Common-sense Options for Regional Water Security

March 2015

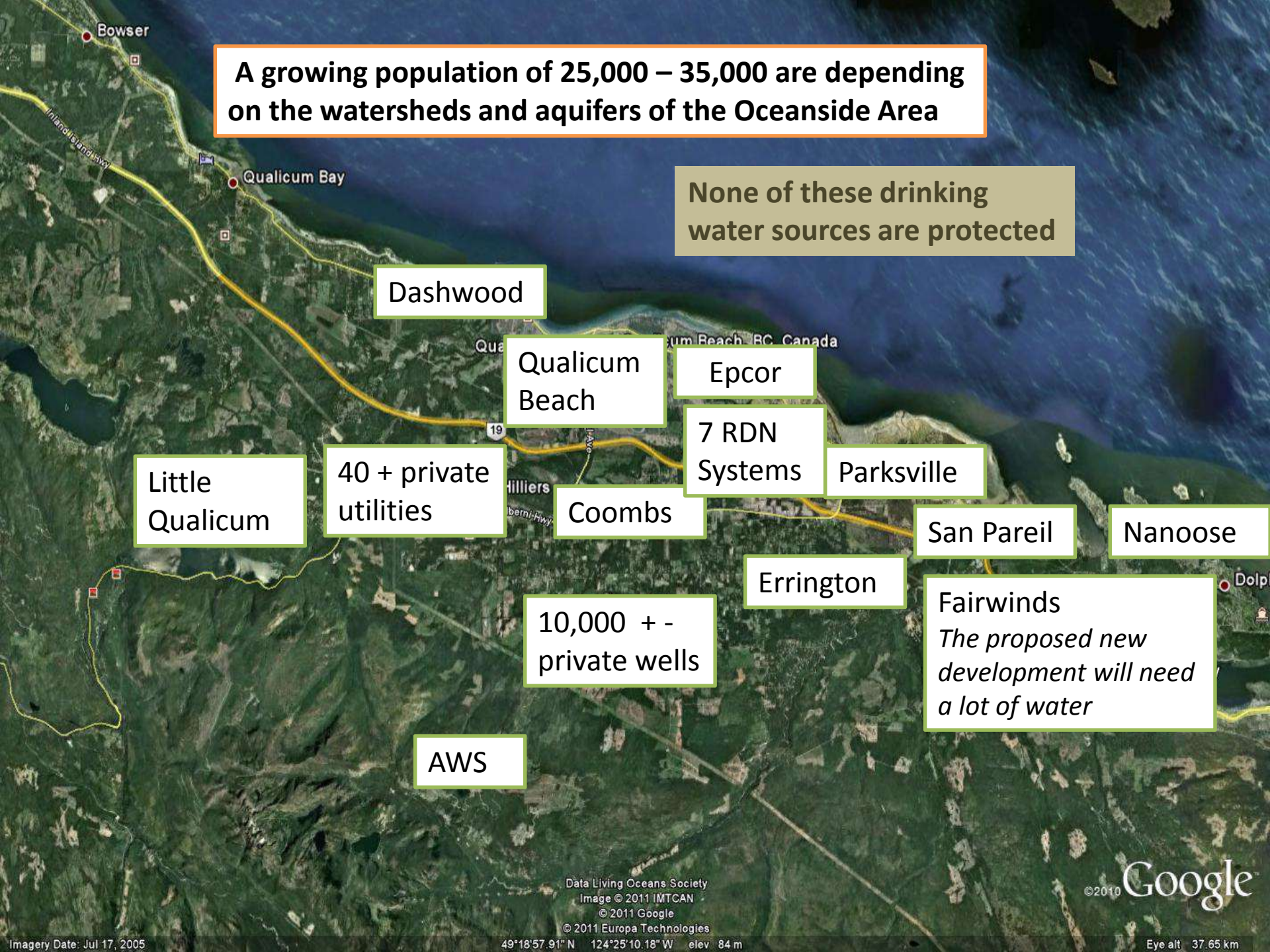
The following presentation identifies some of the issues and several options for drinking water supplies in the Oceanside area of Vancouver Island

...Trevor Wicks ...
TRENTEC INNOVATIONS
Web. http://www.innovationbc.com

No credentials

2,000 years ago they designed and built efficient water systems using a lot of labor and common sense

Approximately the amount of water a family uses in one year


Bowser
Qualicum Bay
A growing population of 25,000 – 35,000 are depending on the watersheds and aquifers of the Oceanside Area
None of these drinking water sources are protected
Dashwood
Qualicum Beach
Epcor
7 RDN Systems
Parksville
Little Qualicum
40 + private utilities
Coombs
San Pareil
Nanoose
Errington
Fairwinds
The proposed new development will need a lot of water
10,000 + - private wells
AWS
Data Living Oceans Society
Image © 2011 IMTCAN
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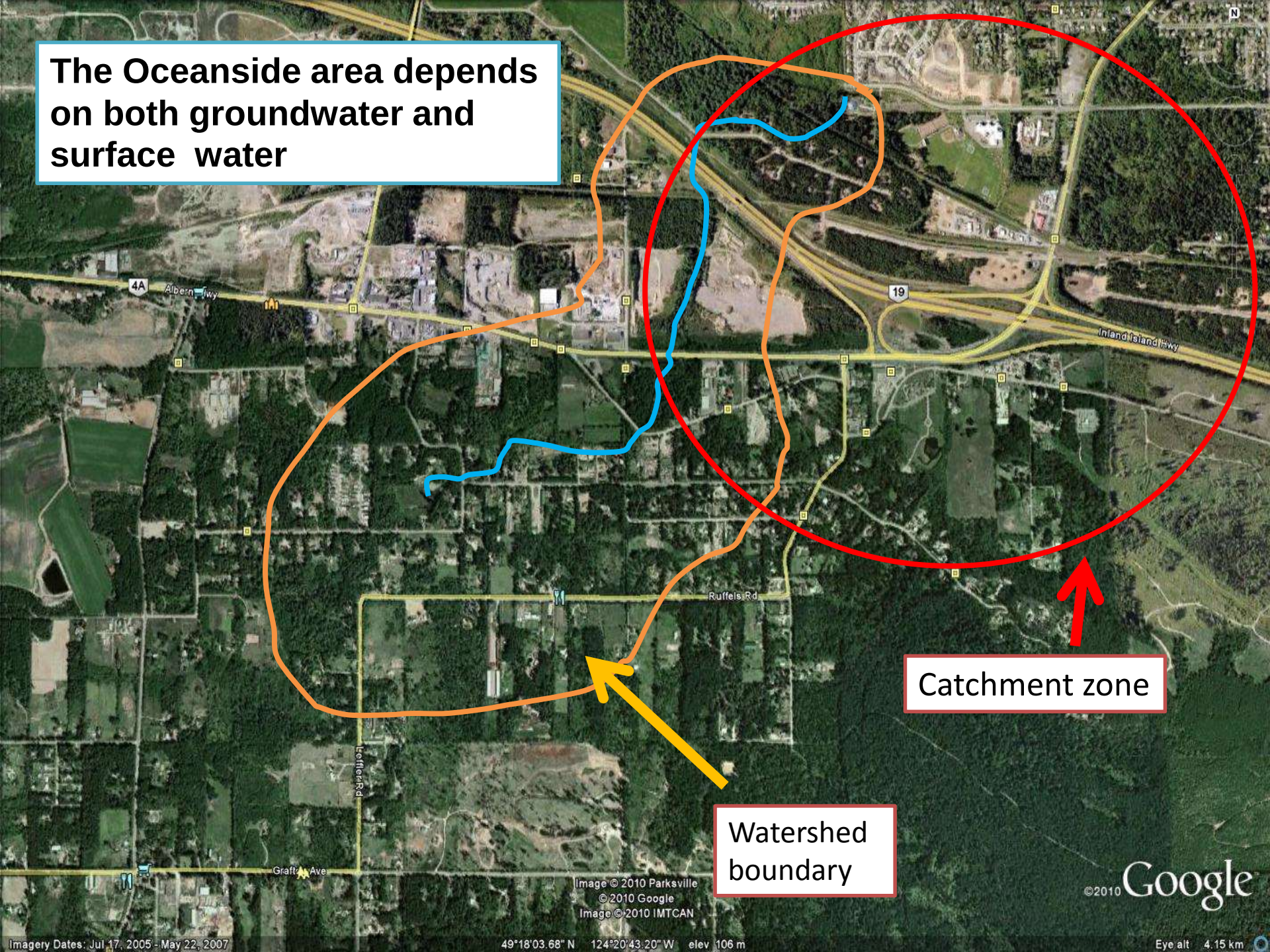
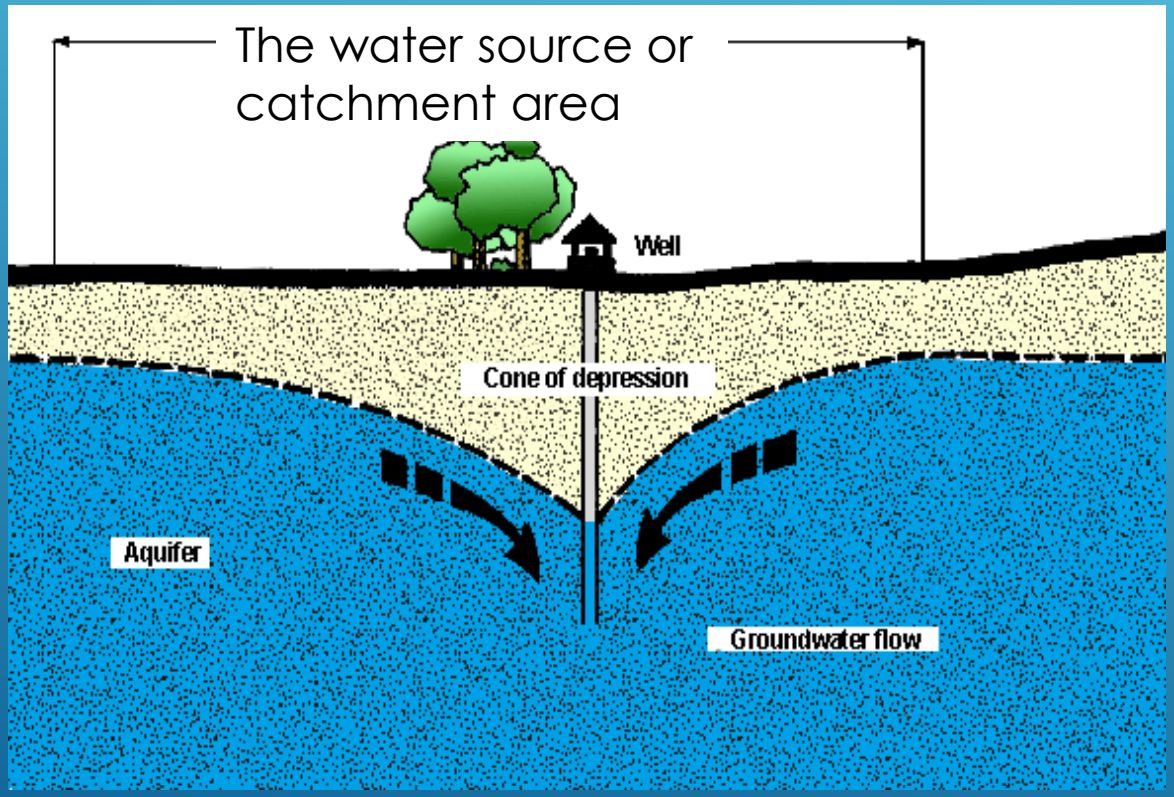
Imagery Date: Jul 17, 2005
49°18'57.91" N 124°25'10.18" W elev 84 m
Eye alt 37.65 km

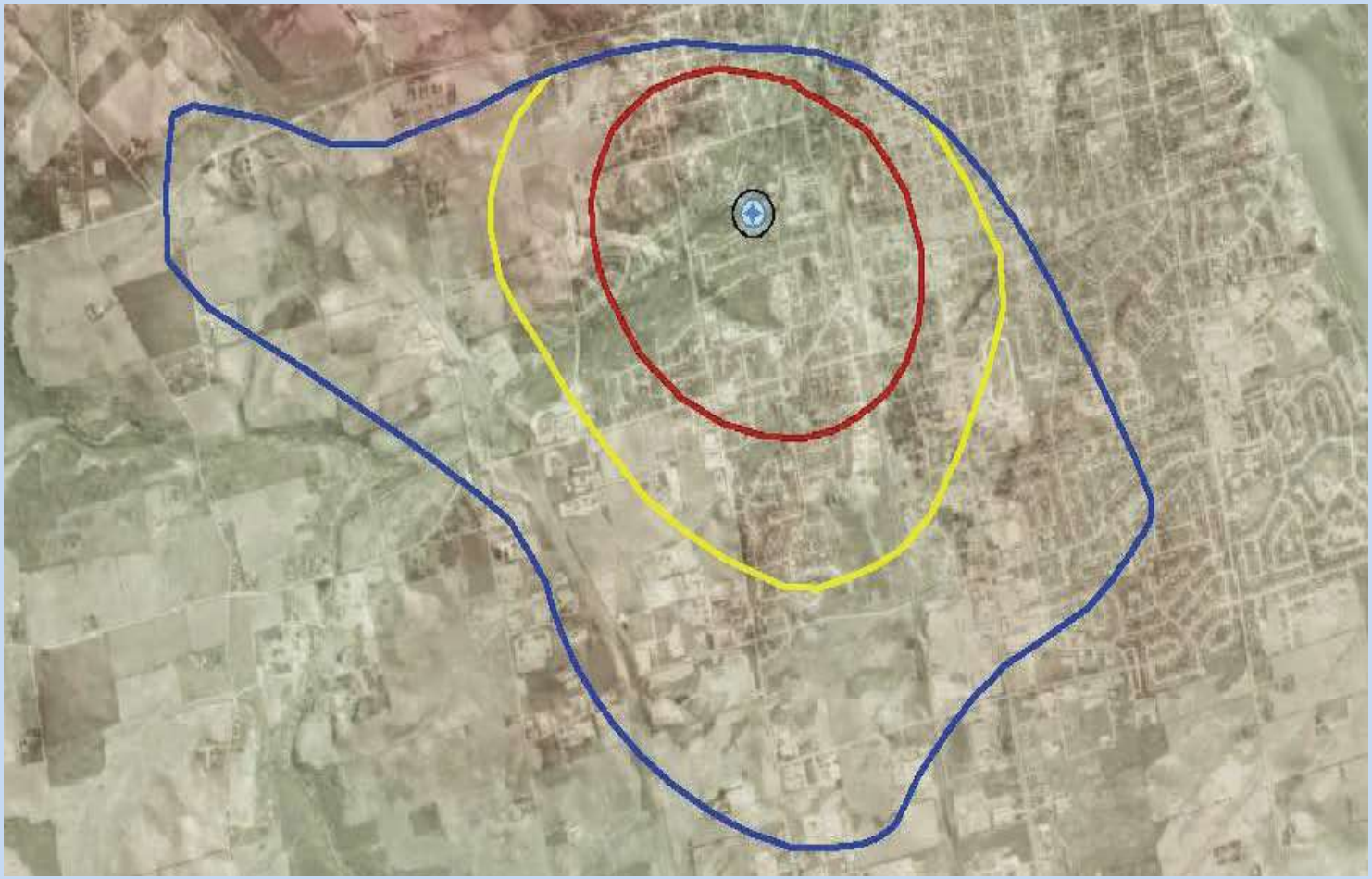
All of our drinking water originates as precipitation, in the form of rain or snow.


The Oceanside area depends on both groundwater and surface water
4A
Alberni Hwy
19
Inland Island Hwy
Ruffels Rd
Leffler Rd
Graft Ave
Catchment zone
Watershed boundary
Image © 2010 Parksville
© 2010 Google
Image © 2010 IMTCAN
©2010 Google
Imagery Dates: Jul 17, 2005 - May 22, 2007
49°18'03.68" N 124°20'43.20" W elev 106 m
Eye alt 4.15 km

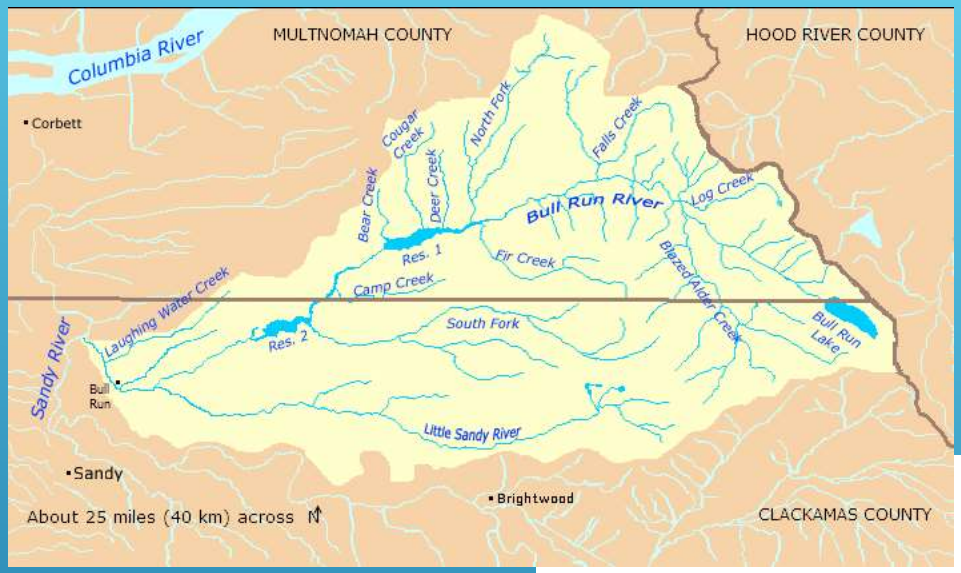
Ground-water basics



Ground-water catchment zone or recharge area

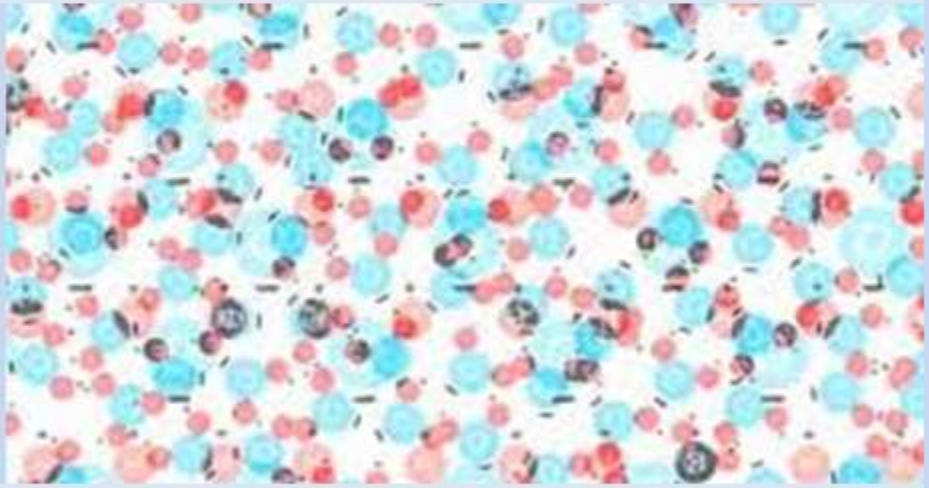


Surface Watershed



Drinking water source protection is essential

Water is a universal solvent



80,000 chemicals and hundreds of micro- organisms in our environment

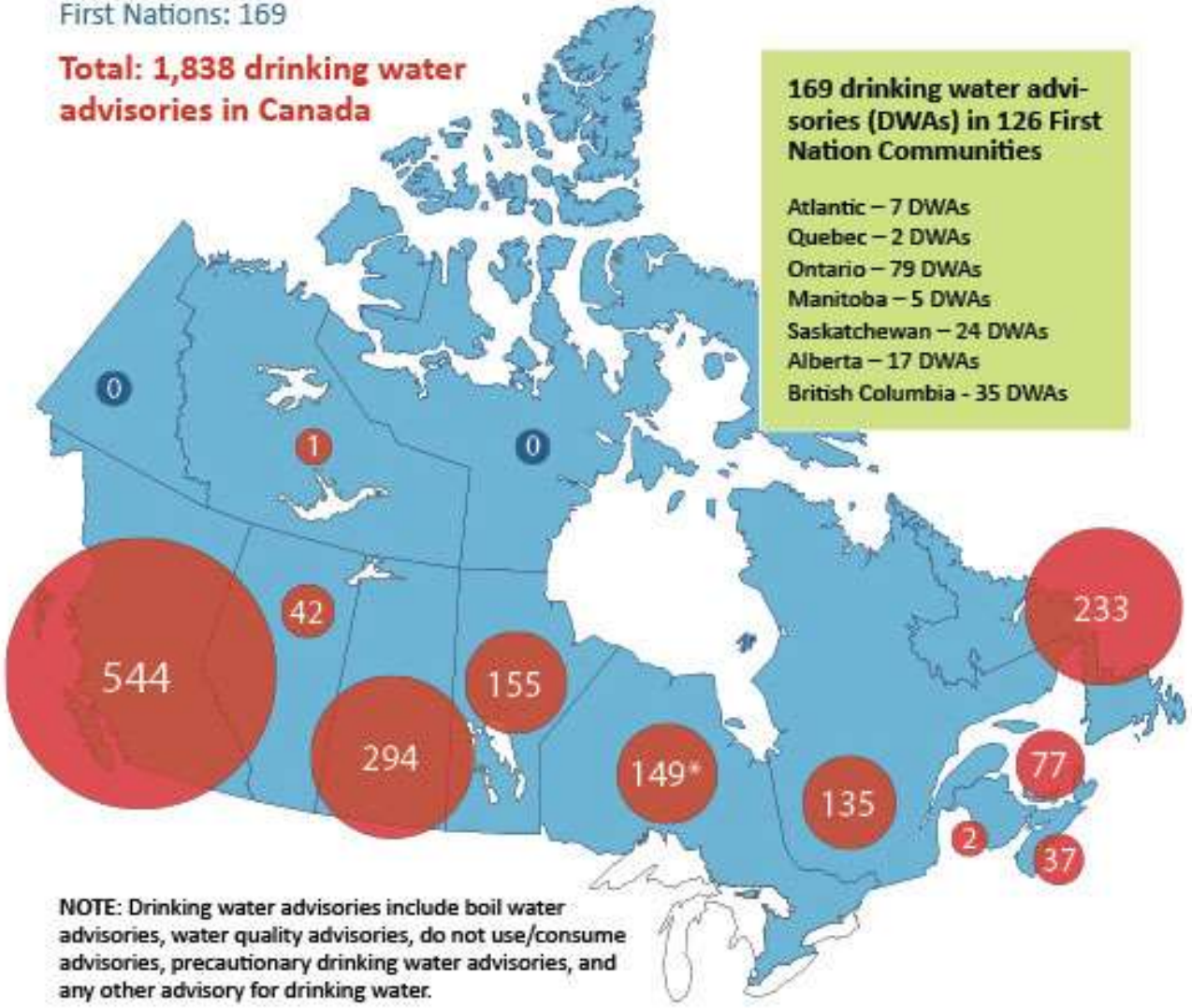
Water can contain traces of thousands of substances

Drinking water advisories by jurisdiction

Provinces and territories: 1,669

First Nations: 169

Total: 1,838 drinking water advisories in Canada



169 drinking water advisories (DWAs) in 126 First Nation Communities

Atlantic – 7 DWAs
Quebec – 2 DWAs
Ontario – 79 DWAs
Manitoba – 5 DWAs
Saskatchewan – 24 DWAs
Alberta – 17 DWAs
British Columbia - 35 DWAs

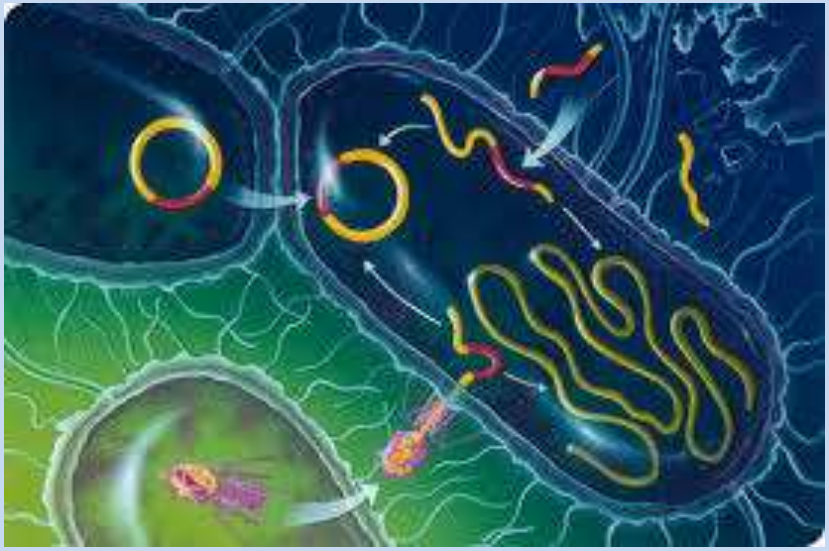
NOTE: Drinking water advisories include boil water advisories, water quality advisories, do not use/consume advisories, precautionary drinking water advisories, and any other advisory for drinking water.

*Information for Ontario only includes Boil Water Advisories.

Water treatment is necessary in many situations

Is expensive and uses a lot of energy and chemicals

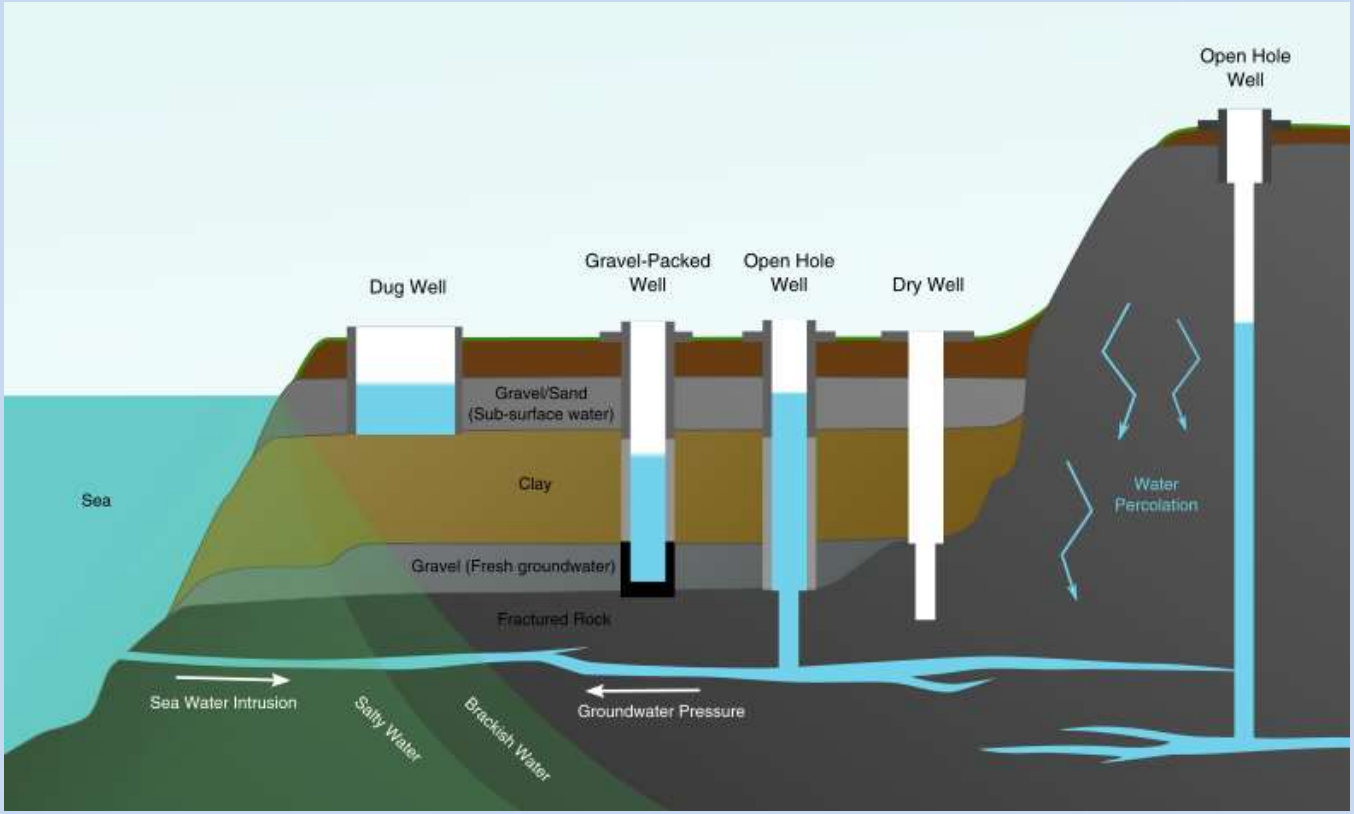
Disinfection can kill some biological contaminants

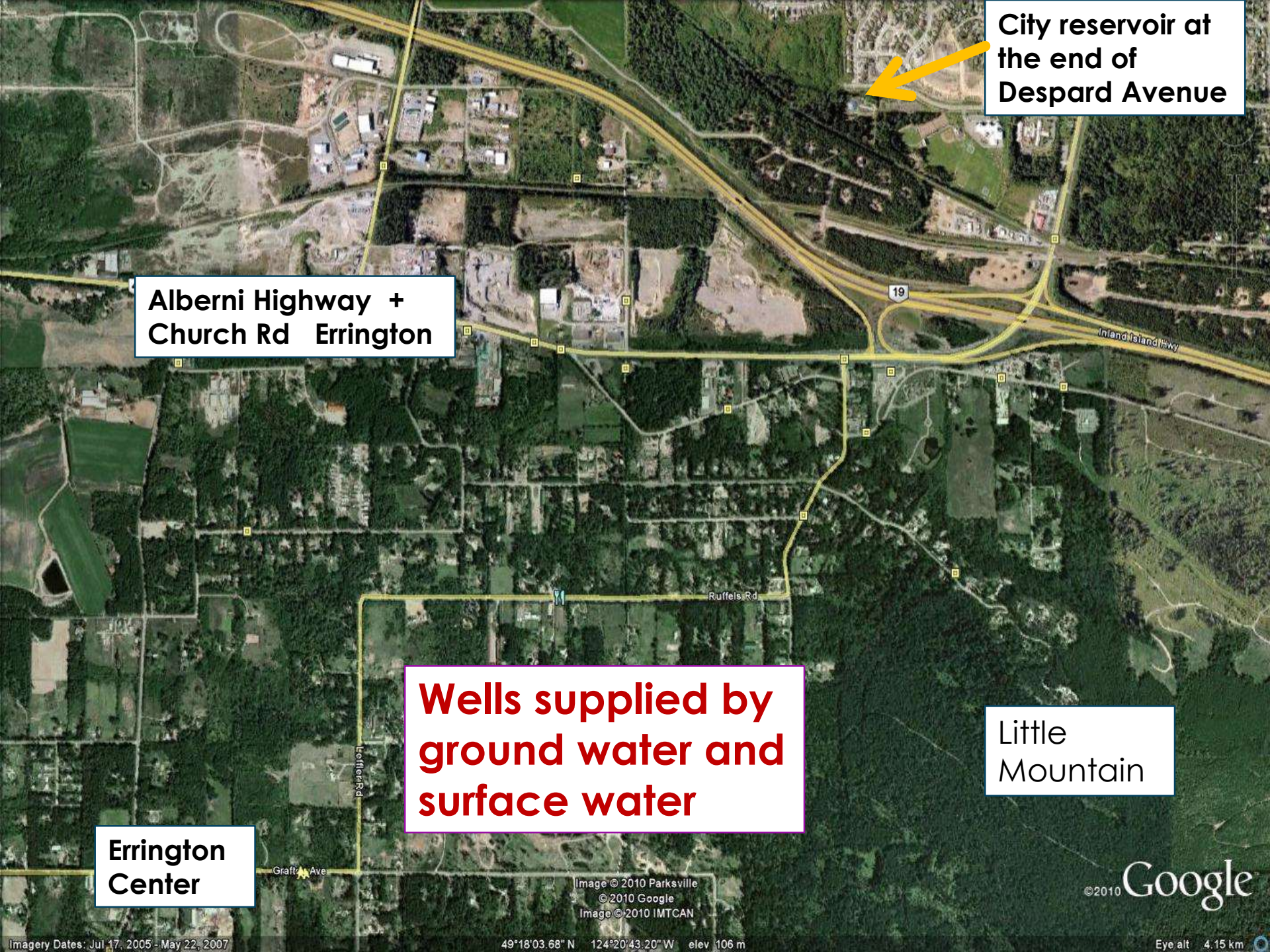


Disinfection with chlorine can have adverse health effects

Groundwater in this area

There are thousands of wells




City reservoir at the end of Despard Avenue
Alberni Highway + Church Rd Errington
19
Inland Island Hwy
Ruffels Rd
Leffler Rd
Graft Ave
Wells supplied by ground water and surface water
Little Mountain
Errington Center
Image © 2010 Parksville
© 2010 Google
Image © 2010 IMTCAN
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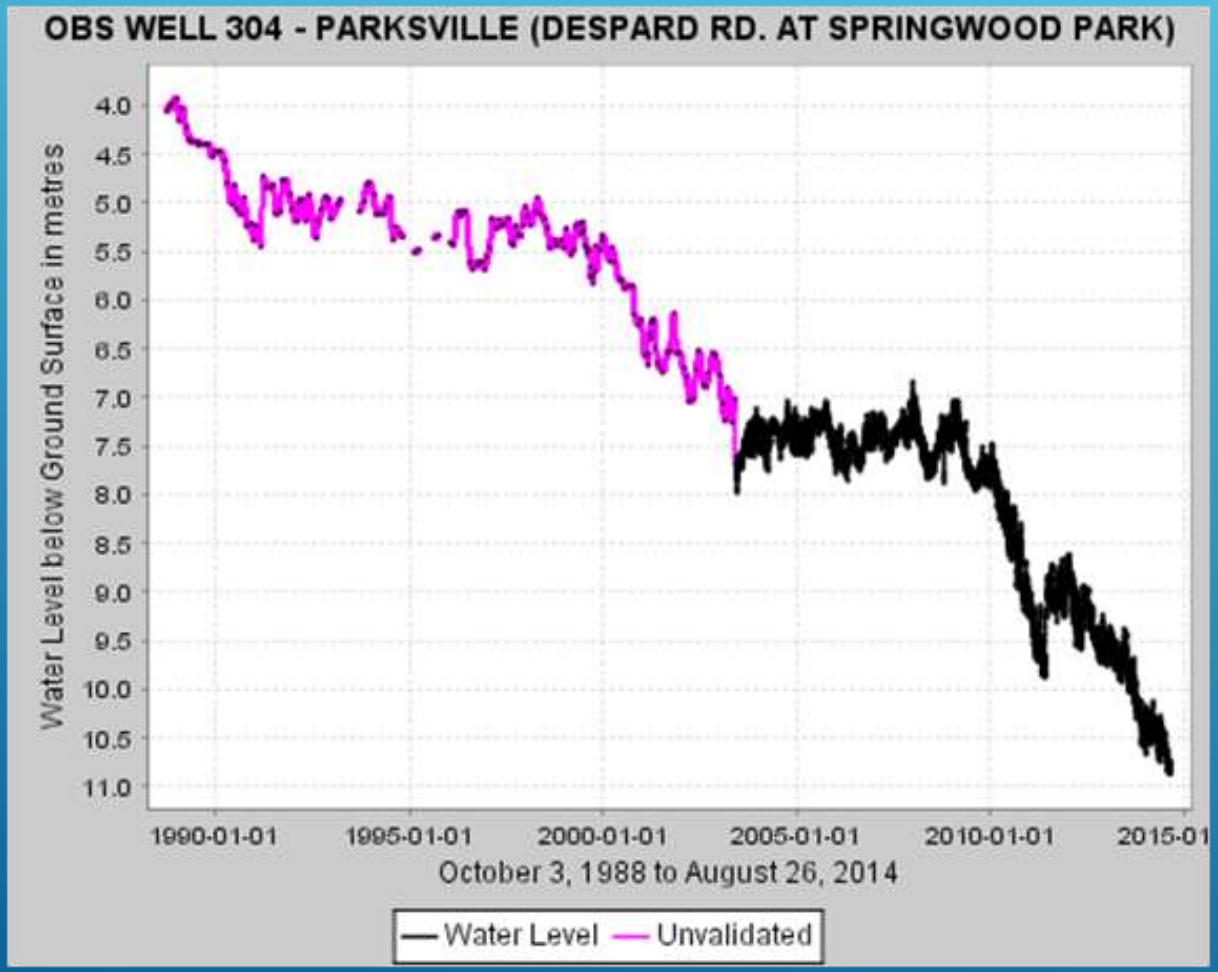
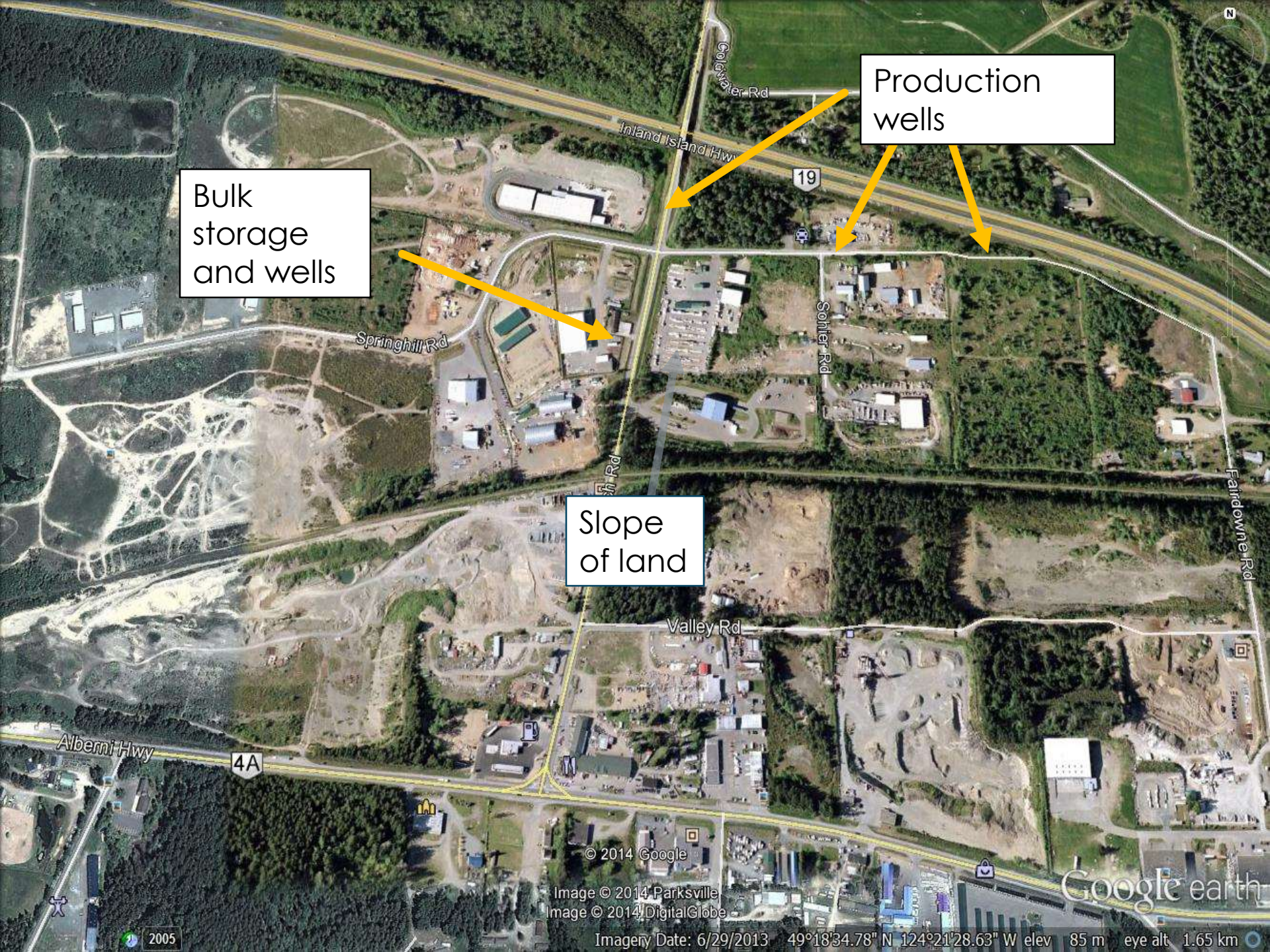
Imagery Dates: Jul 17, 2005 - May 22, 2007
49°18'03.68" N 124°20'43.20" W elev 106 m
Eye alt 4.15 km

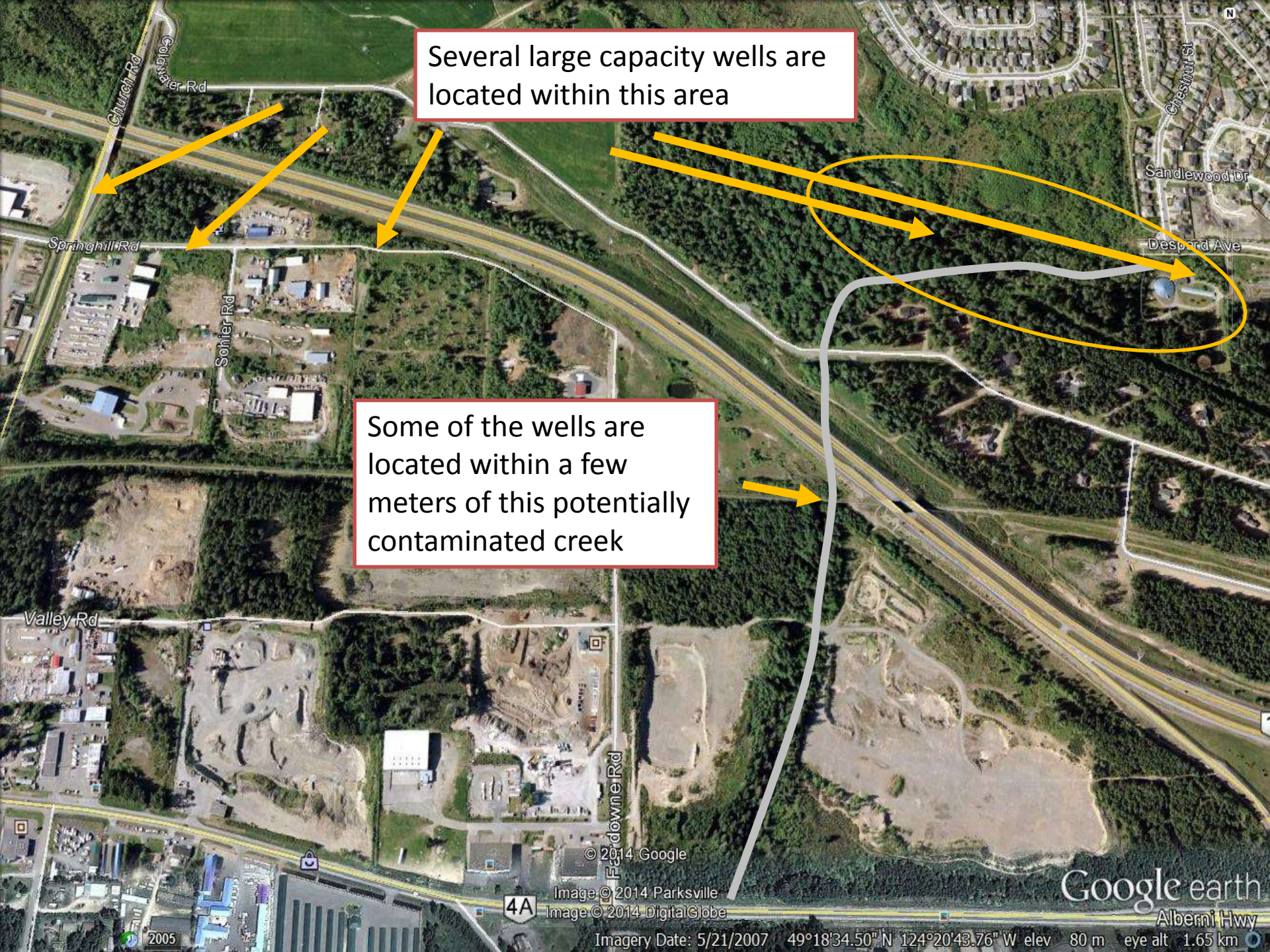
The groundwater levels at an observation well in Springwood Park continue to drop at an alarming rate. The level is now down to 11 meters. Historically the groundwater level was at the surface of the land.



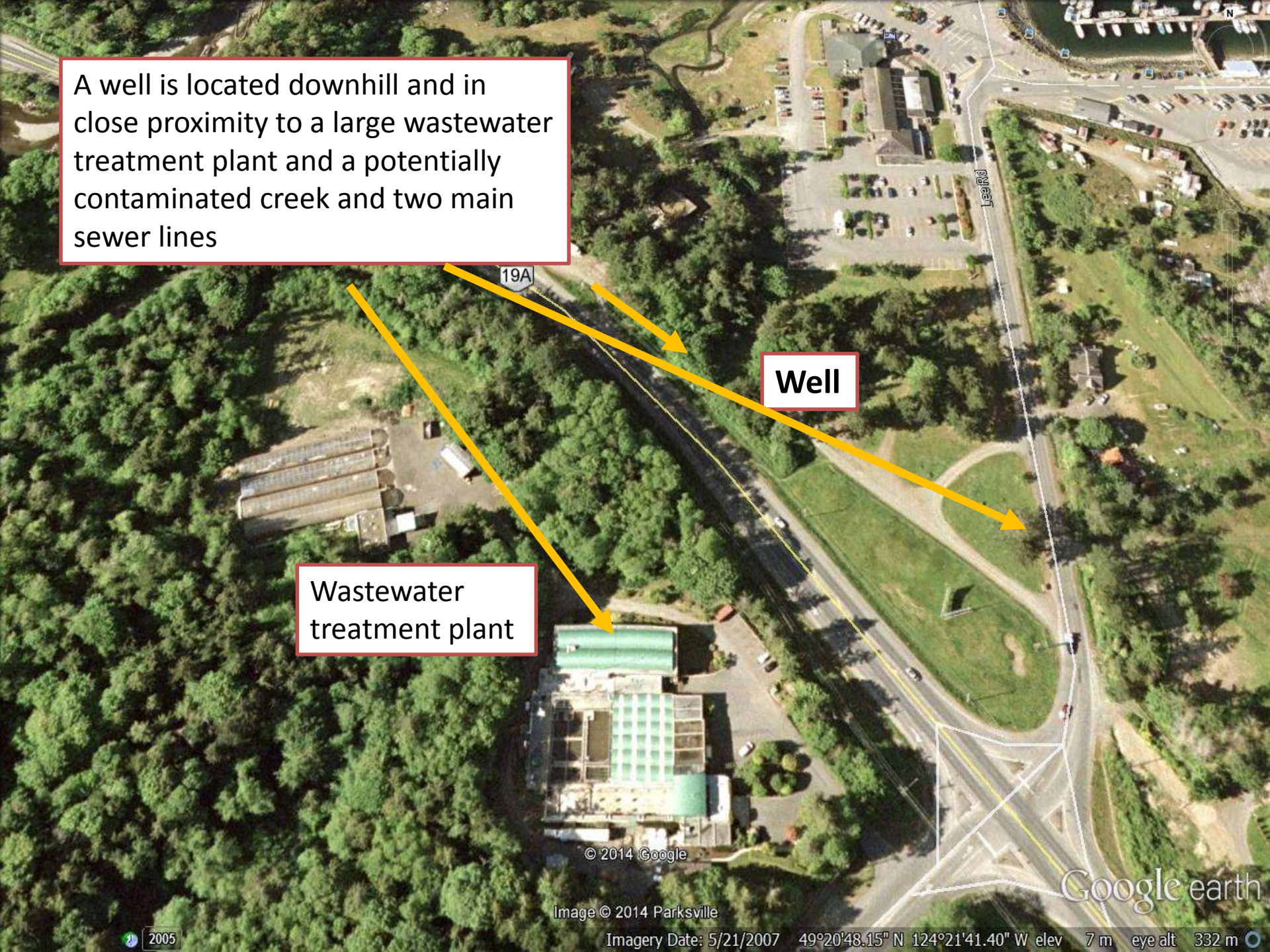
The continued decline indicates that extraction at the current rates is unsustainable.

The lowering groundwater levels also increase the risks to human health from contaminating land uses in the groundwater recharge areas.


Production wells
Bulk storage and wells
Slope of land
Goldwater Rd
Inland Island Hwy
19
Springhill Rd
Sohier Rd
Fairdowne Rd
Valley Rd
Alberni Hwy
4A
© 2014 Google
Image © 2014 Parksville
Image © 2014 DigitalGlobe
Google earth
2005
Imagery Date: 6/29/2013 49°18'34.78" N 124°21'28.63" W elev 85 m eye alt 1.65 km


Several large capacity wells are located within this area
Some of the wells are located within a few meters of this potentially contaminated creek
Church Rd
Springhill Rd
Sohier Rd
Sandlewood Dr
Despard Ave
Valley Rd
Faddowne Rd
4A
Alberni Hwy
© 2014 Google
Image © 2014 Parksville
Image © 2014 DigitalGlobe
Google earth
2005
Imagery Date: 5/21/2007 49°18'34.50" N 124°20'43.76" W elev 80 m eye alt 1.65 km

Private utility
groundwater well


A well is located downhill and in close proximity to a large wastewater treatment plant and a potentially contaminated creek and two main sewer lines
19A
Lee Rd
Well
Wastewater treatment plant
© 2014 Google
Image © 2014 Parksville
Google earth
2005
Imagery Date: 5/21/2007 49°20'48.15" N 124°21'41.40" W elev 7 m eye alt 332 m

Several wells are located in this area and could be subject to sources of contamination from old rail yard activity
A cemetery is located uphill from this well-field
Sandlewood Dr
Despard Ave
Coldwater Rd
19
4A
Wildgreen Way
Smithers Rd
Bellevue Rd
Tramfield Rd
Allsbrook Rd
© 2014 Google
Image © 2014 Parksville
Image © 2014 DigitalGlobe
Google earth
2005
Imagery Date: 6/29/2013 49°18'26.38" N 124°19'34.15" W elev 69 m eye alt 1.65 km

Drilling a well for drinking water

Two wells located in this roadside ditch

For more than thirty five years significant quantities of back-hauling of waste materials has been used to fill abandoned gravel pits

Storage or equipment and materials is occurring over a large area

Seepage could recharge groundwater

Using the precautionary principle

Do you believe the water originating from this area is completely safe to drink???
Should most of the high production drinking water wells in this area be shut down???
4A
Alberni Hwy
19
Inland Island Hwy
Ruffels Rd
©2010 Google
Imagery Dates: Jul 17, 2005 - May 22, 2007
49°18'03.68" N 124°20'43.20" W elev 106 m
Eye alt 4.15 km

SLAPP Strategic Lawsuits Against Public Participation

Such concerns should be brought through the BC legal system

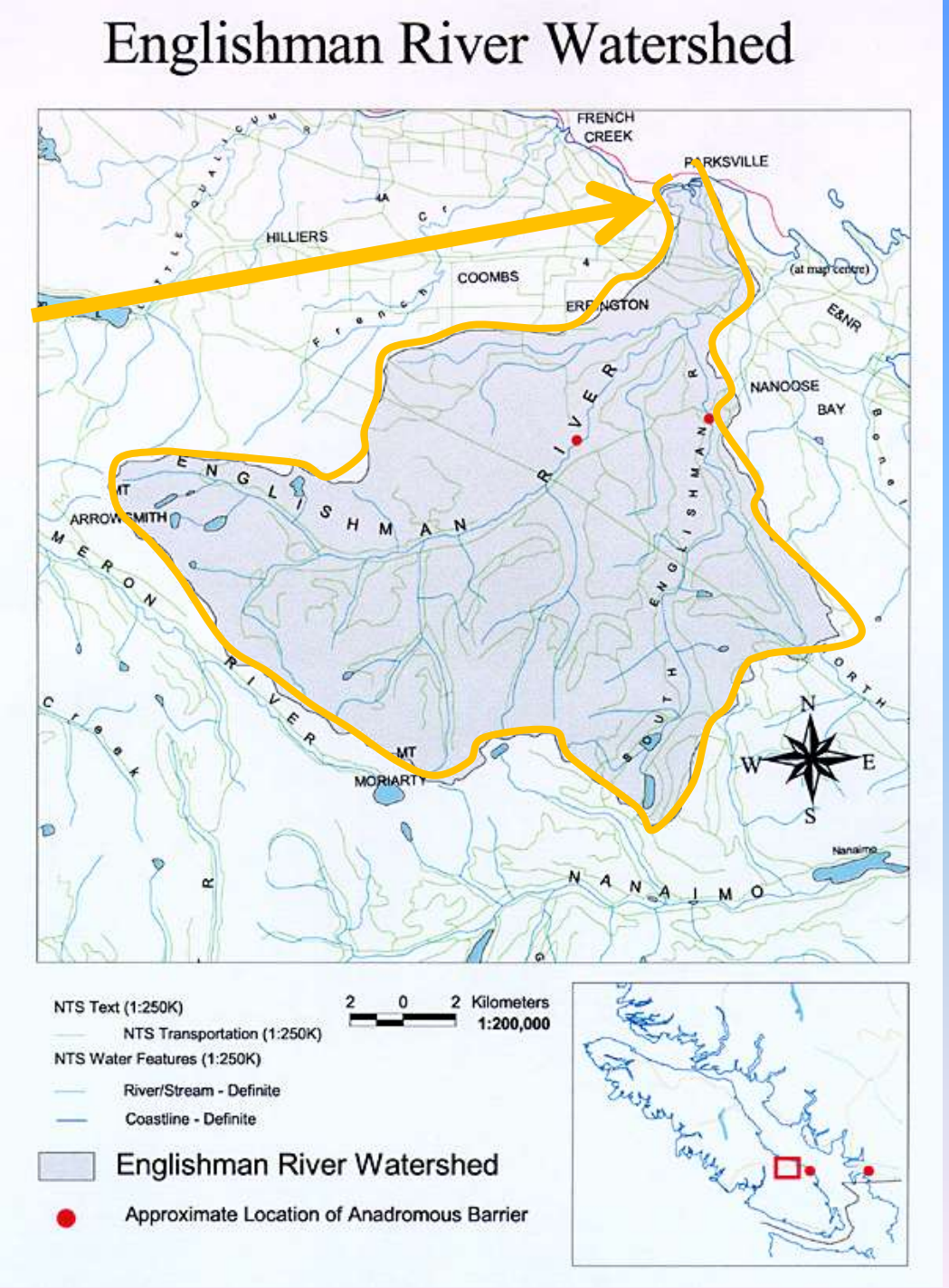
VIHA

Parkville's drinking water, from surface water sources.

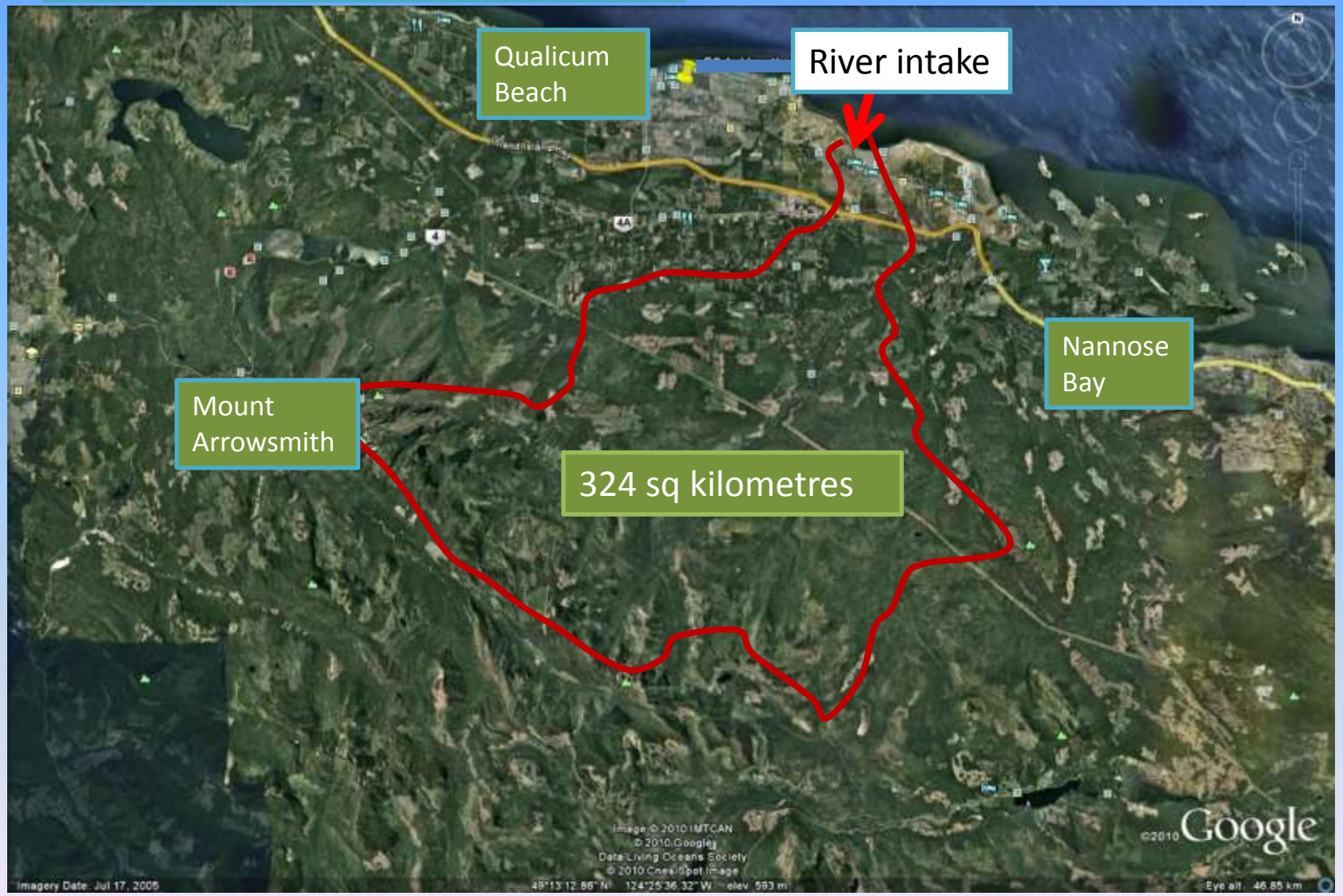
The Arrowsmith Water Service drinking water supply originates from within the Englishman River Watershed.

The service supplies water to the City of Parksville and areas within the Regional District of Nanaimo

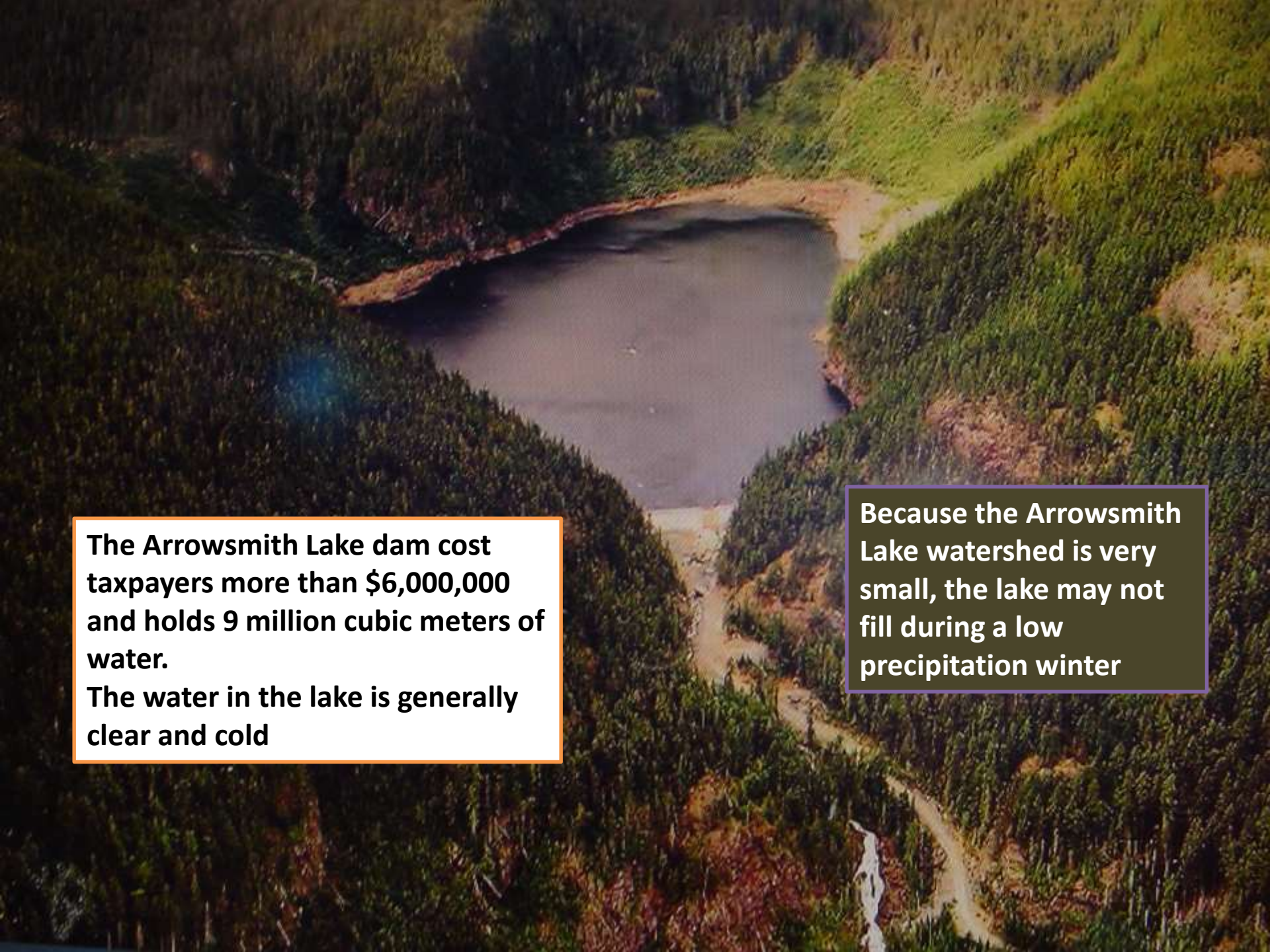
The intake for the drinking water system is located just below the orange bridge in Parksville



Parksville Drinking Water Source



The current surface water intake is not dependable to supply safe drinking water, for a growing population



The Arrowsmith Lake dam cost taxpayers more than $6,000,000 and holds 9 million cubic meters of water.
The water in the lake is generally clear and cold

Because the Arrowsmith Lake watershed is very small, the lake may not fill during a low precipitation winter

City of Parksville Water Supply & Distribution System

April 2011

The following 4 slides include questions that are superimposed onto a presentation made in 2011

Prepared By:
Mike Squire, AScT
Manager of Operations

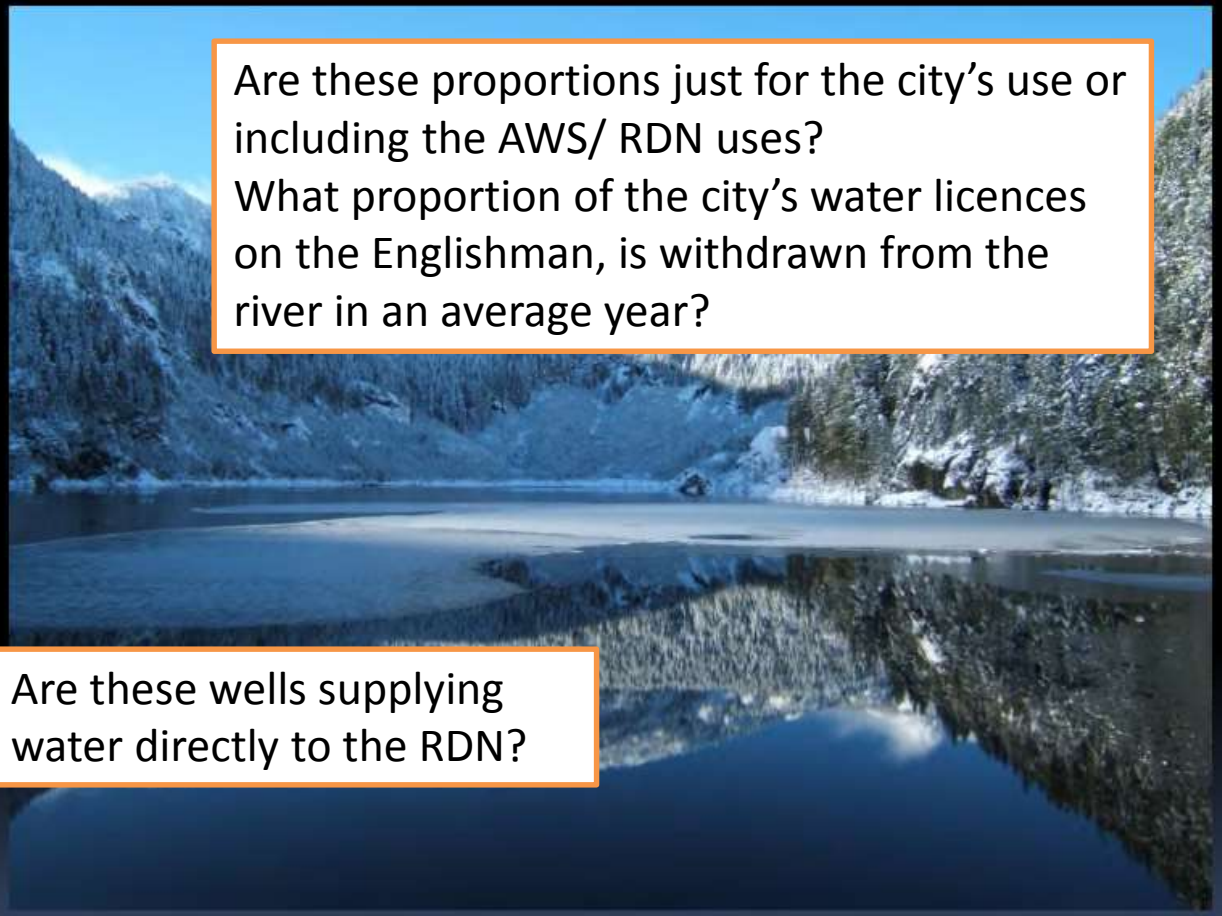
City of Parksville

City of Parksville Water System Overview

Two Sources…….

Englishman River
51 %

Railway Wells
24 %
Springwood Wells
25 %



Are these proportions just for the city's use or including the AWS/ RDN uses?
What proportion of the city's water licences on the Englishman, is withdrawn from the river in an average year?

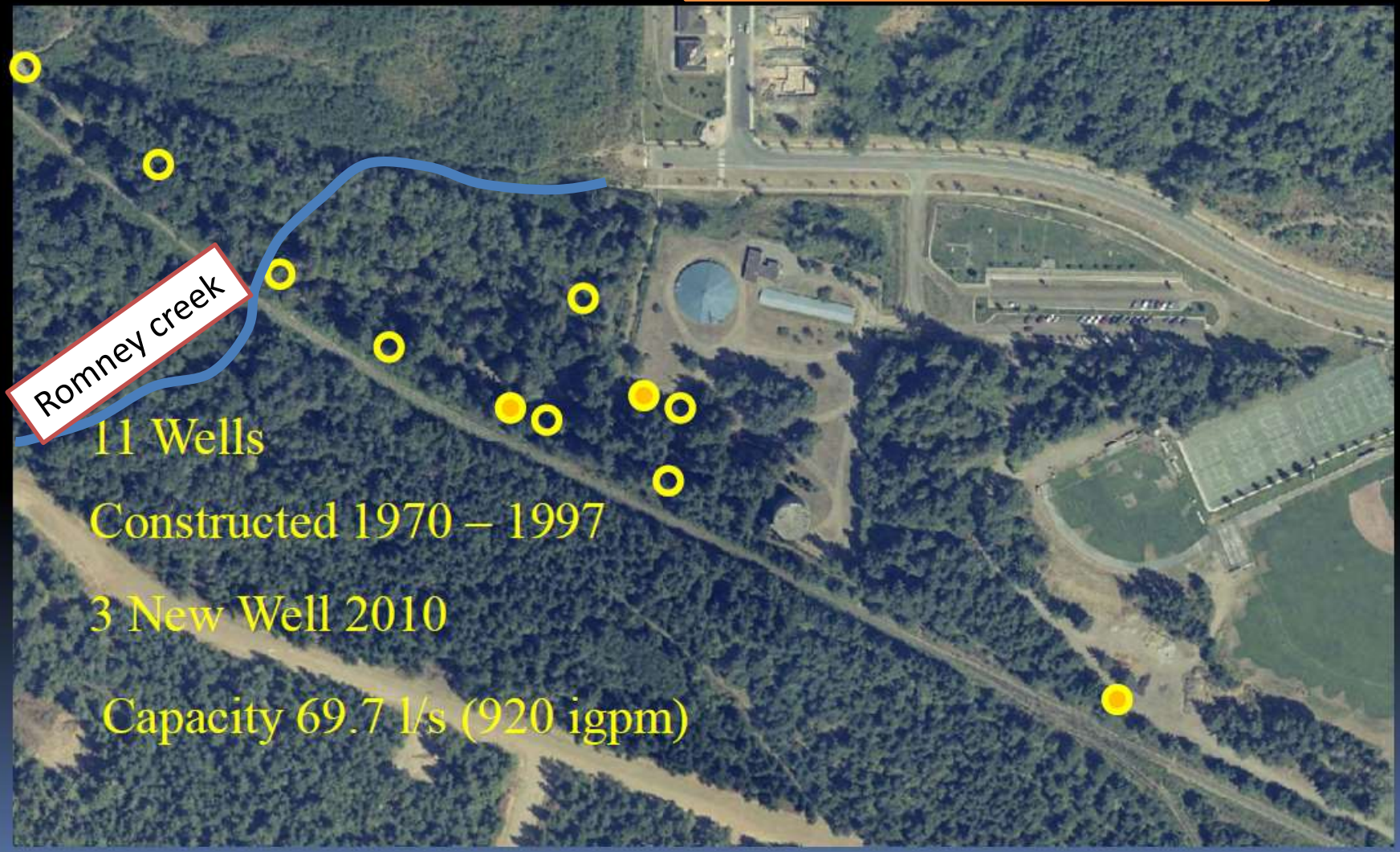
Are these wells supplying water directly to the RDN?

Arrowsmith Lake Reservoir

Overview

Springwood Wells

This air photo is several years old areas have been developed since it was taken ?



Overview

Railway Wells

Buckerfields and Recycling depot under photos

Typical Well Head Installation

How old is this photo?

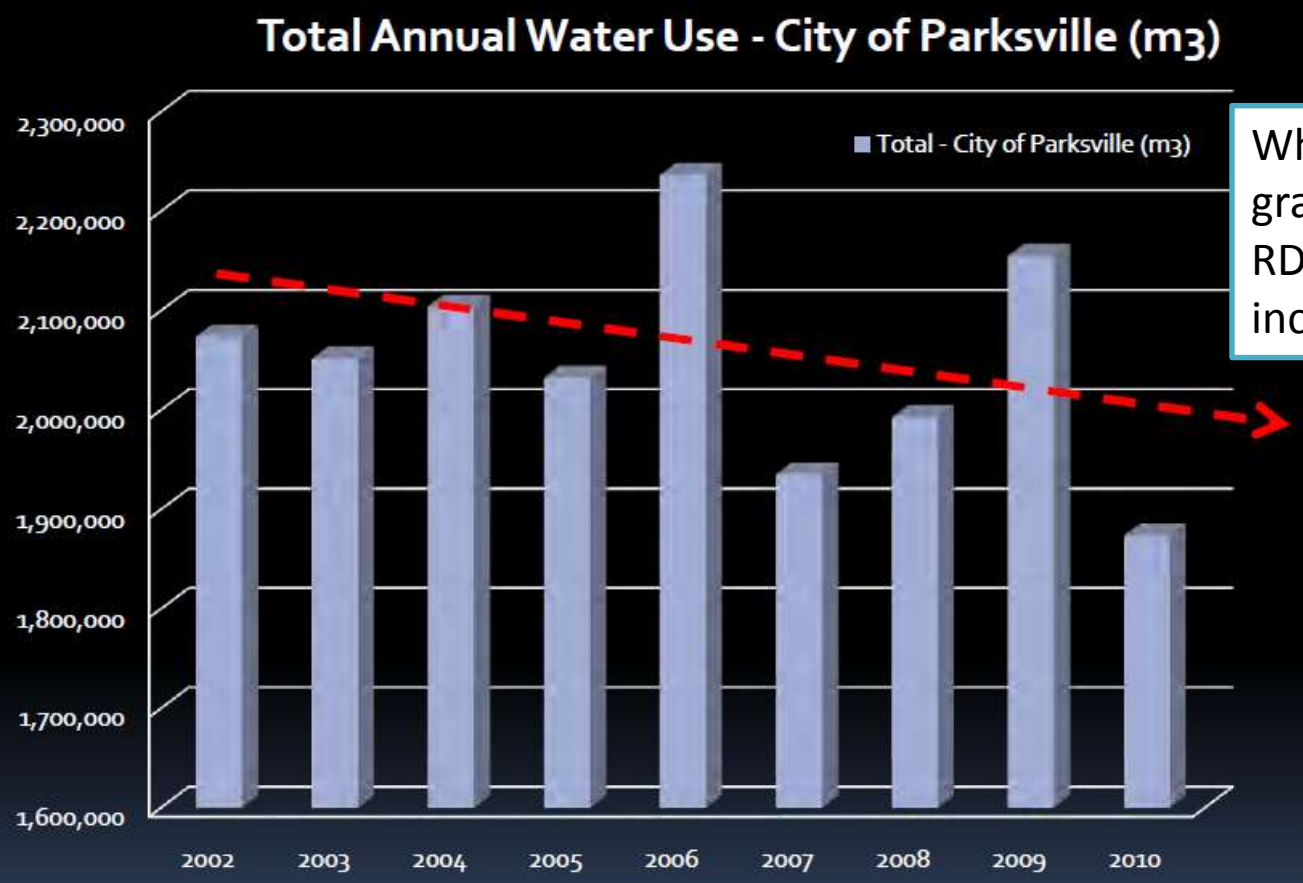
7 Wells

Constructed 1994 - 1998

Capacity 34.5 l/s (455 igpm)

This area is developed now

Why do we need Water Treatment and a New Intake ?

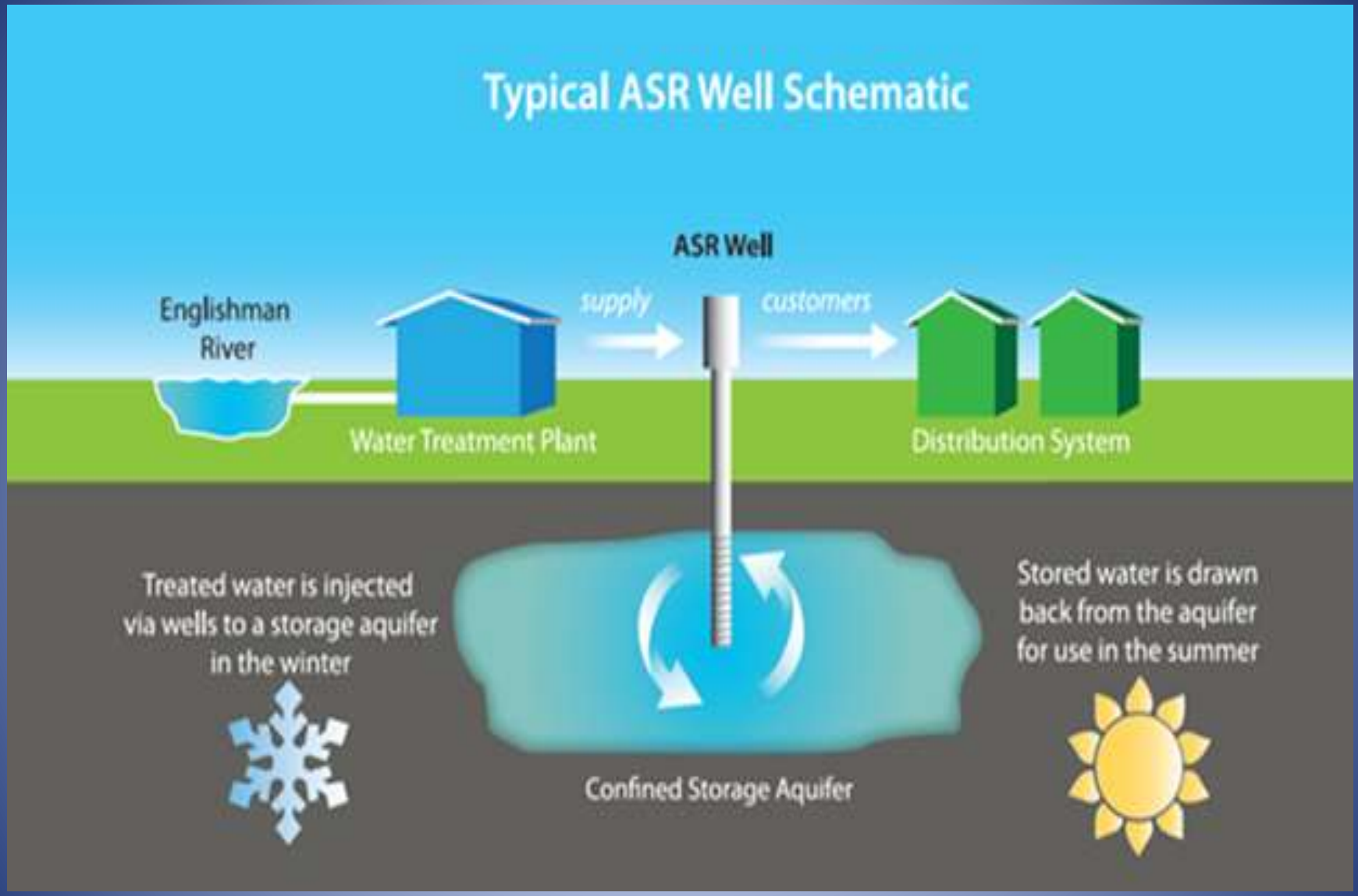


What does this graph look like with RDN water use included ?

Total Annual Water Use – Declining Trend

arrowsmith
WATER SERVICE
&
englishman river
WATER SERVICE

needed a lot of water before the development of the next phase could continue

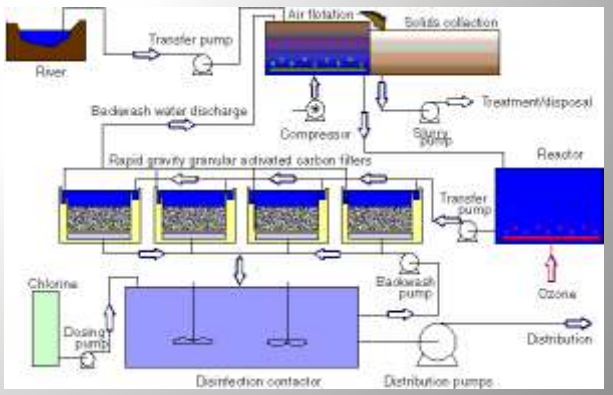

Typical ASR Well Schematic
ASR Well
Englishman River
supply
customers
Water Treatment Plant
Distribution System
Treated water is injected via wells to a storage aquifer in the winter
Confined Storage Aquifer
Stored water is drawn back from the aquifer for use in the summer

Heavily engineered approach:

Extensive planning and design component

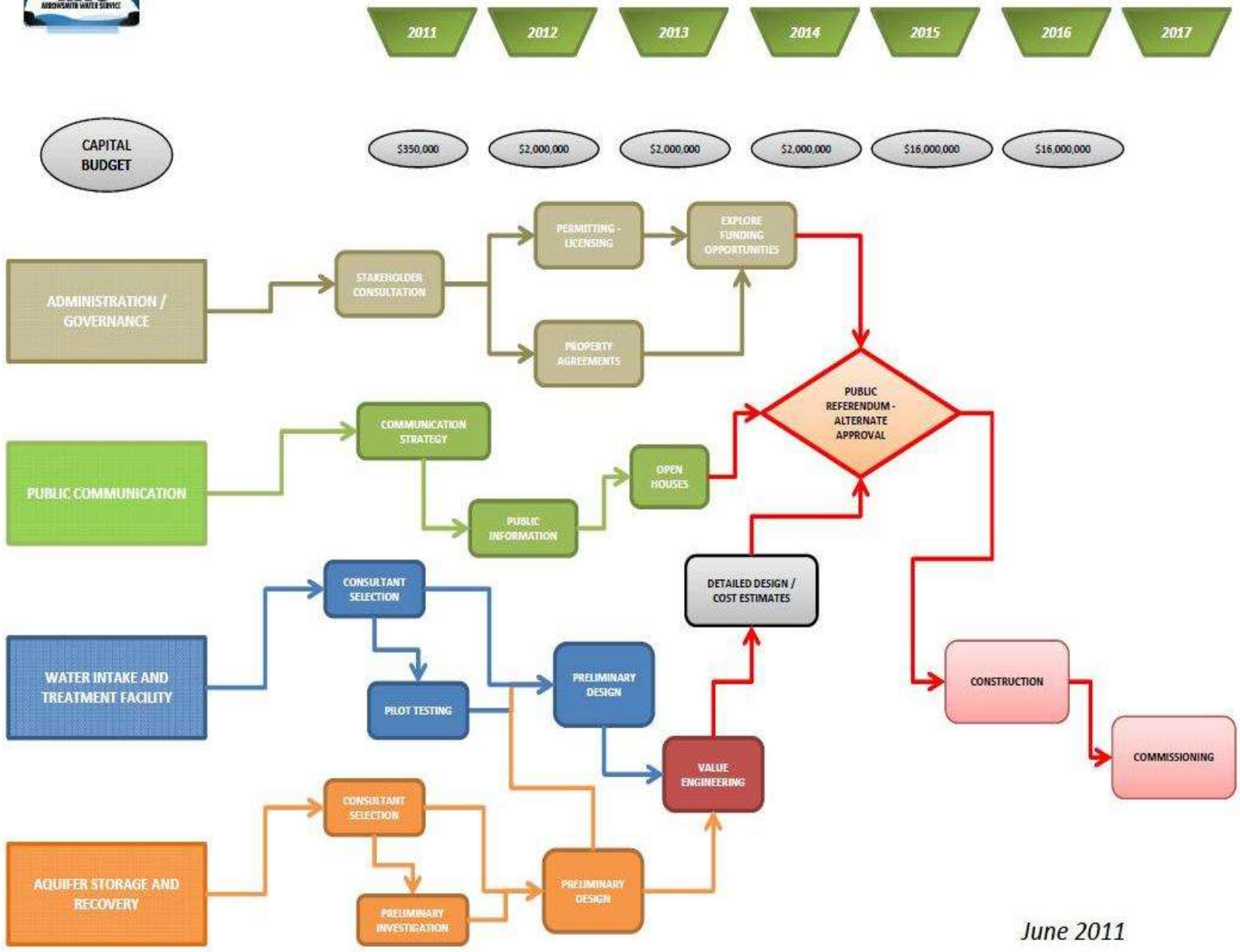
Dependence on expensive construction resources i.e. concrete, pipe, pumps, labour

High level of maintenance costs i.e. electrical energy, chemicals, labour etc.



Infrastructure commitment is more centralised and not readily adaptable

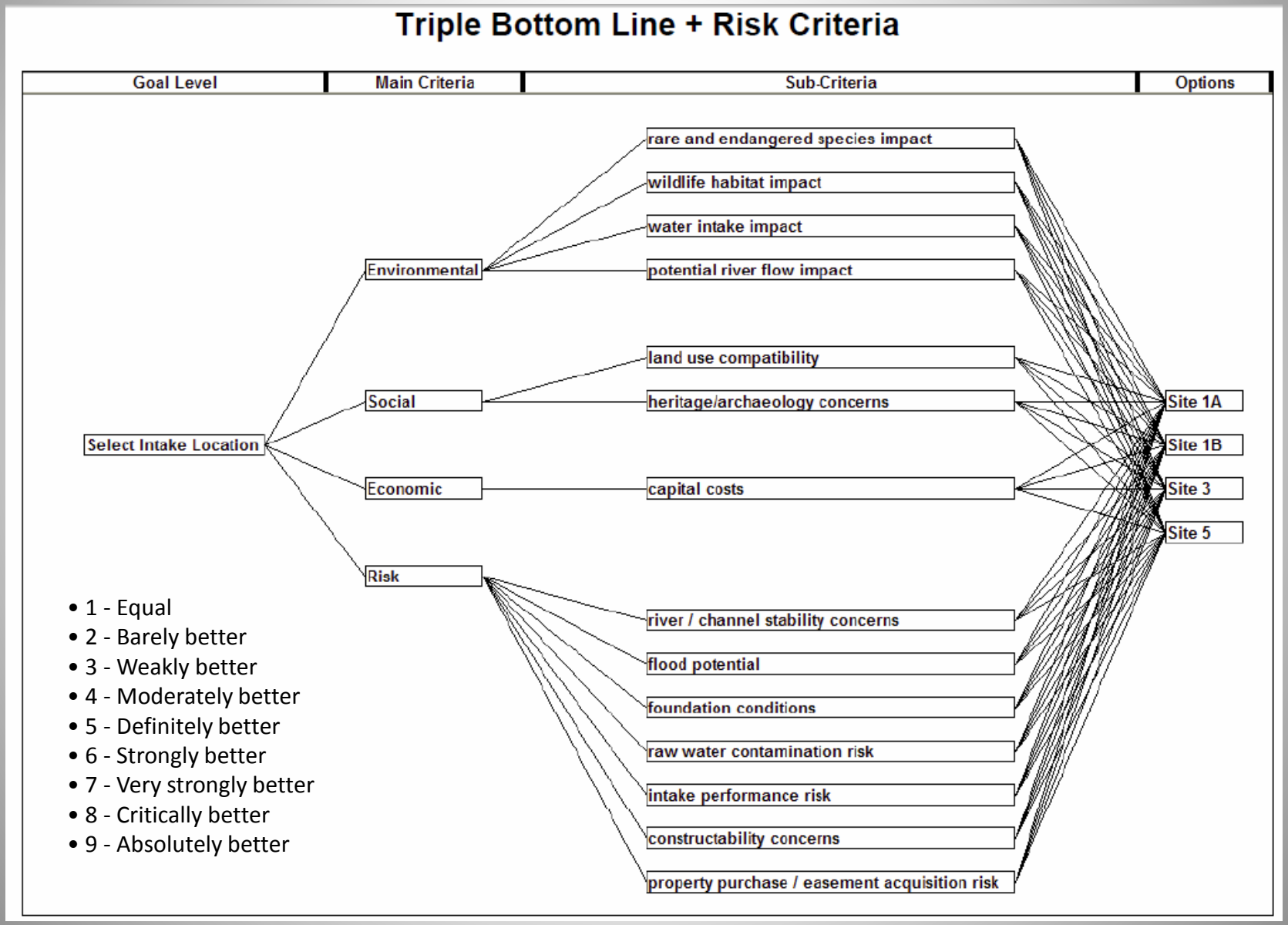
AWS – IMPLEMENTATION PLAN SCHEDULE (critical path)

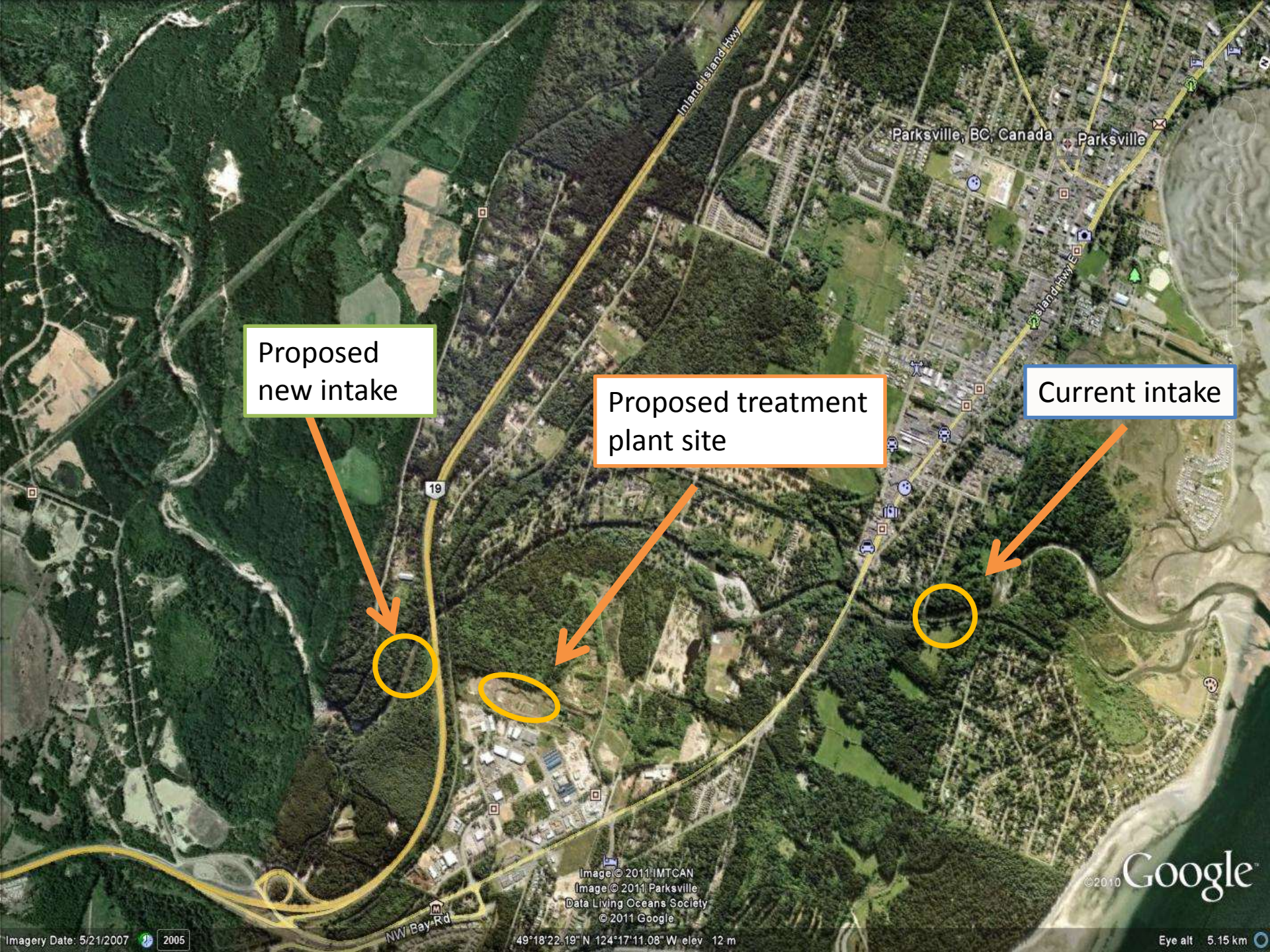


June 2011

From AWS consultants report

Graph below extracted from report. http://www.arrowsmithwaterservice.ca/aws_documents/aws_dp8-2.pdf




Proposed new intake
Proposed treatment plant site
Current intake
Inland Island Hwy
Parksville, BC, Canada
Parksville
Island Hwy E
19
NW Bay Rd
Image © 2011 IMTCAN
Image © 2011 Parksville
Data Living Oceans Society
© 2011 Google
©2010 Google
Imagery Date: 5/21/2007
2005
49°18'22.19" N 124°17'11.08" W elev 12 m
Eye alt 5.15 km

Will the proposed treatment plant, treat a wide range of possible contamination threats?

Auto wrecker upstream

Bank collapse partially blocking river upstream of the new multi-million dollar intake and treatment plant.

A catastrophic collapse of the clay banks could cause significant problems by temporally damming the river and possibly creating a flash flood.

Department of Fisheries and Oceans have responded

Suggested Operational Cost Comparison Between Proposed ASR system and a Natural Advantage System (NAS)

Relative Cost/ Risk Potential	ASR	NAS
Raw water quality .. potential contamination level	High - Extreme	Very low
Power to pump water for treatment	High	Zero
Cost of first treatment	+ - Very High	Minimal
Cost to pump water to ASR site	High	Zero
Water loss potential from aquifer	High	Zero
Potential for adverse issues with pressure storage	High	Zero
Cost to pump water out of aquifer	High	Zero
Cost of second treatment	Low	Zero
Cost to pump water for distribution	Moderate	Low
Total infrastructure upkeep and devaluation	High	Low
Cost of personnel, power, treatment chemicals etc	High	Very low
Potential for future costs increases to effect system	High	Very low

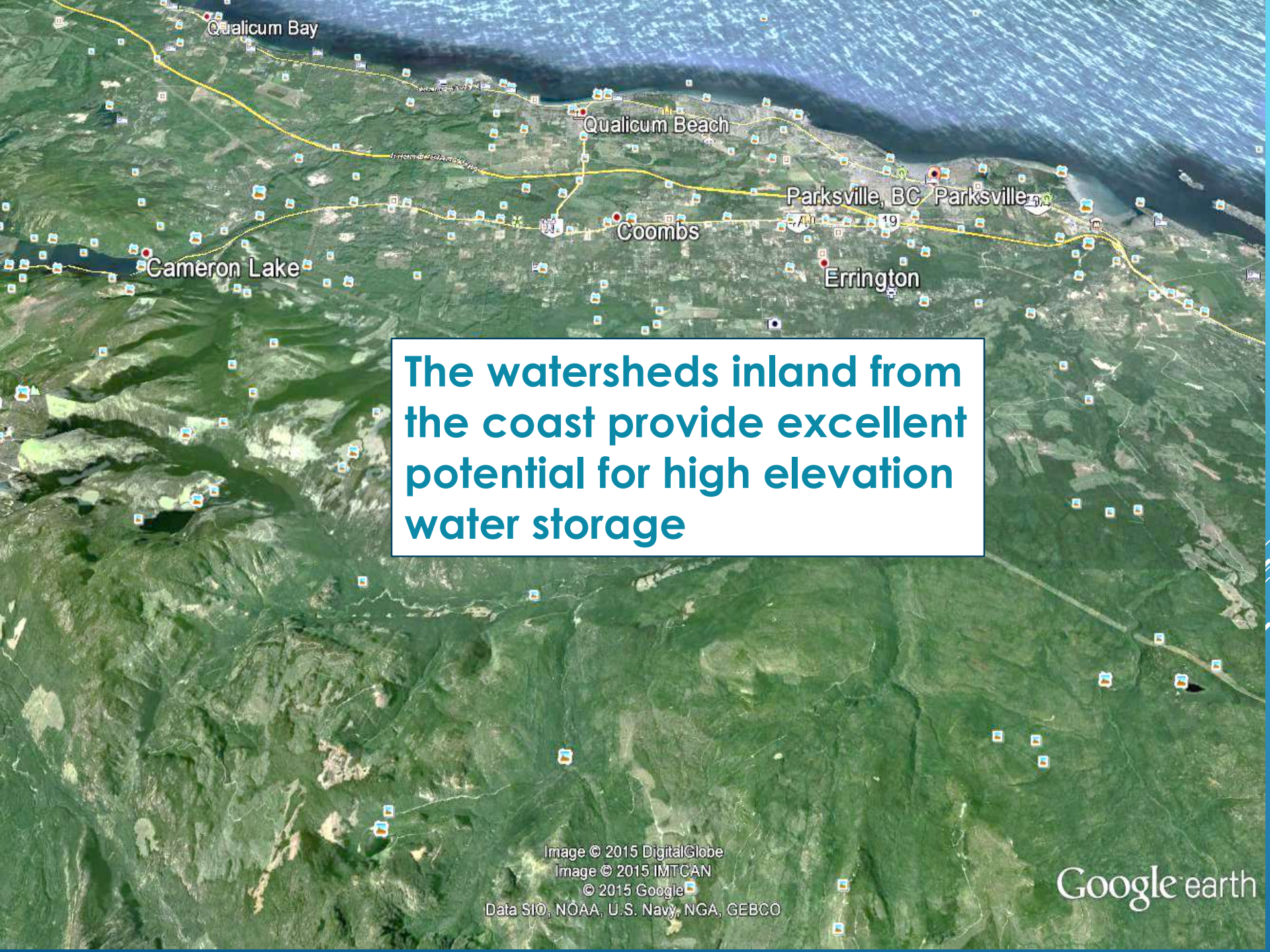
Soft environmentally compatible approach

- Protect water quality and quantity from the source
- Take full advantage of surplus winter precipitation

- Minimize the need for heavy infrastructure
- Work with the natural topography

- Develop decentralised, adaptable systems

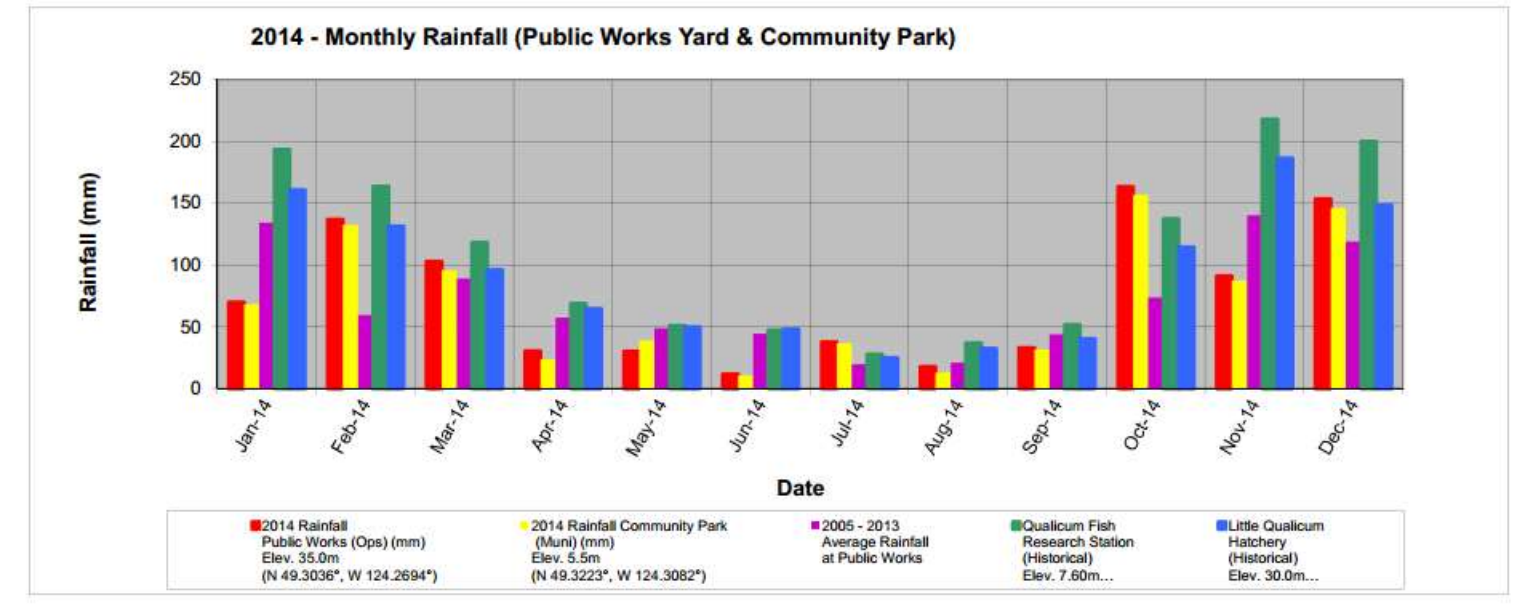
Once installed a gravity feed system would require no power and very limited maintenance
Until the settlers came and drained, paved and sucked water out of the ground, mother nature and beavers recharged all of the aquifers for free

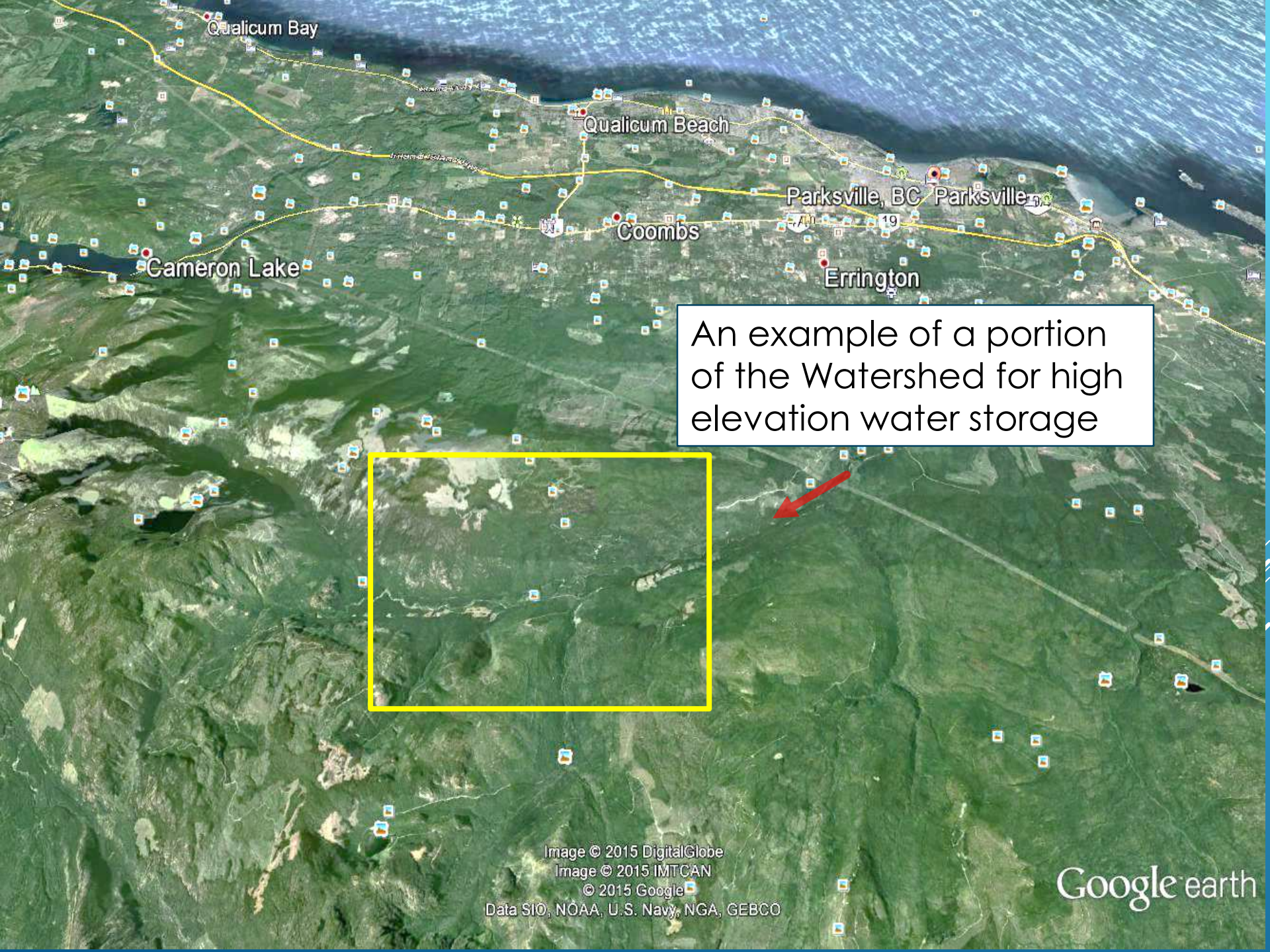

Qualicum Bay
Qualicum Beach
Parksville, BC
Parksville
Coombs
Cameron Lake
Errington
The watersheds inland from the coast provide excellent potential for high elevation water storage
Image © 2015 DigitalGlobe
Image © 2015 IMTCAN
© 2015 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth

Storing high quality water at high elevation has many benefits

1. Water is relatively clean
2. Minimal contamination risk
3. Provides ecological and fisheries benefits
4. Eliminates the need for summer extraction from the river
5. Reduces storm flooding
6. Will flow downhill for free
7. Very low operational costs
8. Can generate electric power
9. Can supply many different areas

High flow diversion and storage of water would occur in late fall, winter and in spring and early summer during storm events.




Qualicum Bay
Qualicum Beach
Parksville, BC
Parksville
Coombs
Cameron Lake
Errington
An example of a portion of the Watershed for high elevation water storage
Image © 2015 DigitalGlobe
Image © 2015 IMTCAN
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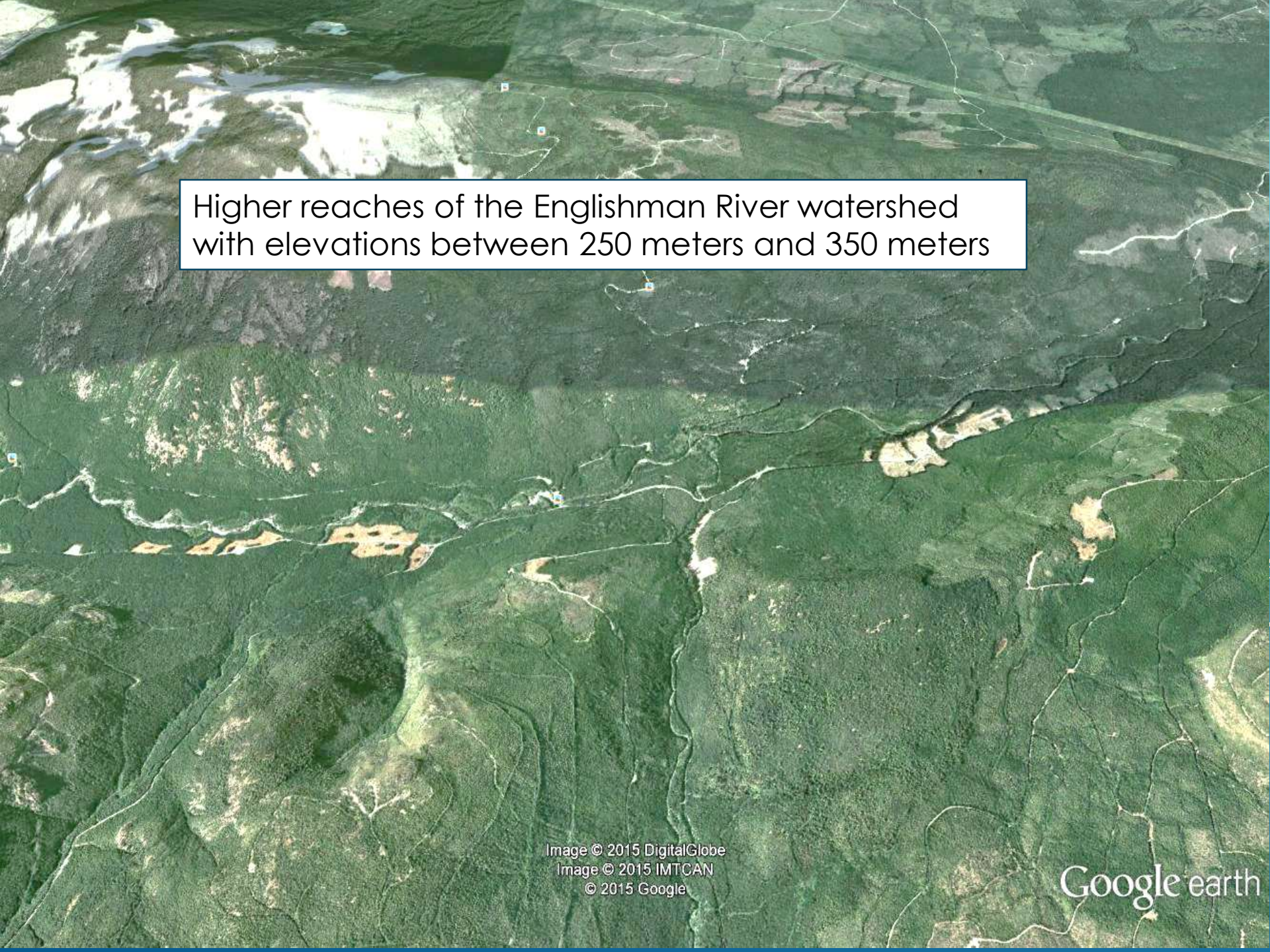
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth


Higher reaches of the Englishman River watershed with elevations between 250 meters and 350 meters
Image © 2015 DigitalGlobe
Image © 2015 IMTCAN
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Channel overflow structure on the side of the main stream

The existing creek or river channel would not be directly impacted

Image © 2015 DigitalGlobe
Image © 2015 IMTCAN
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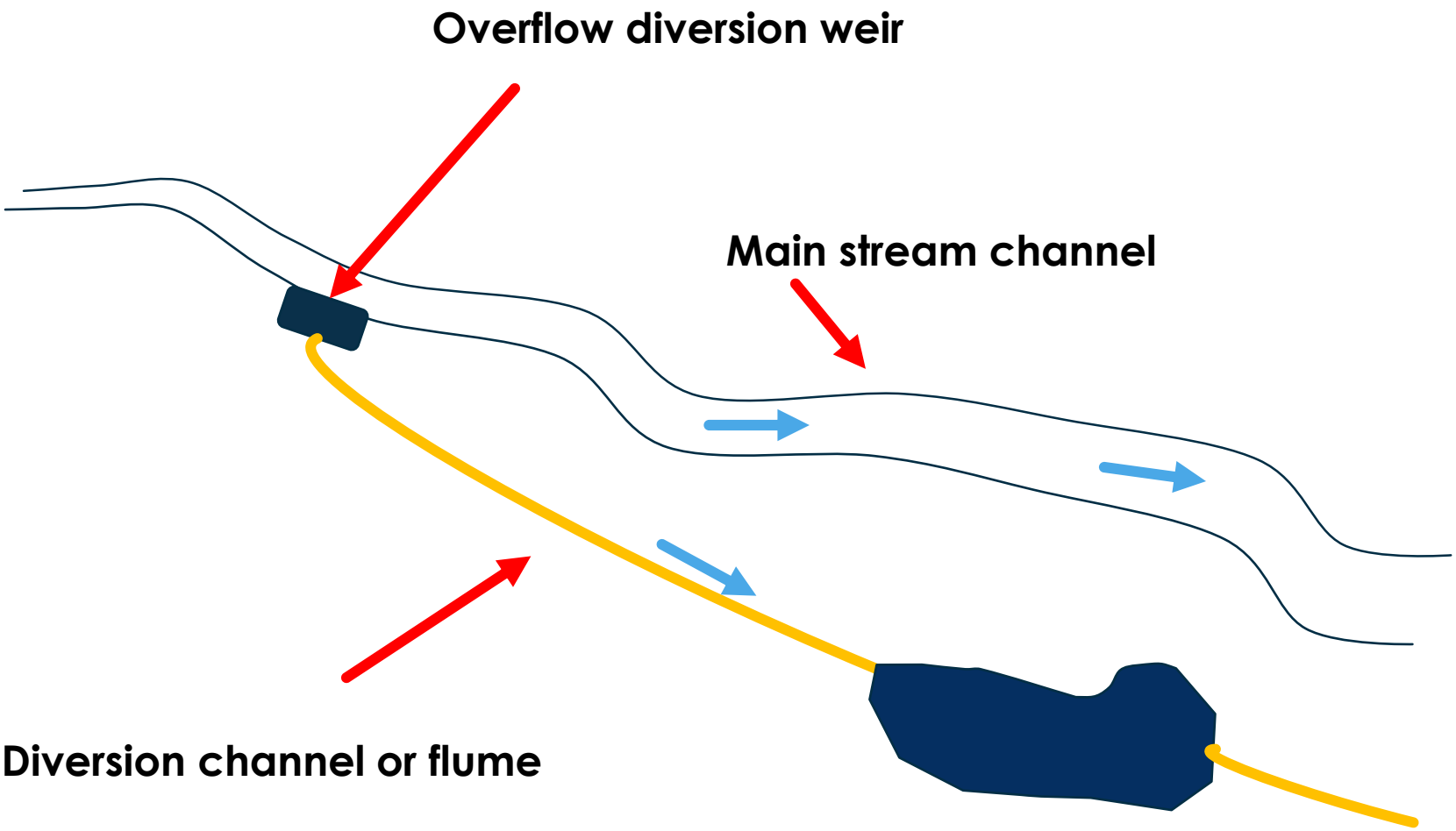

Overflow diversion weir
Main stream channel
Diversion channel or flume

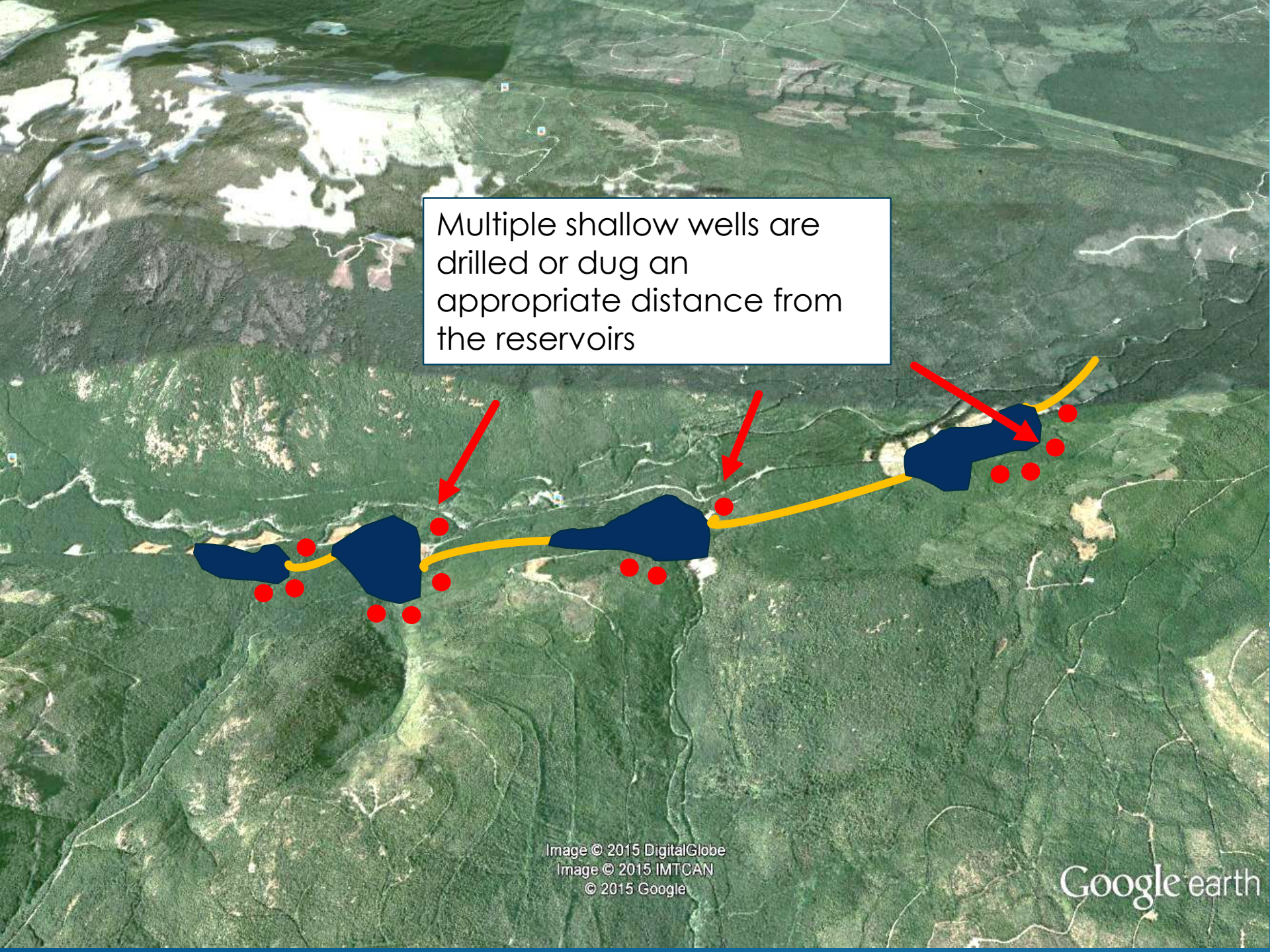
The diversion channels carry water to fill constructed storage ponds / lakes

The ponds /lakes are constructed into the natural topography and are interconnected with naturalised streams and/or wetlands

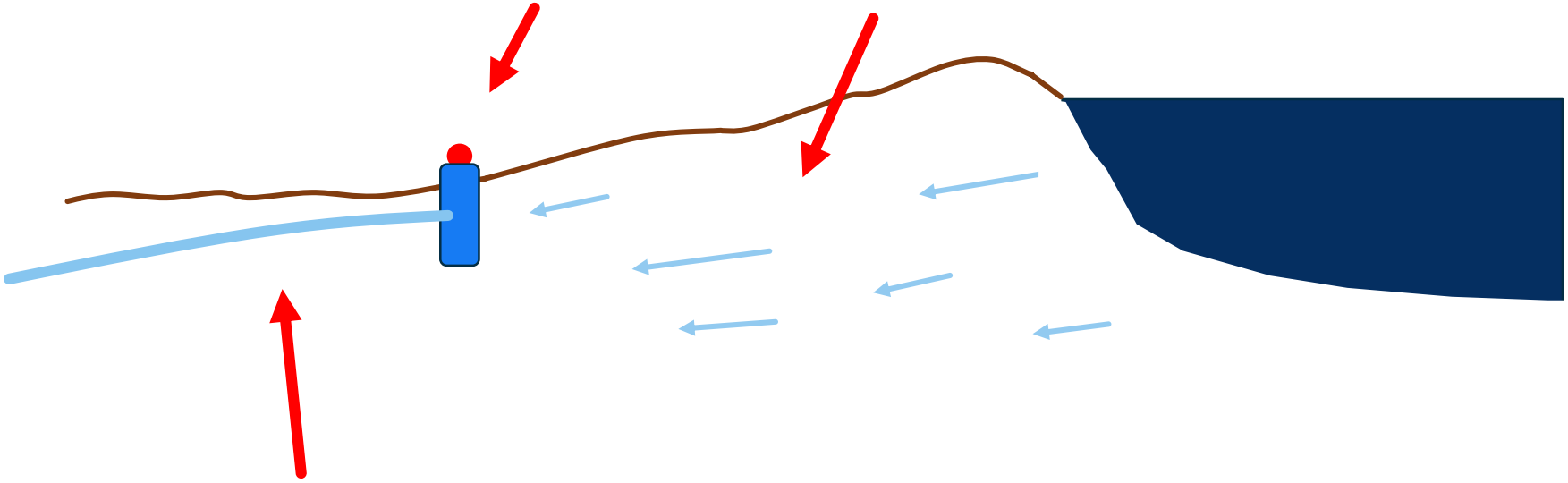
The ponds/lakes can be vegetated with indigenous plants and trees.

Many of the retention areas will receive inflow from surrounding land

Overflow structures allow the fresh water to fill the ponds and the surplus to flow back to the stream

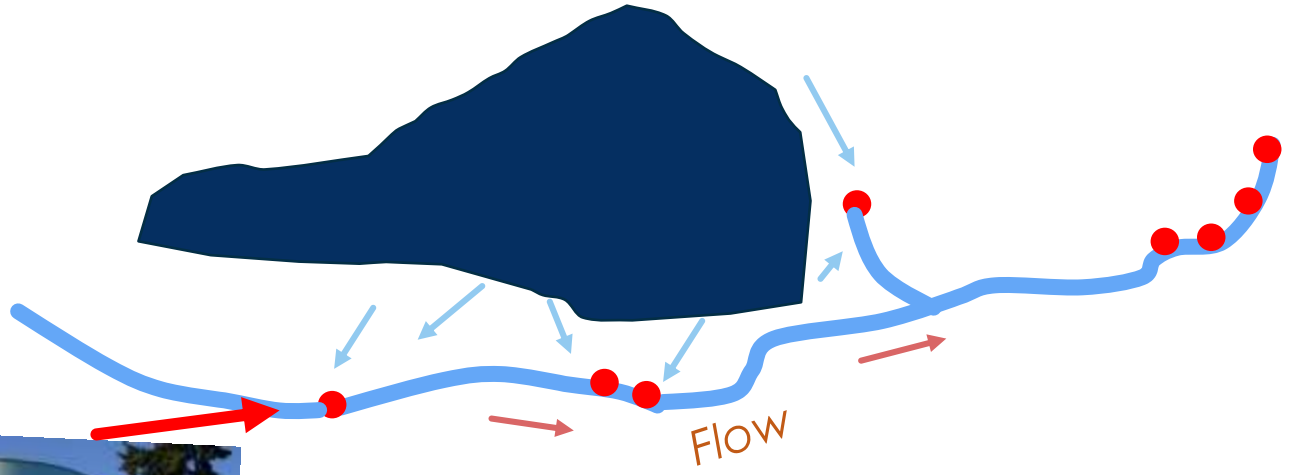

Multiple shallow wells are drilled or dug an appropriate distance from the reservoirs
Image © 2015 DigitalGlobe
Image © 2015 IMTCAN
© 2015 Google
Google earth

The water from the reservoirs slowly infiltrates the surrounding land and recharges the groundwater for the wells.



The wells are inter-connected by small diameter syphon pipes, that carry the water downhill under pressure

The multiple syphon pipes are sized for continuous flow with remotely controlled valves downhill



A reservoir of ‘head water’ is maintained by pumps powered by in-line turbine generators

Micro hydro in-line turbines could be installed anywhere in the downhill, pressure side of the supply system.

Qualicum Bay
Qualicum Beach
Parksville, BC
Parksville
Coombs
Cameron Lake
Errington
An advantage of multiple, small diameter, high pressure gravity lines, is that the source to delivery has many available options.
Image © 2015 DigitalGlobe
Image © 2015 IMTCAN
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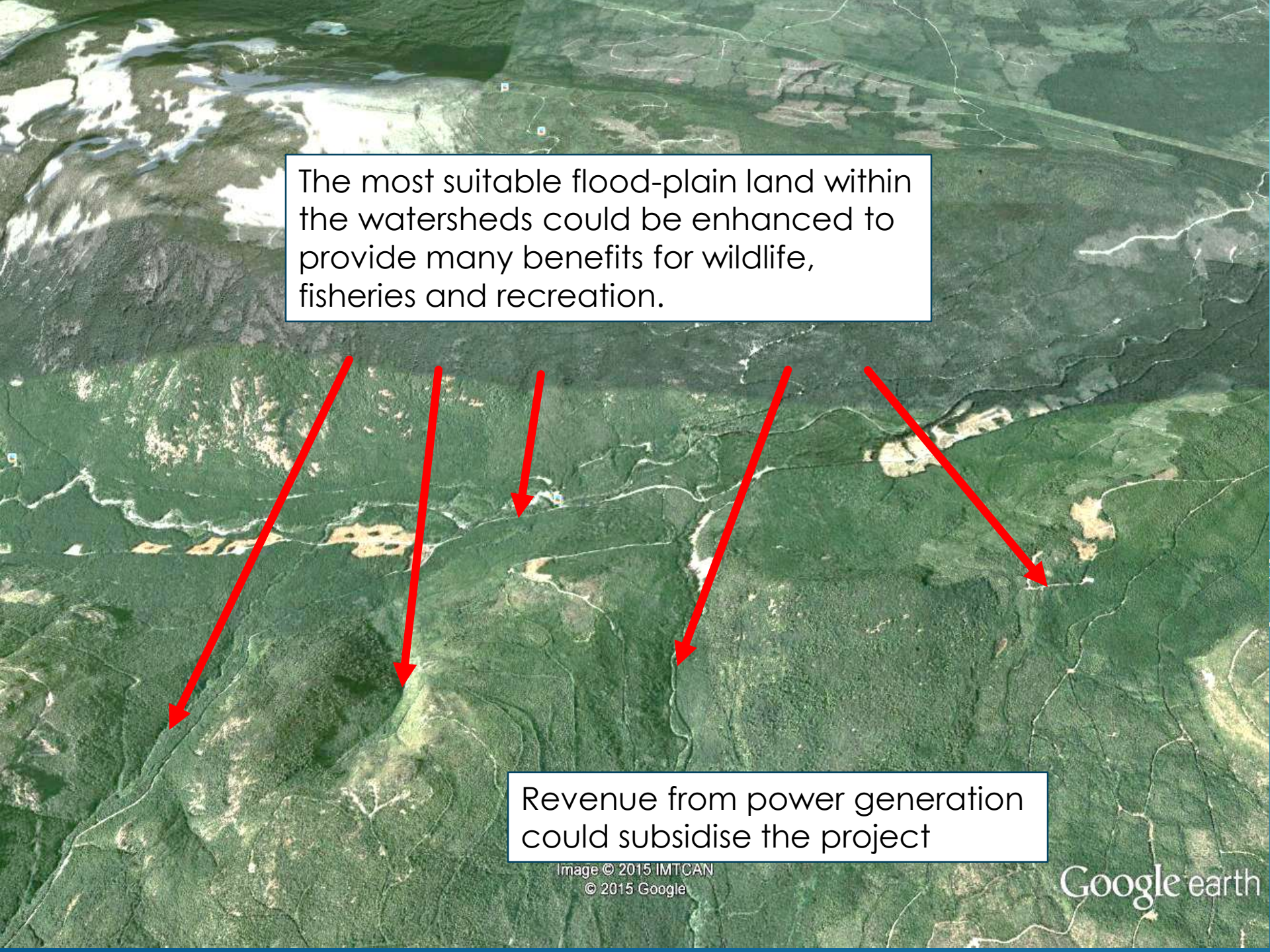
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth


The most suitable flood-plain land within the watersheds could be enhanced to provide many benefits for wildlife, fisheries and recreation.
Revenue from power generation could subsidise the project
Image © 2015 IMTCAN
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Google earth

Many other options are possible for storage of surplus winter water
Two of the possible locations for water storage / recharge reservoirs
Resort Dr
Resort Way
Greig Rd
Tuan Rd
Seaway Dr
Arbutus Rd
Jenkins Gull Rd
Gull Way
19
Chattell Rd
Allsbrook Rd
Island Hwy E
Inland Island Hwy
Kaye Rd
Madrona Dr
Rouger Rd
Arbutus Dr
Craig Dr
Bay Dr
Saturna Dr
Britannia Dr
Cape Cod Dr
Gabriola Dr
Terrien Rd
Ballenas Rd
NW Bay Rd
Yeo St
© 2012 IMTCAN
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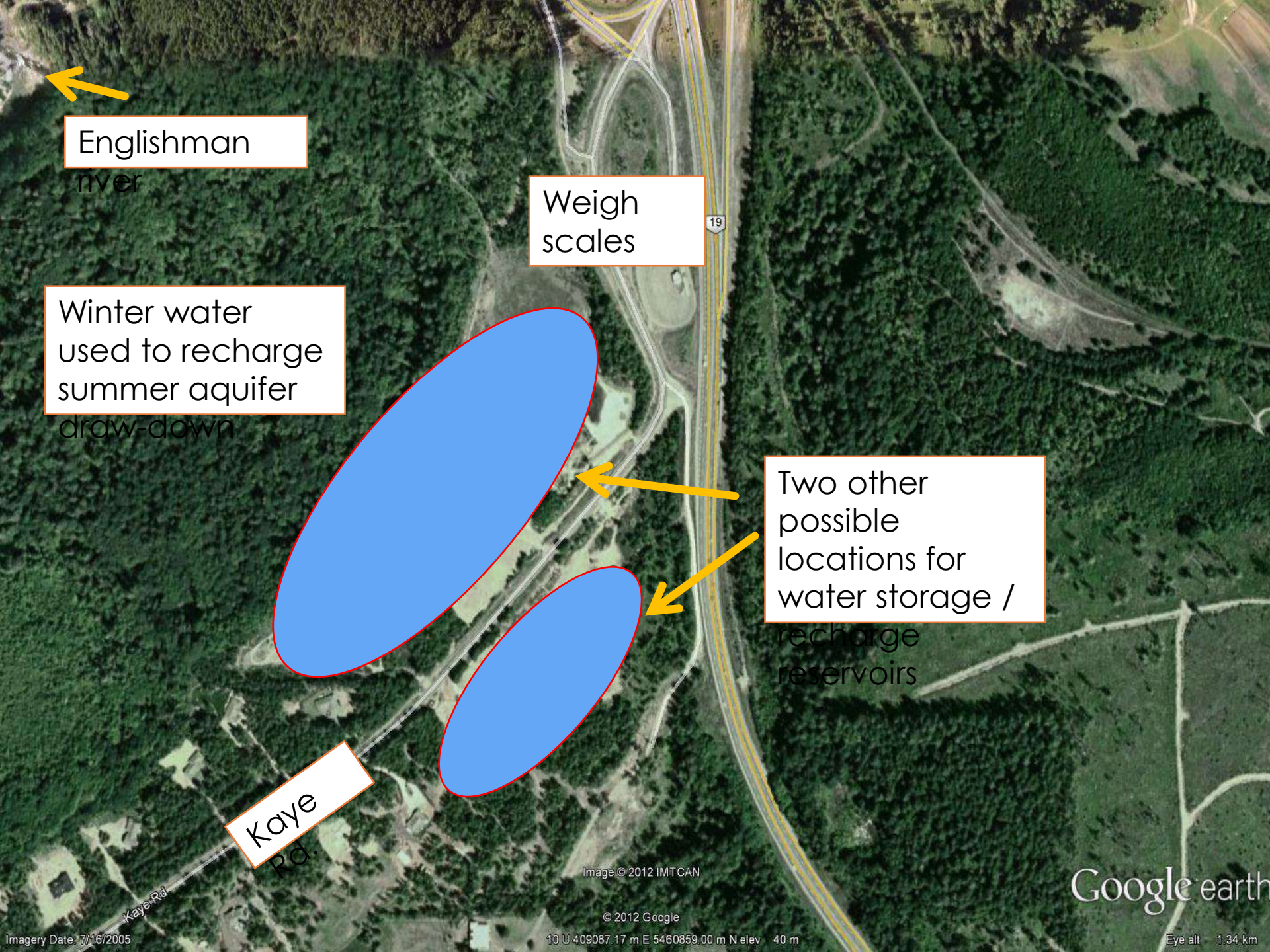
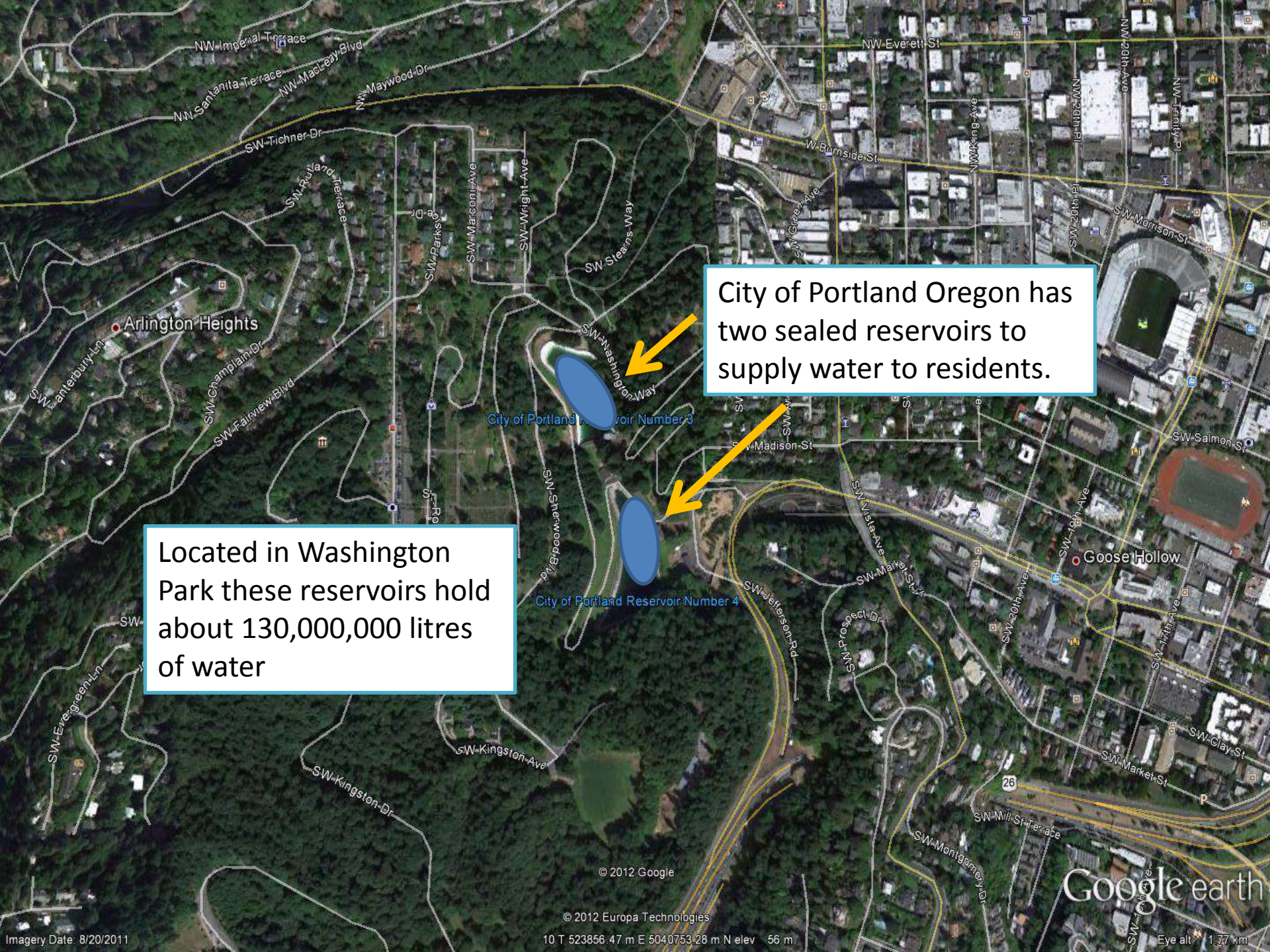
© 2012 Google
Google earth
Imagery Date 5/21/2007
Eye alt 3.23 km


Englishman river
Weigh scales
Winter water used to recharge summer aquifer draw-down
Two other possible locations for water storage / recharge reservoirs
Kaye Rd.
19
Image © 2012 IMTCAN
© 2012 Google
Imagery Date: 7/16/2005
10 U 409087.17 m E 5460859.00 m N elev 40 m
Eye alt 1.34 km
Google earth


City of Portland Oregon has two sealed reservoirs to supply water to residents.
Located in Washington Park these reservoirs hold about 130,000,000 litres of water
City of Portland Reservoir Number 3
City of Portland Reservoir Number 4
Arlington Heights
Goose Hollow
NW Imperial Terrace
NW Everett St
NW Maywood Dr
SW Tichner Dr
W Burnside St
SW Morrison St
SW Salmon St
SW Madison St
SW Market St
SW Clay St
SW Kingston Ave
SW Kingston Dr
SW Jefferson Rd
SW Prospect Dr
SW Mill St Terrace
SW Montgomery Dr
SW Fairview Blvd
SW Champlain Dr
SW Canterbury Ln
SW Rutland Terrace
SW Marconi Ave
SW Wright Ave
SW Stearns Way
SW Washington Way
SW Sherwood Blvd
SW Vista Ave
SW 18th Ave
SW 20th Ave
SW 17th Ave
NW 20th Ave
NW 23rd Pl
NW King Ave
SW Green Ave
SW 20th Pl
NW Hoyt Pl
© 2012 Google
© 2012 Europa Technologies
Google earth
Imagery Date: 8/20/2011
10 T 523856.47 m E 5040753.28 m N elev 56 m
Eye alt 1.77 km

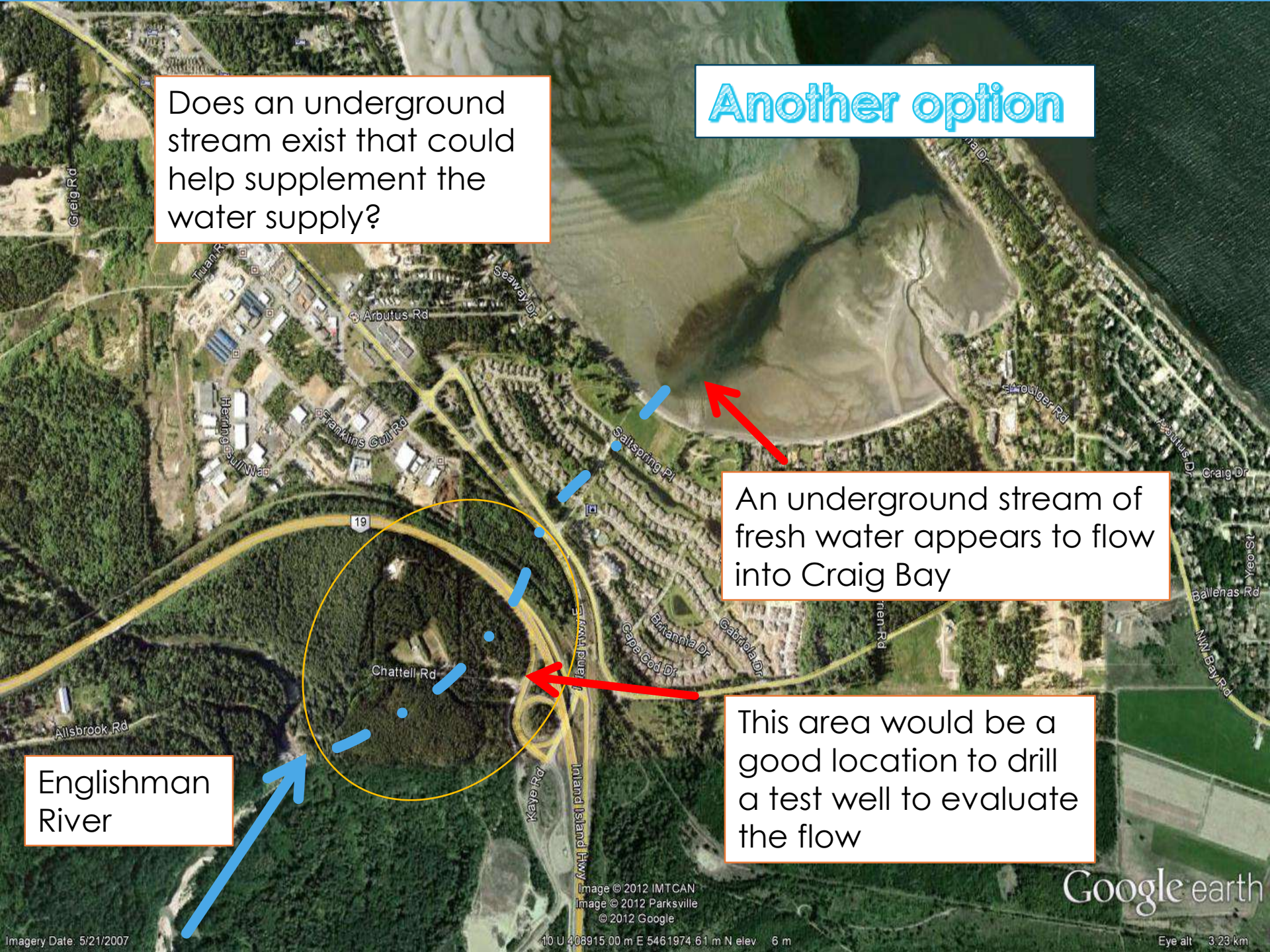

Another option
Does an underground stream exist that could help supplement the water supply?
An underground stream of fresh water appears to flow into Craig Bay
This area would be a good location to drill a test well to evaluate the flow
Englishman River
Greig Rd
Arbutus Rd
Seaway Dr
Saltspring Pl
Craig Dr
Ballenas Rd
NW Bay Rd
Chattell Rd
Allsbrook Rd
Kaye Rd
Inland Island Hwy
Britannia Dr
Gabriola Dr
Cape Cod Dr
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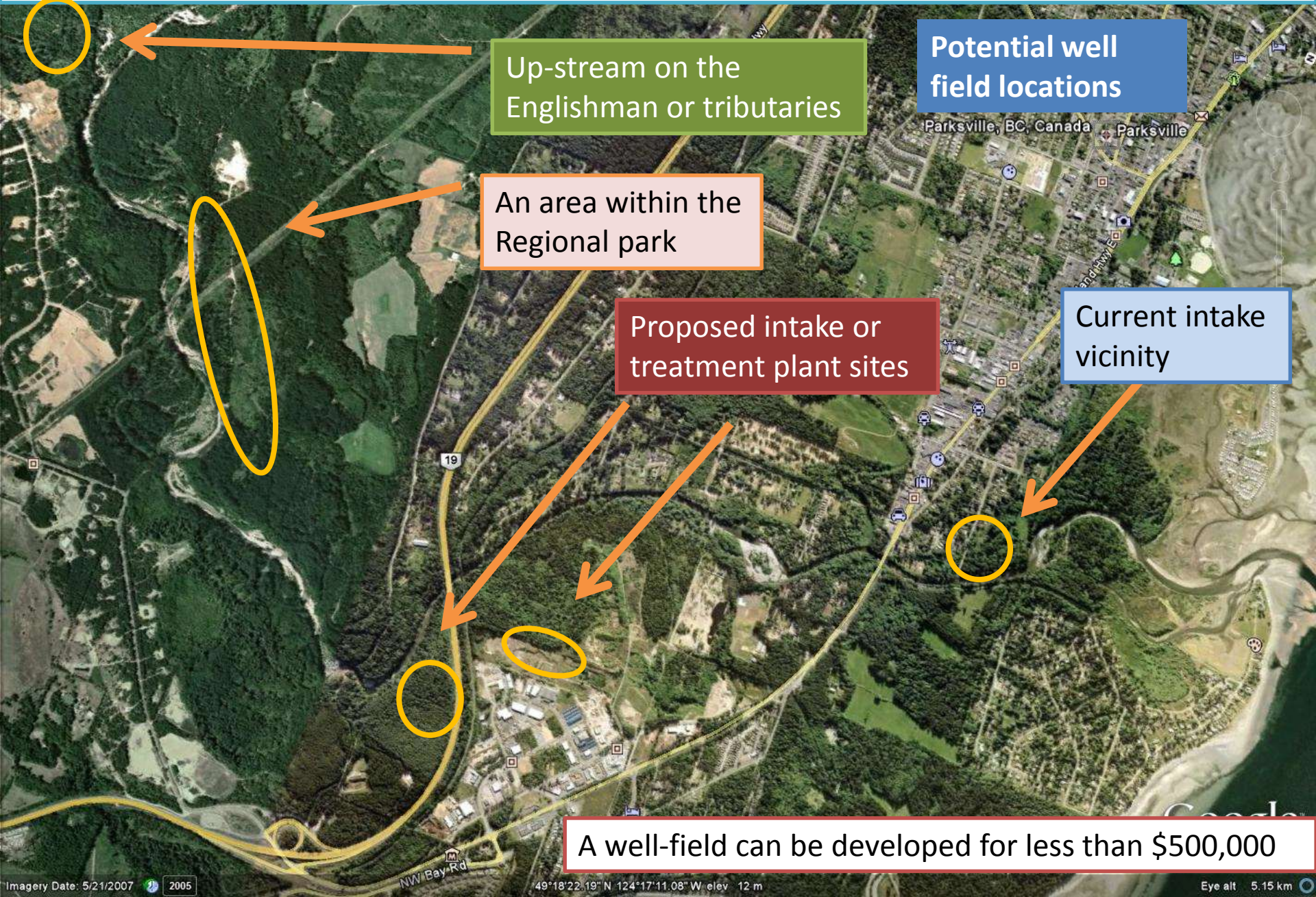
Image © 2012 Parksville
© 2012 Google
Google earth
Imagery Date: 5/21/2007

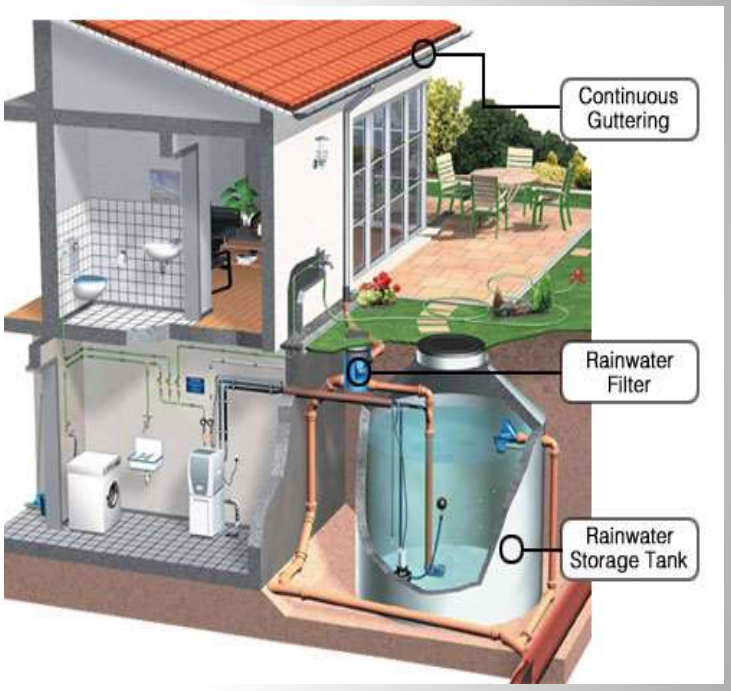
Develop a well field/s upstream and in proximity to the Englishman River or a tributary?
The location and depth of the wells could eliminate the need for a full water treatment plant, as with San Pareil and Qualicum's river wells.

The cost of drilling a well $12,000 – $20,000
10 inch main pipe $26,000 per kilometre

Potential sites for well-field development utilizing naturally filtered water to reduce or eliminate the necessity for water treatment other than disinfection.



Encourage rainwater harvesting, storage and utilisation systems.



Drinking Water Free Refill Center 2002

Pure drinking water, free of chemical disinfectant

troubled water paul manly

Troubled Water - full film

Manly Media

Subscribe 69

23,309

Contact your water supplier or the Vancouver Island Health Authority, if you have Questions or Concerns about your drinking water.

Thank You

...Trevor Wicks ...

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March 2015