



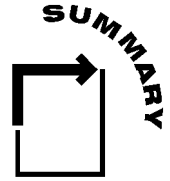
Greater Vernon Water

Master Water Plan



March 2004

EXECUTIVE SUMMARY



The Master Water Plan (MWP), completed in the spring of 2002, established the goals and direction for long-term regional water system planning for the Greater Vernon area. The MWP set out an aggressive strategy to improve the quality of drinking water, delivered to the customers. The plan also focused on the continued importance of irrigation water supply to the agricultural industry and set out a strategy to maintain cost competitive water delivery.

The two key elements of the plan were the separation of irrigation and domestic water systems in the short term and the construction of a single, central water treatment plant to provide treated water to the domestic water distribution system. Considerable progress has been made towards implementation of the plan over the last two years. A new regional utility, Greater Vernon Water (GVW) has been formed and is functioning well. Additional technical work to further refine the original plan has been carried out.

In spite of all of the successes in implementing the plan to date, there has been one area of disappointment – the lack of success in achieving senior government funding. The GVW is still actively pursuing senior government funding and is confident that these additional dollars will be forthcoming at some point in the future. In the short-term, however, it is necessary to change the direction of the plan in order to still achieve the critical health protection goals, while at the same time keeping water rate increases to an affordable level.

Why an Addendum?

While the original MWP provided a robust, flexible direction, the cost impacts in the next few years would be significant. Proceeding with the plan was predicated on the receipt of capital grants from the senior levels of government and a willingness of GVW to increase water rates substantially in the near term. In spite of the efforts by the GVW, by mid-2003, it was clear that senior government funding was not forthcoming in the near term. The GVW needed to change direction. In September 2003, the GVW Project Director, presented the Greater Vernon Services Commission (GVSC) Committee with a proposed water system development financing strategy that would reduce capital expenditures in the first phase of the work to the point where the utility would be “self funded” through water user rates. The Committee agreed with this approach.

This addendum is intended to develop additional details on the revised direction and confirm that the first phase work can be accomplished with a reasonable increase in water rates over the next several years.

The Proposed Direction

The three fundamental elements of the MWP remain. These are:

- *Domestic water quality will be improved on a phased basis, with the ultimate goal of meeting or exceeding the targets set out in the MWP.* These targets reflect what will likely be the future regulations in British Columbia. They are also consistent with other jurisdictions in Canada and the USA.
- *The use of two water supply sources provides flexibility and reliability.* The use of two major sources provides the operational flexibility to optimize the most cost effective water supply at various times of the year. In particular, the gravity flow potential of the Duteau Creek supply can be used to reduce supply power costs. In addition, the availability of two supplies allows one source to be taken off-line in the event of emergency conditions that would compromise the drinking water quality in one of the water supplies.
- *Separation of the existing combined water system will provide the most cost effective water management in the long term.* Portions of the existing water distribution system serve both domestic and agricultural irrigation customers (termed the “combined system”). On an annual basis, approximately 80% of this water is used for irrigation of agricultural land. With the increasing requirement for drinking water treatment, it does not make economic sense to treat the water going to irrigation. Separation of the existing combined system into separate domestic water and irrigation water systems will allow the appropriate water quality to be applied to the end use.

The revised direction of the MWP is not entirely new. It was one of the options that was seriously considered in the preparation of the original MWP. What the GVW has been able to do, however, is to take advantage of recent water treatment technology advances in ultraviolet disinfection and high-rate clarification to make the option more cost effective and more robust in terms of treatment performance.

There are two major changes from the original MWP. The first is that there will be two water treatment plants (one on the Kalamalka Lake supply and one on the Duteau Creek source), instead of the single central plant. The second is that the separation of the combined water distribution system will be phased over a longer period. This means that all the water in the combined system will be treated to drinking water quality in the early years of the plan. Full separation will occur in the second phase of the plan.

The main components of the revised regional water strategy are as follows.

1. The new, enclosed McMechan Reservoir, currently under design, will be commissioned in early 2005. This will eliminate the use of the old, open water reservoir at the site – a key part of achieving the drinking water public health protection goals.
2. The Kalamalka Lake source will continue as one of the two domestic water sources. The first phase of implementation will see ultraviolet disinfection added to reduce the public health risk quality associated with this water supply. The treatment works will be located at the Mission Hill site, on the south side of the City. The Phase 1 works will also include clearwell storage, secondary chlorination, and treated water pumping into the PZ 483 pressure zone.
3. The second phase of water quality improvement on the Kalamalka Lake supply will consist of the addition of chemical coagulation and separation (filtration) processes to deal with the potential taste and odour problem and high turbidity. This second phase work will not proceed until senior government funding is available. The taste and odour issue is not a direct health issue and is an intermittent problem that only occurs for a short period of time in some years. The availability of two treated water supplies will give the GVW more flexibility in dealing with the issue, until additional treatment processes are implemented in the second phase.
4. The capacity of the Kalamalka Lake supply system will be upgraded from the existing 30 ML/d to about 60 ML/d. The existing pumping station on the lake will be converted to a raw water pumping station, pumping to the new Mission Hill water treatment plant. The existing pumps will be replaced with large capacity pumps and a general refurbishing of the station carried out to improve operational conditions.

5. A new water treatment plant will be constructed for the Duteau Creek supply. The plant would be located in the eastern Coldstream Valley, west of the Duteau Creek Headgates. This plant will have an initial capacity of about 160 ML/d. It will direct treated water into the existing combined water distribution system. Water treatment processes will include high-rate clarification, ultraviolet disinfection and secondary chlorination. Once separation of the combined water distribution system is complete, this plant will only provide water to the separated domestic water distribution system.

6. The first phase of separation of the combined water system will focus on the Bella Vista - Swan Lake area, south of Goose Lake. The Goose Lake reservoir will become part of the irrigation system. It will no longer provide water for domestic use. This will eliminate any potential public health risk associated with the open reservoir. Separation of this area, along with other areas where irrigation supply can be provided by a local, untreated water source, will reduce the peak demands on the Duteau Creek supply. This will allow a downsizing of the new water treatment plant, since the full initial capacity will not be required once separation of the combined water distribution system is complete. Operating economics and the need to add filtration to the Duteau Creek supply will drive the timing of separation of the remaining combined system. At this point, it is expected that separation will be completed in the 2011 to 2021 time frame.

Summary

The original MWP was a sound direction that would have accomplished the regional water goals in a short time frame. Unfortunately, without senior government funding, this scheme would put a significant financial burden on existing domestic water customers. Due to advances in water treatment technologies in the last few years, the GVW has been able to refine and improve one of the other strategies considered in the original MWP planning work. The revised direction accomplishes the short-term needs of improved drinking water protection and system reliability, while still meeting the long-term regional water management goals.

The new direction accomplishes the goal of reducing the capital expenditures in the initial phase of construction to an amount that can be funded without a significant water rate increase. The expected capital expenditure in this first phase will be in the order of

\$35 million (in 2003 dollars) – down from the original MWP spending of \$72 million. Has the need to spend the additional dollars disappeared? No - what the change has done is to shift some of the capital dollars into the future, where they can be funded by a larger water user base and, hopefully, by senior government funding.

The new direction requires that water quality improvements be achieved by treating a larger quantity of water in the near term – water going to both domestic and irrigation use. This will increase the *operating cost* of delivering domestic water in the short-term. The overriding benefit, however, is that the overall strategy is more affordable to the existing water users – a key factor in accomplishing the successful implementation of a regional water strategy.

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THE MASTER WATER PLAN

SECTION 1

1.1 THE BACKGROUND

The Master Water Plan (MWP), completed in the spring of 2002, established the goals and direction for long-term regional water system planning for the Greater Vernon area. The MWP set out an aggressive strategy to improve the quality of drinking water, delivered to the customers. The plan also focused on the continued importance of irrigation water supply to the agricultural industry and set out a strategy to maintain cost competitive water delivery.

The two key elements of the plan were the separation of irrigation and domestic water systems in the short term and the construction of a single, central water treatment plant to provide treated water to the domestic water distribution system. Considerable progress has been made towards implementation of the plan over the last two years. A new regional utility, Greater Vernon Water (GVW) has been formed and is functioning well. Additional technical work to further refine the original plan has been carried out.

In spite of all of the successes in implementing the plan to date, there has been one area of disappointment – the lack of success in achieving senior government funding. The GVW is still actively pursuing senior government funding and is confident that these additional dollars will be forthcoming at some point in the future. In the short-term, however, it is necessary to change the direction of the plan in order to still achieve the critical health protection goals, while at the same time keeping water rate increases to an affordable level.

1.2 THE FORMAT

The original Master Water Plan was based on fourteen working papers that covered the various elements of the regional water plan. The addendum process involved the preparation of a “fifteenth” working paper that followed the same format as the original work.

The objective of Working Paper No. 15 was to document the activities to date and to propose any revisions to the original MWP, while keeping the regional water goals in sight. This working paper was reviewed with the Technical Steering Committee at a workshop. The Committee comments were incorporated into the final version.

This addendum report presents a summary of the working paper. The reader is directed to Working Paper No. 15 for additional information on the details of the revised MWP direction.

R E P O R T

WHY AN ADDENDUM?

In any project implementation, proceeding from the planning level to construction takes place in steps. At each step, additional information is available to refine the original direction or, perhaps, to modify the course. Many of the technical activities, which have occurred over the last 18 months, have filled in gaps in the information or taken engineering planning to a higher level. The conclusions of the work, in general, are consistent with the assumptions of the MWP and, on their own, would not dictate an addendum.

What has been most significant is the outcome of financial planning to date. While the original MWP provided a robust, flexible direction, the cost impacts in the next few years would be significant. Proceeding with the plan was predicated on the receipt of capital grants from the senior levels of government and a willingness of GVW to increase water rates substantially in the near term.



Kalamalka Lake

In spite of the efforts by the GVW, by mid-2003, it was clear that senior government funding was not forthcoming in the near term. The GVW needed to change direction. In September 2003, the GVW Project Director, presented the Greater Vernon Services Commission (GVSC) Committee with a proposed water system development financing strategy that would reduce capital expenditures in the first phase of the work to the point where the utility would be “self funded” through water user rates. The Committee agreed with this approach.

This addendum is intended to develop additional details on the revised direction and confirm that the first phase work can be accomplished with a reasonable increase in water rates over the next several years.

In order to achieve these reduced initial expenditures, the regional water plan will now focus on one of the original directions, looked at in the MWP. This strategy would see a more gradual separation of the combined system into separate irrigation and domestic

systems. It requires the use of two water treatment plants – one on the Kalamalka Lake supply and one in the eastern Coldstream Valley on the Duteau Creek source.

Both the original MWP direction and the proposed revised direction are viable technical solutions. They differ primarily in the phasing of combined water system separation. The key to the revised direction is that the regional water scheme is now more affordable to the existing water customers.

WHAT'S BEEN ACCOMPLISHED

3.1 ACTIVITIES SINCE 2002

Since the approval of the MWP in the spring of 2002, progress has been made on a number of fronts. These include:

Organization	Activity
Greater Vernon Water	<ul style="list-style-type: none"> formation of Greater Vernon Water, under the GVSC
Sandwell Engineering	<ul style="list-style-type: none"> appointment as Program Manager development of a program to oversee the regional water implementation
Greater Vernon Water	<ul style="list-style-type: none"> continued financial planning and funding discussions with senior levels of government
KWL Associates / QDS Quadra Development Solutions	<ul style="list-style-type: none"> development of a water distribution hydraulic model and additional planning on combined water distribution separation
Sandwell Engineering	<ul style="list-style-type: none"> review of the transfer of water licenses
Sandwell Engineering	<ul style="list-style-type: none"> piloting of various water treatment technologies on the Kalamalka Lake and Duteau Creek sources
QDS Quadra Development Solutions	<ul style="list-style-type: none"> siting investigations for water treatment plant sites in the western Coldstream Valley – Kalamalka Lake area
Associated Engineering	<ul style="list-style-type: none"> preliminary engineering and geotechnical assessment of a potential water treatment plant site in the western Coldstream Valley

Associated Engineering	<ul style="list-style-type: none"> design of the new McMechan Reservoir
Larratt Aquatic Consulting	<ul style="list-style-type: none"> continuation of the Kalamalka Lake Water Quality Study
Greater Vernon Water	<ul style="list-style-type: none"> implementation of more comprehensive raw and treated water quality data systems

3.2 THE RESULTS

As a result of the activities to date, it is possible to draw stronger conclusions or to set a more definitive direction on the regional water issues. These include:

Water Demand Projections

There is a higher level of confidence on existing water usage patterns. This provides a strong platform for future projections. While a range of total water consumption for the region can be reasonably estimated, prediction of the quantity of domestic water that will be required is more challenging. This is because the amount of domestic water required is tied into the separation of the combined water distribution system.

If the combined system is fully separated, less domestic water is required. If some of the areas that require more expensive separation remain as combined areas, the amount of domestic water usage goes up. Further analysis is underway to determine the economic “sweet-spot” on how far to go with separation. This will then define the domestic water required and the size of the water treatment plants.



Don Weixl Photo

City of Vernon

Source Water Quality

More information is available on the two major sources – Duteau Creek and Kalamalka Lake. With the formation of GVW, raw water monitoring has been consolidated and automated, continuous measurement of select parameters is being carried out. This information will be invaluable in the planning and design of the two water treatment plants.



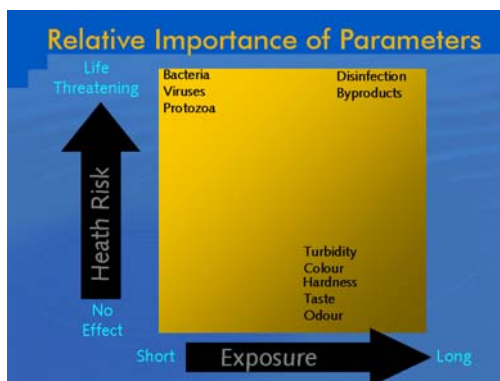
Kalamalka Lake

The potential for reoccurrence of the taste and odour problem, experienced in 1999, on the Kalamalka Lake supply is still not fully defined. There has not been an event since 1999, however, limnological studies indicate that there is a strong likelihood that taste and odour problems will occur on an intermittent basis. Given the current lack of senior government funding, the potential taste and odour problem will not be tackled in the first phase, as it is not

a public health issue. The treatment strategy developed, however, will allow the issue to be dealt with once the dollars are available.

The Regulatory Situation

The regulatory situation in British Columbia has not changed significantly since the completion of the MWP – the future direction is still not clear. On one hand, the continued flexibility of the regulatory approach is compatible with the phasing of water treatment contained in the MWP. On the other hand, the lack of definitive regulations,



coupled with the fact that authority now exists at a local level, creates more uncertainty. This introduces a greater degree of risk relative to regulatory decisions, particularly on the turbidity criteria and need for filtration.

The new Drinking Water Officer for the Okanagan has recently been appointed. Initial discussions with Mike Adams and his staff on

the proposed MWP direction have been positive. It is intended to submit the updated MWP to the Drinking Water Officer, once it has been approved by the GVSC Committee.

Water Treatment Technology

There have been two significant advances in water treatment technology since the original plan work. These form a key basis for the MWP revision.

The first is in ultraviolet (UV) disinfection technology. In early 2000, the technology was gaining acceptance in larger water treatment plants as a primary disinfection process. Much of the experience was in using UV following a filtration process, to ensure that turbidity levels were low enough to allow effective disinfection, particularly for cryptosporidium oocysts. Since that time, there has been additional studies and experience in using UV on unfiltered supplies. This experience, coupled with additional raw water data collected on the Kalamalka Lake source, mean that UV and chlorination alone can be used as an effective first step in improved water treatment.



Clarification Process

The second major advance is in the area of high-rate clarification. A number of proprietary processes are in various stages of development and application. Two processes that are particularly attractive for the Duteau Creek source are:

- AquaDAF™ high-rate dissolved air flotation process, developed by Odeco Degremont.
- Actiflo™ high-rate ballast assisted clarification process, developed by US Filter.

The original concept, looked at in the MWP, suggested a large, open earth basin clarification system that is used by the Black Mountain Irrigation District. There were two major disadvantages with this approach. The first was that the performance is variable and inefficient, presenting a very real risk of not meeting the water quality goals.

The second is that the large basin would not be needed after combined system separation. This would result in a significant redundant capital cost.

With the emergence of the high-rate clarification processes, it is feasible to replace the large, earth basins with a very compact mechanical plant. This will vastly improve the performance and allow the process to be more cost effectively integrated into the ultimate treatment plant, following the completion of system separation.

Water Distribution Separation

The additional hydraulic modeling and preliminary engineering analysis has looked at the details of combined water distribution system separation in much more depth than in the concept planning under the MWP. The work to date has generally confirmed the accuracy of the originally estimated costs. As recommended in the MWP, the recent work has also looked at how far to go with system separation. This includes supplying some areas of the combined system with domestic water or using point-of-entry treatment units at individual homes in rural areas that are on the future irrigation supply.

The revised plan direction opens up different doors in terms of separation timing and opportunities, due to the provision of treated water in both the separate and combined water distribution systems in the near term. Proper planning of the separation program is even more complex, as the driver is now economics not water quality. The separation decisions and timing need to consider not only distribution piping issues but water treatment costs as well. The revised plan direction provides the flexibility to handle a range of separation scenarios.



Senior Government Funding

The decision on the original direction of the MWP was based partly on the expectation of senior government funding through the Canada-British Columbia Infrastructure Program. The magnitude of the funding would dictate how steeply the water user rates would need to increase to fund the capital improvements. An application, with a supporting

documentation, was submitted to the program in mid-2002. To date, no commitment of senior government funding has been received.

It is still the intention of GVW to aggressively pursue senior government funding. Under the new strategy, the Phase 1 work will precede based solely on GVW financing. The Phase 2 work, that will deal with the taste and odour issue on the Kalamalka Lake supply and add further multi-barrier treatment protection, will proceed when senior government funding is obtained.

MASTER WATER PLAN REVISIONS

SECTION 4

The original goal of regional water management is still the same:

To ensure the economical supply and distribution of a sufficient quantity and quality of water in the interests of both the agricultural and non-agricultural users in the Greater Vernon community.

What will change is how this goal is reached. The three fundamental elements of the MWP remain. These are:

- *Domestic water quality will be improved on a phased basis, with the ultimate goal of meeting or exceeding the targets set out in the MWP. These targets reflect what will likely be the future regulations in British Columbia. They are also consistent with other jurisdictions in Canada and the USA.*
- *The use of two water supply sources provides flexibility and reliability. The use of two major sources provides the operational flexibility to optimize the most cost effective water supply at various times of the year. In particular, the gravity flow potential of the Duteau Creek supply can be used to reduce supply power costs. In addition, the availability of two supplies allows one source to be taken off-line in the event of emergency conditions that would compromise the drinking water quality in one of the water supplies.*
- *Separation of the existing combined water system will provide the most cost effective water management in the long term. Portions of the existing water distribution system serve both domestic and agricultural irrigation customers (termed the “combined system”). On an annual basis, approximately 80% of this water is used for irrigation of agricultural land. With the increasing requirement for drinking water treatment, it does not make economic sense to treat the water going to irrigation. Separation of the existing combined system into separate domestic water and irrigation water systems will allow the appropriate water quality to be applied to the end use.*

The revised direction of the MWP is not entirely new. It was one of the options that was seriously considered in the preparation of the original MWP. What the GVW has been able to do, however, is to take advantage of recent water treatment technology advances

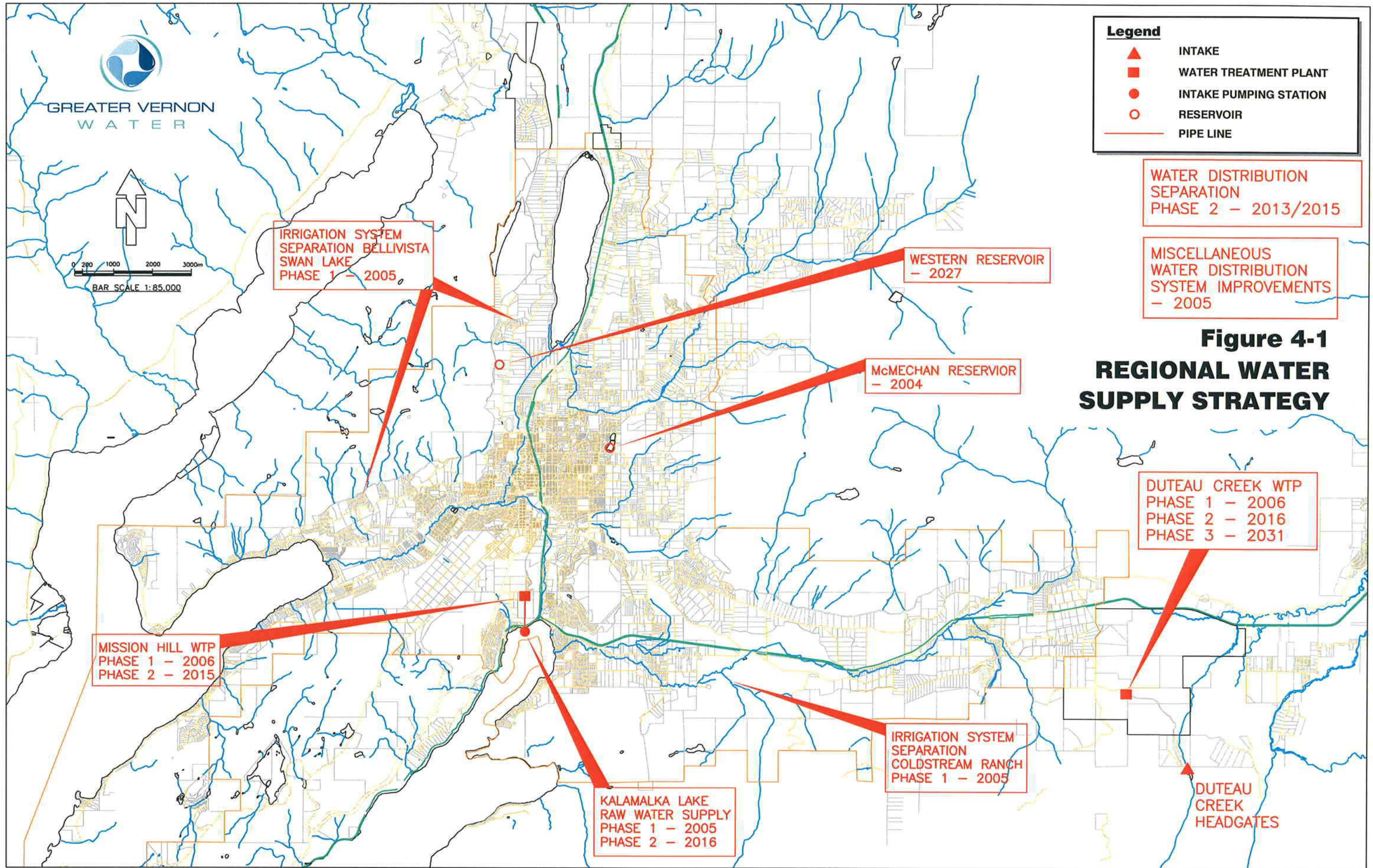
in ultraviolet disinfection and high-rate clarification to make the option more cost effective and more robust in terms of treatment performance.

There are two major changes from the original MWP. The first is that there will be two water treatment plants (one on the Kalamalka Lake supply and one on the Duteau Creek source), instead of the single central plant. The second is that the separation of the combined water distribution system will be phased over a longer period. This means that all the water in the combined system will be treated to drinking water quality in the early years of the plan. Full separation will occur in the second phase of the plan.

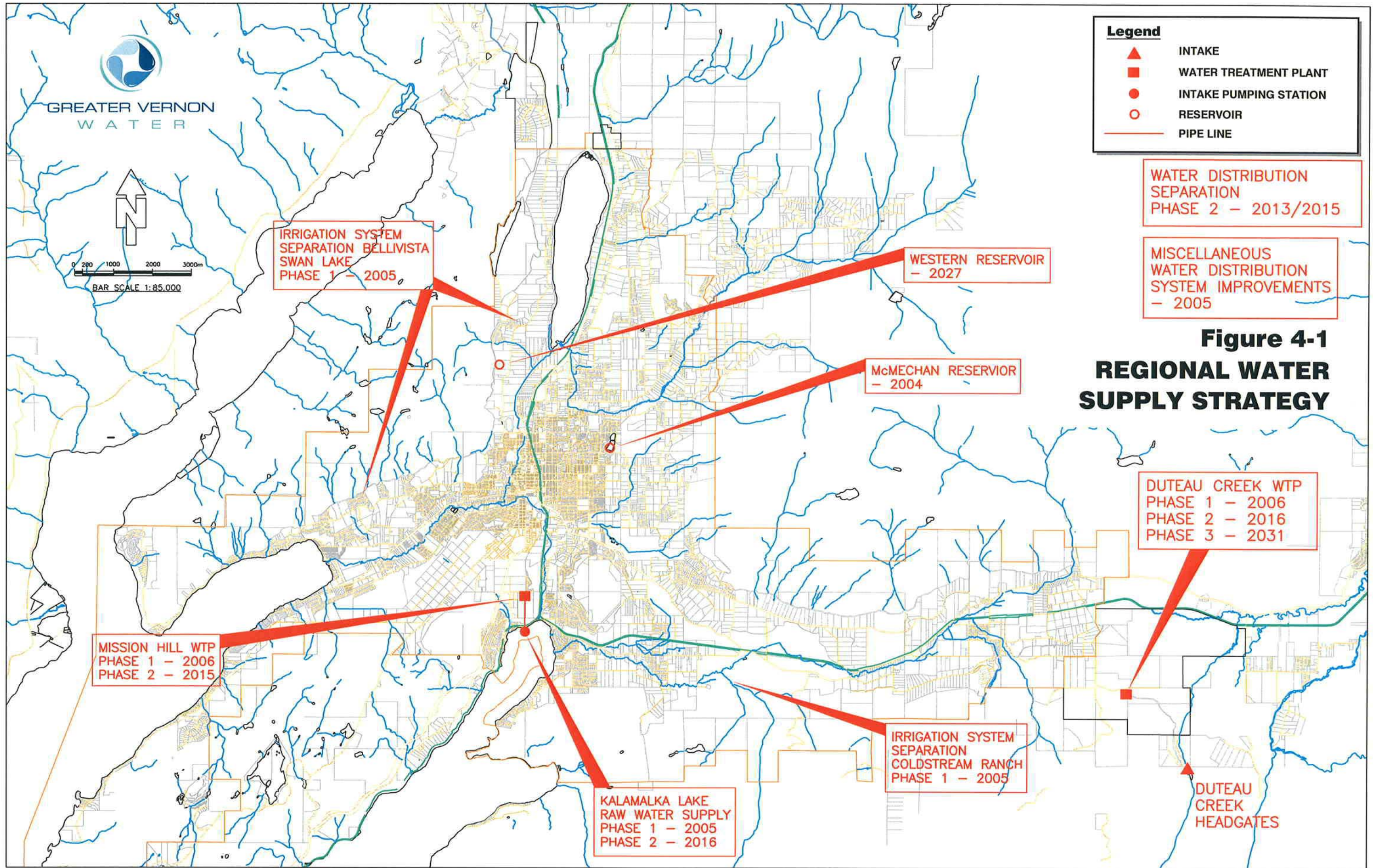
The main components of the revised regional water strategy are as follows. A schematic of the proposed regional water system approach is shown in Figure 4-1.

1. The new, enclosed McMechan Reservoir, currently under design, will be commissioned in early 2005. This will eliminate the use of the old, open water reservoir at the site – a key part of achieving the drinking water public health protection goals.
2. The Kalamalka Lake source will continue as one of the two domestic water sources. The first phase of implementation will see ultraviolet disinfection added to reduce the public health risk quality associated with this water supply. The treatment works will be located at the Mission Hill site, on the south side of the City. The Phase 1 works will also include clearwell storage, secondary chlorination, and treated water pumping into the PZ 483 pressure zone.
3. The second phase of water quality improvement on the Kalamalka Lake supply will consist of the addition of chemical coagulation and separation (filtration) processes to deal with the potential taste and odour problem and high turbidity. This second phase work will not proceed until senior government funding is available. The taste and odour issue is not a direct health issue and is an intermittent problem that only occurs for a short period of time in some years. The availability of two treated water supplies will give the GVW more flexibility in dealing with the issue, until additional treatment processes are implemented in the second phase.
4. The capacity of the Kalamalka Lake supply system will be upgraded from the existing 30 ML/d to about 60 ML/d. The existing pumping station on the lake

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will be converted to a raw water pumping station, pumping to the new Mission Hill water treatment plant. The existing pumps will be replaced with large capacity pumps and a general refurbishing of the station carried out to improve operational conditions.

5. A new water treatment plant will be constructed for the Duteau Creek supply. The plant would be located in the eastern Coldstream Valley, west of the Duteau Creek Headgates. This plant will have an initial capacity of about 160 ML/d. It will direct treated water into the existing combined water distribution system. Water treatment processes will include high-rate clarification, ultraviolet disinfection and secondary chlorination. Once separation of the combined water distribution system is complete, this plant will only provide water to the separated domestic water distribution system.
6. The first phase of separation of the combined water system will focus on the Bella Vista - Swan Lake area, south of Goose Lake. The Goose Lake reservoir will become part of the irrigation system. It will no longer provide water for domestic use. This will eliminate any potential public health risk associated with the open reservoir. Separation of this area, along with other areas where irrigation supply can be provided by a local, untreated water source, will reduce the peak demands on the Duteau Creek supply. This will allow a downsizing of the new water treatment plant, since the full initial capacity will not be required once separation of the combined water distribution system is complete. Operating economics and the need to add filtration to the Duteau Creek supply will drive the timing of separation of the remaining combined system. At this point, it is expected that separation will be completed in the 2011 to 2021 time frame.

The estimated capital costs for the revised MWP direction are shown in Table 4-1. The period of 2004 to 2010 has been shown as “Phase 1”. The second and third phases cover the periods from 2011 to 2021 and beyond 2022, respectively. Costs have been updated to 2003 dollars. The capital cost components include a 30% engineering and contingency allowance.

Table 4-1
Capital Costs
Regional Water System

ELEMENT	COST (MILLION \$) ¹		
	PHASE 1 2004 TO 2010	PHASE 2 2011 TO 2020	PHASE 3 2021 TO 2041
Regional System Planning	0.3		
Water Supply	1.3	2.9	2.0
Water Treatment			
• Duteau Creek WTP	16.1	5.0	3.0
• Mission Hill WTP	6.0	14.0	
Water Transmission/Storage			
• McMechan Reservoir	4.0		
• Other Improvements	0.3	9.6	4.0
Water Distribution			
• Combined System Separation	5.5	22.1	
• Other Improvements	1.5		
TOTAL BY PHASE	35.0	53.6	9.0
TOTAL			97.6

Notes:

1. Costs are in 2003 dollars. See Working Paper No. 15 for details on the components of each cost element.

THE NEXT STEPS

The suggested immediate actions and the time frames are summarized below.

Actions	Time Frame
<ul style="list-style-type: none"> • Detailed water supply delivery strategy and water treatment plant sizing development 	Spring 2004
<ul style="list-style-type: none"> • Preliminary design of the Duteau Creek water treatment plant 	Mid 2004
<ul style="list-style-type: none"> • Preliminary design of the Kalamalka Lake raw water supply upgrade and the Mission Hill water treatment plant 	Mid 2004
<ul style="list-style-type: none"> • Preliminary design of Phase 1 Separation Program 	Mid 2004

SUMMARY

The original MWP was a sound direction that would have accomplished the regional water goals in a short time frame. Unfortunately, without senior government funding, this scheme would put a significant financial burden on existing domestic water customers. Due to advances in water treatment technologies in the last few years, the GVW has been able to refine and improve one of the other strategies considered in the original MWP planning work. The revised direction accomplishes the short-term needs of improved drinking water protection and system reliability, while still meeting the long-term regional water management goals.

The new direction accomplishes the goal of reducing the capital expenditures in the initial phase of construction to an amount that can be funded without a significant water rate increase. The expected capital expenditure in this first phase will be in the order of \$35 million (in 2003 dollars) – down from the original MWP spending of \$72 million. Has the need to spend the additional dollars disappeared? No - what the change has done is to shift some of the capital dollars into the future, where they can be funded by a larger water user base and, hopefully, by senior government funding.

The new direction requires that water quality improvements be achieved by treating a larger quantity of water in the near term – water going to both domestic and irrigation use. This will increase the *operating cost* of delivering domestic water in the short-term. The overriding benefit, however, is that the overall strategy is more affordable to the existing water users – a key factor in accomplishing the successful implementation of a regional water strategy.