March 8, 2021

Does the Water Licence for a Coal Mine Capture its Impact on the Water Resource? Examining Benga Mining Limited's Proposed Grassy Mountain Mine in the Headwaters of the Oldman River Basin

By: Chris Hopkinson

Matters Commented On: Grassy Mountain Mine Project Water Diversion Licence Application by Benga Mining Limited (Riversdale Resources (16 October 2017)); Oldman River Basin Water Allocation Order, Alta Reg 319/2003

An earlier ABlawg post examined the general implications of proposals to re-open the *Oldman River Basin Water Allocation Order*, Alta Reg 319/2003 (WAO) so as to allow a greater proportion of the 11,000 acre-feet (AF) reserved by that Order to be used for industrial purposes, such as coal mining (see details on the proposals here). The Order as currently framed limits this to 150 AF. This post examines why this proposed change is such an important issue by considering in detail the water issues associated with one proposed mine in the upper Oldman Basin, namely the Grassy Mountain Mine proposed by Benga Mining Limited (BML). The post examines the Grassy Mountain Mine Project Water Diversion Licence (WDL) Application by BML (Riversdale Resources (16 October 2017)) to explore the viability of their proposed water use in the context of competing water demands and the WAO. The examination draws from materials shared and discussed as part of the Grassy Mountain Coal Project Joint Review Panel Public Hearing (*Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project Between The Minister of the Environment, Canada and The Alberta Energy Regulator, Alberta*, OC 262/2018; documents available here). The analysis presented below first considers the disclosed WDL water uses associated with the Coal Processing Plant (CPP) and evaporative loss from the Raw Water Pond (RWP). It then moves to elements of water loss from the mine site that are either omitted from the WDL or expected to exceed the pre-mine background levels. Finally, potential implications of proposed water uses within the context of low frequency high impact drought periods are considered.

The overall conclusions are that BML's water licence application likely understates its actual impact to the regional water resource, and that the overall hydrological effects of increased mining activity in the upper Oldman basin will reduce water availability for all users downstream, thus leading to an increased risk of water-related conflict during times of drought.

Background

The Oldman River Basin (ORB) has a dry climate where annual evaporative demand can exceed precipitation. This is particularly true in downstream regions of the basin, where irrigation water is critical in sustaining Alberta's agricultural sector and food security (J Byrne at al, "Current and future water issues in the Oldman River Basin of Alberta, Canada" (2006) 53:10 Water Science

& Technology 327; Stewart B Rood & Jenny W Vandersteen, "Relaxing the Principle of Prior Appropriation: Stored Water and Sharing the Shortage in Alberta, Canada" (2010) 24 Water Resources Management 1605). Consequently, annual runoff from snowmelt and rainfall in Eastern Slopes areas like Crowsnest Pass is a critical component of the overall supply into the Oldman Reservoir and on to downstream users where the basin is closed to new allocations.

Coal mining operations are water intensive, and precise consumptive estimates can be difficult to obtain. Global average estimates for each clean metric tonne (CMT) of coal produced range from ~250 L (Claire M Côte et al, "Systems modelling for effective mine water management" (2010) 25:12 Environmental Modelling & Software 1664) to over 650 L (Ian Overton, "Aren't we in a drought? The Australian black coal industry uses enough water for over 5 million people", *The Conversation* (3 May 2020)), and even as high as ~3000 L/CMT for thermal coal mines in China (Erik Olsson, *Water use in the Chinese coal industry* (Independent Thesis, Uppsala University, 2015)). Much water is recycled on-site and the consumptive fresh water needs are highly variable. Estimates of open pit mine fresh water consumption range from ~200 L to > 400 L/CMT for Australian examples (Côte et al, 2010). For the Murray River metallurgical coal mine (Taggart Engineering, *Preliminary Design of Coal Washing Plant of Murray River Coalmine of HD International Mining Industry Co., Ltd in Northeast BC, Canada* (August 2013)) in a cool humid part of the Canadian Rockies in NE BC, the proposed consumptive clean water use for coal processing alone is ~270 L/CMT (assuming a "raw" to "clean" conversion of RMT = 1.8 x CMT). Actual water uses tend to be divided amongst the CPP, dust mitigation, workforce supply and sanitation, irrigation/reclamation, vehicle/machinery washing, and other facilities; while primary outputs are discharges to the environment as stream flow following treatment, evaporative losses to the atmosphere and water exported in coal that leaves the site (Overton, 2020).

As a starting point to this exploration, we note that during questions about the mine water requirements for the CPP and the WDL application during the Grassy Mountain Coal Project Joint Review Panel Public Hearing, it was confirmed that: "…Benga believes that the amount of water that's been applied for is -- is and will be sufficient for the -- for the project." (Grassy Mountain Hearing Transcript Volume 20 (20 November 2020) at 4167).

Water Diversion License Components

From Section C of the Grassy Mountain Coal Project Description, it was estimated that the mine operations would need up to ~975 ML/yr (1 ML = 1 Megalitre = 1,000 m^3) for the CPP, roadway dust mitigation and potable supply and sanitation. Of this, 297 ML was assumed to be consumptive or lost from the site from two primary sources: i) 237 ML as moisture content in exported coal; and ii) 60 ML lost as evaporation in roadway dust suppression. The single largest component of water use was estimated to be coal washing at ~200 L/CMT (given as 110 L/RMT). This coal washing estimate is consistent with the lowest volume estimates from other mines (Côte et al, 2010; Olsson, 2015; Overton, 2020), though for Grassy Mountain this use was designated non-consumptive; i.e. returned to the natural hydrology of the site.

A little over a year later, the Grassy Mountain Coal Mine WDL application was submitted, with a total request for 558,772 m^3 (~559 ML) from two local licence transfers from Crowsnest Pass

MD and Devon Canada Corporation, plus one new industrial allocation request of 150 AF (185 ML) or the total industrial allocation available under the Oldman WAO. This combined request is ~416 ML lower than the estimated mine requirement in the earlier Project Description document. The break down of water requirements also differs, with: i) 57 L/RMT (up to a maximum of 478 ML in year 12) requested for the CPP as "make up" water to replace water lost as moisture in exported coal and water that leaves the CPP in reject material; ii) wash down "make up" water of 2 ML/yr for cleaning purposes; iii) evaporation from the Raw Water Pond (RWP) that supplies the CPP of 25.8 ML/yr; and iv) a contingency or hold back of 10% the maximum available allocation. Including the 10% contingency, these estimated annual project water uses exceed 500 ML for 11 out of the 23 years of proposed mine operation, with year 12 showing the highest coal production at 4,614,500 CMT and water use at 556.63 ML, or ~2 ML short of the maximum allocation.

To put this into context, the 57 L (or 0.000057 ML) WDL estimate of water use to clean each tonne of "raw" coal during peak production, is less than 10 flushes of a standard toilet. The apparent discrepancy between the estimated project water needs in 2016 (~975 ML, Riversdale Resources, August 2016) and the allocation request in 2017 (~559 ML, Riversdale Resources, 2017) for an output of ~4.5 million CMT during years of peak production was attributed to additional water conservation measures proposed in the interim (Grassy Mountain Hearing Transcript Volume 20). However, such a large drop in anticipated water needs for comparable coal outputs does warrant further investigation.

First, notable absences from the 2017 WDL application are: i) dust mitigation; ii) workforce water supply and sanitation; and iii) irrigation/reclamation. For items i) and ii), 60 ML and 15.5 ML were respectively proposed in the 2016 project description but no value for irrigation or greening of the site during annual reclamation activities was found. From the reclamation plan, the total area to be reclaimed is 1463 Ha, which suggests an average rate of reclamation exceeding 500,000 m^2/yr (reported estimate varies from 0 to 2,070,000 m^2/yr). Irrigation estimates for mine site reclamation in the cooler and more humid environment of NE BC (Taggart Engineering, 2013) suggest ~1.0 L/m^2d, so using a conservative estimate of 60 days of irrigation in a single year, this results in an average 30 ML/yr water requirement. Combined, therefore, three anticipated water needs that are absent from the WDL application could amount to >**105 ML/yr**. While the exact water requirements and sources for these water balance components vary by year and are uncertain, all three are important such that the mine cannot operate without them. Moreover, 60 ML/yr for dust suppression and 30 ML/yr for reclamation could be below actual needs given water may need to be applied multiple times on some days due to the high Chinook winds and dry summers characteristic of the Crowsnest area.

Second, the water allocation requested for coal washing is exclusively directed towards water leaving the site within cleaned coal and reject material, indicating that all wash water will be recycled with only a single point of loss from the Raw Water Pond (RWP) as evaporation. This indicates a highly efficient coal processing procedure that uses less water than is typical across other coal mines around the world (Côte et al, 2010; Olsson, 2015; Overton, 2020). The single source of evaporation loss from the RWP is estimated to be 25.8 ML/yr. However, based on BML's own hydrological study data (SRK Consulting, *Grassy Mountain Surface Hydrology Baseline and Effects Assessment* (August 2016) at 14-15) this volume of loss may be underestimated. The local baseline hydrology assessment concluded that lake water evaporation at the site is 0.74 m/yr (expressed as a vertical "depth" of water loss). For the RWP open water area of ~0.15 km^2 (from site plan drawings), then, the annual volumetric loss (depth x area) is 111 ML, or ~**82 ML/yr** greater than the WDL application estimate. Indeed, to arrive at 25.8 ML/yr would suggest the pond is either mostly empty most of the time, or evaporative losses are expected to be below the natural watershed land surface evapotranspiration levels, which according to BML's in house hydrological assessment is 0.26 m/yr (SRK Consultants, 2016 at 15), which – while implausibly low for open water – produces an estimate of ~39 ML/yr or 13 ML/yr greater than the value in the WDL application. Consequently, it is unclear how BML arrived at such a low estimate of water use for the CPP as a whole and for the RWP in particular.

A final note on the RWP is that before coal production commences (year zero), the WDL application shows that it will be losing evaporated water at the same rate as in all other years. Notwithstanding that this estimate of evaporative loss appears to be low, this indicates the RWP is full or filling during this time, which is consistent with the need for the RWP to be active in coal production from year one onwards. The planned capacity of the RWP is 1,200 ML (Riversdale Resources, June 2016), or more than two times the total allocation requested. Assuming RWP filling commences in year zero, and all surplus water available in the allocation is used, then even without any contingency, it will take 5 years to reach capacity. With the 10% contingency unused, it will take >13 years to fill, and if a realistic estimate of evaporative loss is used, then at the proposed rate of CPP productivity, it may not fill before the mine ceases to operate. It is unlikely that the RWP must be at maximum capacity in order to be functional and given the apparent reduction in CPP water needs since the project description in 2016, it is possible the WDL application in 2017 assumes a lower RWP capacity and size than the originally proposed 1,200 ML. However, given the water needs that appear unaccounted for or underestimated in the WDL, it is hard to imagine a scenario where the RWP could reach operational capacity if the only water used to fill it is obtained exclusively within the limits imposed by the WDL.

Accepting the high coal wash efficiency implied in the WDL application and confirmed at the public hearing, then, it appears certain elements of mine water use might be unaccounted for in the water license application and at least one element may be underestimated. Ignoring the problem of filling the RWP at project onset, the net result could be an under-estimation of annual water needs in the 150 ML to 200 ML range. If an additional ~150 ML were required to sustain mine operations at the CMT production rate predicted, then the Grassy Mountain mine water use would exceed the requested total allocation from year 2 to end of mine life. This assessment does not take into account maintenance of instream flow needs, the differential between the pre- and post-mine land surface hydrology, or the impact of extreme events like droughts or floods.

While impossible to know, perhaps BML suspected there could be a discrepancy between their needs and accessible water licenses. After submitting the WDL application to AER, BML was named as the client on a Consultant Lobbyist Registration (CL-10972-06 - Notice of Change), which was active from September 2018 to December 2020 (extended December 2019) to lobby (amongst others) senior staff and elected officials with Alberta Environment and Parks (AEP) on the subject of the "Water Act and water licences in southwest Alberta." On November 20th, 2020, AEP presented an information briefing to the three Municipal Districts impacted by the

Oldman WAO (Pincher Creek, Ranchland, Crowsnest Pass), with a proposal to change several elements of the WAO including the removal of some restrictions on new allocations (see Nigel Bankes and Cheryl Bradley's post on the briefing here). For example, AEP's proposal would remove the limit on industrial allocations from the 150 AF currently available from the total 11,000 AF reserve, and pool the industrial allocation category with all other uses (including irrigation and community supply) and increase this pool to 8,800 AF. If such a change went ahead, this would enable BML to apply for a new or increased allocation. Though recall, BML acknowledged at the public hearing (also on November 20th, 2020) that "Benga believes that the amount of water that's been applied for is and will be sufficient for the project." As such, it is assumed BML does believe that the water license they have applied for of 559 ML/yr will be sufficient for all needs for which a license is required.

Landcover Change

In addition to the question of whether all mine-related water uses are captured within the WDL, there is a likelihood that changes in landcover associated with mine development will alter the natural water and energy balance of the site. For example, it is known that a forest-covered landscape tends to lose more water to the atmosphere as evapotranspiration than a comparable environment that is not forest covered (Kathleen A Farley, Esteban G Jobba & Robert B Jackson, "Effects of afforestation on water yield: a global synthesis with implications for policy" (2005) 11 Global Change Biology 1565). Open pit mines have also been observed to generate a localised summertime "heat island" effect relative to surrounding forests (Slavomir Labant et al "Utilization of Geodetic Methods Results in Small Open-Pit Mine Conditions: A Case Study from Slovakia" (2020) 10:6 Minerals 489), which is expected to elevate evaporative losses. Changes in runoff and evaporative demand are acknowledged in BML's hydrological assessment (at 21-22), where the proportion of precipitation that contributes to downstream runoff (runoff coefficient) is presented for undisturbed and reclaimed areas as 0.51, for waste rock and fill areas as 0.60 and bedrock areas in the pit as 0.8. While a value of 1.0 was used for open water (which incorrectly implies all precipitation over open water becomes runoff), the report acknowledges that evaporation must be calculated separately for these areas.

The relative areas of undisturbed, reclaimed, waste rock, fill, bedrock and open water vary over the life of the mine, and are reported in the Conservation and Reclamation Plan. It is also reported that pre-disturbance open water areas amount to 0.1 Ha (~1,000 m^2), while the total area of surface water ponds and ditches is 74.6 Ha (~746,000 m^2), with 18.4 Ha (~184,000 m^2) remaining as a post closure lake (Riversdale Resources, June 2016). It is beyond the scope of this post to perform a full water balance assessment but to illustrate one important change that results from the mine activity, the pre mine water loss can be compared to that during mine operations for those land covers converted to open water.

From BML's open water evaporation depth of 0.74 m/yr and the background or pre mine landcover evapotranspiration depth of 0.26 m/yr (SRK Consultants, 2016), then for the total area of land converted to open water of ~745,000 m^2, the increase in evaporative loss approximates ~358 ML. Removing the "Raw Water Pond" (examined above) and the "End Pit Lake" (~184,000 m^2, Riversdale Resources, June 2016) that forms near the end of mine life, the net increase in annual evaporative loss over ponds and ditches relative to the pre mine condition becomes ~**197 ML/yr**. Again, this estimate is open to different forms of calculation based on the data or method adopted, and there will be some offsetting associated with more rapid runoff over impermeable landcovers. However, the point is that potential losses of water from mine-related water management structures are not trivial, will be higher in warm and dry years when water resources are otherwise stressed, and have the potential to represent a significant fraction of the annual WDL allocation, yet represent a loss of water from the natural background that is not factored into the WDL.

Downstream

Regarding the question of water volumes passed to the downstream environment, three areas of concern are: i) the potential for enhanced flood flows from site-level surface drainage; ii) maintaining sufficient instream flow to support aquatic ecosystem functions at all times; iii) maintaining sufficient flow to support downstream or more senior licence holders during times of drought. It is out of scope here to explore the possible role of site-level drainage on flood flows, and it is expected that BML and other potential mine operators in the Eastern Slopes would design and operate their sites to mitigate the downstream transfer of flood waters. However, the floods of 2013 on the Bow, Oldman and Elk rivers serve as reminders of the erosive and inundation destruction propagated from extreme rain on snowmelt events (John W Pomeroy, Ronald E Stewart & Paul H Whitfield, "The 2013 flood event in the South Saskatchewan and Elk River basins: Causes, assessment and damages" (2015) 41:(1-2) Can Water Resources J 1). For example, flood flows from Cougar Creek watershed (44 km^2) upstream of Canmore, which is slightly smaller in size but similar orientation and elevation range to the Blairmore (51 km^2) and Gold (62 km^2) Creek watersheds on either side of Grassy Mountain, resulted in the loss of bankside houses and the complete destruction of a section of the four-lane Trans-Canada Highway ("Canmore's Cougar Creek flood aftermath visible 100 days later" *CBC News* (28 September 2013)).

In the South Saskatchewan River Basin, large-scale water use projects must carry out a scientific assessment of Instream Flow Needs (IFN), which may be used as the basis for a Water Conservation Objective (WCO) as part of project approval (Government of Alberta, "A desk-top method for establishing environmental flows in Alberta rivers and streams" (1 April 2011)). These IFN are intended to represent the minimum flow requirements or flow regime that are needed to protect the aquatic habitat and functioning of the downstream riverine environment. From the public hearing, it was confirmed that an obligation of BML's surface water allocation will be to maintain flow levels on Blairmore and Gold Creeks that are deemed safe for fish habitat maintenance. The implication of this requirement is that BML must use a portion of its water allocation to meet these IFN requirements during times when flows fall to critical levels. The threshold flow volume for Gold Creek was not available but for Blairmore it is 0.07 m^3/s (~6 ML/day) from August to April and 0.19 m^3/s (16.4 ML/day) from May to July. To meet the Crowsnest River WCO, there is a minimal obligation for the mine to return at least 500 m^3/day (0.5 ML/day) via either Blairmore or Gold Creeks during low flow conditions. The Gold Creek obligation may be larger than Blairmore but on a daily basis, if flow augmentation is required on Blairmore to meet the WCO, then the mine will already be meeting its Crowsnest obligation of 500 m^3/day.

Aside from natural flow variations, one reason for low flows on Blairmore discussed at the hearing was if saturated backfill zones (excavated areas where waste material and water are deposited and treated) shut down and treated water could not be returned to the Creek. Should such a shut down occur, it could be for an extended period of days to weeks, with a worst case of 50 days postulated at the hearing (Grassy Mountain Hearing Transcript Volume 20). It is somewhat speculative to say, but if one assumes a situation where the summertime flow on the creek needs to be augmented, on average, by 50% to reach the minimum 0.19 m^3/s flow requirement, then 50 days of such augmentation approximates **410 ML** or 73% of the annual WDL allocation. As this is return flow, it is not automatically taken from the allocation budget but if sufficiently clean treated water cannot be accessed for the IFN obligation, then water may need to be diverted from the RWP makeup or other sources, and this would then limit water availability for mine operations. For example, in year 12, the unused portion of the allocation (including 10% continency) is 51 ML, which is a small quantity relative to the potential IFN liability on Blairmore if flows need to be augmented for an extended period. Such a scenario could place the habitat protection IFN obligations in conflict with the operational, employment and economic needs of the mine.

A rationale for such WCO obligations is the understanding that surface and groundwater resources are highly connected in this Eastern Slopes headwater region of the ORB where up to 90% of the riverine water resource originates (Oldman Watershed Council, 2020). It was acknowledged in BML's hydrological assessment and at the hearing that, over time, groundwater drawdown from the mine excavation is expected to impact the flow on surrounding creeks. It was further explained that water pumped out of the mine will be used to augment the flow on Gold Creek via sedimentation ponds. The process of removing water from the mine and then adding to creek flow would appear to constitute an operational water use, as this diversion of water is a requirement of raw product extraction, as well as meeting WCO obligations under the WDL application. It appears, then, the mine could be proposing to use some of the immense groundwater resource on site as an integral part of operations. It might be argued, perhaps, that such water use represents a "disposal" of groundwater instead of a "diversion", but this would be inaccurate on natural water balance grounds, given these operational movements of water create many opportunities for evaporative loss or changes in water quality that otherwise would not occur. Furthermore, if water from the excavation were intended to be used for, for example, dust suppression and/or reclamation irrigation, then such use must be appropriately licensed, particularly as these uses will incur high rates of evaporative loss; losses that will be transferred downstream in the ORB.

The quantities of groundwater that might be used operationally, if any, are unknown but drawing groundwater down by up to 300 m (Grassy Mountain Hearing Transcript, Volume 17) at the deepest part of an excavation of up to 6.3 km^2 at end of mine could amount to many millions m^3 or many thousands ML/yr in water volume. Such volumes could be orders of magnitude greater than the amount requested in the WDL application. Focussing on expected largely consumptive uses, however, estimates of potential annual site-level open water evaporative (**~197 ML**) and irrigation (**~30 ML**) demands have been provided above, and BML provided their own estimates for dust suppression (**60 ML**) and potable water use (**15.5 ML**). To this, we can also add a possible WDL under-estimation of RWP evaporative loss (**~82 ML**). The exact requirement for flow augmentation on Gold Creek is unknown but using a 50% flow for 50 day worst case estimate on Blairmore as a benchmark (**~410 ML**), it appears the overall IFN liability for both creeks relative to the WDL application could be high and has the potential to exceed the WDL limit of 559 ML under extreme circumstances. So, ignoring the fact that the volume of water extracted from the mine pit would far exceed the WDL limit, and accepting BML's high water use efficiency estimates for coal washing, there is a reasonable probability that during some years the actual water uses, losses and obligations at the mine site could be at least double the 559 ML requested.

Drought

Thus far, this post has primarily addressed typical or average conditions, but it is clear that water budget components like evaporative loss, dust mitigation, instream baseflow levels and, therefore, overall mine operation water requirements will increase during prolonged dry spells. Droughts are a reality in the arid Prairies of Southern Alberta, and can be exacerbated by the extreme Chinook winds characteristic of the region. Droughts occur as a result of dry hot summers, as well as following winters of low snowpack in the Eastern Slopes. Regional Climate Model projections suggest a high probability of severe drought periods of increasing frequency across the Canadian Prairies during future decades (Barry Bonsal et al, "Historical and Projected Changes to the Stages and Other Characteristics of Severe Canadian Prairie Droughts" (2020) 12:12 Water 3370). This, transposed on top of existing trends of increasing temperature (Jiang et al, "Historical and potential changes of precipitation and temperature of Alberta subjected to climate change impact: 1900–2100" (2017) 127 Theoretical & Applied Climatology 725), declining low-flow water supplies and increasing concerns over water quality on the Oldman River during the last century (Byrne at al, 2006). For downstream irrigators and communities, droughts result in reduced crop yields and certain water use bans that can have serious economic consequences and societal inconveniences (e.g. during 2001 to 2002, see Alberta Water Portal Society "Drought in 21st Century Alberta" (17 December 2004)). Historically, Irrigation Districts have worked together to voluntarily curtail their first in time first in right (FITFIR) priority access to water during drought periods, and have agreed to share the loss of access to water equitably amongst other users such as MDs, communities and landowners that may have more junior licences (Rood & Vandersteen, 2010). If such a voluntary system of curtailment fails, then the government can use authority under section 32 of the *Water Act*, RSA 2000, c W-3 to enforce water use reductions by junior licensees.

To date, industrial water allocations, such as the remaining 150 AF allocation requested by BML, have not been a significant source of controversy or conflict because so little of the overall Oldman WAO reserve (11,000 AF) was available for such use. Moving forward, however, if BML secures access to this industrial allocation, there are three plausible scenarios where the historical voluntary arrangement of sharing the water deficit during drought by downstream senior licence holders (i.e. primarily irrigators and communities) may become fragile:

i) BML, realising their water needs may exceed their current WDL application, seek out and apply for new or transferred water licenses, thus increasing their dominant role as a single license holder in headwater water resource management;

ii) BML do not request a new allocation but access surface or groundwater for mine operations outside of a water permit, thus raising concerns over the efficacy of Alberta's water licensing system;

iii) The proposed change to the Oldman Water Allocation Order goes ahead and an additional ~7,000 AF is opened up to potential mine-related industrial allocations upstream of the Oldman Dam, thus dramatically altering the historical apportionment of water resource use in the ORB headwaters.

Given the total area of coal leases in the Eastern Slopes of the ORB is more than ten times greater than BML's alone (see Alberta Wilderness Association, 2021), it is plausible that if they all became operational they may require the entire ~7,000 AF available for new allocations under the proposed WAO changes. Unless all water uses are transparently documented and appropriately licensed by headwater industrial licence holders, there is reason to expect that senior licence holders might be less inclined to share the deficit. This has the potential, therefore, to create a scenario where government intervention could be required to mitigate an environmental disaster, where historically voluntary solutions have been identified.

Typically, everyone suffers during a drought but for mines employing a large workforce, an economic obligation to meet annual production targets, as well as WCO obligations to mitigate drought flows within the confines of a 10% WDL contingency, the potential for conflict is high. Consequently, allowing new water-intensive industrial water allocations in the ORB headwaters, elevates the potential for drought-related conflict amongst both different water licence holders and also the internal competing corporate and socio-environmental obligations of a single large licence holder, like BML.

Conclusion

The largely unresolved question for now is just how much of the mining activity-induced water loss over and above the natural background (operational or incidental) must be captured in the water budget of the WDL? It is a reasonable expectation that any loss of water that results from a new land use project must be captured in that project's licence application. However, in the case of Grassy Mountain Mine, the observations and calculations presented above suggest that BML's WDL request of 559 ML/yr does not account for all water uses or losses that are likely to occur over the site during all years, and the true impact on the regional water resource is likely to exceed the amount communicated by the requested WDL allocation. If the proposed Grassy Mountain Mine's potential under-representation of total water demands is an indicator of what to expect from possible future Eastern Slopes' mines, then the impact of mining in this region is expected to place a new stress on the already stressed water resources of the Oldman River Basin. And, this stress will be most acute during times of drought, when the potential for conflict between on-site water demands and between water license holders will be elevated relative to the present situation.

The case study presented here has not had the benefit of access to all the data, tools, time and resources at BML's disposal. Consequently, some water budget estimates presented above are open to interpretation or alternative methods of estimation. However, they are sufficiently compelling to urge the Grassy Mountain Coal Project Joint Review Panel to conduct an independent review of BML's Water Diversion License application to verify that the budget items are accurate and comprehensive in the context of all water needs of the mine and the requirements of the existing *Oldman River Basin Water Allocation Order*, Alta Reg 319/2003. Finally, Alberta Environment and Parks are urged to conduct a thorough science-based assessment and stakeholder consultation on the viability of the proposal to amend the Oldman Water Allocation Order to allow increased industrial allocations (i.e. mines) in the already water stressed Oldman River basin.

Acknowledgements

Nigel Bankes for valuable discussion on an early draft of this post. Staff members with Alberta Environment and Parks for informative discussion on the Oldman Water Allocation Order and the proposed changes. The ABlawg editorial team for helpful edits and suggestions.

This post may be cited as: Chris Hopkinson, "Does the Water Licence for a Coal Mine Capture its Impact on the Water Resource? Examining Benga Mining Limited's Proposed Grassy Mountain Mine in the Headwaters of the Oldman River Basin" (March 8, 2021), online: ABlawg, http://ablawg.ca/wp-content/uploads/2021/03/Blog_CH_Grassy_Mountain_Water.pdf