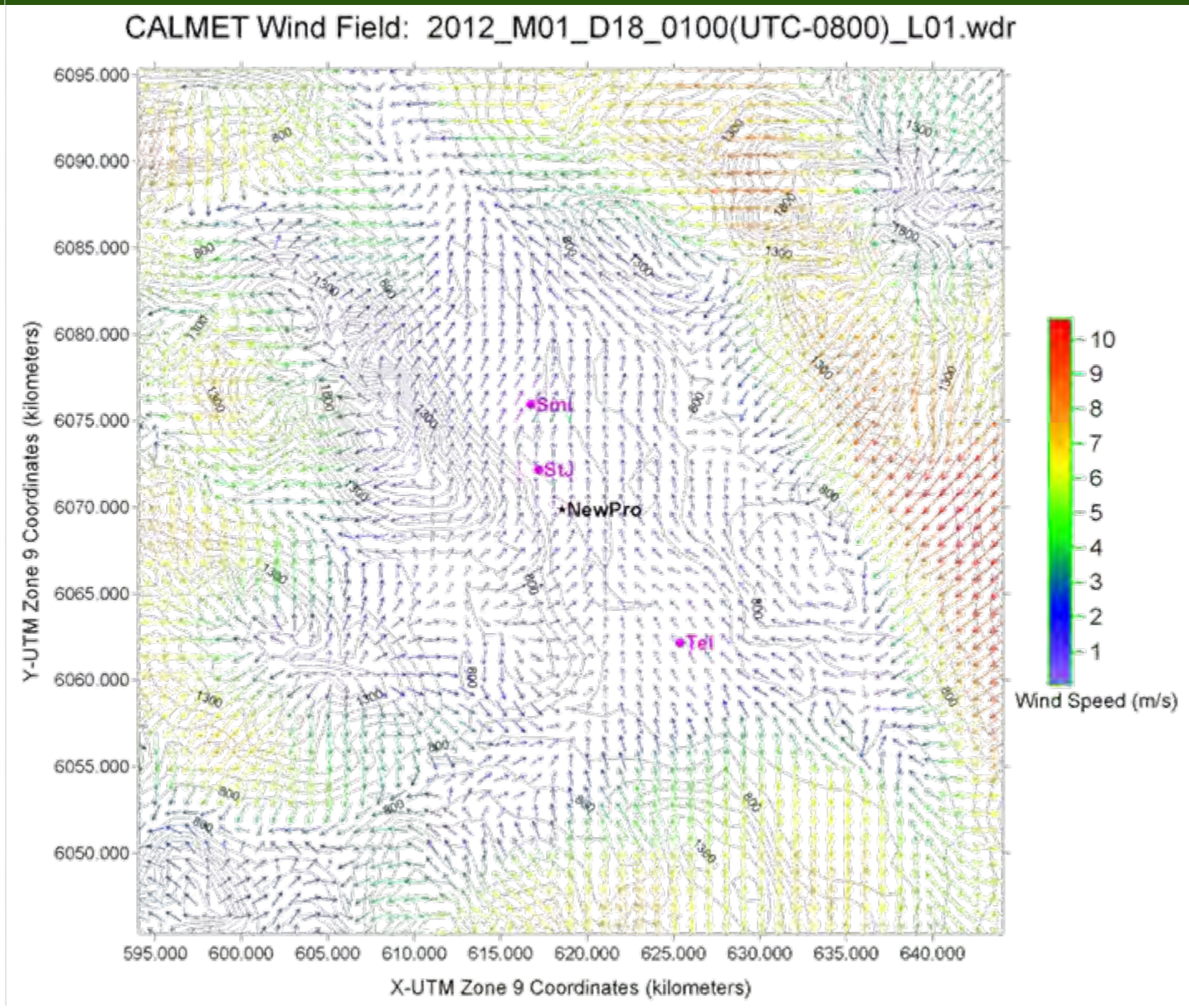
- Checked for reasonableness based on input data and professional judgement
- Winter high impact days all showed similar characteristics in CALMET:
  - Temperature inversions
  - Low mixing heights
  - Stable conditions
  - Low wind speeds and persistent wind direction

Conditions Producing the Highest Result

- Temperature inversion
- Low mixing height
- Stable atmosphere
- Low wind speed
- Southerly wind direction
- Building downwash



Modelled Winds Across Domain



CALPUFF Dispersion Modelling

- Uses CALMET output to transport emitted puffs
- Able to model the calm wind conditions important to air quality in Smithers
- Inputs:
  - CALMET output
  - NEWPRO proposed sources (1st run)
  - NEWPRO currently permitted sources (2nd run)
  - Building information
  - Receptors

CALPUFF Dispersion Modelling

- No chemical transformation modelled
  - Project NOx and SO_2 emissions are too low to affect the $PM_{2.5}$ results
  - Impacts very close to fenceline, insufficient time for in-transit conversion
- No deposition modelled
  - Keeps all emitted mass in the air (not dropped out), thereby increasing modelled air concentrations
  - Impacts very close to fenceline, insufficient time for deposition

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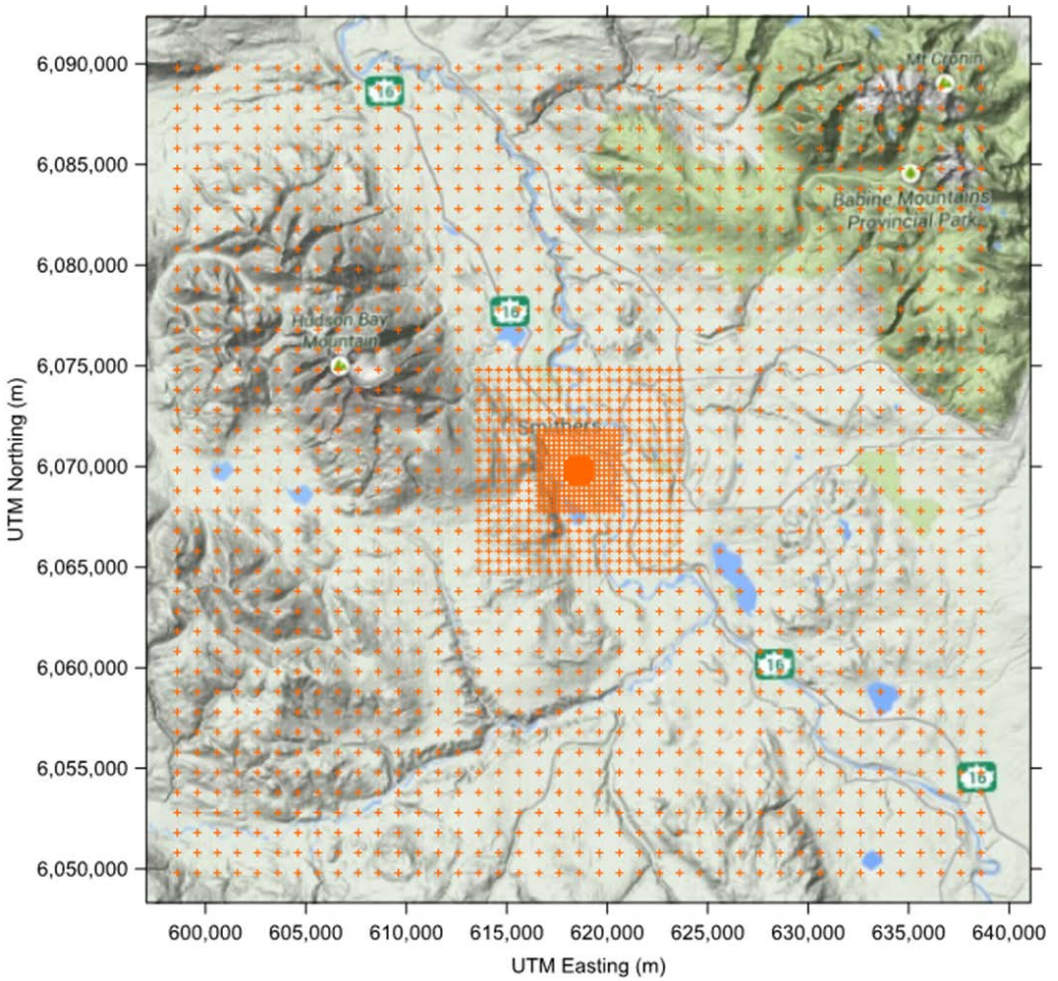
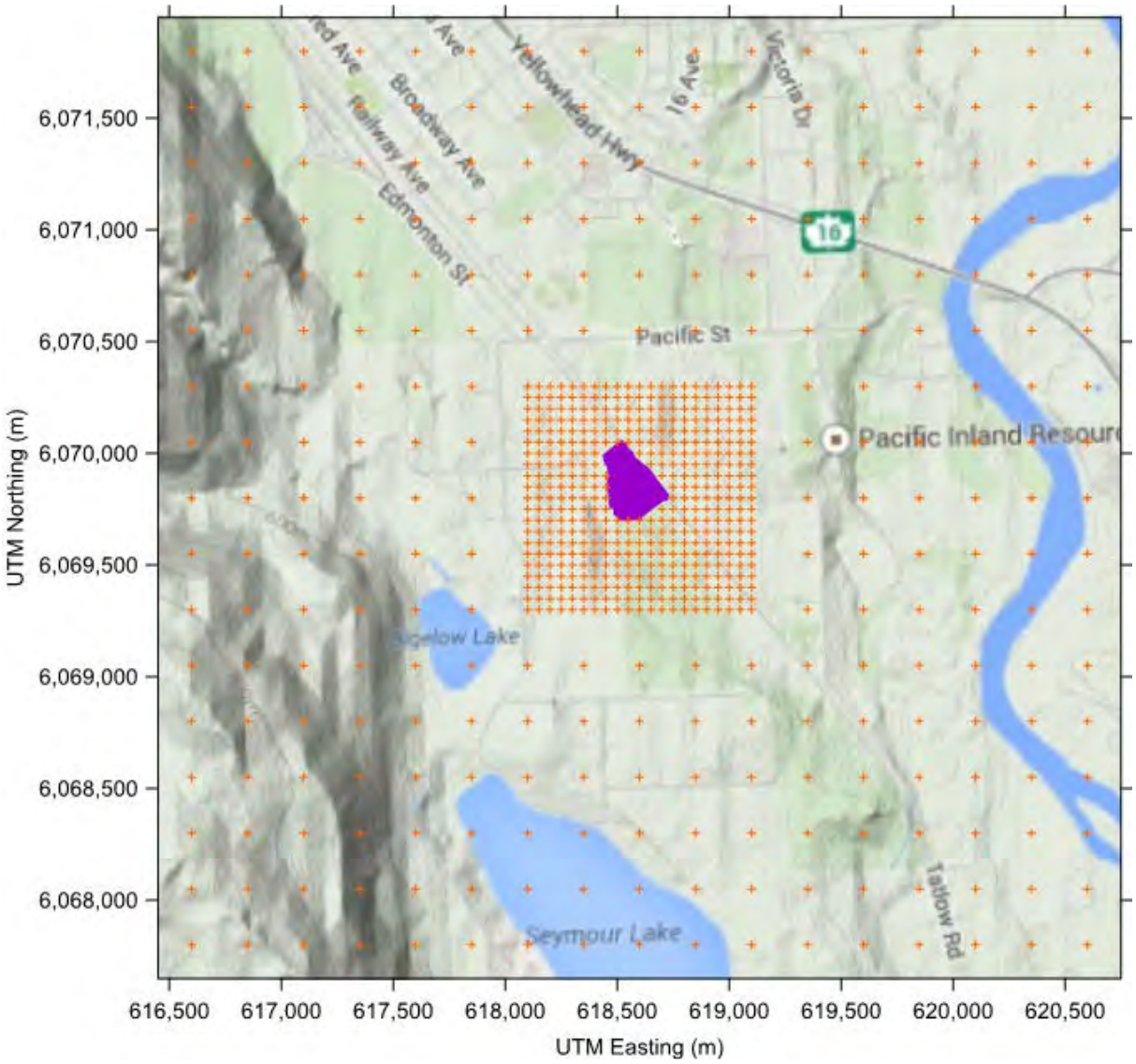
Domainwide Receptors

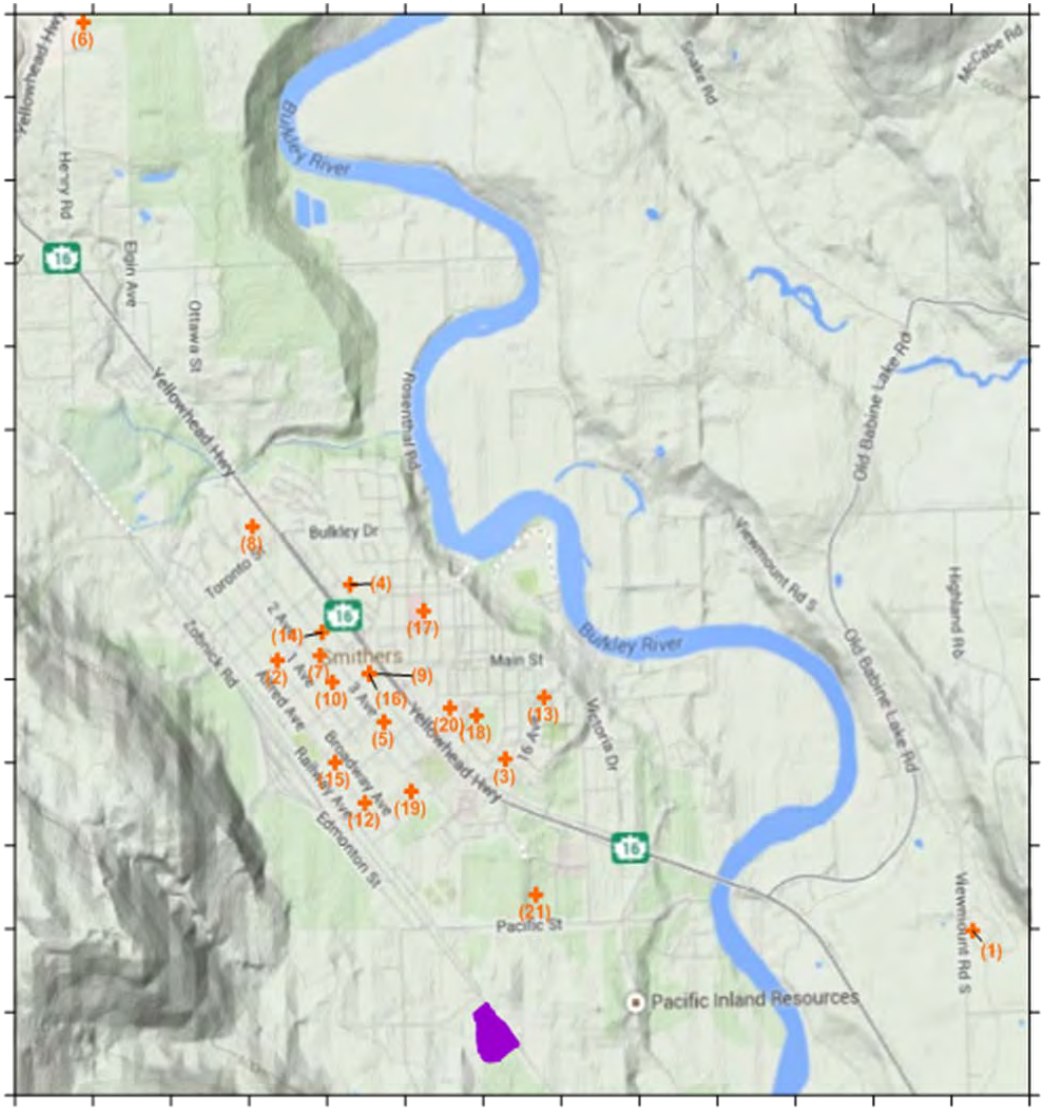
- A “receptor” is placed in each location we want to the model to calculate a concentration
- Receptors are placed more close together nearer the source



Nearfield Receptors



Sensitive Population Receptors



Site Number	Site
1	Ebenezer Canadian Reformed School
2	St. Joseph's School
3	Bulkley Valley Christian School
4	Walnut Park Elementary
5	Mulheim Elementary
6	Lake Kathlyn Elementary
7	Bulkley Valley learning Center
8	Smithers Secondary School
9	Growing Together Playhouse
10	Early Childhood Develpoment Program
11	Bulkley Valley Child Development Center
12	Growing Together Playhouse (2)
13	Smithers Preschool Programs
14	Cutt and Paste Licensed Family Care
15	Discovery House Daycare
16	Smithers & Area Child Care
17	Bulkley Valley District Hospital
18	Bulkley Valley Adult Care Centre
19	The Meadow Senior Assisted Living Complex
20	Ptarmigan Meadow Senior Living Complex
21	Ambleside subdivision

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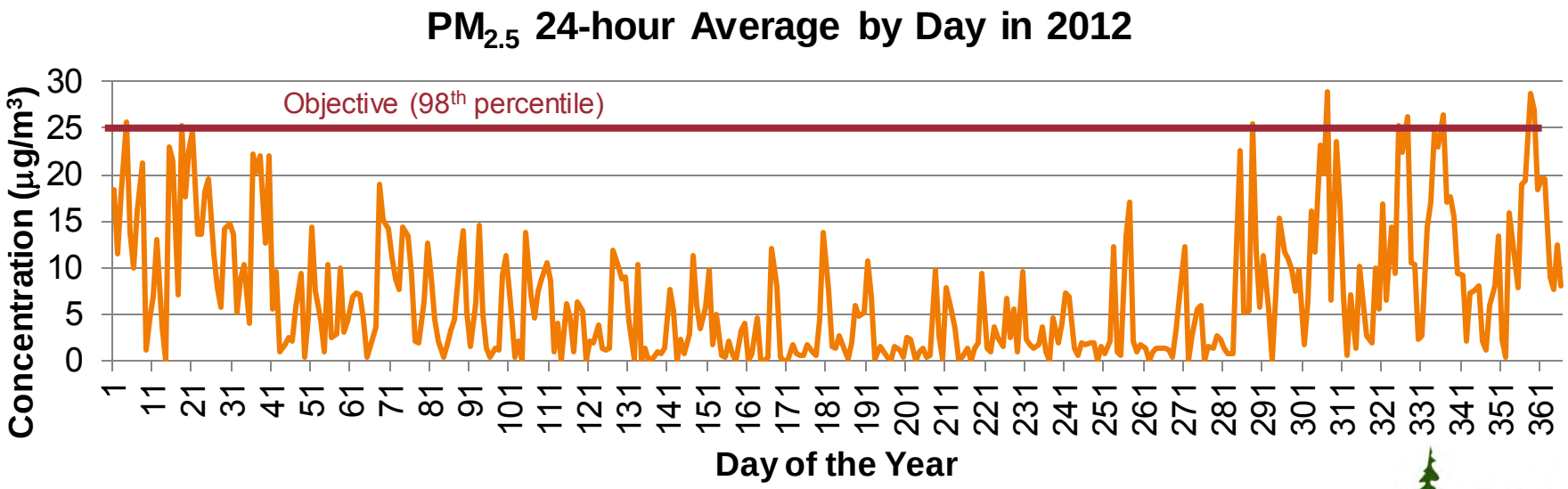
NEWPRO Sources

Scenario	Emission Source	Annual Emissions (tonnes/yr)					
		Total PM	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2
Permitted Facility	Cross Cut Saw Cyclone	21.8	18.5	10.9	--	--	--
	Mat Former Cyclone	21.8	18.5	10.9	--	--	--
	Press Scale Vent Fan	59.1	50.2	29.5	--	--	--
	Three Press Vent Fans	177.2	150.6	88.6	--	--	--
	Mat Saw Recovery Cyclone	5.4	4.6	2.7	--	--	--
	Cyclone Dust Recovery Baghouse	3.8	3.8	3.7	--	--	--
	Refiner-Flaker Baghouse	6.3	6.3	6.2	--	--	--
	Air Density Separator Cyclone	24.2	20.6	12.1	--	--	--
	Secondary Dryer Twin Cylones	51.4	48.8	41.1	11.6	13.6	--
	Primary Dryer Cyclone	60.4	57.4	48.4	23.2	27.1	--
	Hot Oil Heater (Natural Gas Fired)	0.6	0.6	0.6	7.8	7	0.047
	Total Emissions	**432**	**380**	**255**	**43**	**47**	**0.047**
Proposed Pellet Plant	Cyclone Dust Recovery Baghouse	3.78	3.77	3.75	--	--	--
	Refiner-Flaker Baghouse	6.31	6.28	6.24	--	--	--
	Stela Dryer Exhaust Fan	15.7	14.5	13.4	--	--	--
	Hot Oil Heater (Natural Gas Fired)	0.59	0.6	0.6	7.8	6.5	0.047
	Total Emissions	**26**	**25**	**24**	**8**	**7**	**0.047**
Proposed Project Emission Change		**-406**	**-355**	**-231**	**-35**	**-41**	**0**

NEWPRO Modelling Results

Pollutant	Averaging Period	Proposed Plant	Objectives	Background
PM_{10}	24-hour	36.5	50	78
$PM_{2.5}$	24-hour	25.3	25/28	28
	Annual	7.8	8/10	8



NEWPRO Modelling Results

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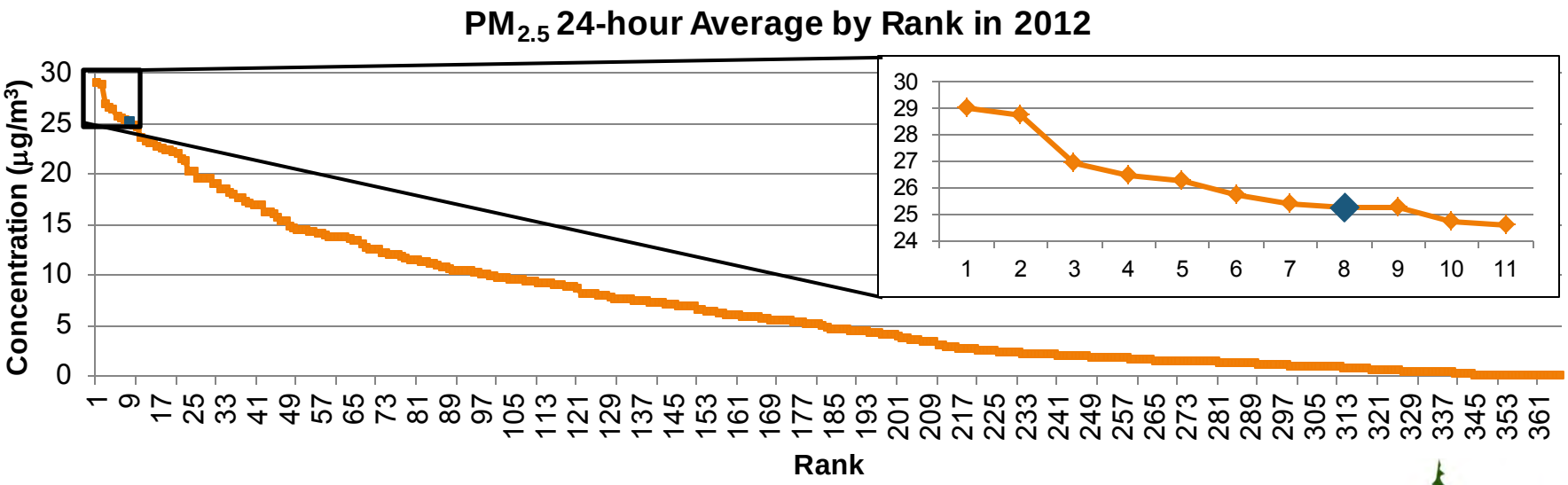


Figure 4-2. PM_{10} 24-hour Maximum (highest of 3 years)

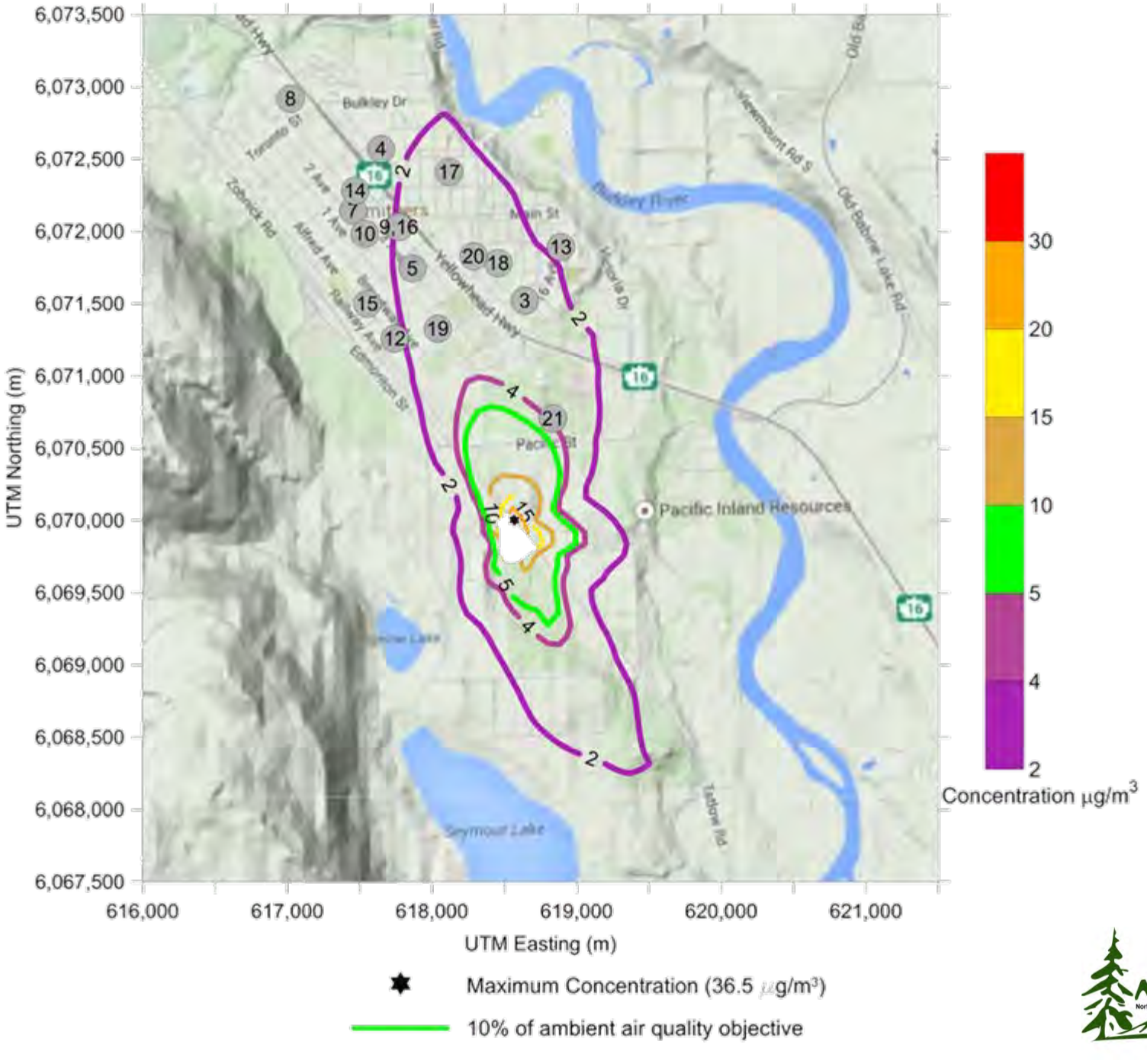
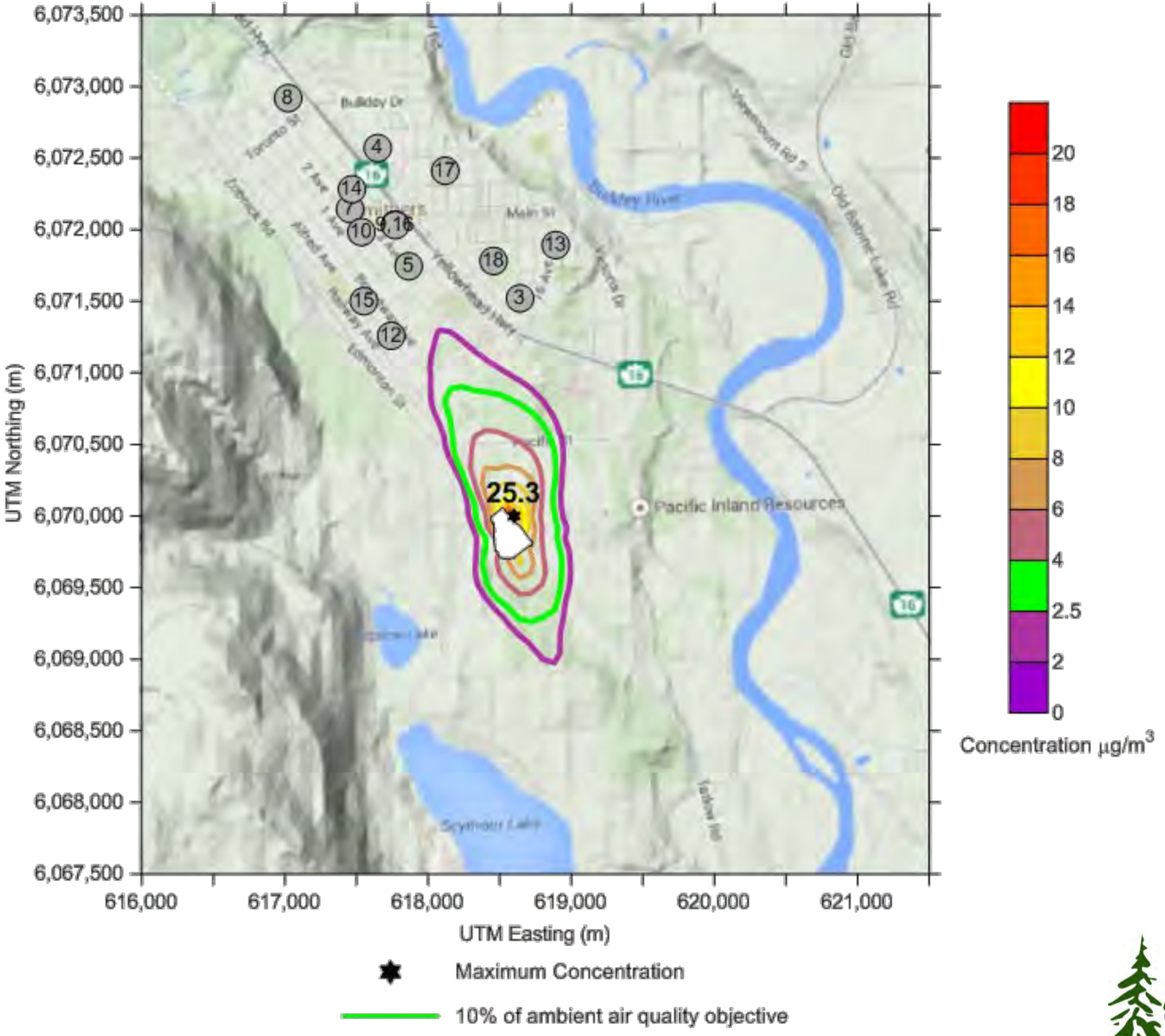


Figure 4-3. $PM_{2.5}$ 24-hour 98th Percentile (highest of 3 years)



$PM_{2.5}$ 24-hour 98th Percentile (highest of 3 years)

22 times lower than currently permitted level; a 529 µg/m³ reduction in modelled concentration

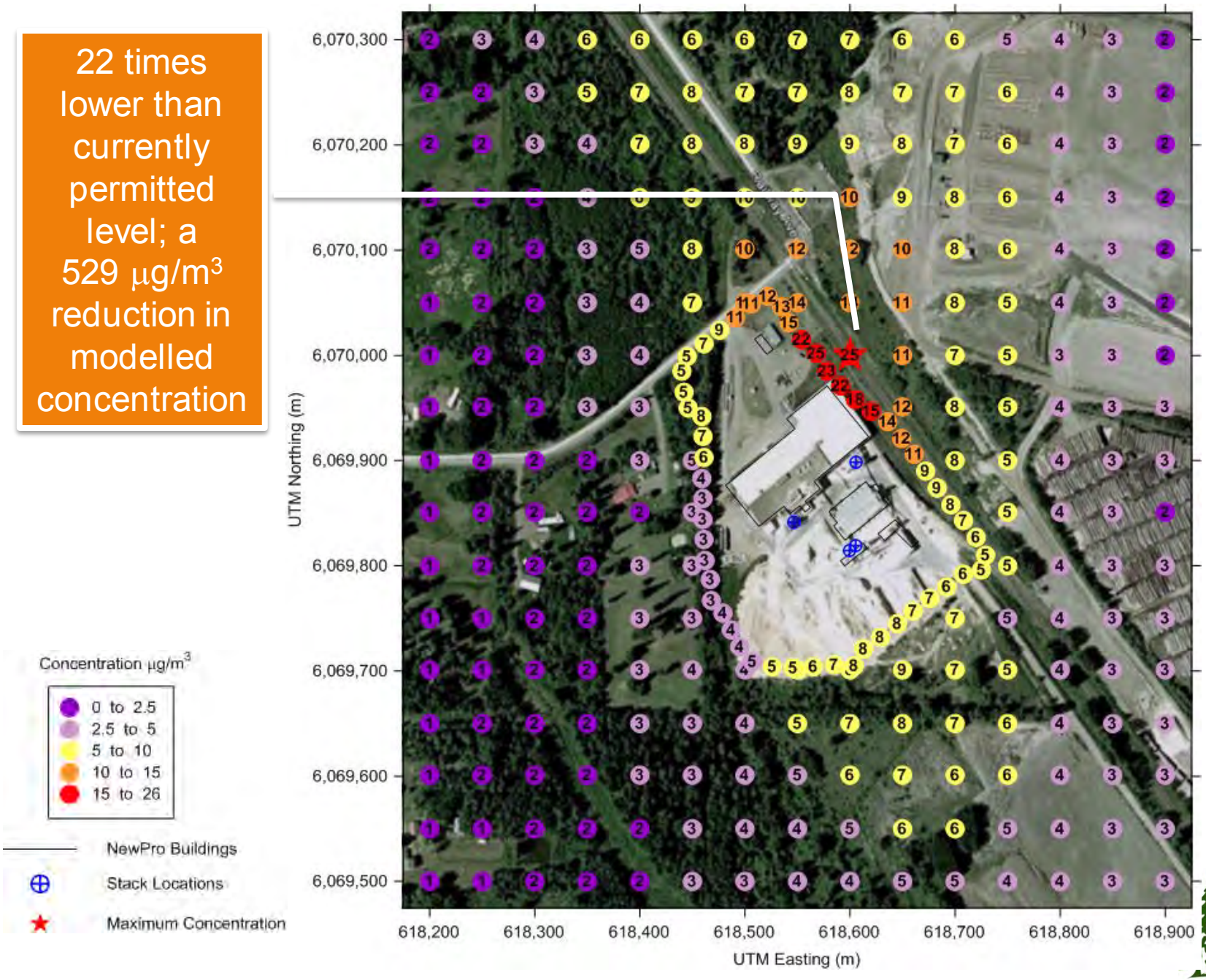
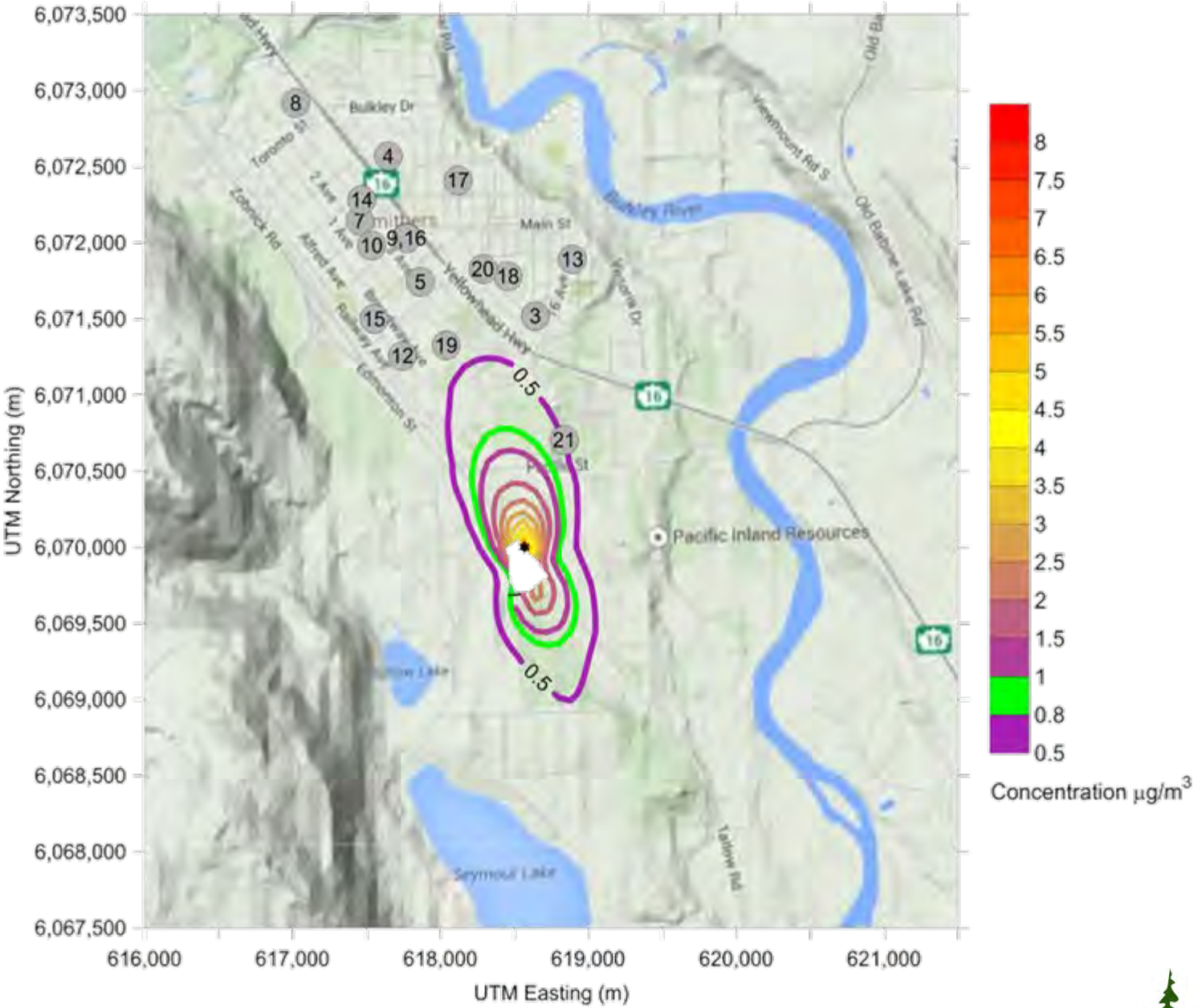
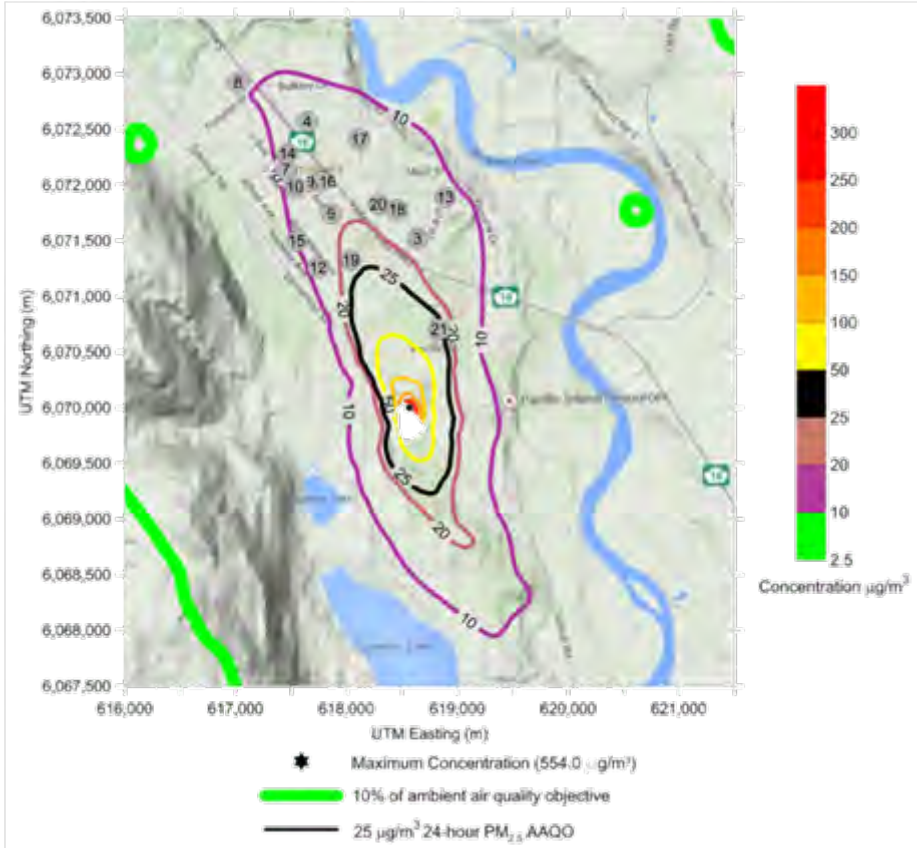


Figure 4-4. $PM_{2.5}$ Annual Maximum (highest of 3 years)

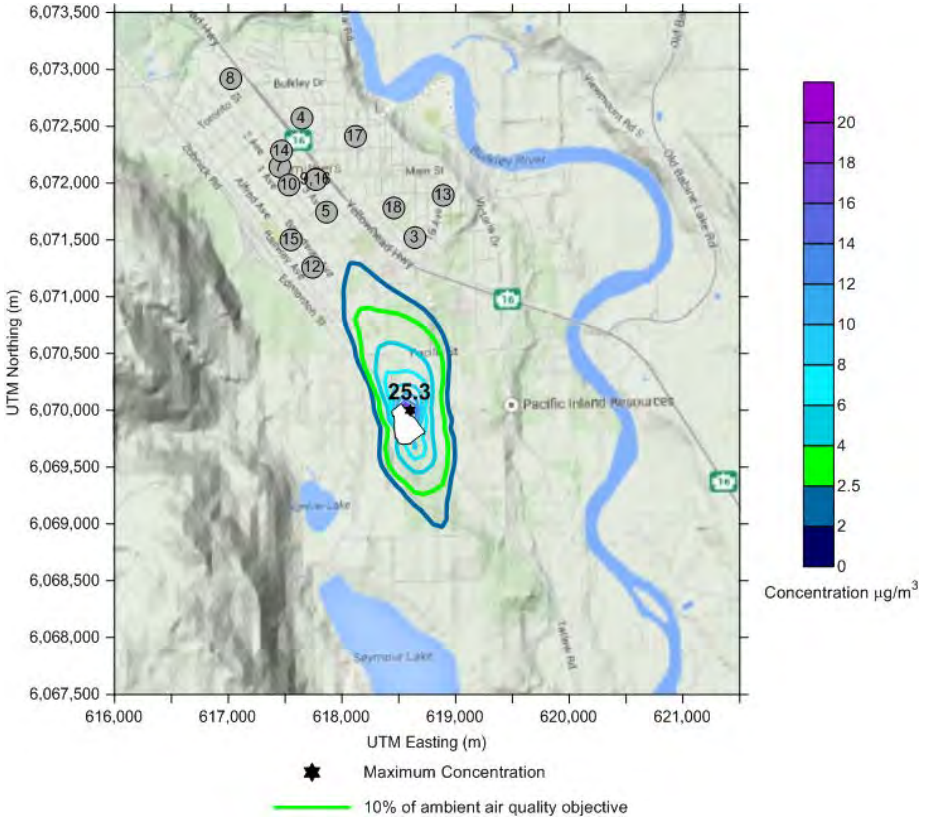


Comparison of $PM_{2.5}$ 98th Percentile

Permitted Facility

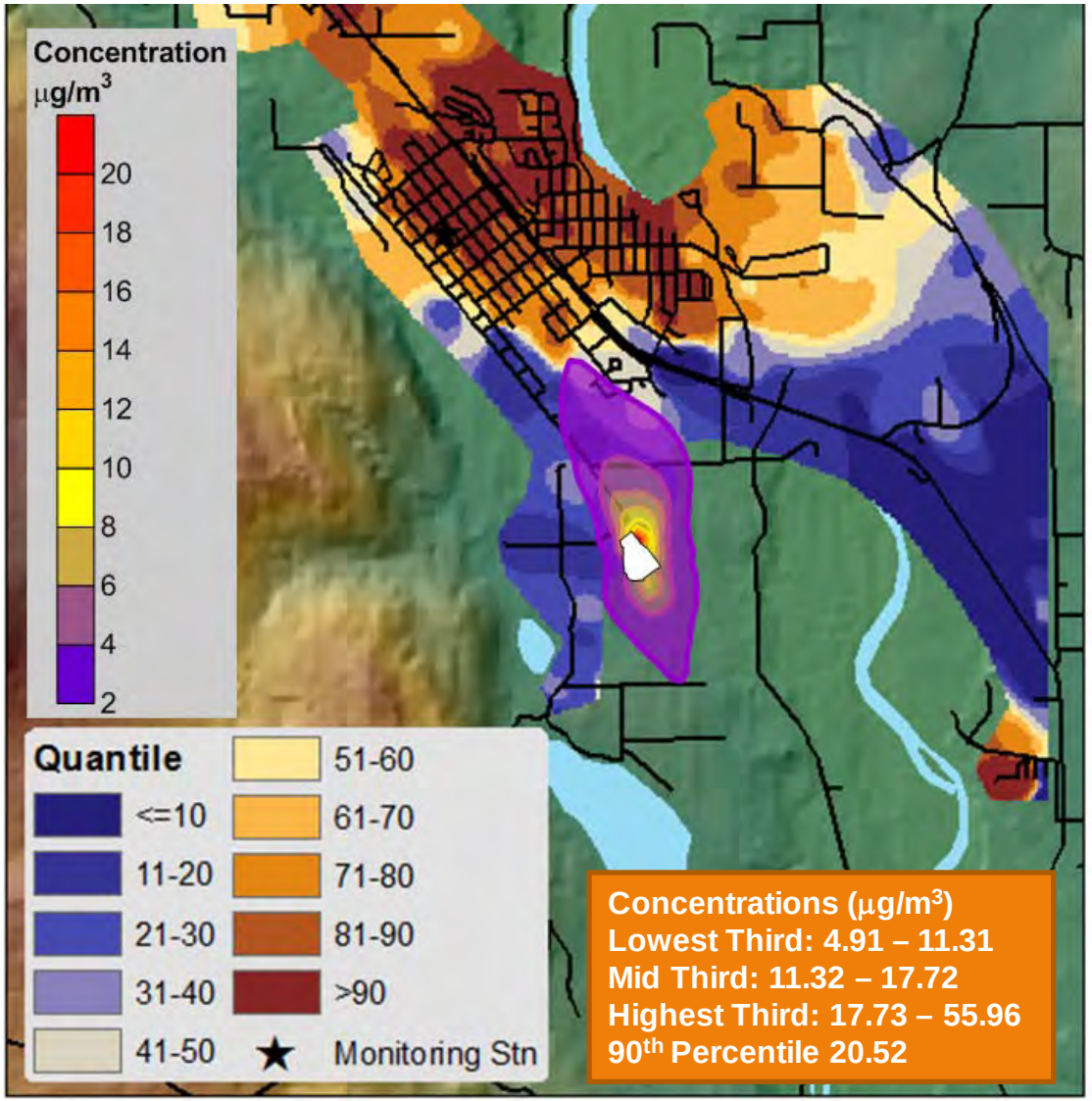


Proposed Pellet Plant



Modelled and Background $PM_{2.5}$ Overlay

- The areas of highest background do not overlap with the predicted impacts
- Estimated cumulative concentration is much lower when paired with modelled values in time and space



Modelling Conclusions

- All maximum project impacts adjacent to the facility fenceline with rapidly decreasing impacts
- Project impacts less than 10% of the air quality objectives within 1.1-km of the facility
- Project impacts less than 10% of the air quality objectives at all sensitive receptors
- Generally highest impacts occur during winter

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Modelling Conclusions

- The cumulative impacts are controlled by the background data
- The models replicated the known controlling meteorological regimes
- The worst-case background plus the worst-case project impact is not representative of the future air quality in Smithers

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