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SPERLING HANSEN ASSOCIATES

- Landfill Engineering
- Solid Waste Planning
- Environmental Monitoring
- Landfill Fire Risk Control

#8- 1225 East Keith Road
North Vancouver, BC. V7J 1J3
Phone: (604) 986-7723
Fax: (604) 986-7734

LEGEND:
- APPLICATION AREAS
- DISTRICT LOT BOUNDARIES
- HWY 97C
- YEAR #1 APPLICATION AREAS (240 Ha)
- (A) INTERNAL STOCKPILE LOCATION
- (2) TEMPORARY STOCKPILE LOCATION (for ARROW TRANSPORTATION ACCESS)

CLIENT: metro vancouver

PROJECT: BIOSOLIDS BENEFICIAL USE REY CREEK RANCH

TITLE: SITE MAP

SCALE:	DATE: yyyy/mm/dd	PROJECT NO:
1:50,000	2014/06/03	PRJ 14025
DESIGNED: SG	DRAWING NO:	
DRAWN: SG	FIGURE 2	
CHECKED: HS		

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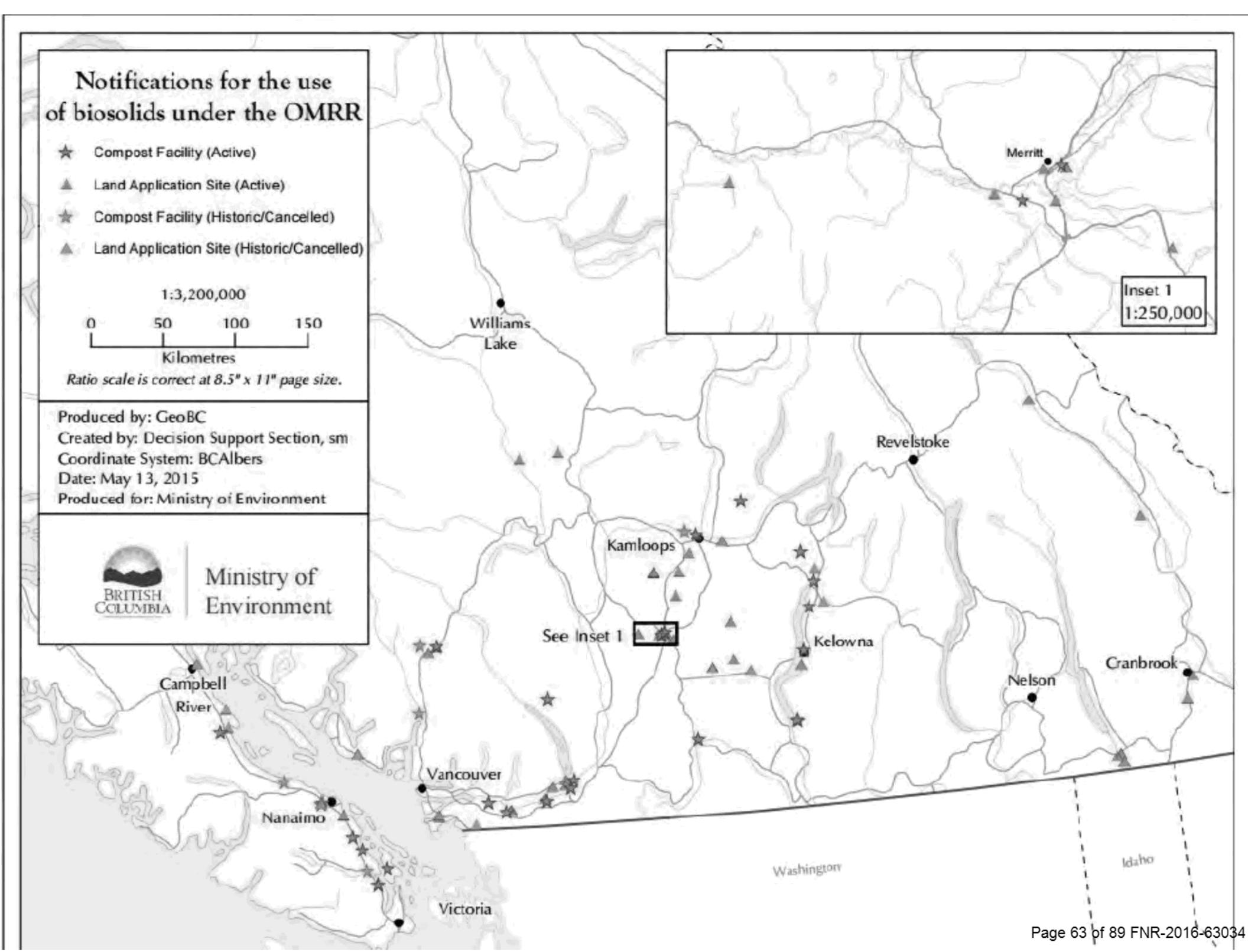
Notifications for the use of biosolids under the OMRR
Compost Facility (Active)
Land Application Site (Active)
Compost Facility (Historic/Cancelled)
Land Application Site (Historic/Cancelled)
1:3,200,000
0 50 100 150
Kilometres
Ratio scale is correct at 8.5" x 11" page size.
Produced by: GeoBC
Created by: Decision Support Section, sm
Coordinate System: BCAlbers
Date: May 13, 2015
Produced for: Ministry of Environment
BRITISH COLUMBIA
Ministry of Environment
Inset 1
1:250,000
Merritt
Williams Lake
Revelstoke
Kamloops
See Inset 1
Kelowna
Cranbrook
Nelson
Campbell River
Vancouver
Nanaimo
Victoria
Washington
Idaho

Popowich, Tracy CSNR:EX

From: Christian Evans <cevans@sylvis.com>
Sent: Tuesday, July 22, 2014 11:22 AM
To: Newman, Reg F FLNR:EX
Cc: Wallace, Brian M FLNR:EX
Subject: RE: Biosolids research
Attachments: 2014 Rey Creek MoF Site Planning.kmz

Hi Reg & Brian,

Nice to be in touch with you both again! I've attached a Google Earth map of all our applied areas in 2011-2014 at the ~8 km end of Rey Lake Road. I've identified a few areas in green that may interest you; elevation can be obtained from Google Earth to confirm their suitability. It would be no problem to take biosolids from our stockpiles as long as they are applied within our Land Application Plan boundary (black border in the KMZ file). I could meet you on site on Tuesday July 29th if that works for you guys. I've spoken to Gord Garthwaite (Rey Creek Ranch owner) and he's happy to have you doing both the ox-eye daisy and native plants trials (although you are correct in suggesting that we are not managing any land or biosolids at the northern end of the property).

Let me know about Tuesday, hopefully that works for you.

Christian

Christian Evans, M.Sc., A.Ag.
Project Coordinator – Residuals

SYLVIS
427 Seventh Street
New Westminster, BC V3M 3L2

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From: Newman, Reg F FLNR:EX [mailto:Reg.Newman@gov.bc.ca]
Sent: Monday, July 21, 2014 2:31 PM
To: Christian Evans
Subject: Biosolids research

Hi Christian
Yes, Brian Wallace (ph: 250-371-3706) and I are interested in doing work on the Rey Creek Ranch. It was good to hear that you were involved with this project. We would like to select sites within the next week. The first project is to look at

the control of an invasive weed, ox-eye daisy near Rey Lake. The second will look at recovery of native plant community closer to Logan Lake. I'm not sure what involvement Sylvis has on the native plant community site. Some questions:

- Can you provide a map of the application areas (still untreated) on Rey Creek Ranch before we go out and select sites?
- For the ox-eye daisy project, we will require a small amount (50 kg) of biosolids. Can we simply "borrow" some from your stockpile near Rey Lake?

I have many more questions. I will wait until I can get you on the phone. Let me know if you are you in tomorrow (Tues 22)?

Reg

Reg Newman
Research Range Ecologist
Ministry of Forests, Lands and Natural Resource Operations
Thompson Okanagan Region - Resource Management
441 Columbia St, Kamloops, BC V2C 2T3
Phone: 250-371-3825; Fax:250-828-4987
Mailto: reg.newman@gov.bc.ca

Sampling and Testing

TOR Objectives (4,5,6)

4. Development and execution of a scientifically defensible testing program to reasonably detect and inform of adverse environmental impact or beneficial environmental effects arising from land application of biosolids and of biosolids based compost. If such execution is not deemed possible by the TWG, then development of an appropriate protocol to undertake such a program, and the expected time and effort requirements to achieve the work with an appropriate degree of scientific rigour.

5. Review of the effectiveness of the current regulatory requirement for a Land Application Plan, including assessing existing monitoring and sampling results and identifying any gaps.

6. Review selected long-term biosolids application in B.C. to assess cumulative effects. OK Ranch – exclosures controlled rate since 2001.

Sampling and Testing Broad Objective

- Establishment and execution of one or more experimental designs, sampling and interpretation of the results to contribute to providing possible scientific evidence of the environmental effects associated with the land application of biosolids and the land application of compost containing biosolids in the Nicola Valley and outside of the Nicola Valley

Sampling and Testing Specific Objectives (scoped down)

1. to identify whether applying biosolids based on BC's regulatory framework results in any substantial changes in soil quality

2. to determine/measure changes in soil chemical status (regarding organic contaminants) at several defined points in time after biosolids application

1. to identify whether applying biosolids based on BC's regulatory framework results in any substantial changes in soil quality

- Background soil characteristics
  - Goal: To determine background soil properties (next slide table or testing)
- Nutrients and trace elements
  - Goal: To determine total and available metal and nutrient contents in soil following biosolids application (compare to next slide table values or compare to pre-application tests results)

Table 1. Regional background soil quality estimates for inorganic substances.[1,2,3,4]

Column I	Column II	Column III	Column IV	Column V	Column VI	Column VII	Column VIII	Column IX
Substance	Region 1 Vancouver Island	Region 2 Lower Mainland	Greater Vancouver Area[5]	Region 3 / 8 Thompson Nicola Okanagan	Region 4 Kootenay	Region 5 Cariboo	Region 6 Skeena	Region 7 Omineca Peace
antimony	(4.0)	15	(4.0)	(4.0)	(4.0)	(4.0)	(4.0)	(4.0)
arsenic	10	20	15	25	10	10	15	15
barium	300	300	150	350	400	300	400	600
beryllium	1.5	1.5	1.0	2.0	2.0	2.0	1.5	2.0
cadmium	0.35	0.40	0.55	0.55	1.5	0.45	0.60	0.90
chromium (total)	90	80	100	150	50	150	65	85
cobalt	50	30	15	30	25	30	15	35
copper	150	45	100	75	45	65	50	75
lead	30	60	300	15	75	9.5	15	35
mercury[6]	(0.025)	0.15	0.4	(0.025)	(0.025)	(0.025)	0.15	(0.025)
molybdenum	(1.0)	(1.0)	6.0	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
nickel	55	80	75	75	50	150	50	60
selenium	(4.0)	(4.0)	2.0	(4.0)	(4.0)	(4.0)	(0.25)	(4.0)
silver	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
tin	(4.0)	(4.0)	(4.0)	(4.0)	(4.0)	(4.0)	(4.0)	(4.0)
vanadium	250	150	100	150	80	100	100	200
zinc	100	100	90	100	200	85	150	150

Footnotes:

1. All values are in ug/g unless otherwise stated. All values have been rounded in accordance with Contaminated Sites Taskgroup rounding rule [5]. Values in brackets indicate that greater than 50% of values were less that the mean detection concentration (MDC) for the substance, consequently tabled regional estimate is one-half the MDC.
2. Each estimate represents the 95th percentile value obtained for a substance in the region or area.
3. Estimates for background soil determinations are provided for the following regions (see Figure 1):
   - Region 1: Vancouver Island
   - Region 2: Lower Mainland
   - Region 3 / 8: includes Thompson-Nicola and Okanagan
   - Region 4: Kootenay
   - Region 5: Cariboo
   - Region 6: Skeena
   - Region 7: includes Omenica Zone 7A and Peace Zone 7B
4. All soil samples, except those analyzed for mercury, were subject to the aqua regia digestion method summarized in

1. to identify whether applying biosolids based on BC's regulatory framework results in any substantial changes in soil quality

What does this objective address? This objective address both pre- and post-application measurements

What else could be addressed through this objective? any geographical/climatic differences and whether the regulatory framework is robust enough to deal with these factors or whether management of biosolid land application needs to be more regionally specific

2. to determine/measure changes in soil chemical status (regarding organic contaminants) at several defined points in time after biosolids application

Goal: survey of possible changes in soil chemical composition with limited interpretation of impact at this point

key pieces of information needed:

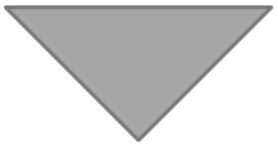
- Regarding biosolids, e.g. moisture content of material applied, bulk density, organic and inorganic chemical composition, organic carbon, ...
- Regarding soil: depth of application and rate of application, soil texture, organic carbon, pH, moisture content at time of biosolidds application, ...

Possible Tests:

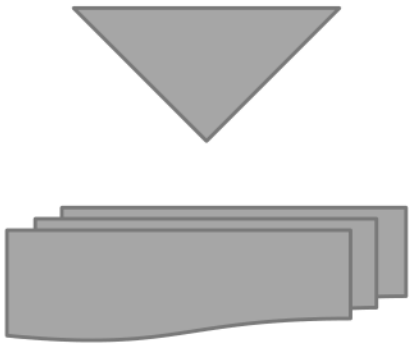
Biosolids/compost	Soil (pre-post)	Plants
Pathogens	Pathogens	As listed in the sampling outline/will be discussed by TWG
Metals	Metals	
Nutrients	Nutrients	
Selected organics	Selected organics	

Organic Contaminants Selection, not a full list, but selected ones

- For Biosolids: CCME (a WWTP in BC is being surveyed through CCME project), Feds (Survey WWTP for organics in Canada), TNSSS, EPA provides some guideline, and TWG!



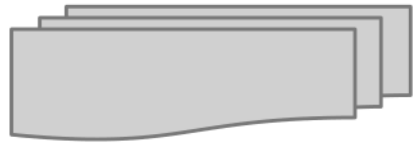
- Based on toxicity, persistence, concentration (literature) and TWG!



Organic Contaminants Selection, not a full list, but selected ones

- For soil sampling: based on inventory in biosolids, literature, and TWG!

- Based on toxicity, persistence, concentration, literature, and TWG!



Future Monitoring ?

- Water:
  - Lack of baseline data
  - Presence of other interactions
  - May be post application?
  - Time!
- Air

MoE Preferred Site

Sites in the Nicola Valley	Site outside of the Nicola Valley
Sunshine Valley Road: fresh experiment with both compost and Biosolids	OK Ranch, fresh experiment with biosolids
Coquihalla Cattle Company: post application sampling	

Site in the Nicola Valley
Sunshine Valley Road Composting Facility (40 ha)

- The only site with the possibility of experiment with both **composted biosolids** (Class A)and **biosolids Class B** (west Kelowna)
- **First application ever:** Feb 2014 –Spring 2015 compost Class A from biosolids (west Kelowna Class B biosolids)
- **Method of application:** Surface application with manure spreading equipment
- No animals on the farm, only hay and forage production

Site in the Nicola Valley Sunshine Valley Road Composting Facility

- **Adjacent Surface Body:** Nicola River to the North of the site
- **Water Wells:** Drinking and irrigation water wells

Site in the Nicola Valley Coquihalla Cattle Company

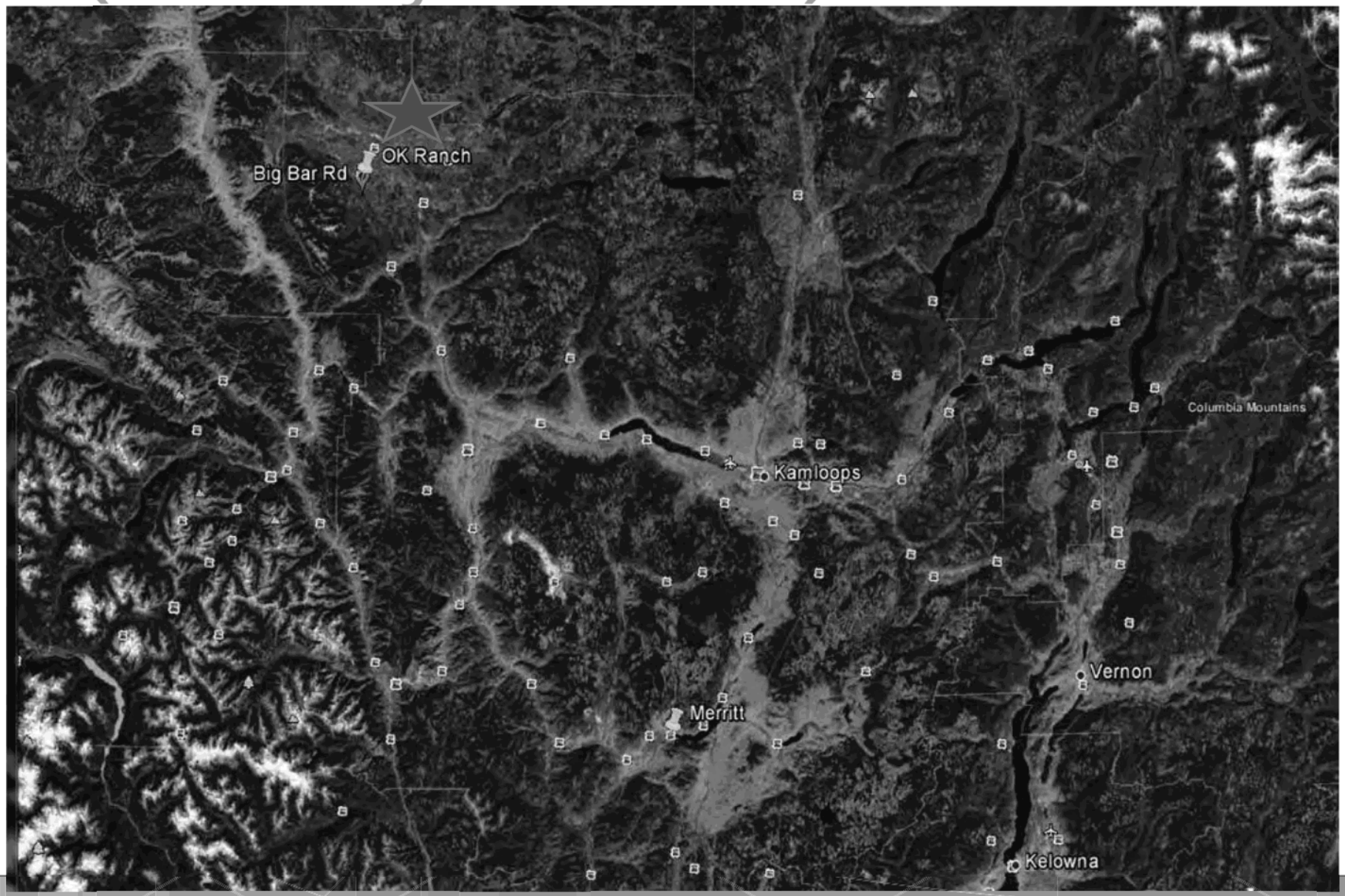
- Metro Van biosolids land application since the 1990's, no application since 2006/7
- 3 years ago (2012?) N-fertilizer have been used on the biosolids plots (fertilizer analyses available)
- **Surface water** Cold Water River (used for irrigation)
- **Available data**: A recent pre-land application soil sampling data is available, as well as historical soil sampling for biosolids land application

Coquihalla Cattle Company

OK Ranch (Outside of the Nicola Valley)

- Biosolids land applied on the upper grassland, stopped in 2007 and re-started in 2014
- Ongoing surface application
- **Surface Water:** Big Bar Creek
- **Water Well:** 5 Km from the land application site
- **Available data:** soil and biosolids analyses (only regularly requirements)
- **Origin of Organic Matter:** Biosolids Class A from Metro (Iona WWT)

OK Ranch (Proximity to Merritt)



OK Ranch (Proximity to Clinton)

Presentations and Packaging of the Organic Contaminant Results

- Based on risk assessment, and risk pathways
  - How much of the contaminant X is necessary to be ingested to cause harm (human, animals)

Communication Strategy

- TWG works on the results and package it based on risk assessments
- Results will go to the AC
- AC will communicate the results to the public

Potential Sampling and Testing Sub-Groups

- Biosolids/Soil: Brian, Maryam, Gordon, Reg, Lauchlan, Les, Wendy
- Plants: Brian, Reg, Wendy, Lauchlan
- Organic contaminants: Lynda, Gordon, Brian, MoE
- Risk: Lynda, MoE
- Human Health: Ian, Christina
- Communication: Laurie, Tania
- Data for long term effects: Laurie, Tania
- Overall Environmental Impacts: all

Timeline

- Project outline, sampling protocol, contract: Sep 30
- Sampling (biosolids, soil (pre-post (or leave the post for a later date): October 31st
- Analyses done: November 15th
- Results: early 2016