

ANEXO N°10.1

INFORME DE ANÁLISIS Y ESTIMACIÓN DE EFECTOS

CARGO N° 10 RES. EX. N°1 / ROL D-018-2019

SCM MINERA LUMINA COPPER CHILE

DOCUMENTO PREPARADO POR

GP Consultores Ltda.[®]
Recursos Hídricos y Medio Ambiente

Versión 1

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ÍNDICE DE CONTENIDOS

| | |
|---|----|
| 1. RESUMEN Y CONCLUSIONES | 3 |
| 2. INTRODUCCIÓN..... | 4 |
| 3. ANTECEDENTES | 5 |
| 3.1 ENTREGAS DE AGUA DESALADA EN CANAL MAL PASO | 5 |
| 3.2 CAUDALES DE AGUA SUPERFICIAL EN CANAL MAL PASO | 7 |
| 4. ANÁLISIS DE EFECTOS DEL HECHO INFRACCIONAL | 9 |
| 4.1 Hecho Infraccional..... | 9 |
| 4.2 Efectos Identificados por SMA | 9 |
| 4.3 Análisis de los Efectos Identificados por la SMA: | 9 |
| 5. REFERENCIAS | 10 |
| 6. APÉNDICES..... | 10 |

1. RESUMEN Y CONCLUSIONES

El presente informe técnico responde a la necesidad de evaluar los potenciales efectos asociados al cargo N° 10 formulado por la Superintendencia del Medio Ambiente (SMA) en contra de SCM Minera Lumina Copper Chile (SCM MLCC), mediante la Res. Ex. N°1/Rol D-018-2019., el cual se refiere a *Incumplimiento del compromiso de entrega de agua desalada en el canal Mal Paso, en un caudal de 100 L/s, en diversos períodos comprendidos entre marzo de 2015 y julio de 2018.*

Para ello se analiza la estadística de entregas de agua desalada (proporcionada por MLCC Caserones) y se compara con el compromiso voluntariamente asumido, además de sus efectos en la magnitud del caudal total que conduce el canal Mal Paso.

En el período analizado (agosto 2014 a diciembre 2018) se presentaron hechos de Fuerza Mayor que impidieron cumplir con lo comprometido durante el 100% del tiempo. Esos hechos corresponden a:

Aluvión del año 2015: Entre el 25 de marzo y el 3 de mayo 2015 no fue posible efectuar entregas de agua desalada. La JVRC autoriza la reanudación el 4 mayo 2015.

Aluvión del año 2017: Entre el 10 de mayo y el 10 de julio no fue posible efectuar entregas de agua desalada. La JVRC autoriza la reanudación el 11 julio 2017.

Además se considera en el análisis un período de 11 días de mantención de la planta por año (equivalente a 3% del período de operación), período en el cual la planta debe parar su operación rutinaria.

Descontando de la estadística esos períodos de tiempo, se observa que las fallas en las entregas de agua desalada se producen durante el año 2016. En ese año se entregó un caudal promedio de 83 L/s en vez de los 100 L/s comprometidos.

En el resto de los años incluidos en el análisis (años 2014, 2015, 2017 y 2018), se entregó un caudal medio anual mayor o igual a 100 L/s, cumpliendo con la entrega comprometida.

Finalmente, según las estadísticas de medición del caudal de aguas que escurre por el canal Mal Paso, la entrega de un caudal menor de agua desalada provocó que escurriera por él un menor caudal equivalente a un 0,8%.

Se concluye que el hecho infraccional no generó efectos que puedan ser evaluados objetivamente, en la calidad o en la disponibilidad de los recursos hídricos naturales.

2. INTRODUCCIÓN

Con fecha 19 de febrero de 2019, la Superintendencia del Medio Ambiente (SMA) formula cargos en contra de SCM Minera Lumina Copper Chile (SCM MLCC), mediante la Res. Ex. N°1/Rol D-018-2019. En este contexto, SCM MLCC ha definido presentar un Programa de Cumplimiento (PDC), dentro del cual es requerido hacer entrega de informes de efectos asociados a los hechos, actos u omisiones que constituyen la infracción en que se ha incurrido.

En virtud de lo anterior, el presente informe técnico responde a la necesidad de evaluar los potenciales efectos asociados al cargo N° 10, el cual se refiere a: *“Incumplimiento del compromiso de entrega de agua desalada en el canal Mal Paso, en un caudal de 100 L/s, en diversos períodos comprendidos entre marzo de 2015 y julio de 2018, según lo indicado en la Tabla N°17 de la presente formulación de cargos”*.

A continuación se reproduce la Tabla N°17 citada.

Tabla N° 17 – Registro mensual de entrega agua desalada en Canal Mal Paso (l/s)*

| | 2014 | 2015 | 2016 | 2017 | 2018 |
|----------------|------|------|------|------|------|
| Enero | | 103 | 101 | 100 | 99 |
| Febrero | | 102 | 100 | 95 | 96 |
| Marzo | | 70 | 97 | 94 | 100 |
| Abril | | 0 | 96 | 99 | 94 |
| Mayo | | 91 | 95 | 30 | 100 |
| Junio | | 93 | 83 | 0 | 100 |
| Julio | | 103 | 73 | 63 | 93 |
| Agosto | 100 | 88 | 0 | 104 | |
| Septiembre | 104 | 102 | 71 | 97 | |
| Octubre | 106 | 101 | 49 | 100 | |
| Noviembre | 104 | 72 | 104 | 95 | |
| Diciembre | 102 | 101 | 94 | 94 | |
| Promedio Anual | 103 | 86 | 80 | 81 | N/A |

Fte: elaborada en base a Carta MLCC VPSAC N° 97/2018, de SCM.

*Valores corresponden al promedio de caudales entregados, en consideración al total de días en el mes. Se han destacado los meses en que el caudal entregado, corresponde a una cifra menor a 100 l/s.

Fuente: Res. SMA Ex. N°1/ ROL D-018-2019, pág.54 y 55.

3. ANTECEDENTES

3.1 ENTREGAS DE AGUA DESALADA EN CANAL MAL PASO

En **Figura N°1** se muestra la ubicación de la Planta Desaladora y el punto de entrega de agua desalada en el Canal Mal Paso.

Punto de entrega:

E – 374.789 m

N – 6.955.216 m

Zona 19J



Figura N°1: Ubicación de Planta Desalinizadora y de la entrega de agua en Canal Mal Paso. Fuente: Basado en información entregada por MLCC.



Figura N°2: Punto de entrega del agua desalada de Caserones en el Canal Mal Paso y estaciones fluviométricas de la DGA en el sector. Fuente: Elaboración Propia.

La estadística de volúmenes diarios de agua desalada entregada en Mal Paso se presenta en **Apéndice A**. Con base en esa información se evalúan los volúmenes anuales entregados, los días efectivos de funcionamiento del sistema (por mantención del sistema y eventos de fuerza mayor –aluviones-) y los caudales promedio entregados. En **Tabla N°1** se presenta la equivalencia en caudal promedio del volumen de agua no entregado en Mal Paso durante el período desde que se inició el compromiso.

Tabla N°1: Entregas de Agua Desalada en canal Mal Paso

| Año | PROG. CTTO + FUERZA MAYOR | REAL |
|--|------------------------------|-------------------|
| 2014 (Agosto) | 1.278.720 | 1.367.234 |
| 2015 | 2.704.320 | 2.695.138 |
| 2016 | 3.067.200 | 2.531.549 |
| 2017 | 2.540.160 | 2.550.018 |
| 2018 | 3.058.560 | 3.062.499 |
| Volumen Total (m3/periodo 2014-2018) | 12.648.960 | 12.206.438 |
| Diferencia (Volumen no entregado (m3/periodo 2014-2018)) | 442.522 | |
| Equivalencia en Caudal promedio no entregado en el período total del compromiso [l/s] | 3,17 | |

Notas:

Aluvión año 2015: Del 25 Marzo al 3 Mayo de 2015, sin entregas de agua.
JVRC autoriza reanudación el 4 Mayo 2015.

Aluvión año 2017: Del 10 Mayo al 10 Julio de 2017, sin entregas de agua.
JVRC autoriza reanudación el 11 Julio 2017.

Fuente: MLCC Caserones

Los promedios han sido evaluados eliminando de dicho cálculo los días que no se efectuó entregas de agua por Fuerza Mayor (Aluviones de los años 2015 y 2017) y descontado los días de mantención del sistema (11 días en 1 año, equivalente al 3% del tiempo de operación).

Considerando los hechos anteriores (mantención y fuerza mayor –aluviones–), varían los valores de la **Tabla N°17** de la Res. SMA Ex. N°1/ ROL D-018-2019, quedando los valores globales indicados en la **Tabla N°1** anterior. Con ello, el caudal promedio de agua desalada entregada es de 97 L/s (período agosto 2014 a diciembre 2018), sin incluir en la evaluación los períodos de tiempo de los Aluviones y de mantención de la planta.

3.2 CAUDALES DE AGUA SUPERFICIAL EN CANAL MAL PASO

En **Apendice B** y **Tabla N°2** siguiente, se entrega la estadística de caudales medidos por DGA en el Canal Mal Paso después de Bocatoma. Esta estación fluviométrica se ubica aguas abajo de la entrega del agua desalada; por tanto, sus registros incluyen las aguas desaladas en el canal.

Cabe hacer notar que la estadística DGA fue cambiada por esa Dirección General, según se presenta en **Apéndice B**. En el Apendice se incluye la información bajada de página web DGA en febrero de 2019 y en Julio de 2019. En el presente informe se efectúa una

actualización del informe previo, incluyéndose ahora la información bajada desde DGA en Julio 2019. Se observan importantes diferencias en los valores publicados en ambas fechas por la Dirección General de Aguas.

Con la nueva información, el caudal promedio mensual de los meses con registro en el período 2014 a 2018, es de 365 L/s

Tabla N°2: Caudales Promedio Mensuales del Canal Mal Paso Después de Bocatoma (incluye agua desalada)

| AÑO | CAUDAL PROMEDIO MENSUAL (L/s) | | | | | | | | | | | | Promedio L/s (meses con registros) |
|------|-------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------------------|
| | ENE | FEB | MAR | ABR | MAY | JUN | JUL | AGO | SEP | OCT | NOV | DIC | |
| 2014 | 430 | | | 270 | 220 | 280 | 230 | 270 | 330 | 350 | 270 | 220 | 287 |
| 2015 | 250 | 410 | 440 | 400 | 300 | 230 | 190 | 260 | | | | | 310 |
| 2016 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 |
| 2017 | 350 | 350 | 350 | 350 | | | | | | | | | 350 |
| 2018 | 500 | 590 | 560 | 460 | 520 | 540 | 600 | 480 | 570 | 460 | | | 528 |

Fuente: <http://snia.dga.cl/BNAConsultas/reportes>

Comparando los valores de **Tabla N°2** con los de **Tabla N°1** se observa:

Los 100 L/s que deben entregarse de agua desalada corresponden aproximadamente a un 27,4% del caudal total que transporta el Canal Mal Paso.

Los 97 L/s de agua desalada que realmente entregó MLCC Caserones, no considerando los períodos de los aluviones de los años 2015 y 2016 y los períodos de mantención de la planta, representan un 26,6% del caudal total que transportó el Canal Mal Paso

4. ANÁLISIS DE EFECTOS DEL HECHO INFRACCIONAL

4.1 Hecho Infraccional

Incumplimiento de entrega de agua desalada en el Canal Mal Paso por un caudal total de 100 L/s, en diversos período comprendidos entre marzo 2015 y Julio 2018.

4.2 Efectos Identificados por SMA

No entregar agua desalada en la cantidad de 100 L/s durante 28 meses en el período marzo 2015 a julio 2018 (período de 41 meses), afectando la sustentabilidad del recurso hídrico (según Considerando 175, pág.55)

4.3 Análisis de los Efectos Identificados por la SMA:

Depuración de la Base de Datos:

En el período analizado, Agosto 2014 a Diciembre 2018 (53 meses, ver **Tabla N°1**), se presentaron eventos que en el presente informe son calificados como de Fuerza Mayor. Durante esos eventos no fue posible entregar agua desalada al Canal Mal Paso.

Los eventos calificados como de Fuerza Mayor son los siguientes:

Aluvión del año 2015: Entre el 25 de marzo y el 3 de mayo 2015 no fue posible efectuar entregas de agua desalada (Aluvión <http://jvrc.cl/nota148/>). La JVRC autoriza la reanudación el 4 mayo 2015.

Aluvión del año 2017: Entre el 10 de mayo y el 10 de julio 2017 no fue posible efectuar entregas de agua desalada (Aluvión <http://jvrc.cl/nota356/>). La JVRC autoriza la reanudación el 11 julio 2017.

Considerando que los eventos anteriores son calificados como fuerza mayor, se eliminan de los registros los días correspondientes a esas fallas. En **Apendice A** se presenta la estadística diaria en forma detallada.

Se destaca que no se ha considerado como Fuerza Mayor a la Falla de la Estación de Reimpulsión de agua desalinizada (EB2) por perturbación eléctrica, en donde, no se entrega agua desalada al canal por cuanto no se contaba con repuestos en el país para su reparación. Se dejó de entregar agua desalada al canal entre 27 julio y 31 agosto 2016, y entre 17 septiembre y 15 octubre 2016. Este hecho pudiese ser calificado como de Fuerza Mayor.

Estadística de Cumplimiento del Compromiso:

En el período analizado de agosto 2014 – diciembre 2018 (ver **Tabla N°1**), el incumplimiento se observa durante el año 2016, año en el cual se entregó un caudal medio anual de 83 L/s.

Para el resto de los años considerados (2014, 2015, 2017 y 2018), se entregó un caudal medio anual mayor o igual a 100 L/s, cumpliendo con la entrega comprometida.

Efectos del Incumplimiento en la Magnitud del Caudal de Aguas del Canal Mal Paso:

De acuerdo con las estadísticas de medición del caudal de aguas que escurre por el canal Mal Paso, la entrega de un caudal menor de agua desalada provocó que escurriera por él un menor caudal equivalente a un 0,8% (ver Numeral 3.2).

5. REFERENCIAS

DGA. Banco Nacional de Aguas (BNA, versión pública en su página web).

MLCC Caserones. Base de datos

6. APÉNDICES

APÉNDICE A: REGISTROS DE CAUDALES DIARIOS DE AGUA DESALADA ENTREGADOS EN MAL PASO

APÉNDICE B: CAUDALES MENSUALES EN CANAL MAL PASO DESPUES DE BOCATOMA

APÉNDICE A: REGISTROS DE CAUDALES DIARIOS DE AGUA DESALADA ENTREGADOS EN MAL PASO

Registro de Flujo Promedio de Entrega de agua diaria en Mal Paso Año 2014 (m3/día)

| | ene-14 | feb-14 | mar-14 | abr-14 | may-14 | jun-14 | jul-14 | ago-14 | sep-14 | oct-14 | nov-14 | dic-14 |
|--------------|--------|--------|--------|--------|--------|--------|--------|----------------|----------------|----------------|----------------|----------------|
| 1 | | | | | | | | | 9,713 | 9,613 | 9,693 | 8,795 |
| 2 | | | | | | | | | 8,049 | 10,326 | 10,631 | 8,378 |
| 3 | | | | | | | | | 6,370 | 10,405 | 9,077 | 9,262 |
| 4 | | | | | | | | | 9,252 | 6,936 | 7,648 | 8,969 |
| 5 | | | | | | | | 8,374 | 10,768 | 9,398 | 8,540 | 9,029 |
| 6 | | | | | | | | 5,250 | 10,779 | 10,381 | 8,960 | 8,942 |
| 7 | | | | | | | | 6,883 | 10,278 | 8,754 | 9,914 | 8,960 |
| 8 | | | | | | | | 10,396 | 10,768 | 9,662 | 9,586 | 8,947 |
| 9 | | | | | | | | 9,788 | 10,808 | 10,475 | 8,688 | 9,112 |
| 10 | | | | | | | | 10,924 | 10,811 | 10,404 | 7,346 | 8,792 |
| 11 | | | | | | | | 11,108 | 6,961 | 10,543 | 7,354 | 9,047 |
| 12 | | | | | | | | 10,493 | 10,858 | 8,815 | 8,122 | 8,946 |
| 13 | | | | | | | | 10,470 | 8,883 | 235 | 10,701 | 8,854 |
| 14 | | | | | | | | 10,494 | 9,385 | | 8,710 | 8,912 |
| 15 | | | | | | | | 9,253 | 10,775 | 9,754 | 8,676 | 8,859 |
| 16 | | | | | | | | 10,610 | 10,794 | 10,854 | 8,595 | 8,876 |
| 17 | | | | | | | | 10,254 | 6,241 | 10,874 | 8,238 | 8,740 |
| 18 | | | | | | | | 10,510 | 5,779 | 10,763 | 8,493 | 8,968 |
| 19 | | | | | | | | 10,100 | 6,760 | 10,836 | 8,544 | 8,817 |
| 20 | | | | | | | | 9,584 | 5,864 | 10,891 | 8,689 | 8,942 |
| 21 | | | | | | | | 9,837 | 6,026 | 10,596 | 7,677 | 8,723 |
| 22 | | | | | | | | 10,641 | 6,506 | 9,145 | 9,026 | 8,888 |
| 23 | | | | | | | | 10,159 | 8,956 | 8,477 | 10,373 | 8,683 |
| 24 | | | | | | | | 10,603 | 10,508 | 8,367 | 10,274 | 8,756 |
| 25 | | | | | | | | 10,178 | 10,558 | 10,762 | 9,729 | 9,245 |
| 26 | | | | | | | | 10,638 | 10,484 | 10,731 | 8,742 | 8,043 |
| 27 | | | | | | | | 10,244 | 10,510 | 10,616 | 10,417 | 8,793 |
| 28 | | | | | | | | 10,706 | 7,345 | 10,551 | 9,898 | 8,827 |
| 29 | | | | | | | | 10,460 | 10,627 | 9,181 | 8,861 | 8,690 |
| 30 | | | | | | | | 10,207 | 9,121 | 7,155 | 8,806 | 8,690 |
| 31 | | | | | | | | 10,313 | | 8,456 | | 8,774 |
| Total | - | - | - | - | - | - | - | 268,475 | 270,537 | 283,956 | 270,008 | 274,258 |

Fuente: MLCC

Registro de Flujo Promedio de Entrega de Agua diaria en Mal Paso Año 2015 (m3/día)

| | ene-15 | feb-15 | mar-15 | abr-15 | may-15 | jun-15 | jul-15 | ago-15 | sep-15 | oct-15 | nov-15 | dic-15 |
|--------------|----------------|----------------|----------------|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1 | 8,906 | 8,764 | 8,609 | 0 | 0 | 8,429 | 8,800 | 9,135 | 8,725 | 8,553 | 8,694 | 8,786 |
| 2 | 8,820 | 9,206 | 8,633 | 0 | 0 | 9,033 | 8,785 | 9,169 | 8,691 | 8,714 | 8,689 | 8,790 |
| 3 | 8,624 | 8,351 | 8,650 | 0 | 0 | 8,723 | 8,822 | 8,924 | 8,693 | 8,460 | 8,717 | 8,782 |
| 4 | 8,678 | 8,815 | 8,614 | 0 | 3,708 | 7,936 | 9,300 | 8,943 | 8,719 | 8,708 | 4,472 | 8,692 |
| 5 | 4,497 | 8,658 | 8,628 | 0 | 8,884 | 9,719 | 8,423 | 8,893 | 8,774 | 8,744 | 0 | 8,586 |
| 6 | 9,165 | 8,801 | 8,630 | 0 | 9,884 | 8,969 | 8,926 | 8,752 | 8,759 | 8,714 | 0 | 8,902 |
| 7 | 9,560 | 8,951 | 8,673 | 0 | 8,845 | 8,995 | 8,987 | 4,889 | 8,768 | 8,731 | 0 | 8,731 |
| 8 | 9,586 | 8,890 | 8,630 | 0 | 8,933 | 8,896 | 9,071 | 0 | 8,746 | 8,750 | 0 | 8,702 |
| 9 | 9,954 | 8,804 | 8,655 | 0 | 7,591 | 8,621 | 8,827 | 0 | 8,789 | 8,729 | 0 | 8,709 |
| 10 | 9,107 | 8,698 | 8,665 | 0 | 7,879 | 8,815 | 8,349 | 2,780 | 8,823 | 8,767 | 0 | 8,711 |
| 11 | 9,545 | 8,779 | 8,670 | 0 | 8,966 | 8,678 | 9,045 | 8,658 | 8,742 | 8,739 | 2,237 | 8,706 |
| 12 | 9,528 | 9,408 | 8,595 | 0 | 8,767 | 8,735 | 9,026 | 8,900 | 8,811 | 8,798 | 8,881 | 8,711 |
| 13 | 8,895 | 9,116 | 8,672 | 0 | 9,123 | 8,683 | 8,974 | 8,935 | 8,783 | 8,798 | 8,640 | 8,719 |
| 14 | 8,834 | 9,075 | 8,721 | 0 | 9,086 | 8,751 | 8,928 | 8,826 | 8,813 | 8,780 | 8,717 | 8,718 |
| 15 | 8,822 | 8,289 | 8,736 | 0 | 8,980 | 5,284 | 8,974 | 7,168 | 8,820 | 8,789 | 8,718 | 8,713 |
| 16 | 8,788 | 8,460 | 8,722 | 0 | 9,326 | 0 | 9,050 | 0 | 8,805 | 8,787 | 8,719 | 8,707 |
| 17 | 8,848 | 9,281 | 933 | 0 | 9,372 | 0 | 8,969 | 8,314 | 8,803 | 8,786 | 8,705 | 8,732 |
| 18 | 8,707 | 9,238 | 0 | 0 | 9,109 | 4,719 | 8,961 | 8,715 | 8,824 | 8,787 | 8,745 | 8,725 |
| 19 | 8,883 | 8,744 | 9,486 | 0 | 9,117 | 9,020 | 9,311 | 8,752 | 8,829 | 8,770 | 8,714 | 8,754 |
| 20 | 8,764 | 8,746 | 8,812 | 0 | 8,804 | 8,949 | 8,590 | 8,777 | 8,829 | 8,789 | 8,783 | 8,652 |
| 21 | 8,766 | 8,837 | 8,708 | 0 | 8,787 | 9,088 | 8,919 | 8,780 | 8,880 | 8,810 | 8,757 | 8,688 |
| 22 | 8,760 | 8,724 | 9,219 | 0 | 8,760 | 8,940 | 8,894 | 8,792 | 8,784 | 8,803 | 8,769 | 8,683 |
| 23 | 8,771 | 8,673 | 8,613 | 0 | 8,712 | 8,969 | 9,081 | 8,811 | 8,758 | 8,825 | 8,786 | 8,688 |
| 24 | 8,762 | 8,605 | 4,380 | 0 | 8,719 | 8,974 | 9,033 | 8,845 | 8,805 | 8,789 | 2,265 | 8,693 |
| 25 | 8,368 | 8,624 | 0 | 0 | 8,760 | 8,908 | 9,021 | 8,825 | 8,742 | 8,779 | 2,018 | 8,700 |
| 26 | 8,845 | 8,663 | 0 | 0 | 9,153 | 8,883 | 9,034 | 8,777 | 8,717 | 8,800 | 8,719 | 8,707 |
| 27 | 9,794 | 8,611 | 0 | 0 | 8,760 | 8,826 | 9,040 | 8,685 | 8,775 | 8,804 | 8,776 | 8,714 |
| 28 | 9,786 | 8,664 | 0 | 0 | 8,662 | 8,811 | 8,987 | 8,563 | 8,734 | 8,760 | 8,792 | 8,590 |
| 29 | 9,385 | | 0 | 0 | 8,950 | 8,801 | 9,007 | 8,759 | 8,822 | 8,760 | 8,746 | 8,712 |
| 30 | 8,752 | | 0 | 0 | 8,786 | 8,796 | 8,684 | 8,690 | 8,582 | 8,784 | 8,870 | 8,688 |
| 31 | 8,636 | | 0 | | 8,266 | | 9,016 | 8,769 | | 8,717 | | 8,784 |
| Total | 275,136 | 246,475 | 188,654 | - | 242,689 | 239,951 | 276,834 | 234,826 | 263,145 | 271,324 | 185,929 | 270,175 |

Fuente: MLCC.

Nota: Marzo a Mayo 2015: Aluvión (<http://jvrc.cl/nota148/>)

Registro de Flujo Promedio de Entrega de Agua diaria en Mal Paso Año 2016 (m3/día)

| | ene-17 | feb-16 | mar-16 | abr-16 | may-16 | jun-16 | jul-16 | ago-16 | sep-16 | oct-16 | nov-16 | dic-16 |
|--------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|----------------|----------------|----------------|----------------|
| 1 | 8,736 | 8,705 | 8,560 | 8,573 | 8,681 | 8,622 | 8,718 | 0 | 10,248 | 0 | 9,759 | 9,382 |
| 2 | 8,736 | 8,704 | 8,380 | 8,642 | 8,687 | 8,614 | 8,717 | 0 | 12,195 | 0 | 10,373 | 8,559 |
| 3 | 8,712 | 8,706 | 8,510 | 8,713 | 8,692 | 1,080 | 8,710 | 0 | 10,770 | 0 | 10,628 | 8,618 |
| 4 | 8,760 | 8,706 | 8,664 | 8,710 | 8,685 | - | 8,690 | 0 | 11,129 | 0 | 9,901 | 8,646 |
| 5 | 8,760 | 8,707 | 8,663 | 8,712 | 8,681 | - | 6,689 | 0 | 11,106 | 0 | 8,630 | 8,628 |
| 6 | 8,760 | 8,712 | 8,640 | 8,714 | 6,130 | - | 7,381 | 0 | 10,909 | 0 | 9,476 | 8,784 |
| 7 | 8,760 | 8,696 | 8,652 | 8,710 | 9,075 | - | 9,202 | 0 | 9,835 | 0 | 10,802 | 8,447 |
| 8 | 8,760 | 8,686 | 8,631 | 8,708 | 9,441 | 4,884 | 7,595 | 0 | 10,428 | 0 | 9,875 | 8,645 |
| 9 | 8,760 | 8,691 | 8,633 | 8,699 | 9,283 | 8,901 | 8,336 | 0 | 9,913 | 0 | 8,653 | 8,673 |
| 10 | 8,760 | 8,711 | 8,646 | 8,699 | 8,523 | 8,764 | 8,509 | 0 | 9,885 | 0 | 8,641 | 8,697 |
| 11 | 8,760 | 8,738 | 8,650 | 8,703 | 9,029 | 8,716 | 8,674 | 0 | 9,868 | 0 | 8,634 | 8,707 |
| 12 | 8,760 | 8,710 | 8,645 | 8,692 | 8,637 | 8,712 | 8,609 | 0 | 9,868 | 0 | 8,628 | 8,691 |
| 13 | 8,760 | 8,690 | 8,688 | 7,812 | 5,921 | 8,664 | 8,634 | 0 | 9,649 | 0 | 8,687 | 8,656 |
| 14 | 8,760 | 8,697 | 6,962 | 8,700 | 7,712 | 8,661 | 8,760 | 0 | 9,499 | 0 | 8,745 | 8,651 |
| 15 | 8,740 | 8,694 | 9,434 | 8,676 | 7,560 | 8,681 | 7,773 | 0 | 9,802 | 0 | 8,754 | 8,666 |
| 16 | 8,613 | 8,670 | 9,693 | 8,674 | 7,570 | 8,679 | 7,625 | 0 | 5,370 | 834 | 8,741 | 8,661 |
| 17 | 8,680 | 8,631 | 8,663 | 8,669 | 9,424 | 8,670 | 8,255 | 0 | 0 | 4,993 | 8,738 | 8,660 |
| 18 | 8,687 | 8,630 | 8,649 | 8,729 | 7,095 | 8,674 | 8,428 | 0 | 0 | 6,764 | 8,743 | 8,661 |
| 19 | 8,686 | 8,610 | 8,648 | 8,681 | - | 8,668 | 8,546 | 0 | 0 | 8,614 | 8,747 | 2,726 |
| 20 | 8,688 | 8,615 | 8,646 | 3,276 | 356 | 8,684 | 8,600 | 0 | 0 | 8,857 | 8,747 | - |
| 21 | 8,695 | 8,620 | 8,643 | 5,188 | 9,322 | 8,674 | 8,138 | 0 | 0 | 9,880 | 8,744 | 6,609 |
| 22 | 8,697 | 8,622 | 0 | 7,239 | 8,808 | 8,677 | 7,490 | 0 | 0 | 10,080 | 8,747 | 8,582 |
| 23 | 8,669 | 8,640 | 8,699 | 7,756 | 9,020 | 8,676 | 7,487 | 0 | 0 | 10,176 | 8,750 | 8,586 |
| 24 | 8,630 | 8,640 | 8,748 | 8,165 | 10,555 | 8,678 | 4,699 | 0 | 3,204 | 10,174 | 8,680 | 8,670 |
| 25 | 8,699 | 8,640 | 8,712 | 9,752 | 10,485 | 8,675 | 42 | 0 | 7,524 | 6,303 | 8,829 | 8,754 |
| 26 | 8,696 | 8,570 | 8,688 | 8,710 | 9,711 | 8,681 | 0 | 0 | 5,823 | 6,503 | 8,777 | 8,755 |
| 27 | 8,696 | 8,571 | 8,724 | 9,982 | 9,830 | 8,664 | 0 | 0 | 5,932 | 9,529 | 8,719 | 6,520 |
| 28 | 8,699 | 8,637 | 8,736 | 8,445 | 10,523 | 8,641 | 0 | 0 | 0 | 9,515 | 8,720 | 9,955 |
| 29 | 8,298 | 8,616 | 8,692 | 8,678 | 9,965 | 8,633 | 0 | 0 | 0 | 9,499 | 8,715 | 8,927 |
| 30 | 8,685 | | 8,717 | 8,668 | 9,705 | 8,712 | 0 | 0 | 0 | 9,111 | 7,846 | 8,642 |
| 31 | 8,704 | | 8,725 | | 8,630 | | 0 | 0 | | 9,888 | | 8,970 |
| Total | 269,806 | 251,265 | 259,741 | 250,075 | 255,736 | 214,385 | 194,307 | - | 182,957 | 130,720 | 270,429 | 252,128 |

Observaciones: El periodo de entrega de agua en septiembre fue utilizando una solución de contingencia que requería coordinaciones con terceros para poner en servicio el sistema.

Fuente: MLCC

Registro de Flujo Promedio de Entrega de Agua diaria en Mal Paso Año 2017 (m3/día)

| | ene-17 | feb-17 | mar-17 | abr-17 | may-17 | jun-17 | jul-17 | ago-17 | sep-17 | oct-17 | nov-17 | dic-17 |
|--------------|----------------|----------------|----------------|----------------|---------------|----------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1 | 8,688 | 8,965 | 628 | 9,673 | 8,385 | 0 | 0 | 7,095 | 7,438 | 8,729 | 8,654 | 9,090 |
| 2 | 8,684 | 8,634 | 8,636 | 9,564 | 8,725 | 0 | 0 | 6,899 | 9,777 | 8,828 | 8,642 | 8,609 |
| 3 | 8,669 | 8,556 | 8,594 | 9,478 | 8,713 | 0 | 0 | 7,293 | 9,305 | 8,843 | 8,648 | 8,831 |
| 4 | 8,641 | 0 | 4,346 | 9,125 | 9,195 | 0 | 0 | 8,027 | 8,798 | 8,779 | 7,922 | 8,663 |
| 5 | 8,610 | 160 | 8,745 | 5,077 | 9,090 | 0 | 0 | 9,699 | 8,760 | 8,688 | 8,747 | 8,648 |
| 6 | 8,588 | 8,646 | 7,515 | 9,227 | 8,630 | 0 | 0 | 9,672 | 8,705 | 9,081 | 8,746 | 8,273 |
| 7 | 8,584 | 8,657 | 8,728 | 9,407 | 8,625 | 0 | 0 | 9,606 | 8,613 | 8,573 | 6,633 | 8,312 |
| 8 | 8,550 | 9,160 | 9,218 | 9,313 | 8,484 | 0 | 0 | 9,768 | 8,598 | 8,633 | 5,329 | 9,686 |
| 9 | 5,706 | 8,716 | 9,431 | 8,701 | 8,967 | 0 | 0 | 9,685 | 8,863 | 8,621 | 8,704 | 9,613 |
| 10 | 8,632 | 8,632 | 9,088 | 8,225 | 5 | 0 | 90 | 2,388 | 8,617 | 8,619 | 7,121 | 8,679 |
| 11 | 8,610 | 8,620 | 8,692 | 8,136 | 0 | 0 | 5,238 | 6,623 | 8,949 | 8,633 | 4,817 | 8,929 |
| 12 | 8,611 | 8,618 | 8,689 | 9,122 | 2,020 | 0 | 8,790 | 6,914 | 8,231 | 8,625 | 5,621 | 0 |
| 13 | 8,293 | 8,611 | 8,605 | 8,841 | 0 | 0 | 9,574 | 10,278 | 8,590 | 8,640 | 6,058 | 7 |
| 14 | 8,423 | 8,630 | 8,482 | 8,443 | 0 | 0 | 8,409 | 10,341 | 9,633 | 8,618 | 5,435 | 8,624 |
| 15 | 8,699 | 8,645 | 5,149 | 8,302 | 0 | 0 | 9,042 | 10,308 | 8,607 | 8,634 | 5,853 | 8,688 |
| 16 | 8,825 | 8,640 | 10,237 | 8,156 | 0 | 0 | 8,243 | 10,768 | 8,609 | 8,955 | 4,635 | 8,697 |
| 17 | 8,884 | 8,441 | 9,066 | 8,157 | 0 | 0 | 7,293 | 7,715 | 8,604 | 9,256 | 4,654 | 8,678 |
| 18 | 9,098 | 8,630 | 8,164 | 8,161 | 0 | 0 | 6,602 | 9,717 | 8,424 | 5,236 | 10,658 | 8,670 |
| 19 | 9,081 | 8,637 | 8,706 | 8,154 | 0 | 0 | 7,514 | 9,701 | 8,576 | 8,022 | 10,737 | 8,674 |
| 20 | 8,838 | 8,635 | 8,592 | 8,138 | 0 | 0 | 7,162 | 9,736 | 9,039 | 8,634 | 10,760 | 8,680 |
| 21 | 8,598 | 8,636 | 8,589 | 9,333 | 0 | 0 | 5,948 | 9,720 | 9,334 | 9,183 | 9,834 | 8,667 |
| 22 | 8,567 | 8,809 | 8,691 | 9,223 | 0 | 0 | 5,837 | 9,705 | 8,665 | 9,146 | 8,659 | 8,677 |
| 23 | 8,883 | 9,985 | 7,497 | 7,999 | 0 | 0 | 7,625 | 9,717 | 9,260 | 9,105 | 9,565 | 8,700 |
| 24 | 9,243 | 10,123 | 7,805 | 8,074 | 0 | 0 | 6,592 | 9,711 | 9,781 | 9,016 | 10,159 | 8,694 |
| 25 | 9,250 | 9,364 | 8,777 | 8,953 | 0 | 0 | 9,057 | 9,735 | 9,431 | 8,243 | 9,598 | 8,685 |
| 26 | 9,288 | 8,650 | 8,310 | 8,344 | 0 | 0 | 9,432 | 9,726 | 9,304 | 8,757 | 9,917 | 8,690 |
| 27 | 8,999 | 8,665 | 6,077 | 8,633 | 0 | 0 | 9,567 | 9,730 | 4,857 | 8,702 | 9,799 | 8,696 |
| 28 | 8,561 | 9,033 | 8,114 | 8,881 | 0 | 0 | 9,326 | 9,723 | 7,059 | 8,739 | 9,795 | 8,396 |
| 29 | 8,527 | | 9,221 | 8,731 | 0 | 0 | 9,682 | 9,725 | 3,203 | 8,657 | 9,797 | 8,187 |
| 30 | 8,722 | | 8,786 | 8,190 | 0 | 0 | 9,649 | 10,315 | 4,853 | 8,660 | 9,807 | 8,209 |
| 31 | 9,103 | | 9,696 | | 0 | | 7,648 | 9,088 | | 8,645 | | 8,204 |
| Total | 268,455 | 229,498 | 250,874 | 257,761 | 80,839 | - | 168,320 | 279,128 | 250,483 | 267,500 | 245,304 | 251,856 |

Fuente: MLCC

 Nota: Mayo-Julio 2017, Aluvión (<http://jvrc.cl/nota356/>)

Registro de Flujo Promedio de Entrega de Agua diaria en Mal Paso Año 2018 (m3/día)

| | ene-18 | feb-18 | mar-18 | abr-18 | may-18 | jun-18 | jul-18 | ago-18 | sep-18 | oct-18 | nov-18 | dic-18 |
|--------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1 | 8,056 | 8,760 | 7,264 | 8,612 | 7,699 | 8,342 | 9,206 | 8,661 | 8,625 | 8,626 | 8,448 | 8,632 |
| 2 | 9,158 | 9,125 | 9,679 | 8,639 | 8,645 | 7,328 | 7,582 | 8,625 | 8,624 | 8,630 | 8,788 | 8,627 |
| 3 | 9,291 | 9,505 | 9,676 | 8,628 | 4,258 | 8,721 | 9,949 | 8,625 | 8,631 | 8,626 | 8,639 | 8,630 |
| 4 | 8,714 | 9,528 | 9,729 | 8,632 | 9,783 | 8,468 | 10,862 | 8,623 | 8,619 | 8,626 | 8,627 | 8,632 |
| 5 | 8,743 | 8,524 | 7,637 | 8,634 | 9,236 | 8,873 | 6,167 | 8,625 | 8,627 | 8,622 | 8,629 | 8,624 |
| 6 | 8,748 | 7,517 | 8,950 | 8,828 | 6,364 | 8,883 | 8,770 | 8,654 | 8,627 | 8,629 | 8,623 | 8,630 |
| 7 | 8,760 | 8,040 | 8,355 | 9,110 | 9,657 | 8,676 | 8,754 | 8,548 | 8,628 | 8,630 | 8,631 | 8,667 |
| 8 | 8,742 | 8,540 | 9,263 | 9,106 | 9,770 | 8,613 | 8,756 | 8,609 | 8,623 | 8,625 | 8,681 | 8,673 |
| 9 | 8,733 | 8,640 | 8,284 | 8,872 | 10,099 | 8,711 | 8,743 | 8,646 | 8,625 | 8,623 | 8,676 | 8,638 |
| 10 | 4,145 | 8,640 | 9,696 | 8,637 | 10,041 | 8,450 | 46 | 8,674 | 8,630 | 8,633 | 8,628 | 8,626 |
| 11 | 5,649 | 8,544 | 8,478 | 8,640 | 9,470 | 8,793 | 30 | 8,621 | 2,916 | 8,631 | 8,626 | 4,407 |
| 12 | 8,831 | 8,280 | 7,493 | 8,637 | 9,714 | 8,880 | 8,633 | 8,269 | 7,749 | 8,630 | 8,627 | 8,625 |
| 13 | 8,536 | 8,065 | 8,195 | 8,643 | 10,023 | 8,592 | 8,862 | 8,972 | 8,642 | 8,623 | 4,163 | 8,625 |
| 14 | 6,590 | 9,140 | 8,621 | 8,642 | 9,613 | 8,730 | 8,524 | 8,674 | 8,628 | 2,812 | 8,649 | 8,625 |
| 15 | 8,684 | 6,833 | 8,362 | 8,707 | 8,763 | 8,537 | 8,252 | 8,700 | 8,622 | 8,599 | 8,454 | 8,629 |
| 16 | 8,268 | 8,588 | 8,642 | 9,047 | 8,494 | 8,515 | 8,749 | 8,867 | 8,623 | 8,628 | 8,638 | 8,626 |
| 17 | 7,824 | 9,070 | 9,136 | 6,716 | 8,558 | 8,588 | 8,751 | 8,829 | 8,629 | 8,625 | 8,262 | 8,678 |
| 18 | 4,607 | 9,020 | 8,967 | 9,093 | 8,686 | 8,668 | 8,743 | 8,820 | 8,644 | 8,629 | 8,372 | 0 |
| 19 | 8,643 | 8,606 | 8,902 | 8,685 | 8,463 | 8,575 | 7,936 | 8,866 | 8,558 | 8,627 | 8,621 | 8,606 |
| 20 | 8,625 | 4,003 | 8,692 | 8,636 | 8,546 | 8,794 | 8,247 | 8,856 | 8,689 | 8,625 | 8,628 | 8,749 |
| 21 | 8,638 | 9,082 | 9,103 | 8,850 | 8,492 | 8,761 | 8,635 | 8,856 | 8,625 | 8,627 | 8,732 | 8,740 |
| 22 | 8,629 | 9,146 | 9,021 | 8,687 | 8,585 | 8,679 | 8,648 | 8,867 | 8,626 | 8,629 | 8,629 | 8,746 |
| 23 | 8,630 | 8,361 | 8,612 | 8,203 | 8,427 | 8,830 | 8,624 | 8,875 | 8,626 | 8,628 | 8,626 | 8,709 |
| 24 | 9,492 | 8,313 | 8,711 | 4,544 | 8,482 | 8,745 | 8,642 | 8,866 | 8,612 | 8,618 | 8,627 | 8,777 |
| 25 | 10,106 | 7,221 | 8,647 | 4,344 | 8,301 | 8,717 | 8,635 | 8,869 | 8,635 | 8,629 | 8,628 | 8,784 |
| 26 | 7,194 | 7,269 | 8,177 | 3,213 | 8,093 | 8,695 | 8,631 | 8,870 | 8,627 | 8,640 | 8,703 | 8,864 |
| 27 | 8,063 | 7,649 | 8,280 | 9,603 | 8,264 | 8,780 | 8,629 | 8,871 | 8,624 | 8,464 | 9,054 | 8,865 |
| 28 | 8,034 | 7,389 | 8,204 | 9,645 | 9,629 | 8,696 | 8,618 | 8,720 | 8,629 | 8,712 | 9,060 | 8,774 |
| 29 | 8,509 | | 8,199 | 6,923 | 8,359 | 9,173 | 8,610 | 8,180 | 8,552 | 8,347 | 9,054 | 8,629 |
| 30 | 7,709 | | 8,234 | 6,179 | 6,654 | 9,458 | 6,332 | 8,141 | 8,688 | 2,763 | 9,056 | 8,625 |
| 31 | 8,380 | | 8,630 | | 9,238 | | 10,677 | 8,143 | | 8,626 | | 8,628 |
| Total | 252,731 | 231,398 | 267,839 | 243,335 | 268,406 | 260,271 | 250,243 | 269,022 | 252,203 | 255,382 | 255,579 | 256,090 |

Fuente: MLCC

APÉNDICE B: CAUDALES MENSUALES EN CANAL MAL PASO DESPUES DE BOCATOMA

Información Bajada en Febrero 2019 (desde página web de DGA)

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|-------------------------|--|--|--|--|-----------------------------|--|--|--|--|--|--|--|--|--|
| GOBIERNO DE CHILE | | | | | | | | | | | | | | | Página: 1 | | | | | | | | | |
| MINISTERIO DE OBRAS PUBLICAS | | | | | | | | | | | | | | | Fecha Emisión: 27-02-2019 | | | | | | | | | |
| DIRECCION GENERAL DE AGUAS | | | | | | | | | | | | | | | | | | | | | | | | |
| CAUDALES MEDIOS MENSUALES (m3/s) | | | | | | | | | | | | | | | | | | | | | | | | |
| PERIODO: 01/01/2014 - 31/12/2018 | | | | | | | | | | | | | | | | | | | | | | | | |
| Estación: CANAL MAL PASO DESPUES DE BOCATOMA | | | | | | | | | | Altitud (msnm): 431 | | | | | UTM Norte (mts): 6955479 | | | | | | | | | |
| Codigo BNA: 03434002-1 | | | | | | | | | | Latitud S: 27° 31' 07" | | | | | UTM Este (mts): 374959 | | | | | | | | | |
| Cuenca: RIO COPIAPO | | | | | | | | | | Longitud W: 70° 15' 57" | | | | | Área de Drenaje (km2): 0,00 | | | | | | | | | |
| SubCuenca: Rio Copiapo Medio (entre R. Jorquera Q. Paipote) | | | | | | | | | | | | | | | | | | | | | | | | |
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Información Bajada en Julio 2019 (desde página web de DGA)

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| GOBIERNO DE CHILE | | | | | | | | | | | | | | | | Página: 1 | | | | | | | | |
| MINISTERIO DE OBRAS PUBLICAS | | | | | | | | | | | | | | | | Fecha Emisión: 15-07-2019 | | | | | | | | |
| DIRECCION GENERAL DE AGUAS | | | | | | | | | | | | | | | | | | | | | | | | |
| CAUDALES MEDIOS MENSUALES (m3/s) | | | | | | | | | | | | | | | | | | | | | | | | |
| PERIODO: 01/01/2014 - 01/01/2020 | | | | | | | | | | | | | | | | | | | | | | | | |
| Estación: CANAL MAL PASO DESPUES DE BOCATOMA | | | | | | | | | | | | | | | | | | | | | | | | |
| Codigo BNA: 03434002-1 | | | | | | | | | | | | Altitud (msnm): 431 | | | | UTM Norte (mts): 6955479 | | | | | | | | |
| Cuenca: RIO COPIAPO | | | | | | | | | | | | Latitud S: 27° 31' 07" | | | | UTM Este (mts): 374959 | | | | | | | | |
| SubCuenca: Rio Copiapo Medio (entre R. Jorquera Q. Paipote) | | | | | | | | | | | | Longitud W: 70° 15' 57" | | | | Área de Drenaje (km2): 0.00 | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| AÑO | ENE | I | FEB | I | MAR | I | ABR | I | MAY | I | JUN | I | JUL | I | AGO | I | SEP | I | OCT | I | NOV | I | DIC | I |
| 2014 | 0.43 | % | | | | | 0.27 | * | 0.22 | | 0.28 | | 0.23 | | 0.27 | | 0.33 | | 0.35 | | 0.27 | | 0.22 | |
| 2015 | 0.25 | | 0.41 | @ | 0.44 | | 0.40 | | 0.30 | | 0.23 | | 0.19 | | 0.26 | % | | | | | | | | |
| 2016 | 0.35 | | 0.35 | | 0.35 | | 0.35 | | 0.35 | | 0.35 | | 0.35 | | 0.35 | | 0.35 | | 0.35 | | 0.35 | | 0.35 | |
| 2017 | 0.35 | | 0.35 | @ | 0.35 | * | 0.35 | % | | | | | | | | | | | | | | | | |
| 2018 | 0.50 | % | 0.59 | | 0.56 | | 0.46 | | 0.52 | | 0.54 | | 0.60 | | 0.48 | | 0.57 | | 0.46 | | | | | |
| 2019 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | | | | | | | | | | | | | | | | | | | | | | | | |
| INDICADOR ES: | * : 1 - 10 Días con Información en el Mes | | | | | | | | | | | | | | | | | | | | | | | |
| | @ : 11 - 20 Días con Información en el Mes | | | | | | | | | | | | | | | | | | | | | | | |
| | % : Más de 20 Días con Información en el Mes | | | | | | | | | | | | | | | | | | | | | | | |
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