Community of Bamfield

Wastewater Treatment Options

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INTRODUCTION

Presentation Goals

Educate & Inform the Community of Bamfield

- Wastewater
- Present Conditions at Bamfield
- Wastewater Management
- Wastewater collection
- Wastewater treatment
- Regulations

Wastewater

Water Use Cycle:

- Extraction and Delivery
  - Private or municipal wells
  - Surface water (Reservoirs, lakes, rivers)
- Domestic Uses
  - Drinking and cooking
  - Washing and cleaning
- Non-domestic
  - Industry
  - Commercial
- Re-introduction to Environment
  - Microorganisms (bacteria, viruses and protozoa)
  - Inorganics (rubber, plastics, grit)
  - Dissolved metals (lead, cooper)
  - Pharmaceuticals (hormones, steroids, antibiotics)
  - Volatiles (oil, grease, hydrocarbons)
  - Nutrients (phosphorous, ammonia)

Community of Bamfield

Existing Wastewater Treatment

Community of Bamfield

- Residential
  - Onsite - septic tanks and disposal fields, some advanced primary (VIHA Permit)
  - 40 raw sewage discharges into Bamfield Inlet
- Commercial
  - 12 authorized discharges (MOE Permit)
  - 4 unauthorized (as of 2012)

Anacla Village

- Present - Onsite - septic tanks and disposal fields
- Future – Secondary Mechanical Treatment Plant

BMSC

- Present - Secondary Mechanical Treatment Plant
- Future – Combined plant with Huu-ay-aht under consideration

Shellfish closures in effect and beach use warnings.

Community of Bamfield

Existing Water Quality

2001-2002

- MOE/ACRD/EC/BMSC/MOH/local shellfish growers
  - Water quality sampling during summer at 12 marine locations
  - Elevated fecal coliform levels above shellfish and recreational use guidelines

2005-2007

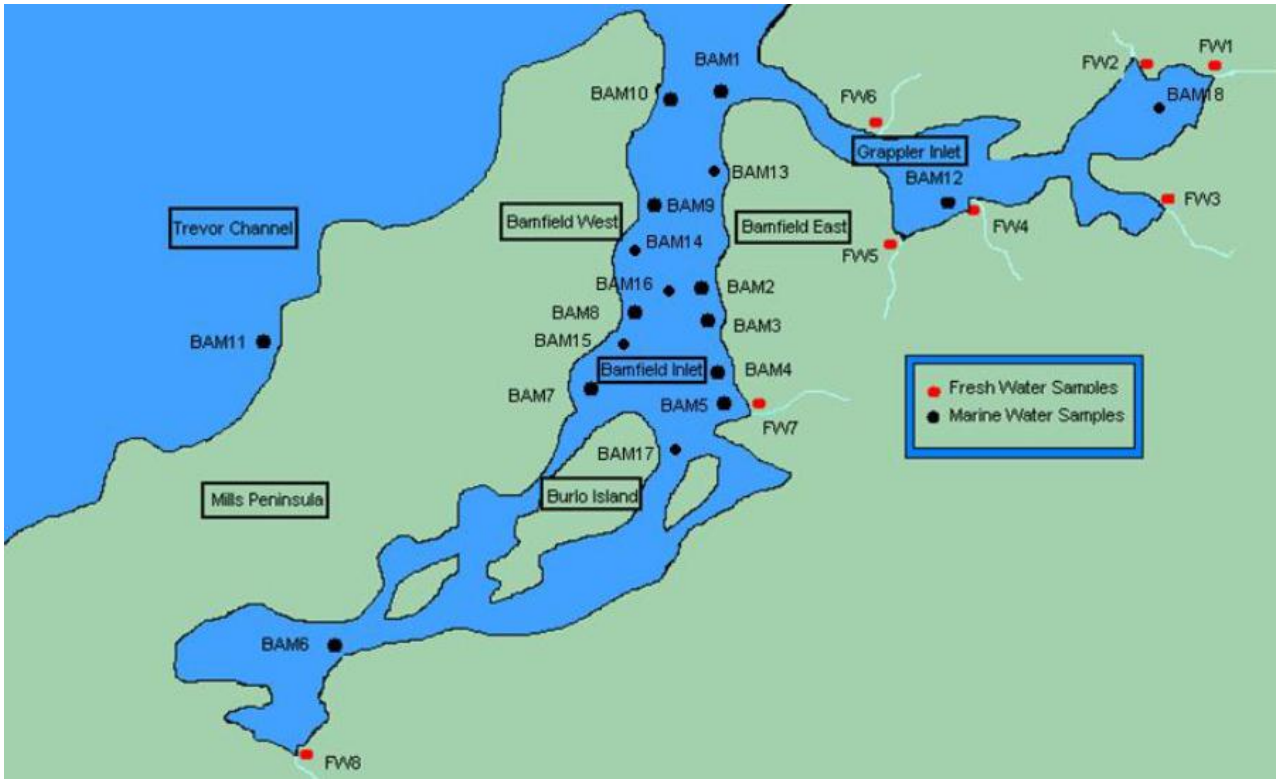
- MOE/ACRD/BMSC/HFN/Bamfield
  - More detailed study using at 18 marine locations using additional indicators:
    - Fecal coliform, E.Coli, nitrogen isotopes, microbial source tracking, and caffeine
    - Sampling was not conducted during the worst time of day (incoming tide)

Community of Bamfield

Existing Water Quality

Results of Sampling

- Highest bacteriological contamination is adjacent to homes and business along inlet and sources are of human origin



MOE Marine and Freshwater Sampling Points 2005-2007 (Source – MOE)

Sample ID	Site Description
BAM1	At Bamfield Marine Station outfall
BAM2	Off of Kingfisher Marina, blue roof
BAM3	Out from storm drain just south of station
BAM4	In front of Hawkeye Marina
BAM5	Just south of loading area Federal Dock
BAM6	At head of Bamfield inlet, on east side
BAM7	At McKay Bay Lodge, north of dock
BAM8	In front of Mills Landing cottages
BAM9	Spore residence, blue house
BAM10	Dock in front of general store
BAM11	Brady's Beach - North end of swimming area
BAM12	Dock in front of SeaBeam Resort - Grappler's Inlet
BAM13	Adjacent to greenhouses near BMSC
BAM14	House across from Community hall
BAM15	Dock in front of Imperial Eagle Lodge
BAM16	Mid-inlet next to red buoy Y54
BAM17	Mid-inlet between Burlo and Rance islands
BAM18	Head of Grappler inlet, out from dock
BAM FW7	East side, south of BAM5 and Federal Dock
BAM FW8	Far end of Bamfield Inlet, south BAM6

Community of Bamfield
Existing Water Quality

Results of Sampling - Details

- Fecal Coliform – geometric mean 2 CFU/100ml at Bam 11 to 144 CFU/100ml at BAM 4. Max up to 1600 CFU/100 ml.
    - Within recreational, but exceeds shellfish guideline
    - Most prevalent in Bamfield Inlet (24 exceedances)
    - Freshwater exceeded as well one year
    - E.Coli on these freshwater sites within limits – indicates non-fecal coliform in freshwater
- Enterococci– geometric mean 1 CFU/100ml at Bam 11 to 144 CFU/100ml at BAM 4. Max up to 682 CFU/100 ml.
    - Exceeded primary recreation guideline 6 times
    - Exceeded the shellfish harvesting guideline 11 times
- Nitrogen isotopes –mussels showed increase nitrogen
- Microbial source tracking – elevated levels at Bam 4,5,6,9, &14
    - Human and animal (deer/horse and dog)
- Caffeine – High levels at BAM 7, 8,9, 15, &16

Community of Bamfield

Existing Water Quality

MOE Proposed Water Quality Objectives

- **Short Term**
  - 5-10 years –Bamfield and Grappler Inlets
  - 5 weekly samples within 30 days not to exceed recreational guidelines:
    - 20 CFU/100 ml enterococci
    - 200 CFU/100 ml fecal coliform
- **Long Term**
  - After 10 years - Bamfield and Grappler Inlets
  - 5 weekly samples within 30 days not to exceed shellfish harvesting guidelines:
    - 4 CFU/100 ml enterococci
    - 14 CFU/100 ml fecal coliform

Community of Bamfield

Why make a change?

Health

- **Risk of acute or serious illness**
  - Pathogens - bacteria, parasites and viruses
  - Algae blooms - toxic
  - Increased chances in summer periods
  - Increased susceptibility in children and elderly
- VIHA and MOE posting warning signs
- Fishing farther out in Channel – more dangerous

Economics

- Shellfish harvesting closure
- Medical treatment
- Lost productivity
- Beautiful area but notoriety as polluter can send tourists packing

Environment

- Heavy metals, hydrocarbons, PCBs, Endocrine disruptors move up the food chain

Wastewater Management

Wastewater Treatment Systems

To meet the MOE objectives things must change!

- **Wastewater Management Objectives**
  - Collection
  - Treatment
  - Disposal of effluent and sludge
- **Wastewater Management Strategies**
  - Centralized
    - Several communities or a large community
    - Residential, commercial, industrial together
    - Single treatment plant
    - Treated far from point of generation
  - Decentralized
    - Single home, cluster of homes, small community
    - Typically residential only
    - Single or multiple treatment plants
    - Treated as close to point of origin as possible

Wastewater Collection and Treatment

Collection

Types

- STEP (Septic tank effluent pumping)
- STEG (septic tank effluent gravity)
- Conventional gravity
- Forcemain
- Low Pressure

Collection Type	Ideal Topography	Sulfide Potential	Construction Cost in Rocky, High Groundwater Sites	Minimum Slope or Velocity Required
STEP	Undulating	High	Low	No
STEG	Downhill	High	Moderate	No
Conv. Gravity	Downhill	Moderate	High	Yes
LP	Uphill	Mod-High	Low	Yes
STEP/STEG Combo	Undulating	High	Low-Mod	No

Wastewater Collection and Treatment

Treatment Technologies

Collection Cost Comparison - Individual Versus Whole Community

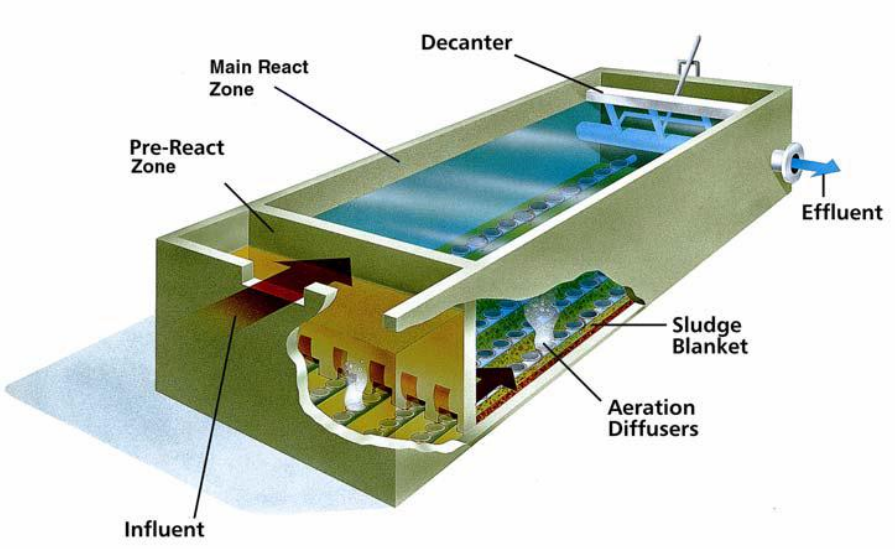
Type	Population Serviced	Cost Rank per System	Cost Rank for Whole Community per Person (Pop. 160)
Individual On-site Septic Tank & Tile Field	2	1	1
Communal On-site Septic Tank & Tile Field	10	2	3
Communal On-site Septic Tank, Packaged Plant & Tile Field	20	2	2
Bamfield Separate Plant (East Side)	Up to 1800	3	4
Expansion HFN/BMSC centralized plant	Up to 2000	3	4

Wastewater Collection and Treatment

Treatment Technologies

Types

- Preliminary
  - Screens and Grit Removal
- Primary (remove scum)
  - Septic Tank
- Secondary (Biological Removal of BOD and TSS)
  - Aerated Lagoons
  - Mechanical treatment
- Advanced (Further removal of BOD and TSS)
  - Membrane
  - Recirculating packed bed filters
  - Constructed wetlands



ICEAS System (Source – www.sanitare.com)

Aerated Lagoon (Source – www.integrityagsytems.com)

Wastewater Collection and Treatment

Treatment Technologies

Comparisons

Type	Aerated Lagoon	Mechanical Treatment (Sequencing Batch Reactor)	Mechanical Treatment (Extended Aeration)	Constructed Wetland (with Aerated Lagoon)
Mechanical Complexity	Most Simple	Average Complexity	Most Complex	Simple
Electronic Control	Simple	Most Complex	Average Complexity	Simple
Level of Operator Expertise	Most Simple	Average Complexity	Most Complex	Simple
Odour Generation	Low	Low	Low	Low
Visual Aesthetics	High Visual Impact	Square tanks most easily camouflaged	Circular clarifiers “Industrial “ look	High Visual Impact (Seen as Green)
Sludge Residual Handling	Desludge every 8-10 years	Secondary wasting every 6-8 weeks	Secondary wasting every 6-8 weeks	Desludge every 8-10 years
Effluent Reliability	Lowest during summer peaks	Most reliable	Average during summer peaks	Average during summer peaks

Wastewater Collection and Treatment

Treatment Technologies

Treatment Cost Comparison - Individual Versus Whole Community

Type	Population Serviced	Cost Rank per System	Cost Rank for Treatment Whole Community per Person (Pop. 160)	Cost Rank for Treatment and Collection Whole Community per Person (Pop. 160)
Individual On-site Septic Tank & Tile Field	2	**1**	5	3
Communal On-site Septic Tanks & Tile Fields	10	2	3	2
Communal On-site Septic Tanks, Packaged Plants & Tile Fields	20	3	4	**1**
Bamfield Separate Plant	Up to 1800*	5	2	5
Expansion HFN/BMSC centralized plant	Up to 2200*	4	**1**	4

* Short term – specific types of plants only

Wastewater Regulations

Existing

SSR – Sewerage System Regulation

- Single homes or small shared domestic systems up to 22,700 L/day on single lot or strata
- Enforced by VIHA

MWR – Municipal Wastewater Regulations

- Provincial – systems over 22,700 L/day
- Enforced by MOE
- Alternative to Liquid Waste management Plan (LWMP)
- Must also meet WSER (for now)

WSER – Wastewater Systems Effluent Regulations

- Federal – systems over 100,000 L/day
- Enforced by Environment Canada
- Applicable to Bamfield due to summer population
- More stringent than MWR in some areas

Wastewater Regulations

MWR or LWMP?

MWR – Municipal Wastewater Regulations

- The advantages of the MWR are:
  - Lesser degree of public consultation required
  - May be quicker to implement
  - No cost of LWMP

- The disadvantages of the MWR are:
  - Referendum required for future spending
  - Public may feel exclude from planning process (lack of acceptance)
  - Not a comprehensive plan to deal with future issues
  - Required to meet WSER until equivalency agreement reached

Wastewater Regulations

MWR or LWMP?

LWMP – Liquid Waste Management Plan

- Not a regulation but a waste control strategy
- Three stage process
  - Inventory and development projection
  - Detailed evaluation and preferred option
  - Financing and Implementation
- Created through a collaborative effort involving residents, business, local government, First Nations and senior government
- **Can be implemented in stages taking** into account :
  - Capacity of the receiving environment
  - Ability to finance the upgraded sewage facilities
  - Public input to the waste management planning process

Wastewater Regulations

MWR or LWMP?

LWMP – Liquid Waste Management Plan

- The advantages of the LWMP are:
  - Local governments can borrow money without the approval of electors for implementation of an approved LWMP
  - Opportunities for public review and consultation
  - Additional means to address water conservation, drinking water source protection, resources from waste, energy conservation, and more
  - Plans for future growth and development
  - Increased likelihood of obtaining grant money

- The disadvantages of the LWMP are:
  - Higher initial cost
  - Can take a year to several years to complete
  - Community participation is mandatory (time commitments)

Next Steps

Getting from present to your goals

You have taken the first step

- Communities that are successful in finding a technically effective, economical and publically accepted solution typically :
  - **Realize that only they can make the best decisions for their community and take responsibility for the problem at hand**
  - Clearly and completely understand their current situation before they start looking for solutions
  - Have or develop strong leadership from within
  - Have clearly defined a vision and appropriate goals
  - Identify and use a set of criteria to meet their goals
  - Commit to the time and energy to identify and examine all options before making decisions
  - Gather information from as many sources as possible before taking action
  - Keep all affected parties involved and informed all along the way