

CHAPTER 9

NON-ECONOMIC ANALYSIS

9.1 NON-ECONOMIC DISCUSSION FOR CHAPTER 8 ALTERNATIVES

The following discussion evaluates the non-economic considerations that need to be taken into account when choosing a preferred alternative. These factors are difficult to quantify monetarily, but are still critical in the preferred alternative selection process. Each of the alternatives will have two sections: positives and negatives.

9.2 SHORT-TERM ALTERNATIVES

9.2.1 Expand the Fort Union Source

Positives:

- Water quality is relatively known.
- The Fort Union is a known source to Gillette and is currently supplying a portion of their water supply needs. The Fort Union has been part of the Gillette system for some time and in its existing configuration is a known commodity.
- Fort Union water is soft. Hardness problems associated with other water sources are not a problem with Fort Union water.
- While not comprehensive, some previous study and research work has been performed regarding Fort Union aquifer properties.

Negatives:

- Fort Union water contains fluoride – especially if it is drawn from deep in the lower member at high rates. Fluoride levels in some of the individual wells are already in excess of the EPA Primary Standard of 4.0 mg/l. Many of the wells are in excess of the EPA Secondary Standard of 2.0 mg/l. Further there is a risk that the EPA may lower the Primary fluoride Standard to 2.0 mg/l, thereby forcing expensive treatment of most of the Fort Union water.

- The Fort Union expansion will require time to build. While not all of the wells will be required immediately, the pumping and transmission structures will be needed as soon as the first well is online.
- The life of the Fort Union Formation at elevated withdrawal levels is uncertain. Unless this option is combined with the ASR alternative as a long-term solution, the future serviceability of this infrastructure may be questionable and can not be relied upon as additive to another source.
- The Fort Union is a popular drinking water source for rural and semi-rural development in the area. Developing and obtaining a water right of the size contemplated may be difficult and may fall junior to other higher priority rights in the area, thereby reducing the certainty of enforcing withdrawal rights.

9.2.2 Treat the Fox Hills Source

Positives:

- The Fox Hills wells are already in place and producing for the City of Gillette. These wells provide known flow rates and are well proven.
- While not immediate, time to construct this alternative is shorter than some of the others.

Negatives:

- By itself, this option does not meet the 8-year planning criteria.
- Any other Fort Union expansion that would be treated at Pump Station #1 would compete with this water for capacity in Pump Station #1 and would require expansion of Pump Station #1 or alternative treatment of the Fort Union water.
- Waste stream disposal logistics.

9.2.3 Use Coal Bed Methane Water (Short-term and Long-term)

Positives:

- Discharge of CBM water has created some political issues locally and between the State of Wyoming and the State of Montana. Reusing that water for a politically prominent beneficial use would be positive for most parties involved.

- CBM operators may share in some of the costs associated with developing this alternative.
- Any incremental energy development that may be made possible by this alternative will provide an added economic benefit to the area.

Negatives:

- CBM operators have expressed a strong desire to deliver water on a constant or near-constant basis. Gillette's needs for additional water, particularly during the short-term planning period, are all peak driven. The constant delivery of CBM water to serve peak demands does not provide a full 8-year solution without storage.
- CBM operators operate their wells to maximize gas production, not to produce water. In reality, water production is a cost to them that they minimize as a matter of course. Initially this will likely not be a problem. However, if well water production declined and CBM operators could produce gas while pumping less, they would then have a competing interest with delivering water to Gillette.
- Ancillary to the discussion above is the fact that someone else is ultimately controlling Gillette's water supply. While this is not a critical flaw, the conditions of that control must be specific and enforceable.
- CBM production is a private and highly competitive industry. While not unheard of, cooperation between CBM operators is not commonplace. This situation makes coordination of finding a significant source of water and negotiating the funding of the infrastructure for that water more difficult.
- In the course of this study, some CBM operators have been cooperative and willing to discuss options and requirements surrounding this alternative. Beyond those few operators a coalition of operators has been formed with little progress to date.
- CBM operators have a cradle-to-grave responsibility for CBM water. They have cited potential liability issues with providing CBM water as drinking water to another party (in this case the City of Gillette). The concept of establishing a break point where responsibility for the water was transferred, for instance the inlet to Pump Station #1 or the inlet to a storage reservoir, did not change their perspective of liability. Both CBM operators that discussed this in-depth indicated they would need in-depth reviews and approvals from their legal departments on the issue.

- Funding the proposed improvements is another unknown. CBM operators have indicated they might be willing to fund a portion of the pipeline, pump stations, or other improvements necessary to bring this water into Gillette. These discussions are positive, but they do not constitute a binding commitment that Gillette can rely upon or plan to fund around.
- The quality of treated CBM water is generally good. However, CBM water has many constituents that if above EPA Primary levels could cause severe problems. A mechanism for detecting these before they reach Gillette would be critical to ensuring the safety of Gillette's water system. No conceptual or specific plans have been developed to date to deal with such a situation. It is an unknown if such plans would require extraordinary effort or commitments which may make this concept unfeasible.
- Discussions with CBM operators indicate that they believe their wells will be producing water through the time horizon of this study. Others disagree with this assessment projecting a steady decline in CBM water production to nearly 0 in 25 years. This study has not researched either side of this claim in-depth as it is outside of the scope of this report. However, this does raise the potential for uncertainty regarding the sustainability of CBM as a long-term source.
- The effect of fluctuating natural gas commodity prices is also an uncertainty. This factor could affect CBM production in the area and the continued operation of the source wells. One CBM operator offered that these wells could potentially be turned over to the City of Gillette for water supply as they are currently permitted as water wells as well. This scenario would leave Gillette in the position of operating and maintaining a large number of wells in remote locations producing low individual yields, which is not an optimal solution for a water-supply well field.

9.3 LONG-TERM ALTERNATIVES

9.3.1 New Madison Well Field and Transmission Main

Positives:

- The Madison Formation is a proven source. Gillette relies heavily on the Madison source for approximately 80% of their water supply in periods of peak demand.

- Madison wells that hit caverns in the formation or can be hydraulically fractured into those formations produce large yields.
- Madison water is considered very good quality with the exception of its hardness.
- The Madison has some published information.
- The hydrogeological modeling in Chapter 5 indicates the Madison has an extremely long life and is capable of producing all of Gillette's incremental long-term water needs with a minor effect on the aquifer relative to its total available water volume. This life helps eliminate uncertainty with the source.
- This alternative provides some backup if the existing Madison infrastructure were to fail.
- With the chosen alignment, pump stations will be located near existing Madison pumps stations, possibly making electrical service easier to obtain.
- With the chosen alignment the pipelines will generally parallel each other with similar hydraulic grade lines, so valving and inter-connections can be used to tie the two lines together. This benefit provides further redundancy by allowing certain sections of the pipeline to be taken out of service without removing the entire line.

Negatives:

- This alternative relies on continuing to use the existing Madison infrastructure throughout the planning period. An interior condition survey of the Madison line is planned, but has not been executed at the time of this report. The unverified condition of this line that has been in service for nearly 30 years is an uncertainty.

9.3.2 Surface Water Impoundment of Madison Water with a Surface Water Treatment Plant and New Transmission Main

Positives:

- This alternative allows CBM producers to deliver water to the new reservoir site with little change to treatment or finished water infrastructure.
- Storage in the reservoir provides backup in case of a failure in the existing Madison line.

Negatives:

- This alternative relies on continuing to use the existing Madison infrastructure throughout the planning period. An interior condition survey of the Madison line is planned, but has

not been executed at the time of this report. The unverified condition of this line that has been in service for nearly 30 years is an uncertainty.

- Due to the nature of the improvements, less grant funding may be available for this alternative.
- This alternative can provide between 5 and 23 days of 2037-demand peak emergency storage.
- This alternative relies on continuing to use the existing Madison infrastructure throughout the planning period. An interior condition survey of the Madison line is planned, but has not been executed at the time of this report. The unverified condition of this line that has been in service for nearly 30 years is an uncertainty.
- The operational and maintenance logistics of maintaining a peaking surface water plant.

9.3.3 Groundwater Storage and Recovery of Madison Water in the Fort Union Aquifer

Positives:

- This alternative allows CBM producers to deliver water to the new ASR site with little change to well field or transmission infrastructure.
- Surface water treatment rules do not apply.
- This project may be able to be combined with a short-term Fort Union alternative.
- Due to the nature of the improvements, more grant funding may be available for this alternative.
- This alternative provides a backup if a failure in the existing Madison infrastructure were to fail.
- This approach will mitigate any declines in the Fort Union Formation caused by new Fort Union/ASR withdrawals. This option will reduce impacts on surrounding wells.

Negatives:

- This alternative relies on continuing to use the existing Madison infrastructure throughout the planning period. An interior condition survey of the Madison line is planned, but has not been executed at the time of this report. The unverified condition of this line that has been in service for nearly 30 years is an uncertainty.

- There are a number of regulatory and technical uncertainties with this approach. These uncertainties at the present time are very large and will require time and effort to resolve, if they are resolvable which will result in a longer time to implement a final solution.

9.4 Long-Term Alternative Advanced Analysis

A more in-depth analysis was prepared for the two viable long-term alternatives to attempt to differentiate them on a non-monetary basis. This analysis was performed by requesting owner input on the criteria, criteria ranking, and criteria importance. A rating of + is poor, ++ is average, and +++ is excellent. Importance is measured on a scale of 1-10, with 1 being insignificant and 10 being critical. The results of this analysis are presented in Figure 9-1. Based on the non-economic criteria developed, the Madison pipeline and wellfield is preferred (total score 147) over the surface water impoundment with treatment (total score 90).

Figure

9-1

9.5 Timeline to Implementation

A prominent non-economic factor discussed herein is that of risk and uncertainty. Some of these concepts involve large amounts of uncertainty that will take time to resolve. It is in Gillette's best interest to solve their water supply problem as soon as possible. Thus, these uncertainties that consume time to resolve must be considered carefully to determine if they are worth pursuit. A timeline to implementation is shown in Table 9-1.

Table 9-1
Timeline to Implementation

Alternative	Time To Implement (Yr)
Short-Term Alternatives	
Expand Fort Union Source	5
Fox Hills Treatment - RO	2.5
Fox Hills Treatment - RO/IX	2.5
Long-Term Alternatives	
Madison Pipeline	6
Surface Water Impoundment and Treatment	7
ASR	10+ (?)

9.6 Conclusion

The positives and negatives discussed in this chapter help refine the decision making process. It is worth noting that some of the discussed alternatives have a number of uncertainties that will take precious time to explore and overcome, if possible. This presents an inherent risk to Gillette as their water needs are dire and immediate.

Based on the criteria developed in Section 9.4 above, the evaluation of the two preferred long-term alternatives reveals that the Madison pipeline and wellfield concept is the preferred alternative from a non-economic perspective. This should be given substantial consideration in conjunction with economic considerations when selecting a preferred alternative.