DRINKING WATER WATERSHED PROTECTION

Public Information Meeting
October 17th 2013
Nanaimo, BC

REGIONAL DISTRICT OF NANAIMO

City of Parksville

CITY OF NANAIMO
THE HARBOUR CITY

PRESENTATION

1. DWWP update
   - → Program 1
   - → Program 2
   - → Program 3
   - → Program 4
   - → Program 5
   - → Program 6
   - → Program 7
2. Water Budget
   - → Background
   - → Overview
   - → Methodology
   - → Findings
   - → Conclusion
3. Watershed Management
   - → What & Why
   - → How & Who

REGIONAL DISTRICT OF NANAIMO

Introduction

In 2008, residents voted to establish a Drinking Water and Watershed Protection Service…

Today, we are going to talk about where we are:

- **DWWP program update**
- **Water Budget Study review**
- **Integrated Watershed Management Planning**

DRINKING WATER WATERSHED PROTECTION

Introduction: Partnerships

Our program is founded on partnerships and collaboration

Municipalities:

City of Parksville

CITY OF NANAIMO THE HARBOUR CITY

District of Lantzville

The public: residents, community associations, streamkeeper groups, professionals, students.

Other governmental organizations:

BRITISH COLUMBIA The Best Place on Earth

Natural Resources Canada | Ressources naturelles Canada

Canada

Other RDN departments:

REGIONAL DISTRICT OF NANAIMO

Sustainability, Wastewater, Rec & Park

Introduction: Program development

2008

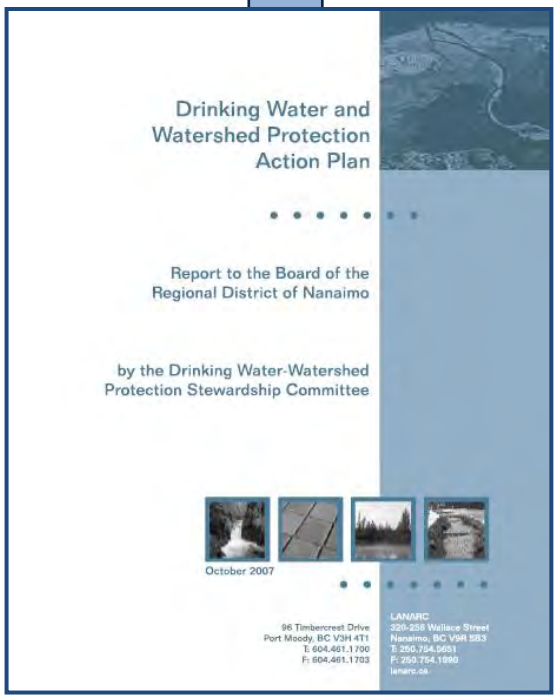
The RDN became **the first regional government in British Columbia to start a Drinking Water & Watershed Protection service**

2009-Present

The DWWP is guided by a **technical advisory committee** of experts from: forestry, hydrogeology, academia, community stewardship, fisheries, water services

The program is guided by the an Action Plan that outlines the key goals and objectives

7 Program Actions



1. DWWP Program Update

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REGIONAL DISTRICT OF NANAIMO

PRESENTATION

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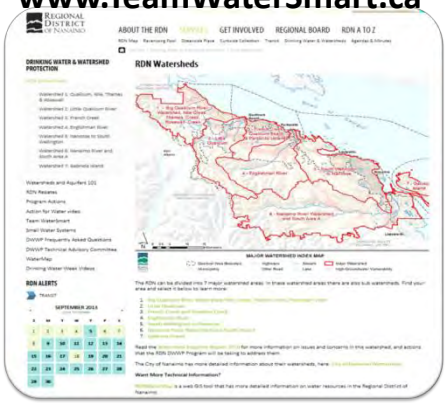
DWWP update: Program 1

Public Awareness and Involvement

- Free Workshops
- Websites
- Community Booth
- Home Visits
- School Program

wellSMART

www.TeamWaterSmart.ca



we practice watersmart because every drop counts irrigation

www.RDNgetinvolved.ca

REGIONAL DISTRICT OF NANAIMO

DWWP update: Program 1

Public Awareness and Involvement

School Program: Fieldtrips

From the classroom….

To the watershed…..

2014 – field trips for Gr. 4 & 5

- Nanaimo River watershed
- Englishman River watershed

PRESENTATION

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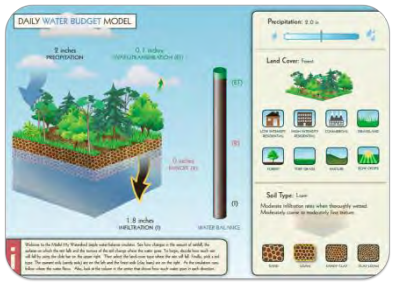
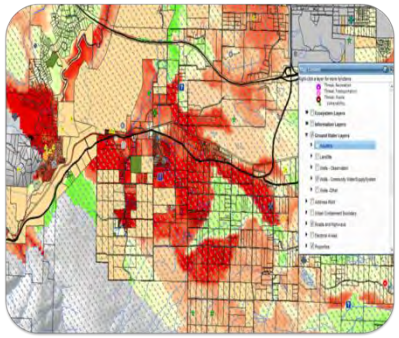
DWWP update: Program 2

Water Resources Inventory & Monitoring

- Water Budget Study
- Water Map
- Provincial Observation Well Network Expansion
- Volunteer Well Level Monitoring
- Community Watershed Monitoring





PRESENTATION

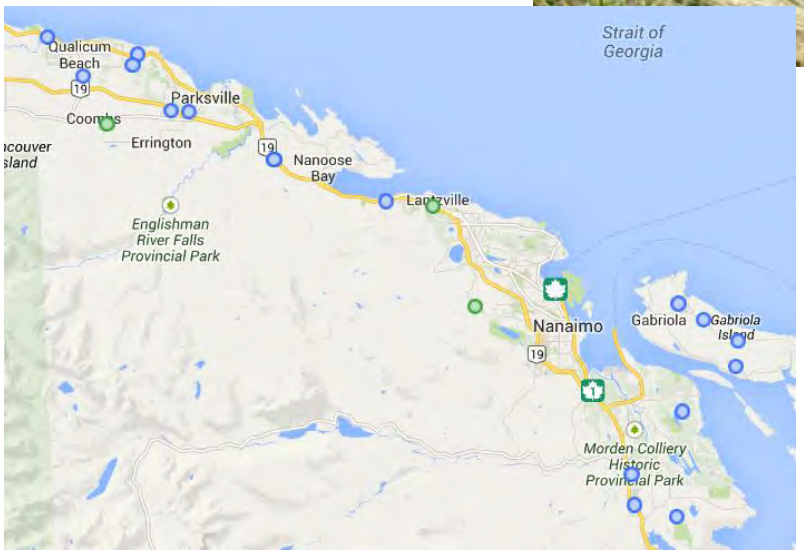
REGIONAL DISTRICT OF NANAIMO

DWWP update: Program 2

Water Resources Inventory & Monitoring: Highlights

Provincial Observation Well Network Expansion

Groundwater monitoring



Volunteer Well Level Monitoring

PRESENTATION

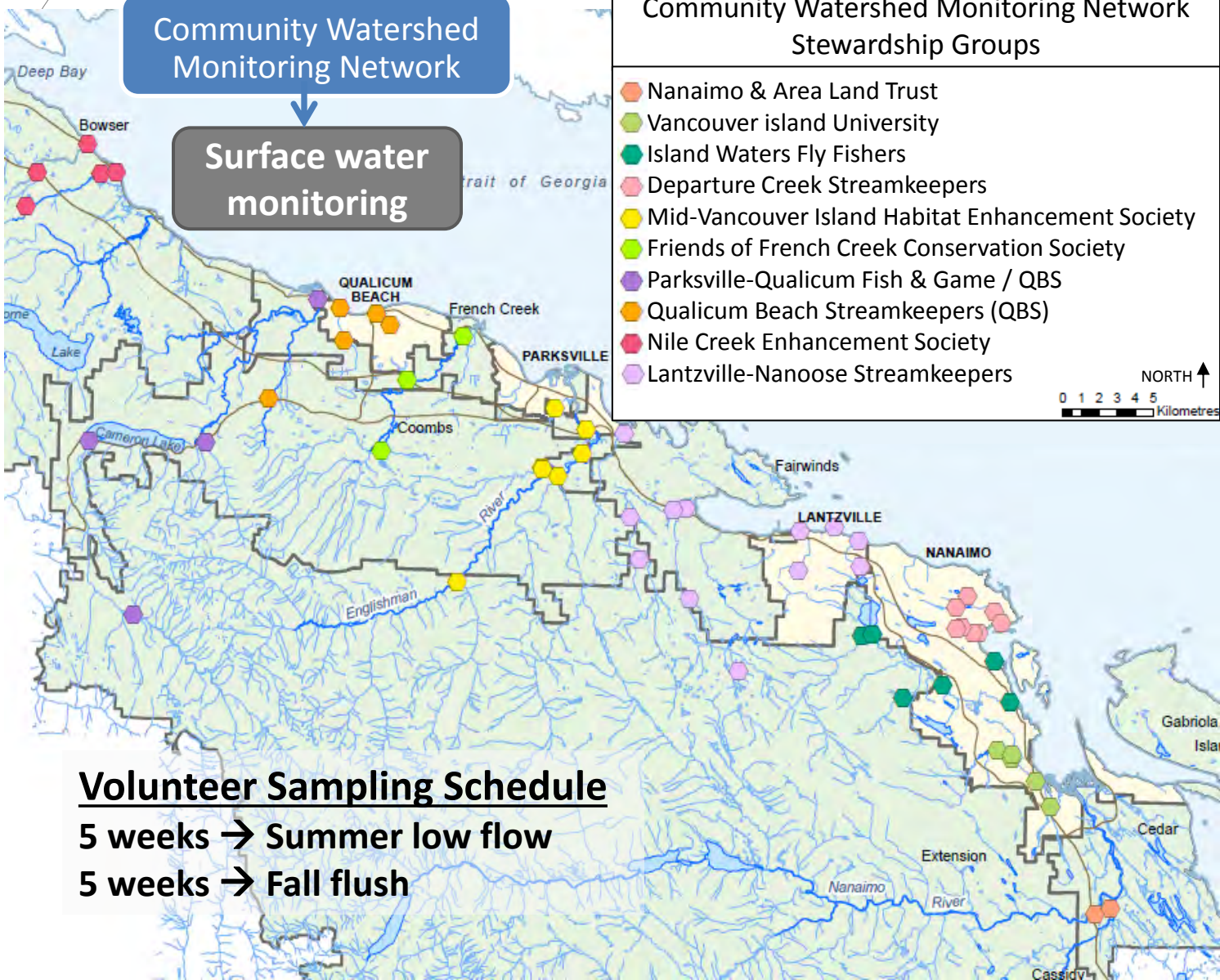
REGIONAL DISTRICT OF NANAIMO

DWWP update: Program 2

Water Resources Inventory & Monitoring: Highlights

Community Watershed Monitoring Network

Surface water monitoring



Volunteer Sampling Schedule

5 weeks → Summer low flow

5 weeks → Fall flush

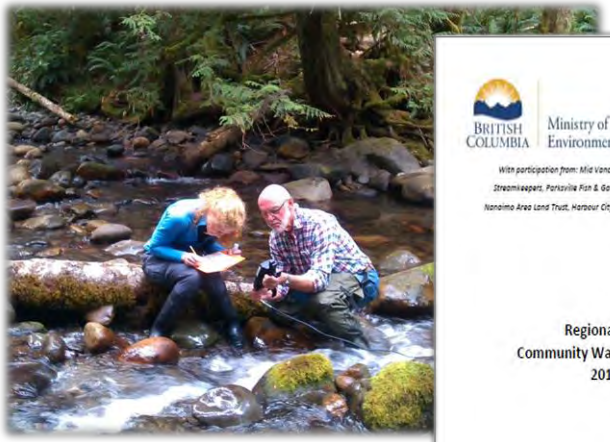
PRESENTATION

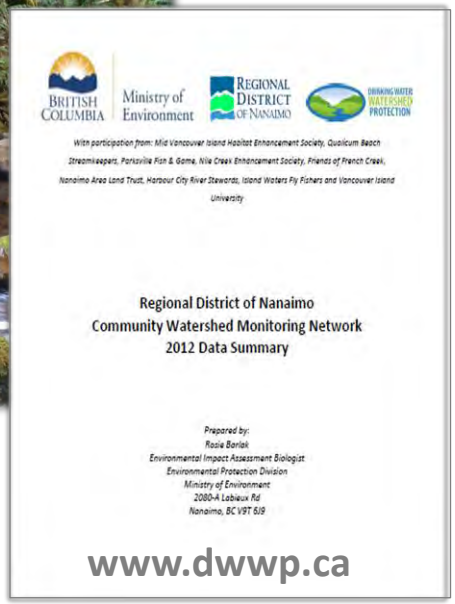
REGIONAL DISTRICT OF NANAIMO

DWWP update: Program 2

Water Resources Inventory & Monitoring: Highlights

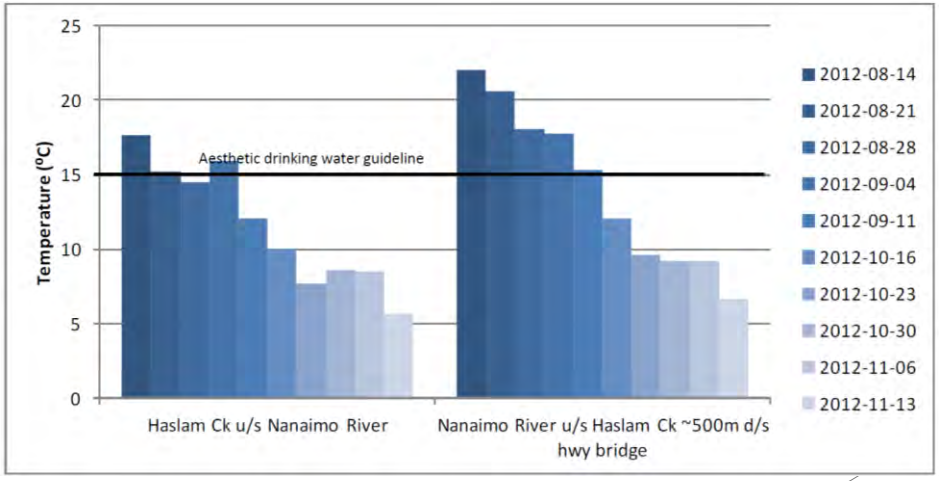
Community Watershed Monitoring Network





Measurements

- **Temperature**
- **Turbidity**
- **Dissolved Oxygen**
- **Specific Conductance**



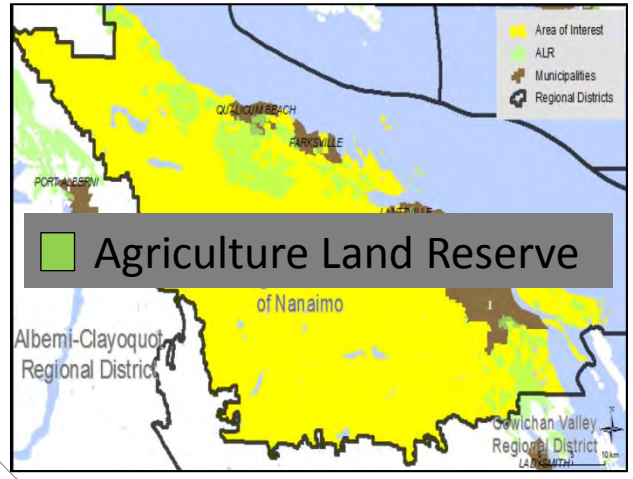
PRESENTATION

REGIONAL DISTRICT OF NANAIMO

DWWP update: Program 3

Land Use Planning & Development

Agricultural Water Demand Model

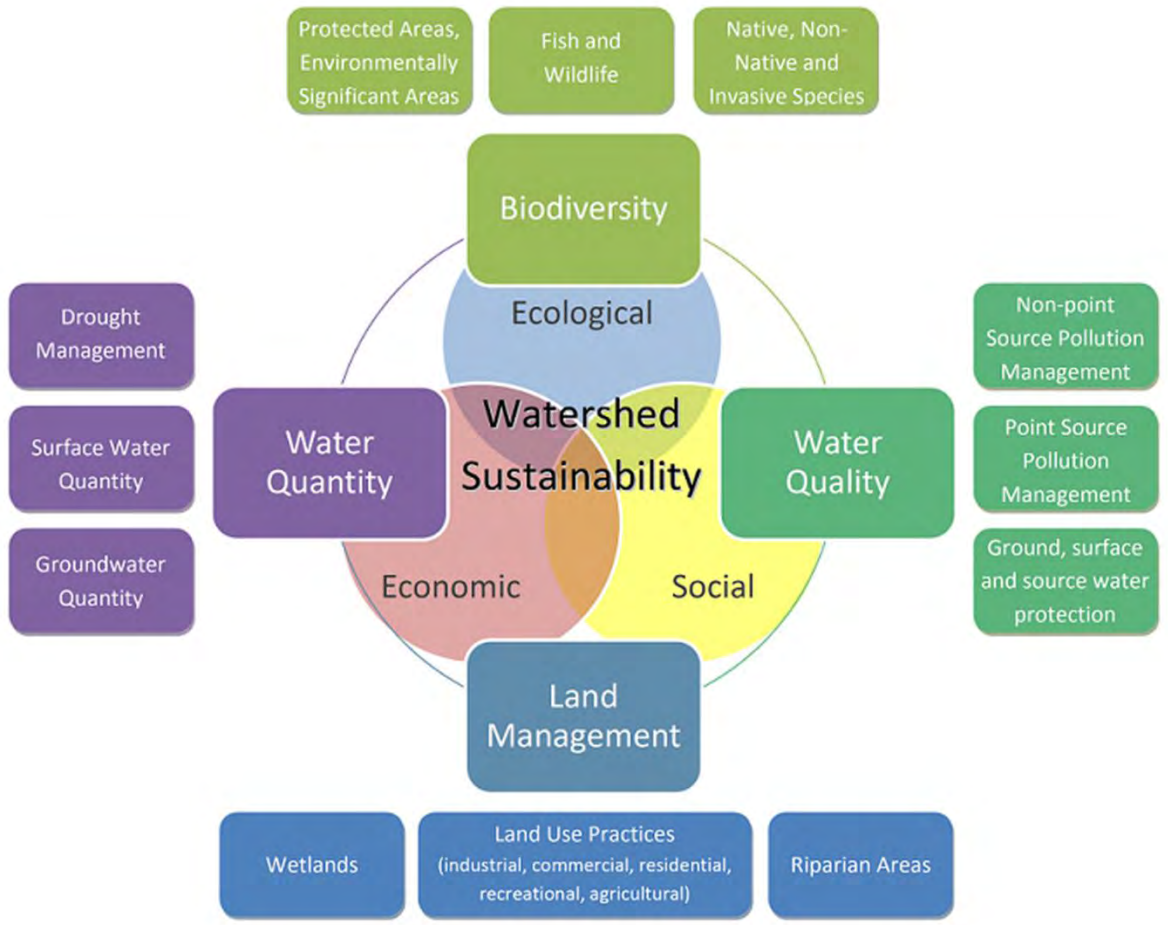


Yellow Point Development Permit Area

PRESENTATION

REGIONAL DISTRICT OF NANAIMO

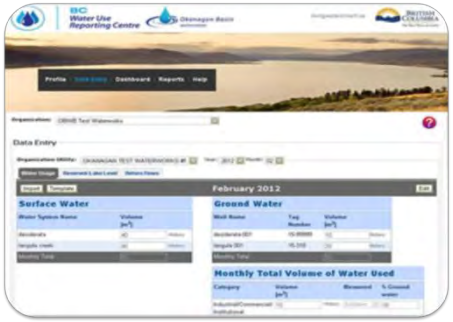
DWWP update: Program 4



PRESENTATION

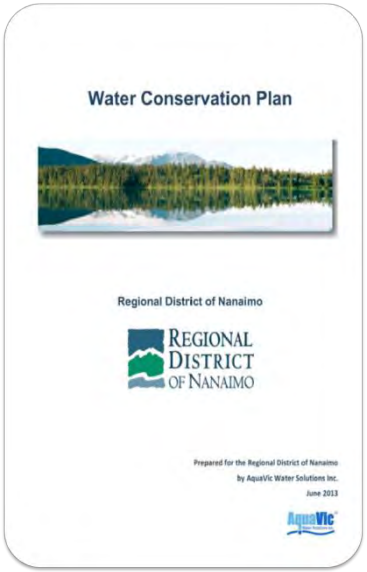
REGIONAL DISTRICT OF NANAIMO

DWWP update: Program 5



Water Use Management

- Water Conservation Plan
- Toilet Replacement Rebate
- Water Purveyor Working Group
- Water Use Reporting Centre
- Rainwater Harvesting Incentive & Guidebook



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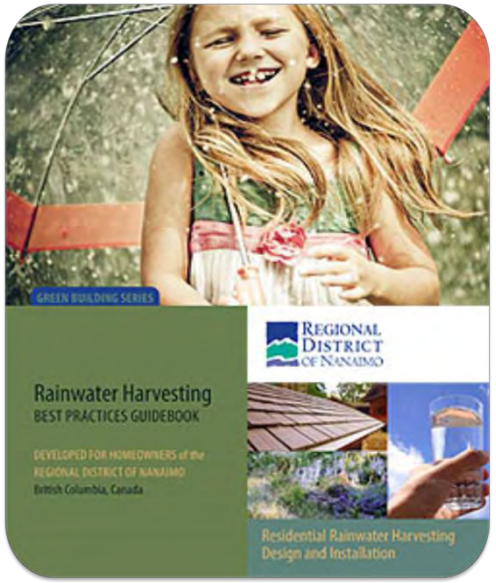
DWWP update: Program 5

Water Use Management

$750 rebate for > 1000 imperial gallons

Rainwater Harvesting Incentive & Guidebook



Storing winter/spring rainwater for summer usage takes pressure off aquifers & municipal supplies

PRESENTATION

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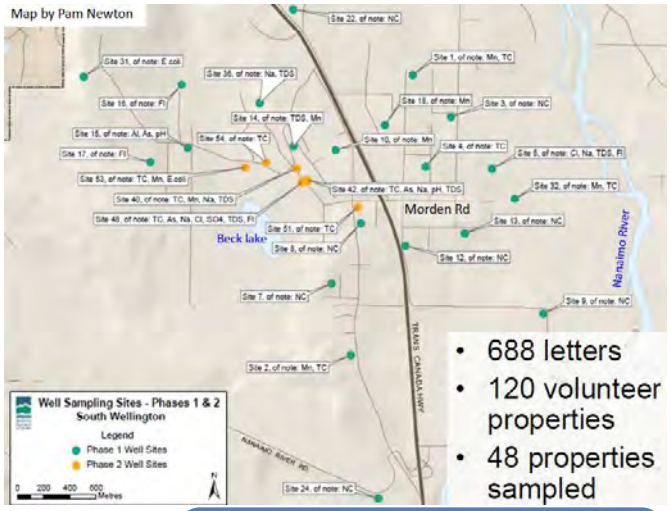
DWWP update: Program 6

Water Quality Management

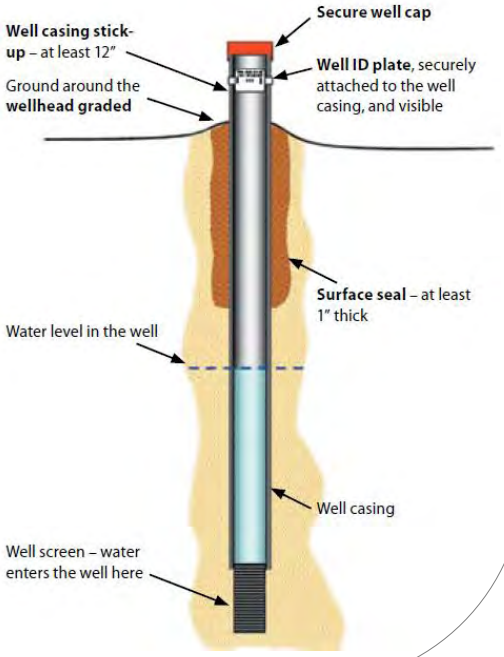


2011 Volunteer Well Water Quality Survey

New!

Rural Water Quality Stewardship Program

No.	Rebate Item
1	Well Cap
2	Surface Seal
3	Well Casing Stick-up
4	Well deactivation
5	Water Quality Testing



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DWWP update: Program 7

Adapting to Climate Change

- **Sustainability -** ensure sustainable aquatic ecosystems with intact riparian vegetation and adequate instream flows.
- **Adaptability -** find ways to do more in-season management of water that is based on real time data.
- **Collaboration -** public processes at the watershed level that develop information and inform decision-making in a public way
- **Efficiency -** conservation of water and more efficient use

2. Water Budget Study

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WATERSHED
PROTECTION

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   - → Program 4
   - → Program 5
   - → Program 6
   - → Program 7
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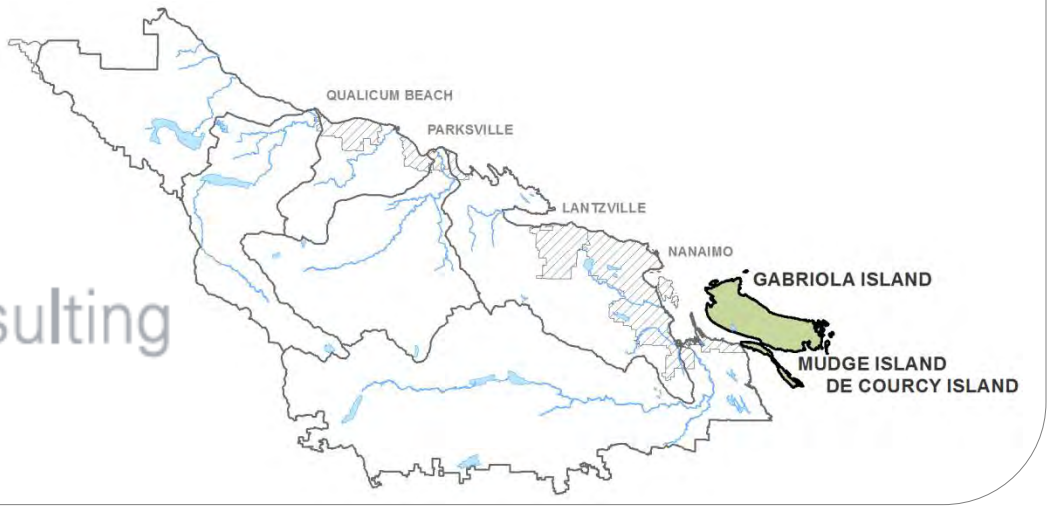
Water Budget Study

- **Gabriola, Mudge, & Decourcey Water Budget Project Report**

Prepared by:

srk consulting



- **Vancouver Island Water Budget Project Report**

Prepared by:

Waterline Resources Inc.

REGIONAL DISTRICT OF NANAIMO

Water Budget Study: Background

Project Goal

To **improve understanding** of regional water resources by:

- Identifying **water stores**
- Estimating **how much water** they hold
- Characterizing **how water moves** between the stores
- Identifying water stores **under stress**

Justification

The Water Budget Project was specifically developed to…..

✓ Meet the goal of the DWWP program:

[to ensure that we have a sufficient, safe and sustainable supply of water]

✓ Address the direction of the 2010 Snapshot Report:

[to ensure sufficient clean water for human, environmental, and economic needs]

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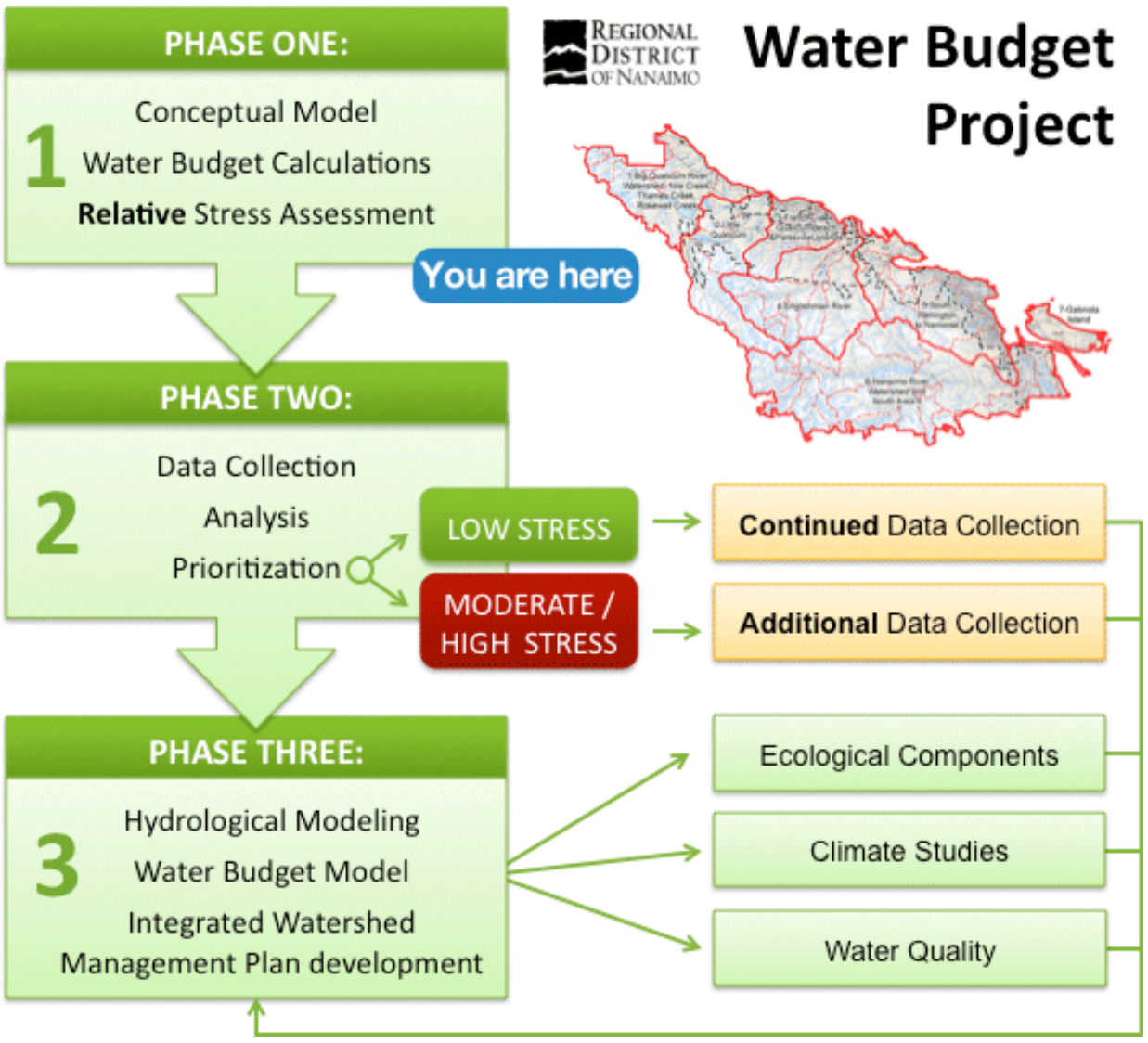
REGIONAL DISTRICT OF NANAIMO

Water Budget Study: Project overview



PRESENTATION

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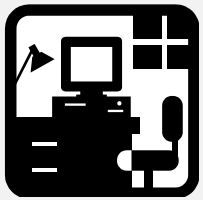
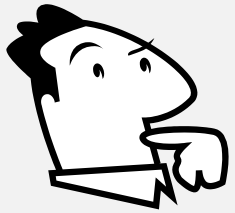
Water Budget Study: methodology

1. Desk study:
   - resource mapping
   - Data compilation



2. Data collection:
   - Water level monitoring
   - Pump tests
   - Geological logging

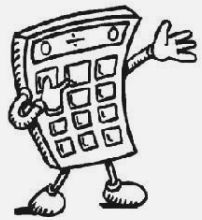
3. Conceptual model development
   - Based on physical characteristics
   - Current scientific understanding



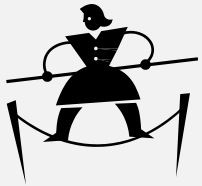
4. Water balance

$$= \text{INPUT} - \text{OUTPUT} + \Delta\text{STORAGE}$$

(Rainfall, US gain) (ET, DS loss, abstraction)



5. Stress assessment
   - Low Stress → surplus
   - Moderate Stress → balance
   - High Stress → deficit



PRESENTATION

REGIONAL DISTRICT OF NANAIMO

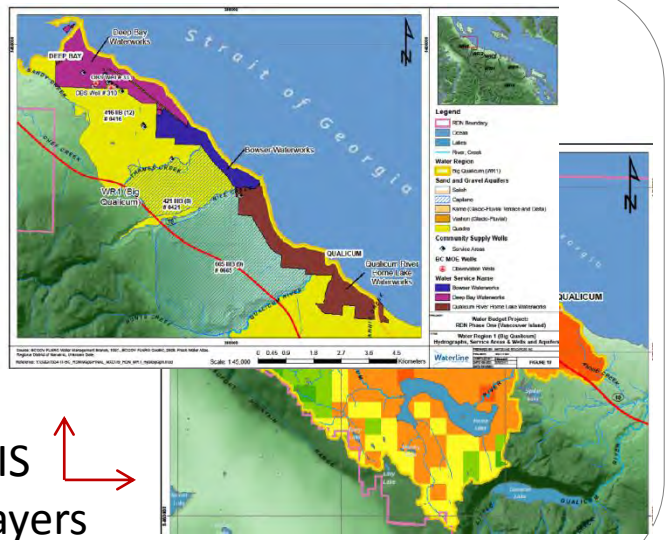
Water Budget Findings: VI-WR1 conceptual model

A

GIS based approach:

- Topography maps
- Climate data
- Land cover maps
- Geological maps
- Water level
- Aquifer properties

B



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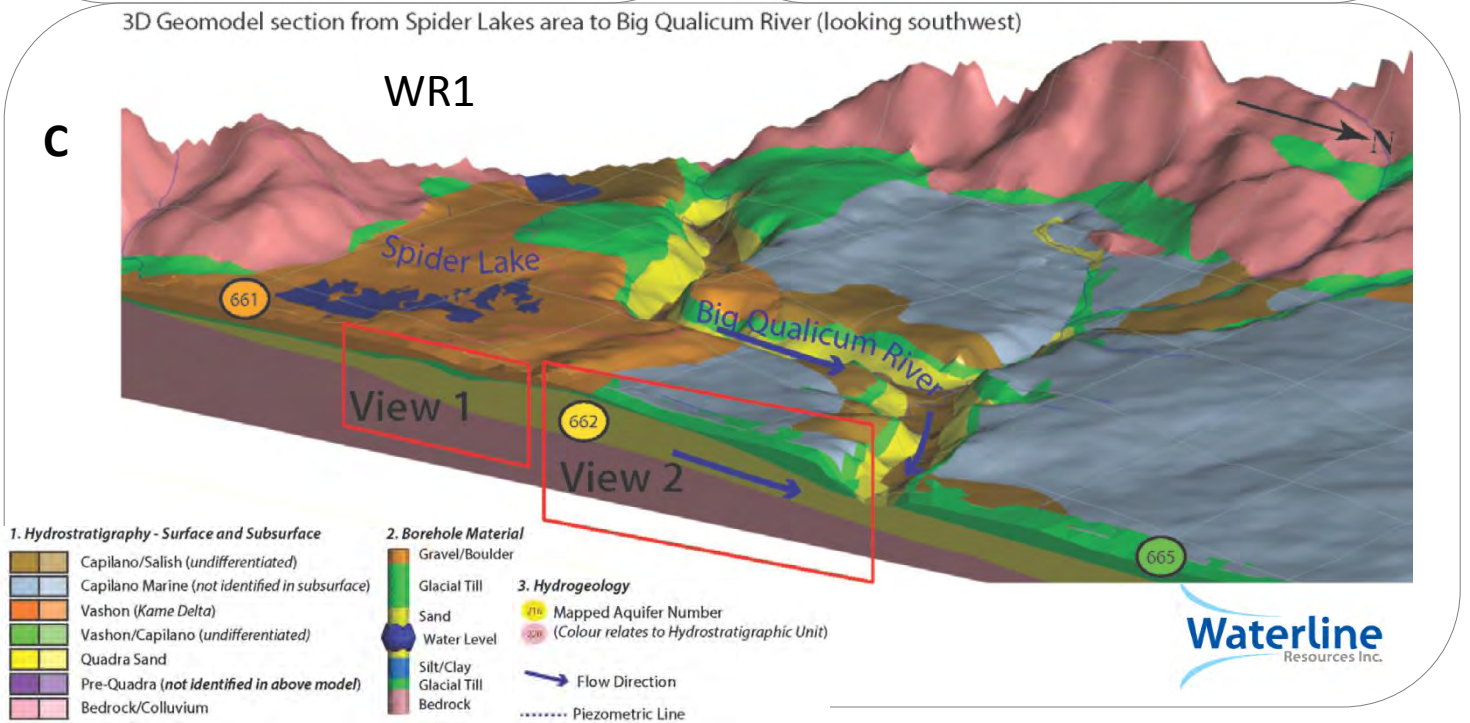
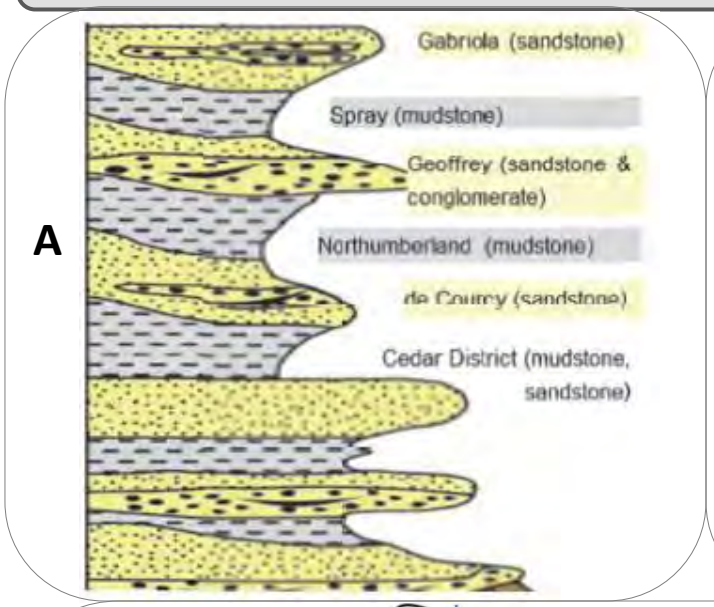
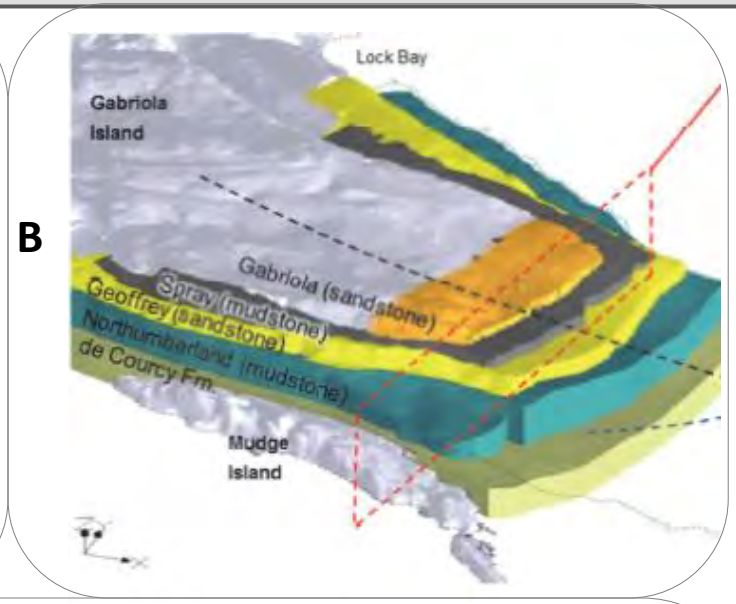


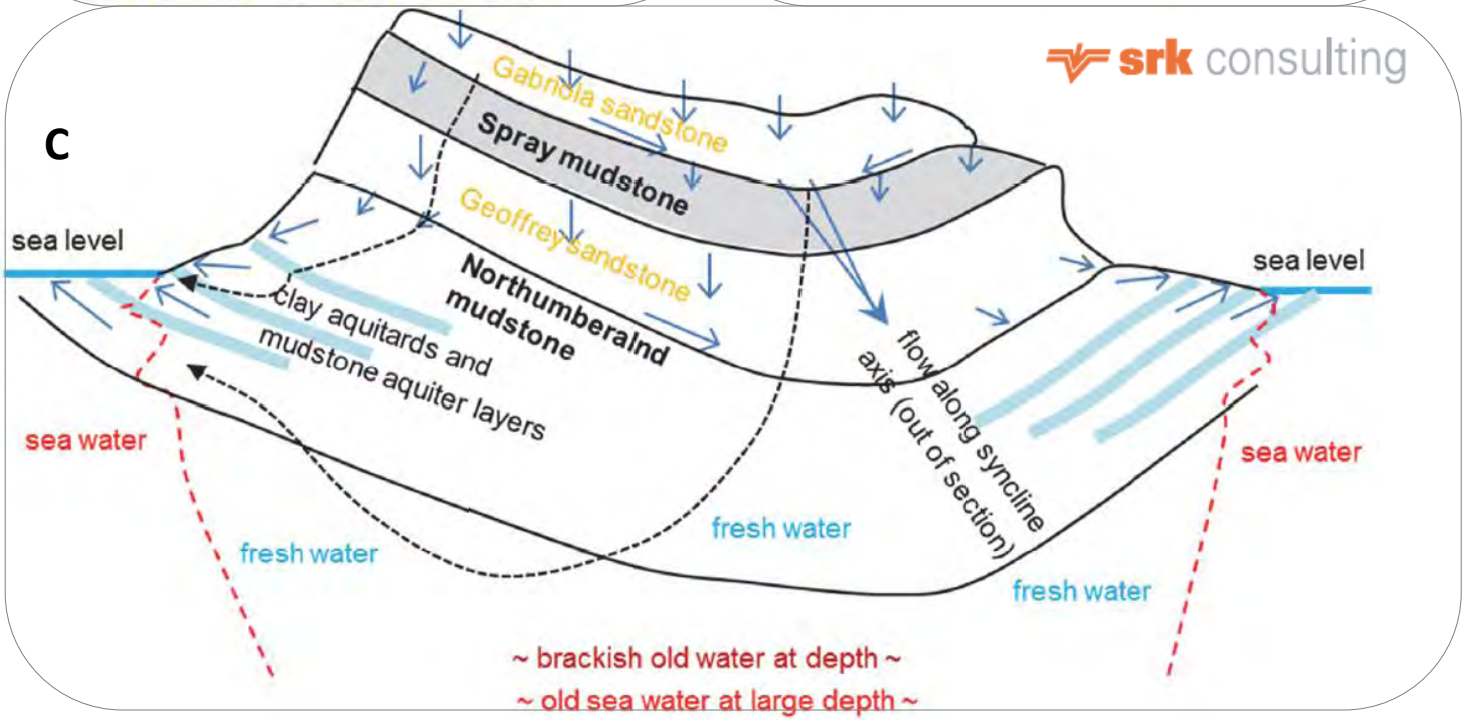
PRESENTATION

REGIONAL DISTRICT OF NANAIMO

Water Budget Findings: Gab conceptual model







PRESENTATION

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   - → Program 2
   - → Program 3
   - → Program 4
   - → Program 5
   - → Program 6
   - → Program 7
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REGIONAL DISTRICT OF NANAIMO

Findings: VI GW relative water stress

Water Region		Watershed or Aquifer Tag No.	Relative Stress Level
Big Qualicum (BQ)	WR1	Nile Creek	Low
		Big Qualicum River	Low
		416	Low
		421	Moderate to High
		665	Low to Moderate
		662	Low to Moderate
Little Qualicum (LQ)	WR2	Little Qualicum Rive	Moderate
		662	Low
		661	Moderate
		664	Low
		663	Moderate to High
		217	Moderate to High
French Creek (FC)	WR3	French Creek	High
		220	Low to Moderate
		216	High
		217	High
		212	Moderate
Englishman River (ER)	WR4	Englishman River	Moderate
		209	Low to Moderate
		220	High
		216	Moderate to High
		219	Low to Moderate
		214	Low
		221	Moderate
South Wellington to Nanoose (SW-N)	WR5	Nanoose Creek	High
		Millstone River	Low to Moderate
		Chase River	Moderate to High
		219	Low
		214	Low
		210	Moderate to High
		218	V. High
		213	Low
		215	Moderate to High
		166	Low
		211	V. High
		167	Low to Moderate
Nanaimo River (NR)	WR6	Nanaimo River	Moderate to High
		160	Moderate to High
		161	Moderate to High
		162	High
		163	V. High
		164	Moderate to High
		165	Moderate

43 Sub-regions

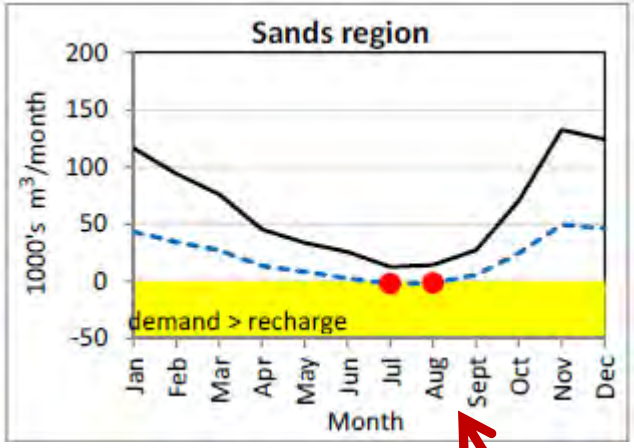
23
- **10 Low stress levels** (WR1, 2, 4 & 5)
- **7 Low/Mod stress levels** (WR1, 2, 4 & 5)
- **6 Mod stress levels** (WR2, 3, 4 & 6)

20
- **11 Mod/High stress levels** (WR1, 2, 4, 5 & 6)
- **6 High stress levels** (WR3, 4, 5 & 6)
- **3 V.High stress levels** (WR5 & 6)

Waterline Resources Inc.

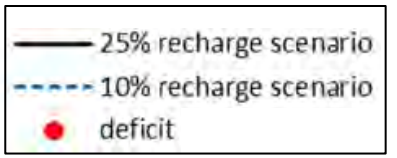
REGIONAL DISTRICT OF NANAIMO

Findings: Islands monthly water stress

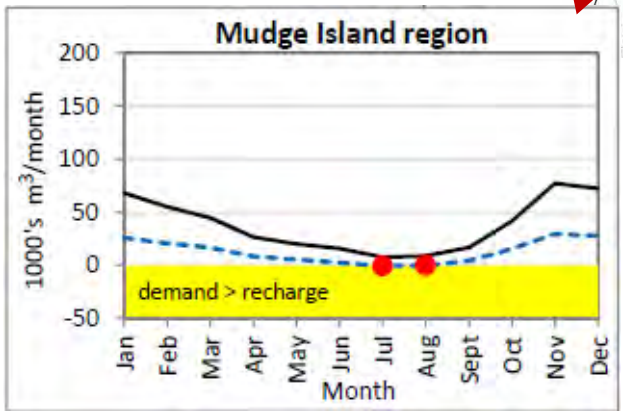


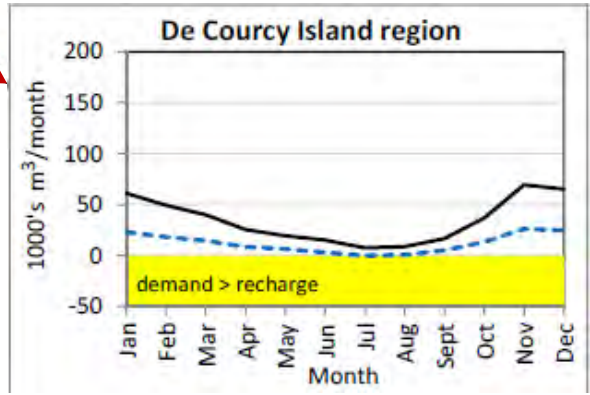
13 Sub-regions

- 5 deficit regions (10% RS) (Jul & Aug)
- 1 deficit region (10% RS) (Apr – Sept)
- 25% RS: 0 deficit regions



srk consulting

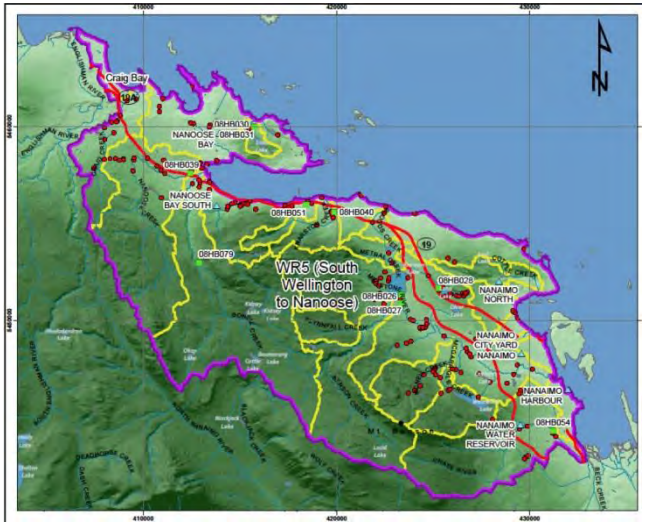




REGIONAL DISTRICT OF NANAIMO

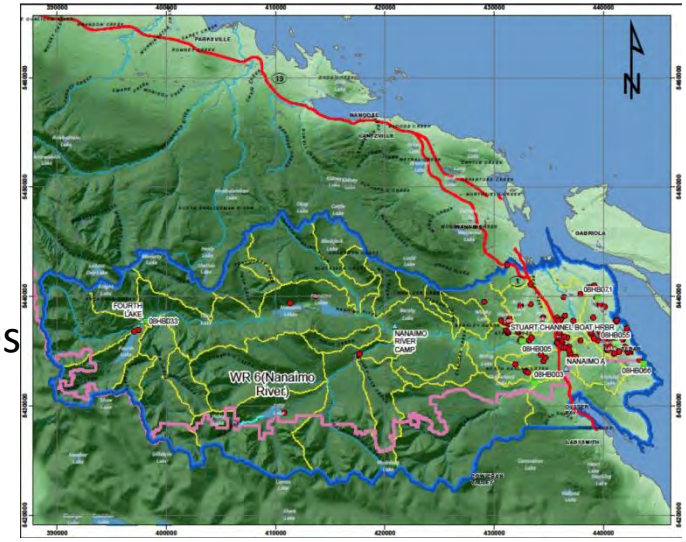
Findings: Vancouver Island

WR5: S.Wellington to Nanoose



- Third largest water region
- Area is approximately 322 km2
- Nine hydrometric stations
- Seven climate stations
- ~248 surface water diversion licenses
- ~1685 wells

WR6: Nanaimo River



- Largest water region
- Area is approximately 939 km2.
- Five hydrometric stations
- Four climate stations
- ~359 surface water diversion licenses
- ~2688 wells

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   - → Program 1
   - → Program 2
   - → Program 3
   - → Program 4
   - → Program 5
   - → Program 6
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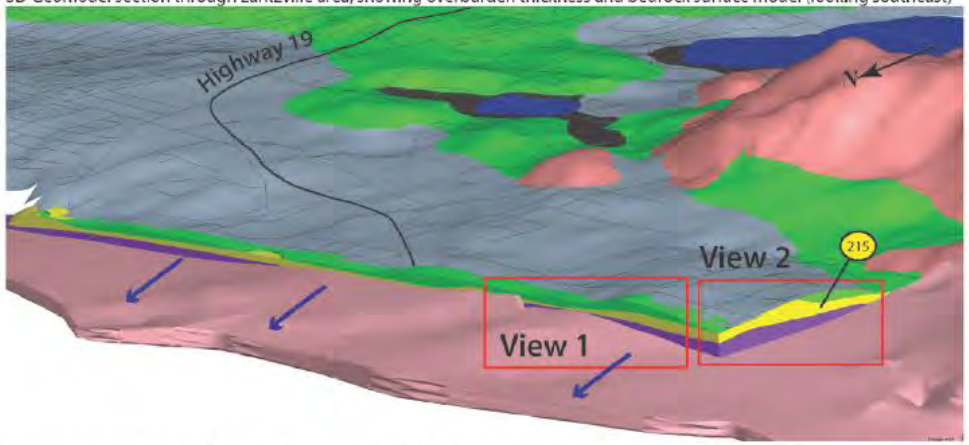
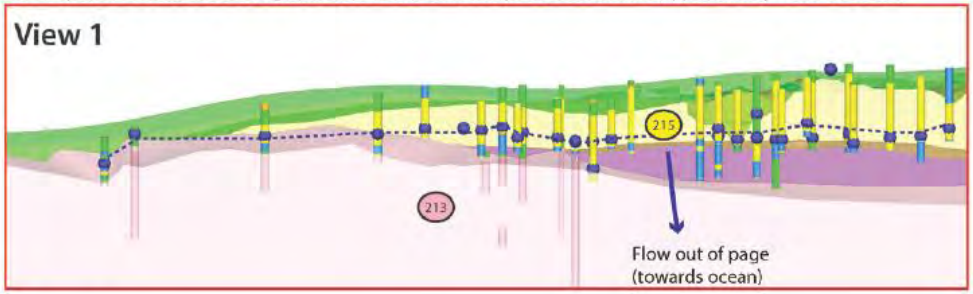
REGIONAL DISTRICT OF NANAIMO

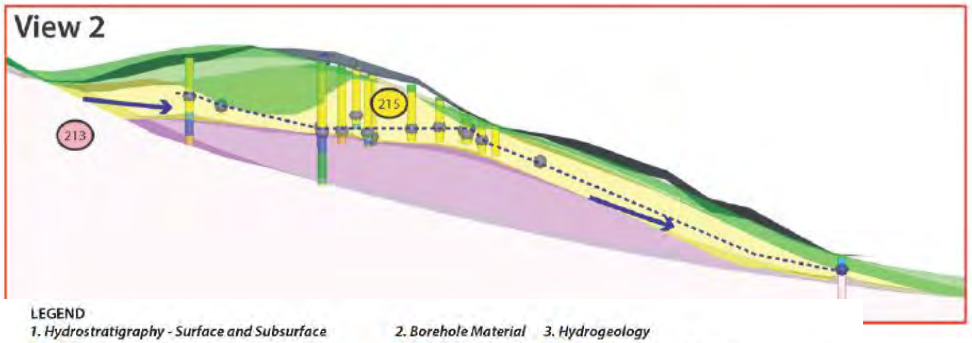
Findings: Vancouver Island

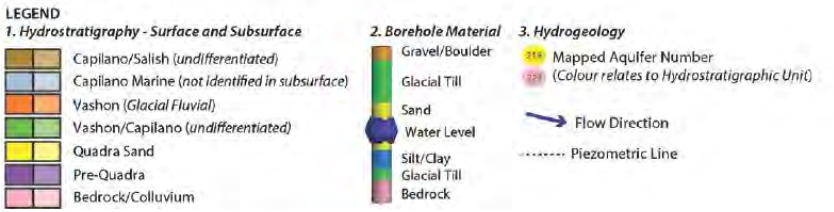
3D Geomodel section through Lantzville area, showing overburden thickness and bedrock surface model (looking southeast)



Close-up view of 3D model showing borehole materials and transparent Geovolumes (approximately 100m-thick slice)







WR5: S.Wellington to Nanoose

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   - → Program 2
   - → Program 3
   - → Program 4
   - → Program 5
   - → Program 6
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2. Water Budget
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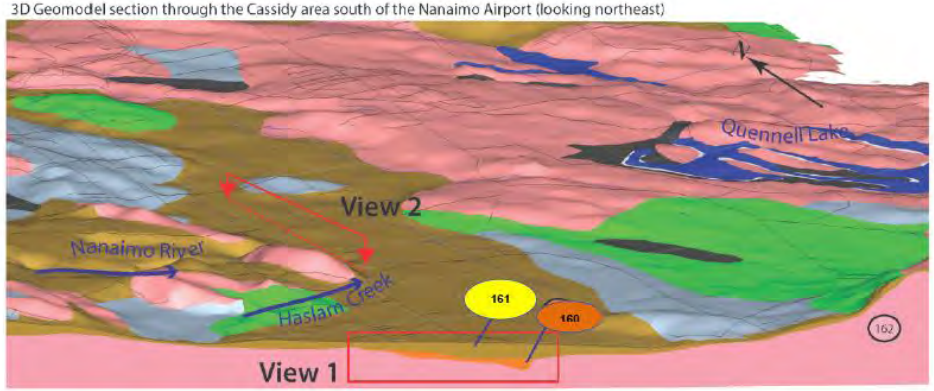
   - → How & Who

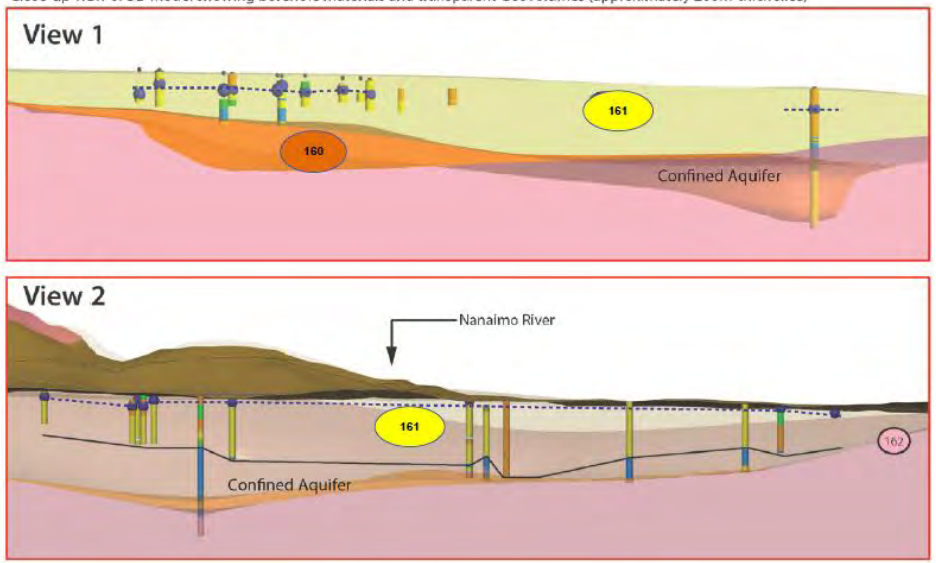
REGIONAL DISTRICT OF NANAIMO

Findings: Vancouver Island

3D Geomodel section through the Cassidy area south of the Nanaimo Airport (looking northeast)



Close-up view of 3D model showing borehole materials and transparent Geovolumes (approximately 200m-thick slice)



LEGEND

1. Hydrostratigraphy - Surface and Subsurface

- Capilano/Salish (*undifferentiated*)
- Capilano Marine (*not identified in subsurface*)
- Vashon (*Cassidy Aquifer*)
- Vashon/Capilano (*undifferentiated*)
- Quadra Sand (not in model above)
- Pre-Quadra (not in model above)
- Bedrock/Colluvium

2. Borehole Material

- Gravel/Boulder
- Glacial Till
- Sand
- Water Level
- Silt/Clay
- Glacial Till
- Bedrock

3. Hydrogeology

- 216 Mapped Aquifer Number
- 220 (*Colour relates to Hydrostratigraphic Unit*)
- Flow Direction
- Piezometric Line

WR6: Nanaimo River

REGIONAL DISTRICT OF NANAIMO

Findings: Vancouver Island

Stress Assessments

(Based on Summer Conditions)

$$\text{Demand } \frac{\text{(OUT)}}{\text{Supply (IN)}}$$

Surface Water

$$\text{Surface Water Stress (\%)} = \frac{\text{Consumptive Demand} + \text{Minimum Conservation Flow}}{\text{Natural Water Supply} + \text{Storage}} \times 100$$

Groundwater

$$\text{Aquifer Stress (\%)} = \frac{\text{GWout}}{\text{GWin}} \times 100$$

- 0-25% = Low Stress Blue
- 25-50% = Low to Moderate Stress Green
- 50-75% = Moderate Stress Yellow
- 75-100% = Moderate to High Stress Brown
- 100-150% = High Stress Red
- >150 % = Very High Stress Red

REGIONAL DISTRICT OF NANAIMO

Findings: Vancouver Island

Stress Assessments

Surface Water

$$\text{Surface Water Stress (\%)} = \frac{\text{Consumptive Demand} + \text{Minimum Conservation Flow}}{\text{Natural Water Supply} + \text{Storage}} \times 100$$

IN: estimated river flow

IN: Licensed storage for managed reservoirs & Average water level variation on natural lakes and wetlands

Watershed	Average Natural River Flow Supply (million m^3)	Storage (million m^3)	Conservation Flow (10% of MAD) (million m^3)	Licensed Demand (million m^3)	Allocation Stress	Stress Level
Nanoose Creek	0.6	0.0	0.7	0.02	107%	High

OUT: 10% of average annual discharge (flow)

OUT: industrial, municipal, domestic, agricultural

$$\frac{0.02 + 0.7}{0.6} \rightarrow \frac{0.72}{0.6} \rightarrow 1.2 * 100 \rightarrow 120\%$$

Findings: Vancouver Island

Stress Assessments

Groundwater

$$\text{Aquifer Stress (\%)} = \frac{\text{GWout}}{\text{GWin}} \text{ x } 100$$

IN: recharge from rainfall + seepage from overlaying aquifer + lateral recharge

Aquifer Tag No.	Aquifer Lithology	Potential Groundwater-Surface water or Aquifer to Aquifer Interaction	MOE Obs Well	Seas. Fluc.	Long Term Fluc.	WL Trend (up or down)	Total Est. AQ. Rec. (TRin) (Rp/I + Rmb)	Est. Ann. Disch to Cr. & Down Grad Aquifer (Tc out) +	Ground Water Use Estimate (ANTHout) =	Total Out [TcOut + $ANTH_{out}$]	Stress Anal. % GW Use of the avail. AQ. Rec.	Relative Stress Assess.
			ID	(m)	(m)	U/D	(m^3/yr)		(m^3/yr)	(m^3/yr)	(%)	Lo, Mod, Hi
219	Quadra	Nanoose Creek, Ocean	392, 393	?	?	L	1.6E+08	1.56E+07	2.8E+06	1.83E+07	11	Lo

OUT: loss to downstream creek or aquifer + human demand (abstractions)

$$\frac{((1.56E+07)+(2.8E+0.6))}{(1.6E+08)} \rightarrow \frac{(1.83E+07)}{(1.6E+08)} \rightarrow 0.11 * 100 \rightarrow 11\%$$

REGIONAL DISTRICT OF NANAIMO

REGIONAL DISTRICT OF NANAIMO

Findings: Vancouver Island

WR5: S.Wellington to Nanoose

Table 46: WR5 (SW-N) – Relative Surface Water Stress Assessment Results

Watershed	Average Natural River Flow Supply (million m^3)	Storage (million m^3)	Conservation Flow (10% of MAD) (million m^3)	Licensed Demand (million m^3)	Allocation Stress	Stress Level
Nanoose Creek	0.6	0.0	0.7	0.02	120%	High
Millstone River	0.67	4.07	2.21	0.9	66%	Moderate
Chase River	0.6	0.5	0.6	0.3	82%	Moderate to High

Table 50: Summary of Water Budget and Stress Analysis – WR5 (SW-N)

Aquifer Tag No.	Aquifer Lithology	Potential Groundwater-Surface water or Aquifer to Aquifer Interaction	MOE Obs Well	Seas. Fluc.	Long Term Fluc.	WL Trend (up or down)	Total Est. AQ. Rec. (TRin) (Rp/I + Rmb)	Est. Ann. Disch to Cr. & Down Grad Aquifer (Tc out)	Ground Water Use Estimate (ANTHout)	Total Out [TcOut + $ANTH_{out}$]	Stress Anal. % GW Use of the avail. AQ. Rec.	Relative Stress Assess.
			ID	(m)	(m)	U/D	(m^3/yr)		(m^3/yr)	(m^3/yr)	(%)	Lo, Mod, Hi
219	Quadra	Nanoose Creek, Ocean	392, 393	?	?	L	1.6E+08	1.56E+07	2.8E+06	1.83E+07	11	Lo
214	NG	Ocean	NA	NA	NA	NA	6.2E+05	0.00E+00	4.4E+02	4.40E+02	0	Lo
210	Buttle Lake Group - Fourth Lake Formation & Mount Hall Gabbro	Nanoose Creek, downgrad Fault Contact & NG	NA	NA	NA	NA	3.1E+06	2.45E+06	3.2E+05	2.77E+06	89	Mod-Hi
218	Benson Fm, IP, VG	Ocean	394	?	?	?	2.0E+06	4.06E+06	2.7E+05	4.33E+06	212	V. High
213	VG	Coal Works and Ocean	NA	NA	NA	NA	1.4E+07	4.12E+05	7.2E+05	1.13E+06	8	Lo
215	Quadra	Ocean	340, 232	1.6, 3.0	5, 7	D/L	6.3E+07	6.05E+07	4.4E+05	6.09E+07	97	Mod-Hi
166	VG & NG	Radial Flow to Long Lk., Dep. Bay, Neck Pt. etc… Ocean	NA	NA	NA	NA	2.2E+06	0.00E+00	0.0E+00	0.00E+00	0	Lo
211	VG & NG	Underground Coal Works	388	10.0	?	precip	3.8E+06	9.18E+06	2.3E+06	1.15E+07	306	V. High
167	Capilano	Benson Fm	NA	NA	NA	NA	3.6E+07	1.77E+07	0.0E+00	1.77E+07	49	Lo-Mod

REGIONAL DISTRICT OF NANAIMO

Findings: Vancouver Island

WR6: Nanaimo River

Table 57: WR6 (NR) - Surface Water Stress Analysis

Watershed	Average Natural River Flow Supply (million m^3)	Storage (million m^3)	Conservation Flow (10% of MAD) (million m^3)	Licensed Demand (million m^3)	Allocation Stress	Stress Level	Actual Demand (million m^3)	Actual Stress
Nanaimo River	62.2	64.2	45.8	51.5	**76%**	Moderate to High	15.5	**48%**

Table 61: Summary of Aquifer Stress Analysis – WR6 (NR)

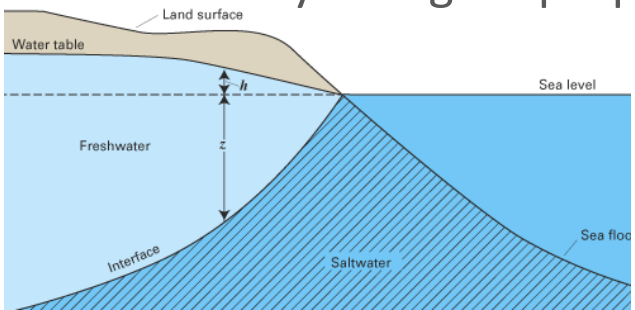
Aquifer Tag No.	Aquifer Lithology	Potential Groundwater-Surface water or Aquifer to Aquifer Interaction	MOE Obs Well	Seas. Fluc.	Long Term Fluc.	WL Trend (up or down)	Total Est. AQ. Rec. (TRin) (Rp/I + Rmb)	Est. Ann. Disch to Cr. & Down Grad Aquifer (Tc out)	Ground Water Use Estimate (ANTHout)	Total Out [TcOut + $ANTH_{out}$]	Stress Anal. % GW Use of the avail. AQ. Rec.	Relative Stress Assess.
			ID	(m)	(m)	U/D	(m^3/yr)		(m3/yr)	(m^3/yr)	(%)	Lo, Mod, Hi
160	Vashon	NR	228	4, 4.5	0	L	1.26E+07	7.84E+06	2.7E+03	7.8E+06	62	Mod-Hi
161	Capilano	NR	330, 312	0, 3.5	9, 6	Aban., D/L	1.26E+08	1.05E+08	2.0E+07	1.2E+08	99	Mod-Hi
162	NG	NR, Ocean	337, 315, 390	7, 15	5, 10	D/L	1.30E+07	3.31E+06	1.1E+07	1.4E+07	110	Hi
163	Quadra	Ocean	?	?	?	?	2.87E+05	1.14E+06	3.1E+05	1.4E+06	502	V.Hi
164	NG	NR	?	?	?	?	1.11E+06	5.05E+03	8.5E+05	8.6E+05	77	Mod-Hi
165	NG	NR	?	?	?	?	3.20E+06	4.13E+05	1.8E+06	2.2E+06	68	Mod

REGIONAL DISTRICT OF NANAIMO

Findings: data gaps

Author recommendations:

1. Mandatory **well log** submission
2. Standardization of **aquifer testing**
3. Increase **well observation** network
4. Reactivation of **stream gauging** (WSC)
5. Increase **saline intrusion monitoring**
6. Improve Water Budget **calculation parameters**
   - Gabriola→ water use data from survey
   - Hydrological properties

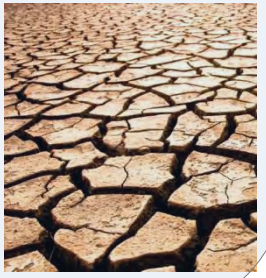


REGIONAL DISTRICT OF NANAIMO

Conclusion

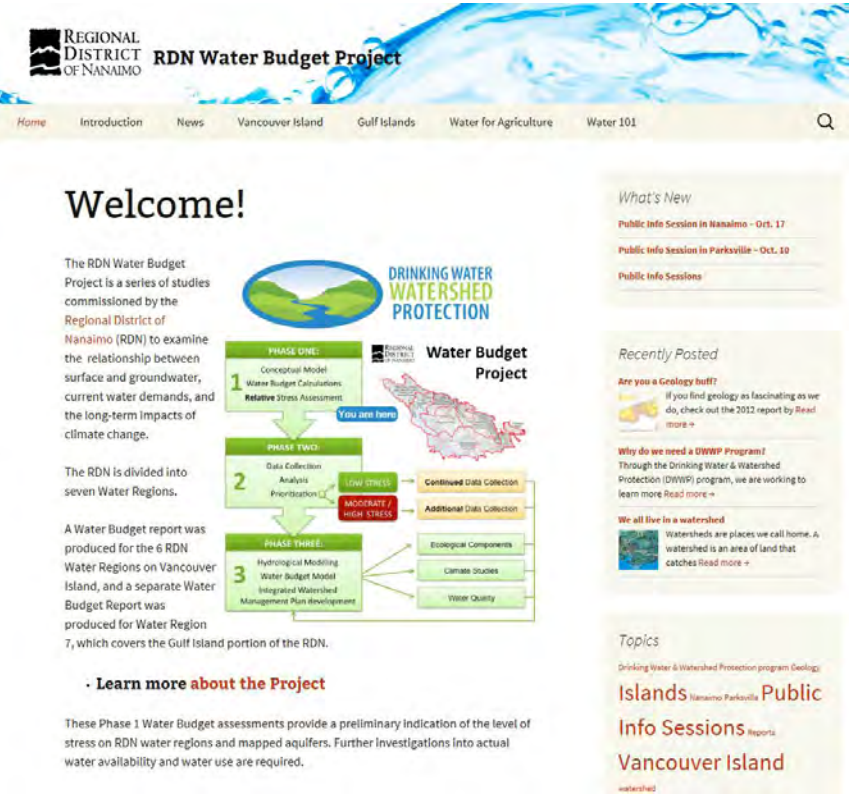
The Phase One Water Budgets provide the most comprehensive collation of information on the region's water resources that has been made available to date

- Results are **purely conceptual** and not intended for water management decision making or policy development
- Large degree of **uncertainty** due to lack of data
- Highlights data gaps and need for **increased monitoring**
- Stepping stone for the future!

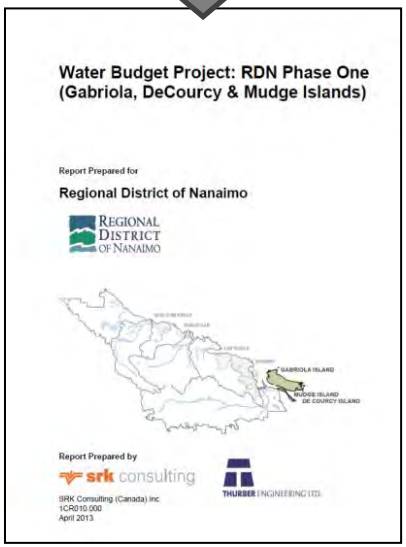


For more details
and to
download the complete reports
VISIT:

www.rdnwaterbudget.ca



Report Download




now
what?
tomorrow
yesterday

3. Integrated Watershed Management Planning

DRINKING WATER
WATERSHED
PROTECTION

REGIONAL DISTRICT OF NANAIMO

PRESENTATION

1. DWWP update
   - → Program 1
   - → Program 2
   - → Program 3
   - → Program 4
   - → Program 5
   - → Program 6
   - → Program 7
2. Water Budget
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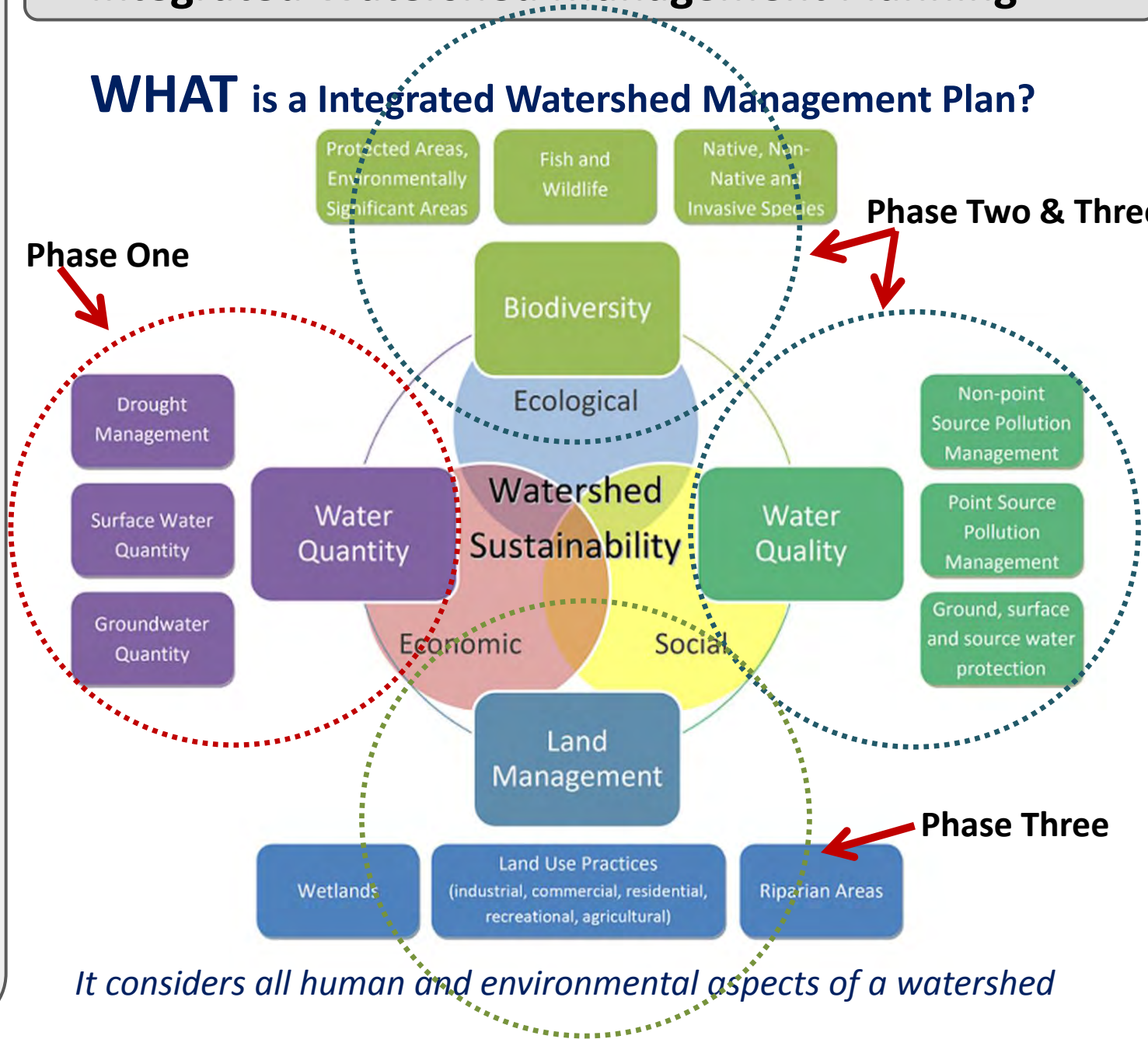
REGIONAL DISTRICT OF NANAIMO

Integrated Watershed Management Planning

WHAT is a Integrated Watershed Management Plan?



It considers all human and environmental aspects of a watershed

REGIONAL DISTRICT OF NANAIMO

Integrated Watershed Management Planning

WHY is it needed?

- Land use activities such as forestry, mining, agriculture, urbanization, fisheries and recreation all impact water resources



- Water resource problems are reaching global proportions; how we manage our water and how our neighbors manage theirs has an impact on all of us



- There is a wide variety of processes that affect the hydrological cycle; only managing one aspect is mismanagement. A holistic approach is the only way forward

PRESENTATION

REGIONAL DISTRICT OF NANAIMO

Integrated Watershed Management Planning

HOW? *What does a planning framework include?*

1. *Identification of **river basin areas** (water regions)* ☑
2. *Identification of **water resources** (surface and ground water)* ☑
3. *Identification of **measurement** parameters (chemical/ecological/social)*
4. *Identification of **protected areas** (forests, parks, fisheries)*
5. *Assess **current state** (i.e. poor, good, high)* → ***WHAT***
6. *Reasons for **not achieving** good status* → ***WHY***
7. ***Action plan** to achieve good status/improve* → ***HOW***

PRESENTATION

1. DWWP update
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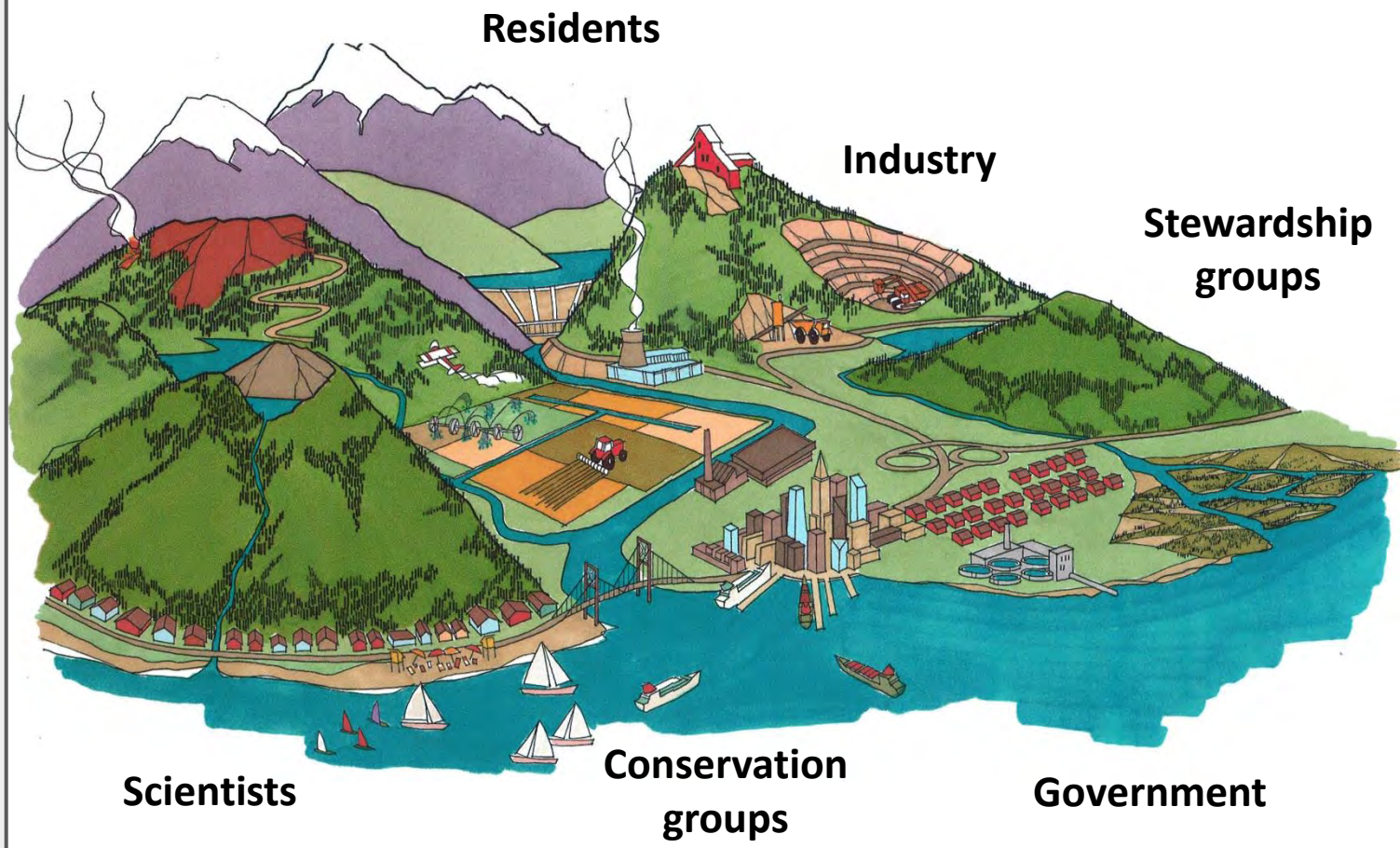
REGIONAL DISTRICT OF NANAIMO

Integrated Watershed Management Planning

WHO?



A key component to the success of these plans is public input…you live in the watershed! You know it best

Where do we go from here?

In your opinion:

- what are the priority watershed issues?
- who is responsible for watershed management?
- what do you think the DWWP program should focus on?

DRINKING WATER WATERSHED PROTECTION

DRINKING WATER
WATERSHED
PROTECTION

Thank You!