

# Hagensborg Water District

## *Drought Management Planning*

**March 2005**

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# 1 Introduction

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Hagensborg Water District is a community located near Bella Coola in northern British Columbia. The water source is a glacier fed stream with approximately 250 connections. The organizational structure of the improvement district consists of a formal board. All positions are held on a voluntary basis.

## 1.1 Purpose and Scope

The underlying purpose of this project is to assist Hagensborg Water District to carry out drought planning activities. This project has been funded by a contribution from the BC provincial government through Land and Water British Columbia (LWBC).

### 1.1.1 Drought Planning Categories

The LWBC Drought Planning Assistance Application lists a total of 9 eligible program categories. A fully comprehensive drought management plan would include information covering almost all of these categories. However, due to limitations of budget, resources and time, it has only been possible to undertake work at this stage in a limited number of these categories. In making the application to LWBC, Hagensborg Water District proposed that activities would be undertaken within the following eligible program categories:

- 5 Development of a water conservation plan
- 6 Drafting bylaws for drought management and /or water conservation.
- 9 Develop educational material related to water conservation

These categories were selected to reflect issues that are of priority in the continuing supply of safe and reliable water to customers of the water supplier. Information covering each of these selected categories is provided in this report.

### 1.1.2 Future Planning Activities

In creating this report we have provided material covering the categories listed above. We have also included brief reference to other program categories and other elements of comprehensive drought planning and water shortage management not included in the list above. These other elements of comprehensive drought planning may be undertaken in the future, when

resources are available. To assist this process we have included in this report section headings and sub headings covering these other elements. The notes under these section headings will assist Hagensborg Water District to complete these components of drought planning at some point in the future. We recommend that a complete water shortage management plan be prepared when resources become available in the future.

### **1.1.3 Water Shortage Management**

Hagensborg Water District may experience a water shortage as a result of several circumstances, including drought: for example, the water source may be accidentally contaminated. This would create the need to warn customers of the circumstances, utilize alternative water supplies, and request other organizations to provide resources.

Many elements of the response to drought are the same as those involved in the response to other circumstances causing water shortage. In this report we have in some cases broadened the scope to provide information and resources that will assist the District to manage a range of water shortages, including drought, but not necessarily confined to drought.

## **1.2 Background to Hagensborg Water District**

The organizational structure of the improvement district consists of a formal board. All positions are held on a voluntary basis.

The water source for Hagensborg Water District is glacier fed stream with approximately 250 connections. The water source is not currently stressed, however there are concerns regarding water service interruptions.

Hagensborg Water District applied for funding under LWBC Drought Planning Assistance Program to develop a water conservation plan, a conservation bylaw and public education. Information leading to these goals is included in this report.

## **1.3 Drought Management Goals**

To be considered comprehensive, a drought and water shortage management plan should achieve a range of goals. These goals may be grouped into broad headings:

- Water Supply and Demand Assessment
- Water Conservation
- Drought Management Planning.

In Table 1.1 we show specific water conservation management goals under each of these headings.

#### **1.4 Drought Planning in BC**

In the recent past some communities in British Columbia have experienced drought, or faced the threat of drought conditions. Many areas in the southern portion of the province have experienced low to extremely low groundwater levels, as well as less high elevation snow than is normal.

In 2004 Land and Water British Columbia Inc. delivered regional drought planning workshops across the province. The Province has provided local governments across B.C. with funding as part of the Provincial Drought Action Plan. The funding is available to water suppliers with stressed water systems and those in drought prone areas or facing rapid population growth, and who intend to implement water conservation or drought management plans. This project is funded by the provincial contribution for drought management.

#### **1.5 Capacity Development**

Planning for drought, and response to drought conditions, is likely to be most effective when the water supply organization involved is able to operate as a sound and sustainable business. To this end, many small water suppliers are actively engaged in capacity development. In this context the phrase "capacity development" means building the technical, managerial and financial resources of an organization so that it can continue to operate as a sound and sustainable business. Capacity development includes a wide range of activities, examples of which are staff training, renewal and enhancement of physical infrastructure, development of effective policies and procedures and creation of a sound business plan.

Hagensborg Water District must continue to provide safe, reliable and sustainable supplies of water to customers, and therefore it should be in a position to operate indefinitely as a sustainable business. Some organizations cease to be viable because they are not able to operate in a way that ensures that revenues exceed expenditures for operations and system renewal. The drought planning measures outlined in this report will help the response to drought conditions. They may also contribute to the business viability of the organization.

An essential early step in capacity development activities is to develop a sound business plan (Table 1.2). In the following we have outlined elements of business planning for small water suppliers in BC. All water supply organizations should have a business plan in place. A water supply

organization that does not operate in a financially sustainable manner cannot offer assurances to customers that the consequences of drought or other water shortages will be adequately managed in the long-term.

### 1.5.1 Business Planning

The complete business plan will consist of these major elements:

- **Facilities Plan:** this outlines the existing facilities, discusses future needs, and outlines the options for meeting future needs.
- **Management Plan:** this outlines operation and maintenance issues, governance, management and administration topics, and marketing and customer service.
- **Financial Plan:** this outlines the operating budget, planned expenditures on system renewal and capital items, and shows how revenues will be generated to cover expenditures.

### 1.5.2 Systematic Steps

Preparation of a business plan can be undertaken by following a series of systematic steps. These include:

- **Organizational Assessment:** the various elements of the organization are examined, usually with the help of a structured series of questions.
- **SWOT analysis:** the strengths, weaknesses opportunities and threats are identified with the help of the staff and trustees.
- **Strategic planning:** managers and trustees work together to identify the long-term objectives of the organization
- **Business plan completion:** the business plan is completed with specialist assistance and with contributions from managers and trustees.

Preparation of a sound business plan is an essential step in achieving sustainable operation. A water supply organization that is not able to maintain sustainable operations may find that response to drought and other water shortages is compromised. Various agencies of the provincial government have encouraged water supply organizations to prepare effective business plans. There may be funding available from provincial agencies to assist in this process.





## 2 Water Supply and Demand

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A comprehensive drought management or water shortage management plan includes a review of water supply and demand. Knowledge of the present and projected demands, and of the capacity of existing and potential sources, is essential in comprehensive planning for drought response management.

We suggest that a review of water supply and demand be undertaken, if not carried out in the recent past, and that the results should be integrated with this drought management project.



## 3 Water Conservation

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This section introduces the general topic of water conservation planning and management. It also provides specific information about a variety of water conservation initiatives for application in Hagensborg Water District.

### 3.1 Water Conservation Planning & Management

A number of communities in Canada are experiencing problems with fresh water resources. In many Canadian communities, supply side management has historically characterized the provision of water. That is to say, communities have focused on the continuing development of water sources to keep pace with demand. An alternative focus on demand side management, which in essence encourages consumers to use less water in order to balance supply and demand, is likely to lead to a more sustainable society.

Many small rural communities in British Columbia experience challenges in providing safe and reliable water supplies. Water conservation strategies can play a major part in maximizing the effectiveness of existing resources. They may also play a major role in avoiding the worst consequences of drought.

A comprehensive water conservation plan has several important elements. In Table 3.1 we have shown the major elements that make up a comprehensive water conservation plan for small and medium sized water supply organizations in British Columbia. Some of these elements may not be applicable to certain communities. For example, a remote and very small water supply organization directly adjacent to an abundant supply of potable water is unlikely to place a high priority on restrictions in sprinkler use. Most communities are not in this position, and many of the elements shown on Table 3.1 will form part of their comprehensive water conservation plan.

The work described in this report has included the preparation of a water conservation plan for Hagensborg Water District. In some cases, parts of the water conservation plan were in place prior to the preparation of this report.

## Benefits and Barriers to Water Conservation

Some benefits and challenges associated with water conservation are summarized in the following:

### Benefits of conservation

- Reduction of environmental impacts
- Increase in capacity to maintain drinking water quality standards
- Avoidance of supply limitations
- Deferral of capital costs for infrastructure expansions.

### Barriers to conservation

- Overcapitalization
- Low water prices
- Supply side engineering bias
- Inadequate data collection
- Lack of funding for demand side management
- Inflexible policies

Water conservation planning and management is a continuous process. The water conservation plan should be reviewed and updated at regular intervals, typically once per year. Some components of the water conservation plan, for example monitoring of bylaw compliance and maintenance of public awareness, will require regular involvement of staff.

## 3.2 Water Conservation Bylaw

It may be necessary to implement regulatory controls to ensure that consistent and coordinated conservation efforts are being made among all users of the water supply system during times of limited water supply. Many communities have already created bylaws to regulate water use and increase water conservation efforts. Two activities that are commonly regulated through bylaws are residential lawn watering and irrigation.

A bylaw may be used by Hagensborg Water District to restrict the use of water by customers. A bylaw allows the Trustees to limit the use of water at certain times of the year, at certain times of the day, and for certain purposes.

### 3.2.1 Draft of Bylaw

A draft of a Water Use Bylaw is provided in Appendix A3.A. The bylaw applies only to water supplied by the District. Bylaw restrictions do not apply to the use of rainwater, "gray" water or any form of recycled water.

Water resources are generally under greater stress in the summer months; rainfall is reduced compared to the winter months, which in turn limits supply in the summer. On the other hand demand in the summer is higher because customers use for water for outdoor irrigation, washing cars and other items, and various forms of recreational use. The Bylaw enables the Trustees to impose progressively stricter limits on the use of water, to correspond with decreases in the availability of water supplies.

Water shortages may be predicted using a variety of resources. These include web sites managed by the provincial and federal governments that provide information about rainfall, river flows, lake levels and snow pack on a provincial basis. Water shortages may also be predicted through examination of factors including customer usage, local groundwater levels, soil moisture content, flow in local rivers, and review of long-term weather forecasts.

## 3.3 Leak Detection Program

At some point the Hagensborg Water District will want to quantify the water losses that occur in the water distribution system. Especially during periods of drought, it is important to ensure that precious water supplies are not wasted en route. The National Research Council has posted the following information about leak detection on its website at <http://irc.nrc-cnrc.gc.ca>:

In many water distribution systems a significant percentage of water is lost while in transit from treatment plants to consumers. According to an inquiry made in 1991 by the International Water Supply Association (IWSA), the amount of lost or "unaccounted for" water is typically in the range of 20 to 30% of production. Unaccounted for water is usually attributed to several causes including leakage, metering errors, and theft – leakage is the major cause. In addition to environmental and economic losses caused by leakage, leaky pipes pose a public health risk, as leaks are potential entry points for contaminants if a pressure drop occurs in the system.

Economic pressure, concern over public health risk and simply the need to conserve water motivate water system operators to implement leakage control programs. There are two major steps in any systematic leakage control program: (i) water audits, and (ii) leak detection surveys. Water audits involve detailed accounting of water flow into and out of the distribution system or parts of it. The

audits help to identify areas having excessive leakage. Unfortunately, they do not provide information about the location of leaks. To do so, leak detection surveys must be undertaken.

In leak surveys, the water distribution system is checked for leaks by using acoustic equipment, which detects the sound or vibration induced by water as it escapes from pipes under pressure. Acoustic equipment include listening devices such listening rods, aquaphones (or sonoscopes), and geophones (or ground microphones). These are used to listen for leak sounds at contact points with the pipe such as fire hydrants and valve. Acoustic equipment also includes leak noise correlators. These are modern computer-based instruments that have a simple field set-up and work by measuring leak signals (sound or vibration) at two points that bracket a suspected leak. The position of the leak is then determined automatically based on the time shift between the leak signals calculated using the cross-correlation method.



Commonly used listening devices including ground microphones and listening rods (source: Palmer Environmental Limited)

The following website provides more information on the subject of leak detection: <http://irc.nrc-cnrc.gc.ca/leak/leakdetect.html>.

### 3.4 Water Conservation Measures

Conservation measures are implemented in response to capacity constraints, population growth, potential drought conditions, the need to reduce costs, or environmental stewardship.

Conservation measures can be categorized into 'hard' and 'soft' initiatives. Hard conservation measures are more demanding or restrictive in their approach to water use efficiency. A 'soft' conservation efficiency approach focuses on negotiation, conciliation, voluntarism and teaching. More detailed information about these conservation strategies is contained in Appendix A3.B, along with examples of measures that can be implemented in water systems serving small to medium sized communities.

### **3.4.1 Xeriscaping**

The word Xeriscape was created in 1981 by Denver Water for landscape water conservation education programs. It is a registered trademark belonging to Denver Water.

Xeriscaping is a systematic water conservation approach to landscaping. The goal is to use fewer resources while still maintaining the beauty and enjoyment of landscaped areas. In Canada, municipal water use doubles each summer. Xeriscaping can reduce summer water use by 70% or more.

During years of severe drought, such as in 2003, communities across British Columbia were forced to impose residential water restrictions or even outright bans.

#### **Benefits of Xeriscaping**

The benefits of Xeriscaping include:

- Under drought conditions beautiful landscapes are still possible.
- Water and maintenance costs can be reduced by up to 60%.
- A landscape will not suffer if it is drought-proof.
- A good xeriscaped yard will increase property values by as much as 15%.

There is a misconception that a Xeriscaped yard consists of a dry, lawn-less, rocky landscape of solely native plants. Dry-only landscaping can be spectacularly colorful. By preparing the soil and watering efficiently, limited areas of more highly watered landscape are completely consistent with wise water use. Many choices of lawn are also consistent with wise water use. There are arrays of interesting plants indigenous to all regions. In addition, non-invasive introduced plants that can also adapt to the local regional climate are wonderful additions: tulips, irises, and roses are examples.

Appendix A3.C describes the seven principles of Xeriscape gardening and lists some useful reading and Internet resources. In addition, an outdoor water conservation pamphlet has been designed for distribution to Hagensborg Water District water users as part of the drought management plan.

### **3.4.2 Water-saving Devices and Efficient Appliance Use**

Indoor water use can be reviewed in order to help with achieving water conservation goals. Household consumption can be reduced by as much as 40% by practicing simple water conservation measures. This can potentially free up large amounts of water for the system. The benefits of conservation include reducing the size of water and energy bills, and minimizing maintenance costs.

Appendix A3.D contains more specific information on indoor water conservation.

## **3.5 Universal Water Metering**

One of the most effective means of encouraging water conservation is through Universal Water Metering. Universal water metering involves moving from a flat-rate (non-metered) system of billing to a volume-based metered user-pay system. In a flat-rate system of billing, users pay a fixed price regardless of the amount of water they consume. In a volume-based system, users pay more for water as they use more. In a volume-based system, consumption meters are used to measure the quantity of water a user consumes in order to subsequently bill them the appropriate amount.

In order to achieve long-term efficiency in the consumption of water, an appropriate pricing structure is required to complement volume metering. The pricing structure can be so arranged to promote appropriate uses and discourage wasteful use. More information on establishing a pricing structure is provided in the next section on Water Pricing. Together, the use of water consumption meters and a volume based price structure, are referred to as Universal Metering.

### **3.5.1 Why adopt Universal Metering?**

The 4 underlying drivers for Universal Metering are:



- Equity – providing an equitable basis for charging for the cost of water and treatment of sewage. That is to say, those who use more water will pay more: that is considered to be fair.
- Water Efficiency and Environmental Stewardship – reduced wastewater, energy savings and greater sustainability of water supply are some of the environmental benefits of improved water efficiency.
- Economic Management – utilities can maximize plant capacity and defer costly expansions when demand can be measured and managed.
- System Management – metering enhances a utilities ability to detect leaks, target areas in need of repair, and measure and identify the areas of real water loss.

According to Environment Canada, universal metering has been shown to reduce water consumption by 15 to 30 percent. Even if there is an abundance of water, there is still the need for its efficient use as it requires human and energy resources to draw, treat, and distribute potable water.

Utilities should complete a water balance to account for usage and loss in the distribution system. Accurate metered information enables utilities managers to more effectively monitor system performance, and prioritize and manage water infrastructure programs.

### **3.5.2 Financial Options**

The installation of water meters costs money. Some small water supply organizations have difficulty in accessing the required funds. Methods of paying for water meter installation include the following:

- Universal metering reserve fund – some of the revenues from the flat rate is allocated to a specific reserve fund to be later used for implementing universal metering,
- User Pay – End users cover the supply and installation cost, either up front or over utility bill financing,
- Third Party Financing – Private companies may offer supply and installation financing to amortize the cost over several years,
- Provincial and Federal infrastructure programs – Utilities may qualify for provincial and/or federal grants associated with metering where it would reduce the need for more costly system expansions.

### **3.5.3 Pricing Structure**

The pricing structure used to charge customers for water can have a major influence on water usage in a community. In general, communities employ a combination of 5 common types of tolls and charges to recover the overall costs of delivering water:

- Capital development charge – this charge is levied when new land is developed, and is intended to recover costs that were incurred in anticipation of the new development. For example, a new water main is typically designed with the intention that it will support an area when fully developed, even when that area is not yet fully developed at the time of installation.
- Connection charge – this charge is collected to pay for the cost of new property hookups.
- Parcel Taxes – this tax is collected annually from property owners and is intended to pay for large capital expenditures and equipment renewal.
- Base Rate – this is the minimum fee each water user will pay regardless of the amount of water they consume. In a flat-rate pricing structure, there is only a base rate. That is, users pay one fixed price for unlimited consumption of water.
- Variable Rate – In volume based pricing structures, users may pay a base rate as well as a variable rate. The variable rate is stated as a dollar amount per consumption unit: for example, \$3.49 per cubic meter.

Appendix A3.G of this document provides more detailed information on water pricing, including a brief description of different water price structures. Setting water rates can be a complex exercise: in considering a water price review we recommend Hagensborg Water District consult with specialists to help with this process.

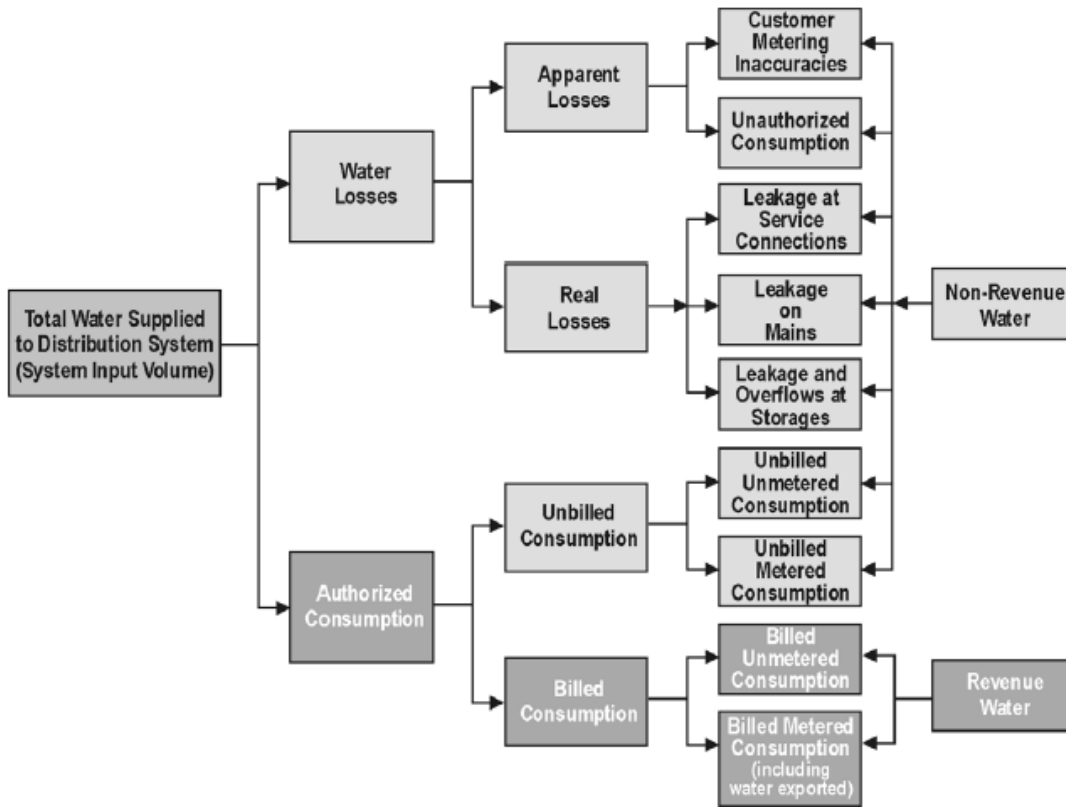
### 3.6 Water Use Monitoring

A key element in a comprehensive water conservation program is the monitoring of water use. Monitoring includes measurement of the amount of water supplied and consumed at certain points in the system. If the water cannot be measured it cannot be managed.

A water audit enables suppliers to determine the amount of water supplied, consumed, and lost in the distribution system. In periods of drought it is important to assure the community that valuable water is not being wasted unnecessarily. The National Guide to Sustainable Municipal Infrastructure has published "Water Use and Loss in Water Distribution Systems – A Best Practice" it is available at <http://www.infraguide.ca> and details water use monitoring as follows:

Ideally, the quantity of water supplied into the water distribution system would equal the quantity of water used by all the customers connected to that system. Absolutely no losses would occur in the water distribution system and all waters consumed, and all maintenance activities, would be accurately metered. In reality, a combination of metered consumption values and calculated values monitor water used and lost. An audit can provide water suppliers with the information they need to make decisions on appropriate operation, maintenance, and capital improvement programs to reduce water loss in their water distribution system.

A water audit should take place yearly for year-to-year comparisons and to prioritize operation and maintenance programs. To perform a water audit, a water distribution system balance flow chart is used, as shown in the following figure. As each task is addressed, the information on water use and loss becomes more complete.



### 3.7 Water Reclamation Projects

When water becomes a scarce resource, as in periods of drought, it becomes more desirable and financially feasible to squeeze more use out of every drop. Even very small water systems can benefit from water reclamation projects – and inevitably will need to do this in periods of severe drought. The Canadian Council of Ministers of the Environment sponsored a workshop entitled “CCME: Linking Water Science to Policy Workshop Series: Water Reuse and Recycling” and published the following information:

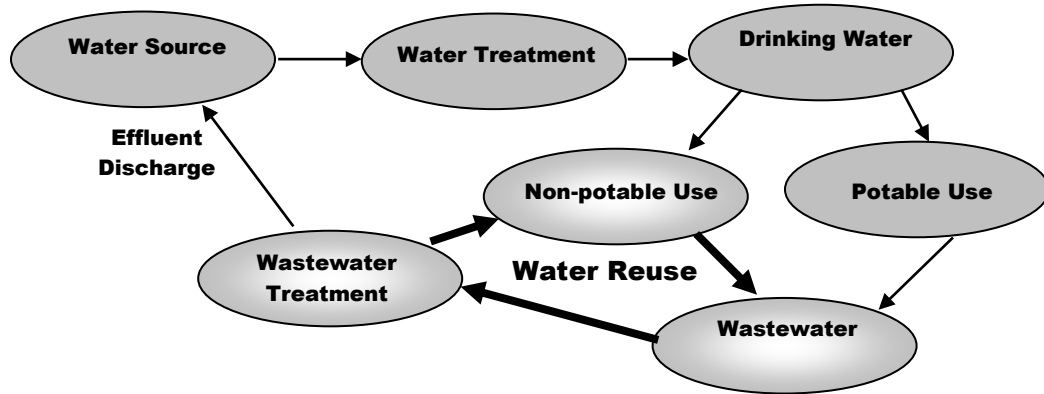
An array of treatment technologies that can be applied in wastewater reclamation and reuse is already available. Many of these technologies, such as biofilters, membrane technologies and UV disinfection, have been developed and applied in Canada. These technologies are increasingly targeted at decentralized (satellite), small-scale, treatment facilities.

- **Wastewater reclamation** involves treatment to a predetermined water quality, which facilitates reuse. In this context, the term wastewater includes typical household grey water, plus permitted inflows of rainwater or storm water.
- **Water reuse** is the use of treated water for beneficial purposes, including agricultural irrigation and industrial cooling. Reclaimed water is treated effluent of a quality suitable for specific reuse.
- **Water recycling** typically refers to industrial systems, in which the effluent is recovered, usually treated and returned back into the industrial process.

Typical examples of water reuse applications include:

- Toilet flushing;
- Irrigation of lawns, parks, landscape, gardens, golf courses, sport fields, school yards, residential lawns, cemeteries, freeways;
- Agricultural irrigation of food and non-food crops;
- Industrial reuse (cooling water, boiler feed water, steel processing, pulp and paper processing);
- Direct wastewater reclamation to augment potable water;
- Groundwater recharge, arresting saltwater intrusion;
- Recreational waters, waterscape (ornamental ponds).

The following figure shows how water re-use can be incorporated into the water cycle:



**Figure 3.3 - Water Reuse Cycle**

### 3.8 Community Education

Conservation measures will be most effective if they are implemented by a majority of water users. Water users will need to be informed and educated about the water system, and about the conservation measures implemented at each drought stage.

The communication plan for Hagensborg Water District may include some of the following components.

#### **Media Releases**

- Local newspapers and radio
- Local Newsletter

#### **Meetings**

- Stakeholder meetings
- Annual General Meeting

#### **Direct Mail**

- Information contained on or with Water Bills
- Pamphlets mailed with water bills containing indoor and outdoor conservation tips

#### **Public Education**

- Information booths at local events
- School programs
- Open Houses

# Appendices

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## Appendix A3.A: DRAFT WATER CONSERVATION BYLAW

*This is a draft, and should be reviewed by legal advisors before being finalized.*

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**Hagensborg Water District: Bylaw No. \_\_\_\_**

A bylaw for the purpose of conserving potable water.

**The Trustees of the Hagensborg Water District ENACT AS FOLLOWS:**

### 1. Definitions

In this bylaw:

“Administrator” means the Administrator of the **Hagensborg Water District**.

“Appliance” means a device or mechanism, in or through which Water is piped or used for a domestic or commercial purpose.

“Exempted Person” means an Owner or Occupier of property identified in Schedule “A” as exempt from one or more of the regulations under this bylaw.

“Farm” means a parcel of land classified as farmland for assessment and taxation purposes.

“Fill” means to fill completely with Water.

“Micro-irrigation or Drip-irrigation System” means a system using irrigation components which consume less than 20 gallons per hour and operate at less than 25 psi to deliver Water to the root zone of the plant material being irrigated, and includes spray emitter systems (Micro-Sprays), point source emitters and linear tape systems as defined in the BC Trickle Manual prepared and published by the BC Ministry of Agriculture and Food, Resource Management Branch (issue 1999), but does not include weeper or soaker hoses.

“Newspaper” has the same meaning as in the *Local Government Act*.

“Notice” means a Notice given under Section 6 of this bylaw.

“Nursery” means a business in which flowers, plants, trees or shrubs are grown or displayed for sale.

“Occupier” has the same meaning as in the *Local Government Act*.

“Officer of the District” means a person appointed by the Board of Trustees.

“Over-Watering” means to Water in a manner that saturates the lawn or landscaped area being watered and results in Water spreading onto areas beyond them.



“Owner” has the same meaning as in the *Local Government Act*.

“Permit” means a Permit issued under Section 9(1) of this bylaw.

“Public Authority” has the same meaning as defined in the *Local Government Act*.

“Restricted Hours” means those time periods during which watering is permitted in Schedule “A” of this bylaw.

“Sprinkler” means a hose connected or other sprinkler system but excludes a Micro-irrigation or Drip-irrigation system.

“Stage” means the Stages 1, 2, 3 and 4 of Water Use Restrictions prescribed in Schedule “A” of this bylaw.

“Vehicle” means a device in, on or by which a person or thing is or may be transported or drawn on a highway.

“Water” means Water supplied by the **Hagensborg Water District** directly or indirectly to an Owner or Occupier or the act of using or applying such Water.

“Water Use Restrictions” means the restrictions prescribed in Schedule “A” of this bylaw.

“Watering Days” means those days during which Watering is permitted in Schedule “A” of this bylaw.

## **2. Application**

This bylaw is applicable in all areas of **Hagensborg Water District**.

## **3. Prohibitions**

(1) The prohibitions in subsections 3(2) and 3(3) are in force at all times of the year.

(2) No person shall damage or allow the deterioration of any Appliance so as to result in a waste of Water.

(3) No person shall waste Water by using more Water than is required to provide a service, produce a product or complete a task, including but not limited to

- (a) allowing a tap or hose to run Water unnecessarily, and
- (b) the Over-Watering of plants or lawns.

(4) No person, being an Owner or Occupier of property in the District, shall use Water or cause Water to be used contrary to the provisions of this bylaw in effect at the time of use.

## **4. Inspection**

An Officer of the District has the authority to enter at all reasonable times on any property that is subject to this bylaw to ascertain whether the requirements of this bylaw are being met or the regulations in this bylaw are being observed.

## **5. Effective Dates of Stages and Restrictions**

(1) Stage 1 and the Water Use Restrictions for Stage 1 prescribed in Schedule “A” are in effect in each year from April 1<sup>st</sup> to September 30<sup>th</sup> both inclusive, except as provided under subsection (2).

(2) The Trustees by resolution, may:

- (a) amend the effective period of time for Stage 1, or
- (b) terminate or bring into effect a Stage more restrictive than Stage 1 at any time of the year for any period of time.

(3) The Stage determined under subsection (2) and the Water Use Restrictions prescribed under Schedule “A” for that Stage take effect on the commencement date stated in this bylaw or stated upon the Notice for that Stage and remain in effect until that Stage is terminated.

(4) A Stage will remain in effect until it is terminated by resolution or otherwise under this bylaw, or until the commencement of another Stage.

**6. Notice**

(1) The Administrator must give Notice or cause Notice to be given to persons of the applicable Stage determined under Section 5(2) and its effective dates of commencement and termination when determined by the Trustees.

(2) The Notice under subsection (1) must be given at least once:

(a) before the commencement of the applicable Stage, and

(b) within a reasonable time after the resolution of the Trustees to terminate the Stage.

(3) The Notice under this section must be published in a local newspaper and on the District web site and displayed on a notice at the District office.

**7. Determination Factors**

In making a determination under Section 5(2), the Trustees may consider, but shall not be bound by, the water available in the water sources supplying the district, and other factors.

**8. Water Use Restrictions**

The Water Use Restrictions for each Stage are prescribed in Schedule "A" to this bylaw and must be obeyed during the period that the applicable Stage is in effect under this bylaw.

**9. Permits, Exemptions and Special Cases**

(1) The district may issue Permits in the special cases and manner prescribed in Schedule "B".

(2) Exemptions and special cases to the regulations in this bylaw are prescribed in Schedule "A".

(3) Exempted Persons and Permit holders are exempted from Section 3 to the extent permitted by Schedule "A" and the conditions of the Permit where applicable.

**10. Schedules**

Schedules "A", "B" of this bylaw form part of and are enforceable in the same manner as this bylaw.

**11. Penalty**

(1) A person who contravenes this bylaw commits an offence, is punishable in accordance with the Offence Act, and on conviction, in addition to the penalties prescribed under the Offence Act, may be subject to fines as determined by the Trustees from time to time.

**12. Bylaw Citation**

This Bylaw may be cited as "Water Conservation Bylaw, No. \_\_\_\_, 2005".

INTRODUCED and given first reading by the Trustees on the .....

RECONSIDERED and finally passed by the Trustees on the .....

\_\_\_\_\_

Chairperson

\_\_\_\_\_

Administrator

**SCHEDULE "A"**  
**to Bylaw No. \_\_\_ : Water Conservation Bylaw, 2005.**

**OUTDOOR WATER USE RESTRICTION STAGES**

**1. STAGE 1 – TWO DAYS PER WEEK LAWN WATERING**

(1) During Stage 1,

(a) no person shall use a Sprinkler to water a lawn growing on a property with

(i) an even numbered address, except on Wednesday and Saturday between the hours of 4:00 a.m. to 9:00 a.m. and 7:00 p.m. to 10:00 p.m.; and

(ii) an odd numbered address, except on Thursday and Sunday between the hours of 4:00 a.m. to 9:00 a.m. and 7:00 p.m. to 10:00 p.m.; and

(b) a person may

(i) water trees, shrubs, flowers and vegetables on any day with a Sprinkler during the prescribed hours for Stage 1 lawn watering and on any day at any time if watering is done by hand-held container or a hose equipped with a shut-off nozzle;

(ii) water newly planted trees, shrubs, flowers and vegetables by any method during installation and for the following 24 hours;

(iii) use Micro-irrigation or Drip- irrigation systems to Water trees, shrubs, flowers and vegetables at any time on any day;

(iv) under the authority of a Permit, water new sod on installation and during the first 21 days after installation, and water newly seeded lawns until growth is established or for 49 days after installation, whichever is less, but only during the prescribed Stage 1 lawn Watering hours;

(v) water all weather playing fields at any time if failure to do so will result in a permanent loss of plant material; and

(vi) wash a vehicle with Water using a hand held container or hose equipped with a shut-off nozzle and at car dealerships or commercial car washes.

(2) As exceptions to the Stage 1 restrictions,

(a) Owners or Occupiers of property who, by reason of physical or mental incapacity, are unable to water their property within the restricted days and times, may water their property on any two days of the week for a maximum of 9 hours per day;

(b) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;

**2. STAGE 2 – ONE DAY PER WEEK LAWN WATERING**

(1) During Stage 2,

(a) no person shall use a Sprinkler to water a lawn growing on a property with

(i) an even numbered address, except on Wednesday between the hours of 4:00 a.m. to 9:00 a.m. and 7:00 p.m. to 10:00 p.m.;

(ii) an odd numbered address, except on Thursday between the hours of 4:00 a.m. to 9:00 a.m. and 7:00 p.m. to 10:00 p.m.;

(b) no person shall use Water to wash sidewalks, driveways or parking lots, exterior windows or exterior building surfaces, except as necessary for repair or if required by law to comply with health or safety regulations; and

(c) a person may

(i) water trees, shrubs, flowers and vegetables on any day with a Sprinkler during the prescribed hours for Stage 2 lawn watering and on any day at any time if watering is done by hand-held container or a hose equipped with a shut-off nozzle;

(ii) water newly planted trees, shrubs, flowers and vegetables by any method during

installation and for the following 24 hours;

(iii) use Micro-irrigation or Drip- irrigation systems to water trees, shrubs, flowers and vegetables at any time on any day;

(iv) water all weather playing fields at any time if failure to do so will result in a permanent loss of plant material; and

(v) wash a vehicle with Water using a hand held container or hose equipped with a shut-off nozzle and at car dealerships and commercial car washes.

(2) As exceptions to Stage 2 restrictions,

(a) Owners or Occupiers of property who, by reason of physical or mental incapacity, are unable to water their property within the restricted days and times, may water their property on one day per week for a maximum of 9 hours per day;

(b) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;

### **3. STAGE 3 – NO LAWN WATERING**

(1) During Stage 3,

(a) no person shall

(i) water a lawn or Boulevard;

(ii) Fill a swimming pool, hot tub or garden pond;

(iii) Fill or operate a decorative fountain at any time; or

(iv) wash a Vehicle or a Boat with Water

(v) use Water to wash sidewalks, driveways or parking lots, exterior windows or exterior building surfaces, except as necessary for repair or if required by law to comply with health or safety regulations;.

(b) a person may

(i) water trees, shrubs, flowers and vegetables on any day between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m. if watering is done by hand-held container or a hose equipped with a shut-off nozzle;

(ii) water newly planted trees, shrubs, flowers and vegetables between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m. only by hand-held container or a hose equipped with a shut-off nozzle during installation and during the following 24 hours after installation is completed;

(iii) use Micro-irrigation or Drip- irrigation systems to water trees, shrubs, flowers and vegetables on any day between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.;

(iv) water all weather playing fields at any time, but only if failure to do so will result in a permanent loss of plant material;

(2) As exceptions to the Stage 3 restrictions,

(a) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions.

### **4. STAGE 4 – PROHIBITION OF WATERING AND OUTDOOR WASHING**

(1) During Stage 4,

(a) All restrictions in Stage 3 shall be in force

(b) no person shall use Water for any form of outdoor watering

(c) no person shall use Water for any form of outdoor washing or hosing of outdoor surfaces.

**SCHEDULE "B"**  
**to Bylaw No. \_\_\_: Water Conservation Bylaw, 2005****PERMITS**

1. During Stage 1, a person who has installed a new lawn, either newly seeded or new sod, may apply to the District for a Permit, which will allow the new lawn to be Sprinkled with Water outside of permitted days, but within Restricted Hours. The Permit shall be conspicuously displayed at the premises for which it was issued.
2. The District shall issue a Permit to an applicant pursuant to Section 1 upon payment to the District of a fee in an amount determined by the Trustees.
3. New sod may be watered for 21 days after installation and newly seeded lawn may be watered until growth is established or for 49 days after installation, whichever is less, provided a Permit pursuant to Section 1 has been issued for the premises at which the new lawn has been installed.
4. Permits will not be issued or be valid during Stages 2 or 3 restrictions.

## A3.B Conservation Measures

*The following information is included to assist Hagensborg Water District to design and implement future conservation measures, and to create further educational materials.*

Conservation measures are often categorized into 'hard' and 'soft' initiatives. Tools available to communities implementing hard conservation measures include:

1. Legal: provincial legislation and regulations, building codes and standards, bylaws, mandatory restrictions, and licensing.
2. Economic and financial - funding and granting conditions, price structuring, metering, and fines.
3. Operational and management – examples are water audits, leak detection programs, best management practices, cost/benefit analyses, treatment plants, backflow and cross connection control programs, recovery/reclamation/reuse/recycle programs, supply (quantity and quality) improvement projects, watershed protection projects, consumption and conservation potential studies, and emergency response plans.

Tools available to communities implementing 'soft' conservation measures include:

- **Planning** - municipal, local or regional land-use planning, watershed management planning, and strategic (utility) planning.
- **Voluntary Restrictions** - residents are asked to voluntarily limit their use of water during periods of demand or drought.
- **Educational and Information Sharing Initiatives** – these initiatives are listed below and will target residential users, commercial and industrial sectors, and schools.
  - Residential - workshops and seminars, news supplements and media announcements, public service announcements, internet information, billing supplements, publications and brochures, outdoor advertising, community and special events, public displays and exhibits, public opinion surveys, focus

- groups, voluntary in-home low-flow fixture and home retrofit programs, toilet leak detection tablet distribution programs, water line insulation programs, waterwise gardening programs, rain barrel programs, logos, speakers' packages, bike patrol programs, citizens task forces, door to door canvassing, community based water stewardship committees, and eco-education programs.
- Commercial/Industrial/Agricultural Initiatives - workshops and seminars, publications, billing supplements and media announcements.
  - School Programs- curriculum programs, poster, writing and other contests, class tours of water facilities, field trips to demonstration xeriscape gardens, publications, and special water related school activities.
- **Government 'lead by example'** – demonstration xeriscape gardens, water efficient irrigation on public properties, conservation information booths, conservation libraries, employee education, practicing indoor conservation measures in government and public building.
  - **Partnerships and Cooperation** – some examples include: partnerships with the British Columbia Water and Waste Association (BCWWA), membership on the Water Use Efficiency Committee, government - industry partnerships, federal government - local government partnerships, building relationships with other utilities, landscape related activities with landscape/irrigation experts, tourism related activities, cooperative associations with special interest groups, partnerships with science/educational enterprises, and cooperation with major users and businesses.

## **A3.C Seven Principles of Xeriscape Gardening**

*The following information is included to assist Hagensborg Water District to design and implement future conservation measures, and to create further educational materials.*

### **1. Planning and Design**

The important first step; ask yourself what it is you would like in your yard. These are some of the most common desires in a landscape:

- Shade and privacy,
- Fruits, flowers, herbs, and vegetables,
- Playground for children.

As is the case in any landscape design, you will also consider your time and money resources. Landscape professionals and local conservation societies can also serve as helpful resources. They can provide offer advice, and help you plan your landscape. Planning is an important step which will allow you to install or change your landscape in phases, which will reduce initial costs.

### **2. Soil Improvement**

Soils can vary within a given site; an analysis based on random sampling can provide information for plant selection and soil amendments. Your landscape will benefit from the addition of sphagnum peat moss, compost, aged manure or other decomposed organic materials. This will improve root development, water penetration and retention. Improve the soil before planting and installing the irrigation system.

### **3. Use appropriate plants**

Even plants with high water needs have a place in a xeriscape. Select plants based on the intended use of the landscape. Use of plants with low water needs and native plants will allow maximum water conservation.

### **4. Practical Lawn Areas**

Turf is best separated from areas with trees, shrubs, ground covers, and flowering plants so that it may be irrigated separately. Often turf can be replaced with other less water demanding materials such as ground covers, low water demand plants, or mulches.

### **5. Efficient Irrigation**

- Consider installing a water efficient drip system for shrubs and trees.



- Turf is best watered with sprinklers, but remember, grass is very thirsty so keep its irrigation system on its own valve.
- Aerate your lawn to improve water penetration.
- Water thoroughly rather than frequently.
- Water early in the morning to reduce loss due to evaporation.
- Ensure there are no leaks in your systems.

## **6. Use of Mulches**

Mulches cool soil, minimize evaporation, reduce weed growth, slow erosion, and provide landscape interest.

Organic mulches include:

- Bark chips, wood grindings, straw, dead leaves, compost.

Inorganic mulches include:

- Rock and gravel products.

## **7. Good Maintenance**

Regular maintenance includes pruning, weeding, proper fertilization, pest control, and irrigation system adjustments. In a xeriscape these chores will be at a minimum.

## **Useful Resources for Xeriscape Gardening**

*Websites:*

The BC Landscape and Nursery Association of British Columbia's 'GardenWise' website has listings of landscape and garden products, supplies and information for the entire province. It is located at:

<http://www.gardenwise.bc.ca>

<http://www.gardeningbc.com>

<http://www.xeriscape.org>

## A3.D Water-saving Devices and Efficient Appliance Use

*The following information is included to assist Hagensborg Water District to design and implement future conservation measures, and to create further educational materials.*

### Toilets

The toilet is the prime fixture to target when it comes to indoor water conservation. Approximately 26% of the water a household will use is 'flushed' down the toilet. If the toilet is more than fifteen years old it probably uses 18 or more litres per flush. It is possible to install water-saving devices at little or no cost. There are three main options for adapting your toilet to use less water:

- **Water displacement devices** - these devices familiar to most people are the plastic bags or bottles filled with water then suspended inside the toilet tank. They displace several litres of water, saving an equivalent amount during each flush.
- **Water retention devices** - The most common water retention device available is the toilet dam. A set will save about 5 litres per flush when properly installed. Their main attraction is their low cost – under \$10.00 per set.
- **Alternate flushing devices** - Alternative flush devices include early-closure and dual-flush. These are usually attached to the overflow tube inside the toilet tank, and in both cases close the flush valve or flapper after the tank is only partially emptied. In theory this occurs after the bowl has been cleared. The amount of water saved using the dual-flush mechanism is dependant on how long the flush lever is activated.

It is best to monitor the performance of the devices periodically, and if you discover that it becomes necessary to double flush the toilet, something needs to be adjusted or replaced.

### Clothes Washer

There was a time when laundering was one of many labour-intensive and resource-demanding chores that required efficient practices. Now however, with a seemingly unlimited supply of water and energy to heat water, and the effectiveness of laundry appliances, detergents and other laundry agents, much of the drudgery and unpleasantness has been removed from washing clothes.

Recent water shortages throughout BC has forced us to re-assess our wasteful laundering practices:

- Make sure clothes need to be laundered.
- Encourage children to change into play clothes after school so school clothes and play clothes can be worn more than one time.
- Only use the washing machine when you have a full load, but avoid overloading.
- Make sure you use the water-level indicator so that you use only the amount of water that is necessary.
- If your machine 'suds-saver' feature use it. This will reuse clean rinse water for the next load.
- Consider if it is possible to collect rinse water in a nearby washtub and reuse for soaking laundry or watering your garden.
- Choose the cold cycle whenever possible, reserve hot water loads for whites.
- Presoak very dirty clothes to avoid rewashing.

## **Showers**

There is a common misconception that bathing uses more water than showers. This is only true if showers are kept to less than 10 minutes. Installing low-flow showerheads will further reduce consumption. Reduce time in a shower. This will reduce your energy bills as well as saving water.

Conventional showerheads have an average flow rate of up to 20 litres per minute. Installing a properly designed low-flow showerhead can reduce that flow by half and still provide proper shower performance.

Consider purchasing a low-flow showerhead that also has a shut-off button. This allows you to interrupt the flow while you lather up or shampoo, and then resume at the same flow rate and temperature.

## **Faucets**

Consider how many times in a day we turn on a faucet and leave it running while we do something else. Faucets often run needlessly while we do simple tasks like teeth brushing, face washing, hair brushing, shaving, or cleaning.

Remember – turn off the taps!

Consider installing low flow aerators.

Conventional faucets have an average flow rate of 13.5 litres of water per minute. You can install low flow aerators to reduce this flow. As a rule of

thumb, 2 litres per minute should be sufficient for the bathroom, and 6 to 9 litres for the kitchen.

## **Leaks**

Leaks account for about 14% of the water consumption in a typical household and can occur in any given appliance. This is an excellent first step towards water conservation.

Leaking faucets are often caused by a worn out washer, which costs only pennies to replace. Most hardware stores will have faucet repair kits with illustrations showing how to replace a washer.

A toilet that continues to run after flushing, if the leak is large enough, can waste up to 200,000 litres of water in a single year! To find out if you have a leaking toilet, put a few drops of food colouring in the tank at the back of the toilet. Wait a few minutes. If the colour shows up in the bowl, there is a leak.

A flush or flapper valve that isn't sitting properly in the valve seat, a bent or misaligned flush valve lift wires, or a corroded valve seat often causes toilet leaks. All of these are inexpensive and easy to fix.

## **Drinking Water and Kitchen Use**

Typically, less than 5% of the water your family consumes is used in the kitchen for drinking or food preparation.

Dishwashers account for about 1.4% of total household water. The machine should always have a full load before it is used.

Place drinking water in the refrigerator to cool rather than letting the faucets run.



## A3.E Efficient Irrigation - Residential

*The following information is included to assist Hagensborg Water District to design and implement future conservation measures, and to create further educational materials.*

### Reduce

The following is a list of measures that can reduce summer water consumption simply by changing habits.

- Do not irrigate if rain is in the forecast.
- Adjust sprinklers so water is aimed directly at plants rather than sidewalks, paths, driveways or fences. Use sprinklers that emit large droplets rather than a fine mist, again to reduce losses due to evaporation.
- Sprinklers that lay water down in a flat pattern are better than oscillating sprinklers which lose as much as 50 percent of what they disperse through evaporation. Drip irrigation systems which apply water only to the roots zone are the most efficient – and the most expensive alternative.
- Don't water until plants need it. That may sound strange, but far more plants die from over-watering than under-watering. How do you know plants need water? The best way is to let your finger be the guide. Dig down several inches near the base of the plant. If the soil is bone dry, that's your cue to water.
- Stop watering whenever runoff occurs, especially on slopes. That may mean turning the water on and off in cycles to allow moisture to soak into the ground, but it beats watching the water flow down the street.
- Use watering cans, whenever possible, especially when watering just a few patio plants. Watering with a hose may actually put more water on the patio than in the containers as you move from plant to plant.



### Repair Leaks

- Check outside taps for leaking water. A hose mistakenly left dribbling away in the grass or garden can waste thousands of gallons of water over the summer. Remember to close outside faucets tightly every time you shut off the water.
- Replace outdoor hoses that are damaged or leak water.
- Repair or replace leaky pipes.
- Check and maintain your sprinkler system. Repair and replace all leaking or broken sprinkler heads. If you can't get it fixed right away, shut off the sprinkler system or at least that zone so that waste doesn't

## **Retrofit with Efficient Devices and Irrigation Systems**

### Drip and Micro-irrigation

These systems use low-water-volume components at low pressure. This method works well for trees and shrubs and will deliver precise amounts of water to the root zone of the plant.

### Soaker Hoses

This type of watering is good for flower and vegetable gardens. Soaker hoses provide low-volume watering and thus reduces puddling and runoff problems.

### Timers

Timers can be attached to hoses and outdoor faucets. They can be purchased at hardware and gardening stores. The benefit of timers is that it prevents over-watering and can be set to early morning watering which is the most efficient.

### Moisture Sensor

On automatic sprinkler systems, install a moisture sensor. This is a probe placed in the ground that determines when the soil needs water and then turns on the sprinkler. This is probably one of the smartest water-saving devices ever invented. It can save you tons of water and money.

### Controllers

Consistent watering regimens and simple scheduling adjustments are just a couple of the benefits of an automatic controller. On the other hand, a malfunctioning system can flood a landscape and possibly do damage to nearby buildings. Controllers need to be started up in the spring and adjusted for changing rainfall months. In the winter the system must be cleared to prevent freezing or blocking.

## **A3.F Pamphlets**

This section of the appendix consists of a folder with:

**An Indoor water conservation pamphlet**

**An Outdoor water conservation pamphlet**





## A3.G Approaches to Water Pricing

The cost of supplying potable water has been increasing significantly in many parts of Canada. However there has not always been a corresponding increase in the price of water charged to the consumer. Some reasons that costs have increased in BC include:

- new requirements imposed by the British Columbia Drinking Water Protection Act ([http://www.qp.gov.bc.ca/statreg/stat/D/01009\\_01.htm](http://www.qp.gov.bc.ca/statreg/stat/D/01009_01.htm)),
- the need to develop more remote and expensive water supplies to keep up with population growth,
- the need to replace ageing infrastructure, and
- rapid economic development in some areas.

### Utility Revenue Factors

Factors affecting the revenue requirements to recover these costs include:

- |                              |  |
|------------------------------|--|
| • Number of customers served | • Inflation  |
| • Customer water use         | • Interest Rates                                     |
| • Non-recurring sales        | • Capital Financing Needs                            |
| • Weather                    | • Changes to tax laws                                |
| • Conservation               | • Other changes to operating and economic conditions |
| • Use Restrictions           | • Price elasticity                                   |

Most water utilities strive towards an equitable price structure to recover costs. Essentially this means that those who use more water should pay more money.

### Water Rate Structures

A *Water Rate Structure* is a fee or schedule of fees that includes:

- Classifications of customers served,
- Frequency of billing
- Schedule of charges for each class of customer

It can be a challenge to select a rate structure that is responsive to the objectives of both the utility and its community. Pricing policies have an affect on the utility's revenues, as well as the community's social, economic, political and environmental concerns.

Historically, because water has been an insignificant expense in relation to other utilities, customers generally paid little attention to their water bills or the rate structures. As water becomes more expensive to purchase, customers pay more attention to the cost of water, especially the way that water charges are made. Consequently, as water suppliers increase prices, consumers tend to pay more attention to water conservation.

Some common rate structures are:

- **Flat-rate:** customers are charged a fixed price (For example, \$500 per annum) regardless of the amount of water consumed.
- **Uniform rate:** customers are charged in proportion to the amount of water they consume. For example, \$3.49 per m<sup>3</sup>.
- **Inclined Block rate:** customers are charged a certain rate up to a maximum amount of consumption, then the rate increases if the customer continues to use more water. For example, \$3.49 per m<sup>3</sup> up to 10m<sup>3</sup>, \$4.25 per m<sup>3</sup> from 10m<sup>3</sup> to 25m<sup>3</sup>, \$5.60 per m<sup>3</sup> from 25m<sup>3</sup> to 75m<sup>3</sup>, and so on...
- **Seasonal rate:** customers are charged more during the summer, when water is at a premium, than during the rest of the year.

### **Rate Selection Process**

A rate selection process can be lengthy and controversial. Many water organizations obtain experienced advice to help them through the process. Typically there are three main steps:

**Step 1 – Define Goals and Objectives**

It is important to understand why alternative rates structures are being considered. The following table provides some guidelines to help define goals and objectives

Factors to Consider	Rate Structure Objectives
<ul style="list-style-type: none"> <li>• The utility’s history</li> </ul>	<ul style="list-style-type: none"> <li>• Yielding necessary revenue in a stable and predictable manner</li> </ul>
<ul style="list-style-type: none"> <li>• How customers respond to existing and previous structures and increases</li> </ul>	<ul style="list-style-type: none"> <li>• Minimizing unexpected changes to customer bills</li> </ul>
<ul style="list-style-type: none"> <li>• Who are the major classes of customers</li> </ul>	<ul style="list-style-type: none"> <li>• Discouraging wasteful use and promoting justified uses</li> </ul>
<ul style="list-style-type: none"> <li>• The availability of water resources</li> </ul>	<ul style="list-style-type: none"> <li>• Promoting fairness and equity</li> </ul>
<ul style="list-style-type: none"> <li>• The level of current or future costs</li> </ul>	<ul style="list-style-type: none"> <li>• Avoiding discrimination</li> </ul>
<ul style="list-style-type: none"> <li>• Customer and utility concerns</li> </ul>	<ul style="list-style-type: none"> <li>• Maintaining simplicity, certainty, convenience, feasibility, and freedom from controversy</li> </ul>
<ul style="list-style-type: none"> <li>• Socioeconomic status and concerns of customers</li> </ul>	<ul style="list-style-type: none"> <li>• Compliance with applicable laws</li> </ul>
<ul style="list-style-type: none"> <li>• Legal constraints on the utility</li> </ul>	

**Step 2 – Evaluate Available Options**

The first item to assess is the level of effort that will be involved in evaluating options. Typically a core group will study the issue and consult with the public at open meetings. This group should have representation from staff, governing board and customers who will be affected.

Next, a list of alternative rate structures should be identified. Although customer classes and billing frequency should be discussed, most discussion will be around the consumption charges. There are four basic types of charges: declining block, uniform block, inclining block, and seasonal. In addition to these charges, there are options such as service charges, meter charges, and minimum charges.

Finally, both quantitative and qualitative evaluation criteria are developed to determine how well each alternative meets the selected rate objectives. For

example, revenue stability can be assessed with quantitative analysis whereas perceived fairness may often be determined using qualitative criteria.

### **Step 3 – Understand and Communicate Outcomes**

Information such as the revenue effects, and typical customer bills under various rate structures must be communicated. Simple charts, graphs and matrix figures tend to work well for a wide range of audiences because the display reinforces the message, and the numbers add information. Technical outcomes must be presented in easily understood formats that express and support the technical analysis in non-technical terms.