Management's Discussion and Analysis

February 26, 2020

Teck

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Our business is exploring for, acquiring, developing and producing natural resources. We are organized into business units focused on steelmaking coal, copper, zinc and energy. These are supported by our corporate offices, which manage our corporate growth initiatives and provide marketing, administrative, technical, health, safety, environment, community, financial and other services.

Through our interests in mining and processing operations in Canada, the United States (U.S.), Chile and Peru, we are the world's second-largest seaborne exporter of steelmaking coal, an important producer of copper, one of the world's largest producers of mined zinc, and we have an interest in a large producing oil sands mine. We also produce lead, silver, molybdenum and various specialty and other metals, chemicals and fertilizers. We actively explore for copper, zinc and gold, and we hold interests in oil sands assets in the Athabasca region of Alberta.

This Management's Discussion and Analysis of our results of operations is prepared as at February 26, 2020 and should be read in conjunction with our audited annual consolidated financial statements for the year ended December 31, 2019. Unless the context otherwise dictates, a reference to Teck, Teck Resources, the Company, us, we or our refers to Teck Resources Limited and its subsidiaries, including Teck Metals Ltd. and Teck Coal Partnership. All dollar amounts are in Canadian dollars, unless otherwise stated, and are based on our 2019 audited annual consolidated financial statements that are prepared in accordance with International Financial Reporting Standards (IFRS) as issued by the International Accounting Standards Board. In addition, we use certain financial measures, which are identified throughout the Management's Discussion and Analysis in this report, that are not measures recognized under IFRS and do not have a standardized meaning prescribed by IFRS. See "Use of Non-GAAP Financial Measures" on page 60 for an explanation of these financial measures and reconciliation to the most directly comparable financial measures under IFRS.

This Management's Discussion and Analysis contains certain forward-looking information and forward-looking statements. You should review the cautionary statement on forward-looking statements under the heading "Cautionary Statement on Forward-Looking Statements" on page 70, which forms part of this Management's Discussion and Analysis, as well as the risk factors discussed in our most recent Annual Information Form.

Additional information about us, including our most recent Annual Information Form, is available on our website at www.teck.com, under Teck's profile at www.sedar.com (SEDAR), and on the EDGAR section of the United States Securities and Exchange Commission (SEC) website at www.sec.gov.

Business Unit Results

The following table shows a summary of our production of our major commodities for the last five years and estimated production for 2020.

Five-Year Production Record and Our Estimated Production in 2020

Principal Products		2015	2016	2017	2018	**2019**	2020 estimate[3]
Steelmaking coal	million tonnes	25.3	27.6	26.6	26.2	**25.7**	24.0
Copper[1]	thousand tonnes	358	324	287	294	**297**	293
Zinc							
Contained in concentrate[1]	thousand tonnes	658	662	659	705	**640**	620
Refined	thousand tonnes	307	312	310	303	**287**	310
Bitumen[1][2]	million barrels	–	–	–	6.8	**12.3**	13.0

Notes:

[1] We include 100% of production and sales from our Quebrada Blanca and Carmen de Andacollo mines in our production and sales volumes, even though we do not own 100% of these operations, because we fully consolidate their results in our financial statements. We include 22.5% and 21.3% of production and sales from Antamina and Fort Hills, respectively, representing our proportionate ownership interest in these operations. Zinc contained in concentrate production includes co-product zinc production from our 22.5% interest in Antamina.

[2] Fort Hills bitumen results for the year ended December 31, 2018 are included from June 1, 2018.

[3] Production estimates for 2020 represent the midpoint of our production guidance range.

Average commodity prices and exchange rates for the past three years, which are key drivers of our profit, are summarized in the following table.

	US$					CAD$				
	2019	% chg	2018	% chg	2017	**2019**	% chg	2018	% chg	2017
Steelmaking coal (realized — $/tonne)	**164**	-12%	187	+7%	174	**218**	-10%	243	+8%	226
Copper (LME cash — $/pound)	**2.72**	-8%	2.96	+6%	2.80	**3.62**	-6%	3.84	+5%	3.64
Zinc (LME cash — $/pound)	**1.16**	-13%	1.33	+2%	1.31	**1.54**	-10%	1.72	+1%	1.70
Blended bitumen (realized — $/barrel)[1]	**45.20**	+29%	35.12	–	–	**60.12**	+30%	46.14	–	–
Exchange rate (Bank of Canada)										
US$1 = CAD$	**1.33**	+2%	1.30	0%	1.30					
CAD$1 = US$	**0.75**	-3%	0.77	0%	0.77					

Note:
(1) Fort Hills blended bitumen results for the year ended December 31, 2018 are included from June 1, 2018.

Our revenues, gross profit before depreciation and amortization,[1, 2] and gross profit by business unit for the past three years are summarized in the following table.

	Revenues			Gross Profit (Loss) Before Depreciation and Amortization[(1)(2)]			Gross Profit (Loss)		
($ in millions)	**2019**	2018	2017	**2019**	2018	2017	**2019**	2018	2017
Steelmaking coal	**$ 5,522**	$ 6,349	$ 6,014	**$ 2,904**	$ 3,770	$ 3,732	**$ 2,112**	$ 3,040	$ 3,014
Copper	**2,469**	2,714	2,400	**1,080**	1,355	1,154	**617**	877	586
Zinc	**2,968**	3,094	3,496	**831**	1,085	1,173	**601**	869	967
Energy[(3)]	**975**	407	–	**144**	(106)	–	**10**	(165)	–
Total	**$ 11,934**	$ 12,564	$ 11,910	**$ 4,959**	$ 6,104	$ 6,059	**$ 3,340**	$ 4,621	$ 4,567

Notes:
(1) Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.
(2) See “Use of Non-GAAP Financial Measures” section for reconciliation.
(3) Fort Hills blended bitumen results for the year ended December 31, 2018 are included from June 1, 2018.

[1] Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.
[2] See “Use of Non-GAAP Financial Measures” section for reconciliation.

Steelmaking Coal

In 2019, our five steelmaking coal operations in Western Canada produced 25.7 million tonnes of coal, with sales of 25.0 million tonnes. The majority of our sales are to the Asia-Pacific region, with lesser amounts sold primarily to Europe and the Americas. Our long-term annual production capacity is approximately 27 million tonnes, and we have total proven and probable reserves of 840 million tonnes of steelmaking coal.

As planned, Coal Mountain Operations transitioned to closure in the second quarter of 2019. We have offset the loss of production at Coal Mountain through higher production and improved processing throughput at our other Elk Valley operations.

Consistent with our capital allocation framework, in May 2019 we announced that we will not proceed with the MacKenzie Redcap extension at our Cardinal River Operations. The operation is expected to close in the second half of 2020 and then transition to care and maintenance. As a result, Cardinal River production is expected to decrease to approximately 700,000 tonnes in 2020. The lost production is expected to be made up by our Elkview Operations with a plant expansion project scheduled to be completed in the first quarter of 2020.

In 2019, our steelmaking coal business unit accounted for 46% of revenue and 58% of gross profit before depreciation and amortization.

($ in millions)	**2019**	2018	2017
Revenues	**$ 5,522**	$ 6,349	$ 6,014
Gross profit before depreciation and amortization[(1)(2)]	**$ 2,904**	$ 3,770	$ 3,732
Gross profit	**$ 2,112**	$ 3,040	$ 3,014
Production (million tonnes)	**25.7**	26.2	26.6
Sales (million tonnes)	**25.0**	26.0	26.5

Notes:
(1) Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.
(2) See “Use of Non-GAAP Financial Measures” section for reconciliation.

Operations

Gross profit for our steelmaking coal business unit was $2.1 billion in 2019, down from $3.0 billion in 2018, due to lower prices and lower sales volumes. Gross profit before depreciation and amortization for our steelmaking coal business unit declined to $2.9 billion in 2019.

On February 11, 2019, we agreed with POSCO Canada Limited (Poscan) to increase the royalty paid by Poscan in respect of its 20% share of Greenhills’ coal production. As a result, the royalty we received increased by $74 million, from $21 million in 2018 to $95 million in 2019.

Our average realized steelmaking coal selling price in 2019 declined to US$164 per tonne, compared with US$187 per tonne in 2018 and US$174 per tonne in 2017.

Sales volumes were 25.0 million tonnes in 2019, compared with 26.0 million tonnes sold in 2018. Sales

[1] Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.
[2] See “Use of Non-GAAP Financial Measures” section for reconciliation.

volumes were negatively affected by logistical issues throughout the supply chain during 2019. Our 2019 production of 25.7 million tonnes was 0.5 million tonnes lower than 2018, primarily due to logistics chain issues combined with mining challenges at Cardinal River Operations and Fording River Operations.

The adjusted site cost of sales[1, 2] in 2019 was $65 per tonne and within our annual guidance range. As anticipated, this cost was higher than the $62 per tonne cost of product sold in 2018. The increase in 2019 was primarily a result of mining in new, recently permitted areas at a number of our operations, with increased strip ratios to generate production after the closure of Coal Mountain.

As a result of our decision not to proceed with the MacKenzie Redcap extension at our Cardinal River Operations and the short remaining mine life, combined with lower steelmaking prices, we recorded pre-tax non-cash impairment charges of $289 million in 2019.

Capital spending in 2019 included $403 million for sustaining capital, $155 million for major enhancements to maintain and increase long-term production capacity, and $192 million for the Neptune Bulk Terminals upgrade project.

Elk Valley Water Quality Management

We continue to implement the water quality management measures required by the Elk Valley Water Quality Plan (the Plan), an area-based management plan that was approved in the fourth quarter of 2014 by the British Columbia (B.C.) Minister of Environment. The Plan establishes short-, medium- and long-term water quality targets for selenium, nitrate, sulphate, and cadmium to protect the environment and human health, as well as a plan to manage calcite formation. In 2019, the B.C. Government endorsed the use of Saturated Rock Fill (SRF) technology, and we have received approval to construct an expansion of SRF water treatment capacity at Elkview Operations. Elkview Operations' SRF has been successfully operating since January 2018, treating up to 10 million litres per day and achieving near-complete removal of nitrate and selenium from mine-impacted waters.

To the end of 2019, we have spent approximately $437 million (approximately $392 million of capital and $45 million of SRF research and development costs) on implementation of the Elk Valley Water Quality Plan, including construction of the first active water treatment facility (AWTF) at our Line Creek Operations, treating up to 7.5 million litres per day. The second AWTF, at our Fording River Operations, with an expected capacity of 20 million litres per day, is under construction and scheduled to be completed in the fourth quarter of 2020. We have commenced construction of Elkview SRF Phase 2, which has a projected completion date in the fourth quarter of 2020, and in conjunction with Phase 1, will treat up to an additional 20 million litres per day. By the end of the fourth quarter 2020, we expect to have the capacity to treat up to 47.5 million litres per day.

Capital spending in 2020 on water treatment is expected to be approximately $290 million. The majority of the planned spend relates to the completion of our Fording River AWTF and Elkview Phase 2 SRF. In addition, we continue to invest in various innovative technical solutions to address water quality issues. Additional research and development projects are ongoing to continue to improve our understanding of water quality, source control and treatment options.

[1] Non-GAAP Financial Measure. See "Use of Non-GAAP Financial Measures" section for further information.
[2] See "Use of Non-GAAP Financial Measures" section for reconciliation.

Over the following four years, from 2021 to 2024, we plan to invest an additional $350 to $400 million of capital to further increase water treatment capacity to 90 million litres per day by the end of 2024. In addition, during the same period we plan to spend approximately $85 million in capital on source control and calcite management, and approximately $90 million on tributary-specific treatment. Capital spending in 2021 is expected to be similar to 2020 levels and is expected to decrease significantly in 2022 to 2024. Following the completion of both the Elkview SRF Phase 2 and the AWTF at Fording River Operations in 2020, the plan includes the construction of 30 million litres per day of additional SRF capacity at the north end of the Elk Valley and 12.5 million litres per day at our Line Creek Operations. The first phase of our next SRF at the north end of the Elk Valley is designed to treat 15 million litres per day and completion is expected in the first quarter of 2021.

Operating costs associated with water treatment were approximately $1.30 per tonne in 2019 and are projected to increase gradually over the long term to approximately $3 per tonne as additional AWTFs and SRFs become operational. After 2024, ongoing capital costs for construction of additional treatment facilities are expected to average approximately $2 per tonne annually.

Final costs of implementing the Plan and managing water quality will depend in part on the technologies applied and on the results of ongoing environmental monitoring and modelling. The timing of expenditures will depend on resolution of technical issues, permitting timelines and other factors. Our current plan is that the Fording River AWTF will be the last full-scale AWTF and that future treatment facilities will be SRFs. Implementation of this plan will require additional operating permits. We expect that, in order to maintain water quality, some form of water treatment will continue for an indefinite period after mining operations end. The Plan contemplates ongoing monitoring to ensure that the water quality targets set out in the Plan are in fact protective of the environment and human health, and provides for adjustments if warranted by monitoring results. This ongoing monitoring, as well as our continued research into treatment technologies, could reveal unexpected environmental impacts, technical issues or advances associated with potential treatment technologies that could substantially increase or decrease both capital and operating costs associated with water quality management, or that could materially affect our ability to permit mine life extensions in new mining areas. Fish census data obtained in late 2019 showed unexpected and substantial reductions in populations of westslope cutthroat trout in certain mine-affected waters in the Elk Valley. The causes of the reductions are unclear and substantial technical effort is underway to determine whether the reductions are associated with water quality issues, flow conditions and habitat availability, or predation or other natural causes, and to develop a response plan. Until the results of this additional work are available and appropriate mitigation measures in place, we may face delays in permitting or restrictions on our mining activities in the Elk Valley.

During the third quarter of 2018, we received notice from Canadian federal prosecutors of potential charges under the *Fisheries Act* in connection with discharges of selenium and calcite from steelmaking coal mines in the Elk Valley. Since 2014, compliance limits and site performance objectives for selenium and other constituents, as well as requirements to address calcite, in surface water throughout the Elk Valley and in the Koocanusa Reservoir have been established under a regional permit issued by the provincial government, which references the Plan. If federal charges are laid, potential penalties may include fines as well as orders with respect to operational matters. We expect that discussions with respect to the draft charges will continue through the first quarter. It is not possible at this time to fully assess the viability of our potential defences to any charges, or to estimate the potential financial impact on us of any conviction. Nonetheless, that impact may be material.

Rail

Rail transportation of product from our four steelmaking coal mines in southeast B.C. to Vancouver port terminals is currently provided under a 10-year agreement with CP Rail, which expires March 31, 2021. Most eastbound coal deliveries to North American customers are shipped pursuant to an arrangement with CP Rail. The remaining eastbound coal deliveries are shipped via the BNSF Railway. Our Cardinal River Operations in Alberta is served by Canadian National Railway (CN), which transports our product to ports on the west coast.

In December 2019, we entered into a long-term agreement with CN for shipping of steelmaking coal from our four B.C. operations between Kamloops and Neptune Bulk Terminals and other west coast ports, including Ridley Terminals Inc. The agreement runs from April 2021 to December 2026, and will enable us to increase shipment volumes significantly through an expanded Neptune Bulk Terminals. The agreement also provides for investments by CN of more than $125 million to enhance rail infrastructure and support increased shipment volumes to Neptune Bulk Terminals and through Ridley Terminals.

Ports

We continue to progress the Neptune Bulk Terminals facility upgrade project, which will include a five-month period from May to September when we intend to suspend operations at Neptune Bulk Terminals in order to match port capacity with reduced production and improve productivity and safety as we advance construction. This is expected to be the last extended construction outage at Neptune Bulk Terminals. The upgrade project will significantly increase terminal-loading capacity and improve our capability to meet our delivery commitments to our customers while lowering our overall logistics costs. The total cost of the project is expected to be approximately $800 million, consistent with our previous guidance. The business case for this project remains strong. It will provide us with an exclusive terminal that will help us meet the long-term requirements of our customers for consistent, high-quality product at significantly reduced costs. In 2019, we invested $192 million on the Neptune Bulk Terminals facility upgrade project. In addition to the 2020 capital expenditures noted above, the program includes $390 million to be spent in 2020 and approximately $120 million in 2021. The Neptune Bulk Terminals facility upgrades are expected to be completed in the first quarter of 2021 and we are evaluating opportunities to gradually increase port capacity earlier. There is a risk that if completion is delayed, we may limit our production and sales temporarily on expiry of our contract with Westshore Terminals.

Our contract with Westshore Terminals, which expires March 31, 2021, currently provides us with 19 million tonnes of annual capacity. In January 2020, we announced an expanded commercial agreement with Ridley Terminals for shipments of steelmaking coal from Teck's British Columbia operations. The agreement runs from January 2021 to December 2027, and increases contracted capacity from 3 million tonnes per annum (Mtpa) to 6 Mtpa, with an option for Teck to extend up to 9 Mtpa. This will enable Teck to increase its shipment volumes through Ridley Terminals to provide greater flexibility and improved performance within its overall steelmaking coal supply chain.

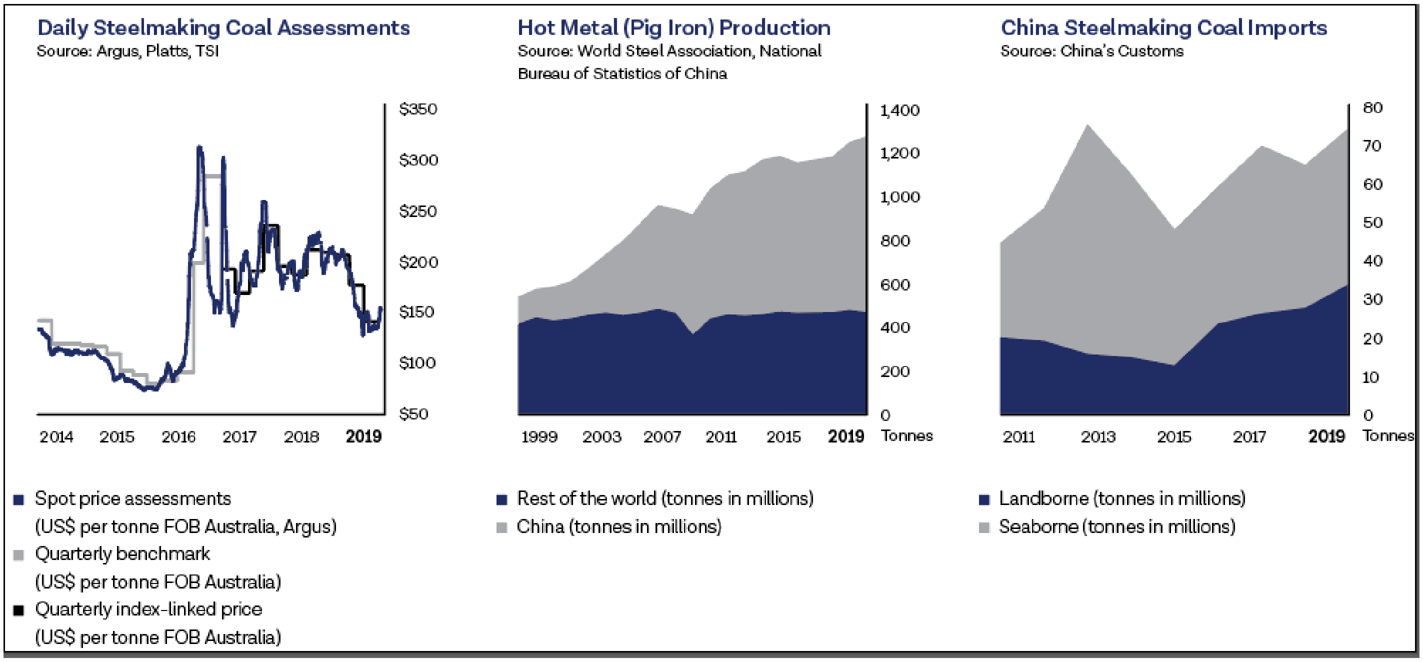
Sales

Our steelmaking coal marketing strategy is focused on maintaining and building relationships with our traditional customers, while establishing new customers in markets where we anticipate long-term growth in steel production and demand for seaborne steelmaking coal. In 2019, we continued to focus our marketing in areas with the greatest demand growth, which included increasing sales volumes to India.

Markets

Steel production and demand for seaborne steelmaking coal remained strong through the first half of 2019 before market conditions deteriorated in the second half of the year. Steelmaking coal spot prices were affected by pressure on steelmakers' margins, created by lower steel pricing and continued high iron ore pricing. The steelmaking coal market remains fundamentally supported by demand from steel capacity growth in India and increased imports into China. Market sentiment has improved slightly for 2020, as steel margins are expected to improve, with higher steel prices and lower iron ore and coking coal costs. While investment in steelmaking coal capacity increased in the past two years, it currently remains low. Permitting processes for steelmaking coal mines remain challenging and capital markets are rationing capital to coal, limiting the supply response.

The following graphs show key metrics affecting steelmaking coal sales: spot price assessments and quarterly pricing, hot metal production (each tonne of hot metal, or pig iron, produced requires approximately 650–700 kilograms of steelmaking coal), and China's steelmaking coal imports by source.



Daily Steelmaking Coal Assessments
Source: Argus, Platts, TSI

Hot Metal (Pig Iron) Production
Source: World Steel Association, National Bureau of Statistics of China

China Steelmaking Coal Imports
Source: China's Customs

Outlook

Throughout 2019, we experienced logistics performance issues across the supply chain due to underperformance in port and rail services, material handling issues and poor weather conditions. As a result, although the logistics supply chain performance improved in the fourth quarter, we are starting 2020 with record-high site inventory levels, which reduces our operating flexibility. Given the potential for weaker demand in the short-term due to the effects of the Coronavirus and the high inventory levels due to rail and port constraints, we are choosing to temporarily reduce production and implement a shutdown of Neptune Bulk Terminals in order to progress the facility upgrade. This reduction, combined with extreme winter weather in January and early February, which was then followed by rail blockades, means that we now expect our steelmaking coal production in 2020 to be between 23.0 and 25.0 million tonnes.

As previously disclosed, we continue to advance mining in new areas at our Fording River, Elkview and Greenhills operations. These new areas are expected to extend the lives of these mines and allow us to increase production to offset the closure of Coal Mountain and Cardinal River operations. Our Cardinal River Operations will transition to closure by the second half of 2020. We are investing in the Elk Valley processing plants and will be transferring mobile equipment from Cardinal River in order to support increased mining activities in the Elk Valley. As part of our strategy to maintain production capacity of approximately 27 million tonnes in the Elk Valley, Elkview Operations is scheduled to complete its plant expansion project in the first quarter of 2020. Our Elkview Operations are anticipating a reduction of strip ratio over the next three to five years.

Although coal prices have softened since the beginning of 2019, market fundamentals remain supportive of our sales plan. Final sales and average prices for the quarter will depend on product mix, market direction for spot priced sales and timely arrival of vessels, as well as the performance of the rail transportation network and port loading facilities. Due to the weather-related challenges discussed above, and rail blockades, we are expecting 2020 first quarter sales to reach approximately 4.8 to 5.2 million tonnes, down from the previous estimate of 5.1 to 5.4 million tonnes. As always, our sales may vary depending on the performance of our logistics chain, which has been negatively impacted by severe winter weather in January and early February and by blockades on rail lines, the construction related to the Neptune Bulk Terminals upgrade project, and strong third-party volumes.

We expect sustaining capital expenditures for our steelmaking coal operations to be approximately $475 million in 2020, including approximately $290 million related to water treatment, $100 million for ongoing operations and $85 million for Neptune Bulk Terminals. Approximately $140 million will be invested in major enhancement projects in 2020, primarily related to increasing the plant capacity at Elkview Operations and the development of new mining areas at our Elk Valley Operations. In addition, RACE21$^{\text{TM}}$ major enhancement capital of $65 million will be invested in the coal operations, mostly for our autonomous haulage pilot at Elkview Operations. Expected capitalized stripping costs in 2020 are approximately $340 to $390 million.

As disclosed in the third quarter of 2019, we plan to complete some of our annual maintenance major plant outages earlier in 2020, reducing our steelmaking coal production in the first half of the year and increasing production in the second half of the year. The Neptune Bulk Terminals' extended construction outage from May to September will also affect our quarterly production and corresponding cost of sales. As a result, we expect quarterly cost of sales per tonne to be higher in the first quarter of 2020 than the fourth quarter of 2019 with the lower production rates, and then decreasing in the fourth quarter of 2020 when we are back to near-full production levels. We expect our 2020 adjusted site costs of sales to be between $63 to $67 per tonne reflecting the extended construction outages to progress the Neptune Bulk Terminal facility upgrades combined with the logistics chain challenges in January and early February.

Transportation costs in 2020 are expected to increase to approximately $40 to $43 per tonne, with lower volumes delivered to Neptune Bulk Terminals during the construction outages and higher rail and port rates.

Copper

In 2019, we produced 297,300 tonnes of copper from our Highland Valley Copper Operations in B.C., our 22.5% interest in Antamina in Peru, and our Carmen de Andacollo and Quebrada Blanca operations in Chile. Copper production rose by 1% from 2018, due to higher ore grades and improved recovery from Highland Valley Copper, offset by lower production from Carmen de Andacollo and Quebrada Blanca.

In 2019, our copper business unit accounted for 21% of our revenue and 22% of our gross profit before depreciation and amortization.

	Revenues			Gross Profit (Loss) Before Depreciation and Amortization[1][2]			Gross Profit (Loss)		
($ in millions)	**2019**	2018	2017	**2019**	2018	2017	**2019**	2018	2017
Highland Valley Copper	**$ 1,005**	$ 941	$ 733	**$ 395**	$ 343	$ 213	**$ 196**	$ 164	$ 18
Antamina	**900**	1,061	936	**614**	794	670	**457**	652	534
Carmen de Andacollo	**394**	488	549	**89**	193	222	**23**	121	142
Quebrada Blanca	**170**	224	182	**(18)**	26	50	**(59)**	(59)	(107)
Other	**–**	–	–	**–**	(1)	(1)	**–**	(1)	(1)
Total	**$ 2,469**	$ 2,714	$ 2,400	**$ 1,080**	$ 1,355	$ 1,154	**$ 617**	$ 877	$ 586

Notes:

[1] Non-GAAP Financial Measure. See "Use of Non-GAAP Financial Measures" section for further information.

[2] See "Use of Non-GAAP Financial Measures" section for reconciliation.

	Production[1]			Sales[1]		
(thousand tonnes)	**2019**	2018	2017	**2019**	2018	2017
Highland Valley Copper	**121**	101	93	**124**	103	89
Antamina	**101**	100	95	**101**	99	94
Carmen de Andacollo	**54**	67	76	**55**	64	77
Quebrada Blanca	**21**	26	23	**21**	26	23
Total	**297**	294	287	**301**	292	283

Note:

[1] We include 100% of production and sales from our Quebrada Blanca and Carmen de Andacollo mines in our production and sales volumes, even though we do not own 100% of these operations, because we fully consolidate their results in our financial statements. We include 22.5% of production and sales from Antamina, representing our proportionate ownership interest in the operation.

Operations

Highland Valley Copper

Our Highland Valley Copper Operations is located in south-central B.C. Gross profit was $196 million in 2019, compared with $164 million in 2018, primarily due to higher copper production and sales, which offset lower copper prices and lower molybdenum production, sales and prices. Gross profit before depreciation and amortization was $395 million in 2019, compared to $343 million in 2018 and $213 million in 2017.

Highland Valley Copper's 2019 copper production was 121,300 tonnes, compared to 100,800 tonnes in 2018 and 92,800 tonnes in 2017. The increase was primarily due to higher copper grades and improved mill recoveries. Molybdenum production was 24% lower in 2019 at 6.6 million pounds, compared to 8.7 million pounds in 2018, primarily due to lower molybdenum grades and recovery, as anticipated in the mine plan.

We completed the installation of an additional D3 ball mill in May 2019, with commissioning and ramp-up continuing into the first quarter of 2020. Our autonomous haulage project continued in 2019, with nine trucks now fully operational and 26 million tonnes hauled during the year.

Copper production is expected to increase in 2020 compared to 2019 due to higher recoveries from improving ore characteristics, the realization of additional throughput and recovery benefits from the implementation of mill analytics as part of our RACE21^{TM} innovation-driven business transformation program and continued ramp-up of the additional D3 ball mill.

Copper production in 2020 is anticipated to be between 133,000 and 138,000 tonnes, with lower production in the first half of 2020. Annual copper production from 2021 to 2023 is expected to be between 155,000 and 165,000 tonnes per year. Copper production is anticipated to average about 150,000 tonnes per year after 2023, through to the end of the current mine plan in 2027. Molybdenum production in 2020 is expected to be between 4.5 to 5.5 million pounds contained in concentrate, with annual production expected to be between 3.5 to 5.0 million pounds per year afterwards. We continue to advance studies that assess the potential economic viability of extending the Highland Valley Copper mine life to 2040 with completion of a feasibility study expected in 2020.

Antamina

We have a 22.5% share interest in Antamina, a copper-zinc mine in Peru. The other shareholders are BHP Billiton plc (33.75%), Glencore plc (33.75%) and Mitsubishi Corporation (10%). Gross profit in 2019 was $457 million, compared with $652 million in 2018 and $534 million in 2017. Gross profit in 2019 decreased from 2018 primarily due to lower copper and zinc prices, and reduced zinc volume as a result of lower zinc grades as anticipated in the mine plan. In 2019, our share of gross profit before depreciation and amortization was $614 million, compared with $794 million in 2018 and $670 million in 2017.

Antamina’s copper production (100% basis) in 2019 was 448,500 tonnes, compared to 446,100 tonnes in 2018, with slightly higher grades offset by slightly lower recoveries. Zinc production was 303,300 tonnes in 2019, a decrease from 409,300 tonnes of production in 2018, primarily due to lower zinc grades as a result of mine sequencing. In 2019, molybdenum production was 7.8 million pounds, which was 24% lower than in 2018.

In June 2019, Antamina signed a new three-year collective agreement, with a one-time US$64 million labour settlement charge. Our US$14 million share was recognized through cost of sales in the third quarter of 2019.

Pursuant to a long-term streaming agreement made in 2015, Teck delivers an equivalent to 22.5% of payable silver sold by Compañía Minera Antamina S.A. to a subsidiary of Franco-Nevada Corporation (FNC). FNC pays a cash price of 5% of the spot price at the time of each delivery, in addition to an upfront acquisition price previously paid. In 2019, approximately 2.8 million ounces of silver were delivered under the agreement. After 86 million ounces of silver have been delivered under the agreement, the stream will be reduced by one-third. A total of 15.2 million ounces of silver have been delivered under the agreement from the effective date in 2015 to December 31, 2019.

Our 22.5% share of Antamina's 2020 production is expected to be in the range of 88,000 to 92,000 tonnes of copper, 100,000 to 105,000 tonnes of zinc and approximately 2.0 million pounds of molybdenum in concentrate. Our share of copper production is expected to average 90,000 tonnes per year from 2021 to 2023. Our share of zinc production is expected to be between approximately 90,000 and 100,000 tonnes per year from 2021 to 2023, although annual production may fluctuate due to feed grades and the amount of copper-zinc ore processed. Our share of annual molybdenum production is expected to be between 2.0 and 3.0 million pounds per year between 2021 and 2023.

Carmen de Andacollo

We have a 90% interest in the Carmen de Andacollo mine, which is located in the Coquimbo Region of central Chile. The remaining 10% is owned by Empresa Nacional de Minería (ENAMI), a state-owned Chilean mining company. Gross profit decreased to $23 million in 2019 from $121 million in 2018, primarily due to lower production and sales volumes due to strike action by the Workers' Union, which caused the suspension of operations in the fourth quarter, as well as lower copper prices. Gross profit before depreciation and amortization was $89 million in 2019, compared to $193 million in 2018 and $222 million in 2017.

A regulated bargaining process with the Workers' Union commenced in September 2019, and did not result in an agreement. The Workers' Union subsequently commenced strike action on October 14, 2019. Following ratification of a new three-year collective agreement, on December 5, 2019, operations resumed. In August 2019, we also signed a new three-year collective agreement with the supervisory union.

Carmen de Andacollo produced 51,600 tonnes of copper contained in concentrate in 2019, compared to 63,500 tonnes in 2018. The decrease was primarily due to the strike action in the fourth quarter resulting in approximately 9,000 tonnes of lost production. Copper cathode production was 2,400 tonnes in 2019, compared with 3,700 tonnes in 2018. Gold production of 46,800 ounces in 2019 was lower than the 59,600 ounces produced in 2018, with 100% of the gold produced for the account of RGLD Gold AG, a wholly owned subsidiary of Royal Gold, Inc. In effect, 100% of gold production from the mine has been sold to Royal Gold, Inc., who pays a cash price of 15% of the monthly average gold price at the time of each delivery, in addition to an upfront acquisition price previously paid.

Copper grades are expected to continue to decline towards reserve grades in 2020 and future years. Carmen de Andacollo's production in 2020 is expected to be in the range of 57,000 to 62,000 tonnes of copper, including approximately 3,000 tonnes of copper cathode. Annual copper in concentrate production is expected to average between 55,000 and 60,000 tonnes from 2021 to 2023. Cathode production is uncertain beyond 2020, although there is some potential to extend production.

Quebrada Blanca

Our Quebrada Blanca Operations is located in the Tarapacá Region of northern Chile. We have a 60% interest in Compañia Minera Quebrada Blanca S.A. (QBSA). The remaining 30% interests are owned indirectly by Sumitomo Metal Mining Co., Ltd. and Sumitomo Corporation (together referred to as SMM/SC), and 10% owned by ENAMI. ENAMI's 10% preference share interest in QBSA does not require ENAMI to fund capital spending.

Quebrada Blanca Operations

Quebrada Blanca incurred a gross loss of $59 million, the same as in 2018. Quebrada Blanca's gross loss before depreciation and amortization was $18 million in 2019, compared to a profit of $26 million in 2018 and $50 million in 2017.

Since the first quarter of 2017, all supergene ore mined has been sent directly to the dump leach circuit. Mining operations ceased in the fourth quarter of 2018 and mining equipment and personnel have been redeployed to the Quebrada Blanca Phase 2 (QB2) project, and the operation is now focused on leaching the dump material and secondary extraction.

Quebrada Blanca produced 21,100 tonnes of copper cathode in 2019, compared to 25,500 tonnes in 2018.

Cathode production is expected to continue until late 2020 at declining production rates. We expect production of approximately 7,000 to 8,000 tonnes of copper cathode in 2020.

In the fourth quarter of 2019, a US$15 million inventory write-down was recorded due to higher expected unit costs as cathode production declines. We also recorded a pre-tax asset impairment charge of US$23 million related to remaining assets of the cathode operations.

Quebrada Blanca Phase 2

The QB2 project is one of the world's largest undeveloped copper resources. QB2 is expected to have low operating costs, an initial mine life of 28 years and significant potential for further growth.

On March 29, 2019, we closed a transaction where SMM/SC subscribed for a 30% indirect interest in QBSA, which owns the QB2 copper development. SMM/SC contributed $1.3 billion (US$966 million) to QBSA on closing of the transaction and a further $444 million (US$336 million) over the remainder of 2019, including $38 million for interest on the loan advances during 2019.

In the fourth quarter of 2019, we closed the US$2.5 billion limited recourse project financing to fund the development of QB2. With funding from the project financing and the partnering transaction with SMM/SC, our first contributions to the project are not expected until early 2021.

There are currently over 7,500 people actively working across the six major construction areas on the project, with all major contractors progressing in the field. With earthworks and concrete well advanced, the project has commenced steel erection and the placement of mechanical equipment including the first grinding mill. In addition, construction of the tailings dam facility and pipelines is progressing. Although the project continues to target first production in the fourth quarter of 2021 with ramp-up to full production expected during 2022, there have been delays in the schedule primarily due to permitting and social unrest in Chile, which will also affect the cost. A new baseline schedule is being developed in conjunction with an updated capital cost estimate for the first quarter of 2020.

Project development expenditures in 2019 were approximately US$920 million, with approximately an additional US$2.0 billion of capital commitments as at December 31, 2019. Engineering, contracting and procurement activities are all over 95% complete. The development of the project is based on a technical report that is compliant with National Instrument (NI) 43-101.

Drilling and engineering studies for the QB3 project are ongoing. In support of our cost reduction program, we are delaying the start of the prefeasibility study and will continue with targeted development trade-off analysis. The project continues to explore opportunities to more than double the production capacity in order to leverage the extensive resources beyond QB2.

Other Copper Projects

Compañía Minera NuevaUnión S.A., which owns the Relincho and La Fortuna projects, is owned 50% by Teck and 50% by Newmont Corporation. In 2019, our NuevaUnión joint venture continued to advance its feasibility study, which will be completed during the first quarter of 2020. The partners agreed to defer submission of the Environmental Impact Assessment (EIA) from the previously announced fourth quarter of 2019 time frame. Work in 2020 will focus on a review of study results and assessment of optimization opportunities.

Teck and our partners continue to advance the development of five substantial base metals projects, Zafranal, San Nicolás, Galore Creek, Mesaba and Schaft Creek, collectively referred to as the Project Satellite assets. Work in 2020 at Zafranal will focus on advancing permitting efforts, whereas San Nicolás and Galore Creek efforts will be focused on advancing prefeasibility study work and associated environmental and social baseline studies.

As a result of current market conditions and our focus on optimization work, expenditures on NuevaUnión and the Satellite assets are expected to be significantly reduced in 2020. Our 2019 capital expenditures for the Satellite assets were $78 million and funding to NuevaUnión, which is accounted for as an equity investment, was $67 million. Capital expenditures in 2020 for the Satellite assets are expected to be $38 million and funding to NuevaUnión is expected to be $17 million.

Markets

Copper prices on the London Metal Exchange (LME) averaged US$2.72 per pound in 2019, down from US$2.96 per pound in 2018.

Copper stocks on the LME rose by 10% to 145,700 tonnes in 2019, while copper stocks on the Shanghai Futures Exchange rose by 4% to 123,600 tonnes and COMEX warehouse stocks fell 63% to 31,100 tonnes. Combined exchange stocks decreased by 30,900 tonnes during 2019 and ended the year at 304,900 tonnes, the lowest exchange stock level since December 2014. We estimate total reported global stocks, including producer, consumer, merchant, bonded and terminal stocks, stood at an estimated 20.3 days of global consumption versus the 25-year average of 30.2 days.

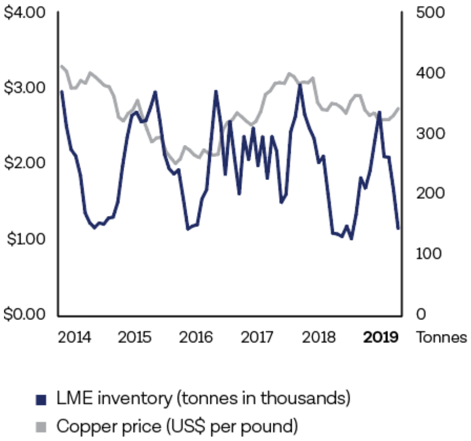
In 2019, global copper mine production fell 0.1% according to Wood Mackenzie, a commodity research consultancy, with total production estimated at 20.8 million tonnes. Wood Mackenzie is forecasting a 1.0%

increase in global mine production in 2020 to 21.0 million tonnes.

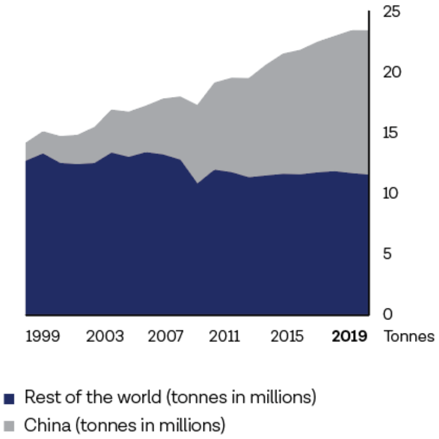
Copper scrap availability decreased in 2019 as imports of scrap and unrefined copper into China, including blister and anode, were down 9% year over year to December 2019.

Wood Mackenzie estimates that global refined copper production grew 0.5% in 2019, while global refined copper demand remained unchanged from 2018. They are projecting that refined cathode production will increase 2.1% in 2020, reaching 24.0 million tonnes. Fundamentals for copper demand are expected to improve over the coming year. Wood Mackenzie forecasts that global copper cathode demand will also increase by 1.8% in 2020, reaching 24.0 million tonnes, suggesting the refined copper market will be relatively balanced in 2020.

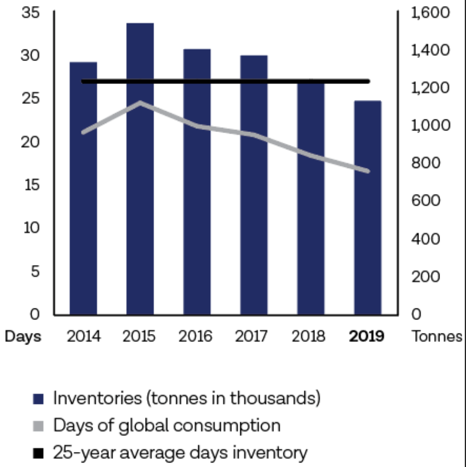
Copper Price and LME Inventory
Source: LME



Global Demand for Copper
Source: Wood Mackenzie



Global Copper Inventories
Source: ICSG, LME, COMEX, SHFE



Outlook

We expect copper production in 2020 to be in the range of 285,000 to 300,000 tonnes, similar to 2019 production levels. Improving throughput and recoveries at Highland Valley Copper, as well as the resumption of operations at Carmen de Andacollo, are expected to largely offset declines at Antamina and Quebrada Blanca.

In 2020, we expect our copper total cash unit costs[1] to be in the range of US$1.55 to US$1.65 per pound before cash margins for by-products, slightly lower than 2019 levels. Copper net cash unit costs[1] are expected to be in the range of US$1.25 to US$1.35 per pound after cash margins for by-products based on current production plans, by-product prices and exchange rates, a decrease from 2019.

We expect annual copper production to be in the range of 300,000 to 315,000 tonnes from 2021 to 2023, excluding QB2, which is expected to add substantially to our overall copper production in 2022.

[1] Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.

Zinc

We are one of the world's largest producers of mined zinc, primarily from our Red Dog Operations in Alaska, and the Antamina copper mine in northern Peru (which has significant zinc co-product production). Our metallurgical complex in Trail, B.C. is one of the world's largest integrated zinc and lead smelting and refining operations. In 2019, we produced 640,100 tonnes of zinc in concentrate, while our Trail Operations produced 287,400 tonnes of refined zinc.

Pend Oreille suspended operations on July 31, 2019 due to the exhaustion of reserves and has transitioned to care and maintenance.

In 2019, our zinc business unit accounted for 25% of revenue and 17% of gross profit before depreciation and amortization.

	Revenues			Gross Profit (Loss) Before Depreciation and Amortization[1][2]			Gross Profit (Loss)		
($ in millions)	**2019**	2018	2017	**2019**	2018	2017	**2019**	2018	2017
Red Dog	**$ 1,594**	$ 1,696	$ 1,752	**$ 837**	$ 990	$ 971	**$ 696**	$ 864	$ 874
Trail Operations	**1,829**	1,942	2,266	**–**	91	209	**(86)**	16	131
Pend Oreille	**56**	98	105	**(4)**	(5)	19	**(7)**	(20)	(12)
Other	**8**	8	8	**(2)**	9	(26)	**(2)**	9	(26)
Intra-segment	**(519)**	(650)	(635)	**–**	–	–	**–**	–	–
Total	**$ 2,968**	$ 3,094	$ 3,496	**$ 831**	$ 1,085	$ 1,173	**$ 601**	$ 869	$ 967

Notes:

[1] Non-GAAP Financial Measure. See "Use of Non-GAAP Financial Measures" section for further information.

[2] See "Use of Non-GAAP Financial Measures" section for reconciliation.

	Production			Sales		
(thousand tonnes)	**2019**	2018	2017	**2019**	2018	2017
Refined zinc						
Trail Operations	**287**	303	310	**284**	304	309
Contained in concentrate						
Red Dog	**553**	583	542	**561**	521	534
Pend Oreille	**19**	30	33	**20**	30	32
Antamina[1]	**68**	92	84	**68**	93	85
Total	**640**	705	659	**649**	644	651

Note:

[1] Co-product zinc production from our 22.5% interest in Antamina.

Operations

Red Dog

Our Red Dog Operations, located in northwest Alaska, is one of the world's largest zinc mines. Gross profit in 2019 was $696 million, lower than $864 million in 2018, primarily due to lower zinc and lead prices, and higher smelter processing charges as a result of higher benchmark treatment charges. Red Dog's gross profit before depreciation and amortization in 2019 was $837 million, compared with $990 million in 2018 and $971 million in 2017.

In 2019, zinc production at Red Dog was 552,400 tonnes, lower than 583,200 tonnes produced in 2018, primarily due to lower throughput and zinc grades. Lead production in 2019 of 102,800 tonnes was slightly higher than 98,400 tonnes in 2018.

Construction progressed on the US$135 million mill upgrade project called VIP2, with planned start-up on schedule for the first quarter of 2020. The project, which started construction in late 2017, is expected to increase average mill throughput by about 15% over the remaining mine life, helping to offset lower grades and harder ore. We are also realizing additional throughput and recovery benefits from the implementation of mill analytics as part of our RACE21™ innovation-driven business transformation program.

Red Dog's location exposes the operation to severe weather and winter ice conditions, which can significantly affect production, sales volumes and operating costs. In addition, the mine's bulk supply deliveries and all concentrate shipments occur during a short ocean shipping season that normally runs from early July to late October. This short shipping season means that Red Dog's sales volumes are usually higher in the last six months of the year, resulting in significant variability in its quarterly profit, depending on metal prices.

In accordance with the operating agreement between Teck and NANA Regional Corporation, Inc. (NANA) governing the Red Dog mine, we pay a royalty on net proceeds of production each quarter. This royalty increases by 5% every fifth year to a maximum of 50%. The most recent increase occurred in October 2017, bringing the royalty to 35% from 30%. The NANA royalty charge in 2019 was US$231 million, compared with US$252 million in 2018. NANA has advised us that it ultimately shares approximately 60% of this royalty, net of allowable costs, with other Regional Alaska Native Corporations pursuant to section 7(i) of the *Alaska Native Claims Settlement Act*.

Red Dog's production of contained metal in 2020 is expected to be in the range of 500,000 to 535,000 tonnes of zinc and 95,000 to 100,000 tonnes of lead. From 2021 to 2023, Red Dog's production of contained metal is expected to be in the range of 500,000 to 540,000 tonnes of zinc and 80,000 to 90,000 tonnes of lead per year.

We are implementing an increased number of tailings and water-related projects in 2020 to manage increased precipitation and water levels at Red Dog Operations. The frequency of extreme weather events has been increasing and these projects are aimed at ensuring that we can continue to optimize the asset and avoid any potential constraints on production in the future.

Trail Operations

Our Trail Operations in southern B.C. produces refined zinc and lead, as well as a variety of precious and specialty metals, chemicals and fertilizer products.

Trail Operations incurred a gross loss of $86 million in 2019, in comparison to a gross profit of $16 million in

2018. The decline in gross profit is primarily due to contracted increases in electricity costs following the sale of the Waneta Dam in July 2018, historically low treatment charges in the first half of 2019, as well as an electrical equipment failure in one of four rectifiers at the zinc refinery in August 2019. Repairs to the rectifier were completed at the end of November, ahead of schedule, at a cost of $6 million. Trail Operations' gross profit before depreciation and amortization was nil in 2019, compared with $91 million in 2018 and $209 million in 2017.

Refined zinc production in 2019 was 287,400 tonnes, compared with 302,900 tonnes in 2018. The decline in refined zinc production was primarily due to the electrical equipment failure. Refined lead production in 2019 was 69,000 tonnes, compared with 61,000 tonnes in 2018. Silver production rose to 14.0 million ounces in 2019 from 11.6 million ounces in 2018 due to higher silver contained in purchased concentrates.

Our recycling process treated 41,000 tonnes of material during the year, and we plan to treat about 46,500 tonnes in 2020. Our focus remains on treating lead acid batteries and cathode ray tube glass, plus small quantities of zinc alkaline batteries and other post-consumer waste.

Trail Operations completed the installation of a second new acid plant in the second quarter of 2019 at a total investment of $174 million since construction began in the first quarter of 2017. The new plant will significantly improve operating reliability and flexibility, reducing downtime and maintenance costs.

In 2020, we expect Trail Operations to produce 305,000 to 315,000 tonnes of refined zinc, and approximately 60,000 to 70,000 tonnes of refined lead. Zinc production from 2021 to 2023 is expected to increase slightly to 310,000 to 315,000 tonnes per year, while annual lead production is expected to remain similar at 65,000 to 70,000 tonnes.

Pend Oreille

Pend Oreille mine, located in Washington state, suspended mining and concentrate production on July 31, 2019, due to the exhaustion of its current reserves. The mine has been placed on care and maintenance.

Zinc production for 2019 was 19,400 tonnes, lower than 29,700 tonnes in 2018 and 33,100 tonnes in 2017, as a result of the suspension of operations. The suspension of concentrate production at Pend Oreille has not had a significant impact on our Trail Operations.

Markets

Zinc prices on the London Metals Exchange (LME) averaged US$1.16 per pound for the year, lower than US$1.33 per pound in 2018.

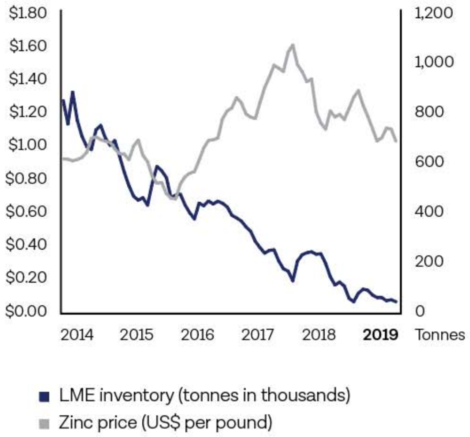
Zinc stocks on the LME fell by 78,100 tonnes in 2019, a 60% decline from 2018 levels, finishing the year at 51,200 tonnes, the lowest LME stock levels since early 2008. Stocks held on the Shanghai Futures Exchange (SHFE) rose 7,900 tonnes in 2019, a 40% increase from historically low levels at the end of 2018. SHFE stocks finished the year at 28,000 tonnes, the second consecutive year SHFE zinc stocks ended below 30,000 tonnes, levels not seen since the start of SHFE zinc stock reporting in 2007. We estimate total reported global stocks, which include producer, consumer, merchant, bonded and terminal stocks, fell by approximately 45,500 tonnes in 2019 to 640,000 tonnes at year-end, representing an estimated 17 days of global demand, compared to the 25-year average of 40 days.

In 2019, global zinc mine production increased 3.1% according to Wood Mackenzie, a commodity research consultancy, with total production reaching 13.3 million tonnes. Wood Mackenzie expects global zinc mine production to grow to 14.0 million tonnes in 2020, largely attributable to several new mines that are expecting to reach full production in 2020, following ramp-up in 2019.

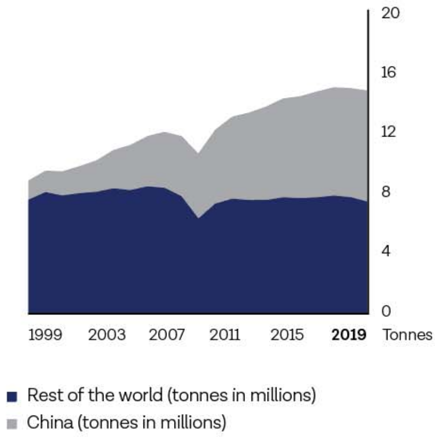
Wood Mackenzie estimates that the global zinc metal market remained in deficit in 2019, recording a shortfall of 0.5 million tonnes. Global refined zinc demand was lower at 14.0 million tonnes, an estimated drop of 1.1% from 2018.

Wood Mackenzie estimates that global refined zinc production increased 1.9% in 2019, with refined production reaching 13.5 million tonnes. They also estimate that refined zinc production will see a 5.2% increase in 2020 over 2019 levels, to 14.2 million tonnes. With global metal demand forecast to grow 1.0% to 14.2 million tonnes, the refined metal market is expected to be relatively balanced in 2020. The combination of current low zinc prices and elevated treatment and refining charges, which represent the miners' contribution to smelters for converting zinc concentrates in zinc metal, is proving challenging especially for higher cost miners.

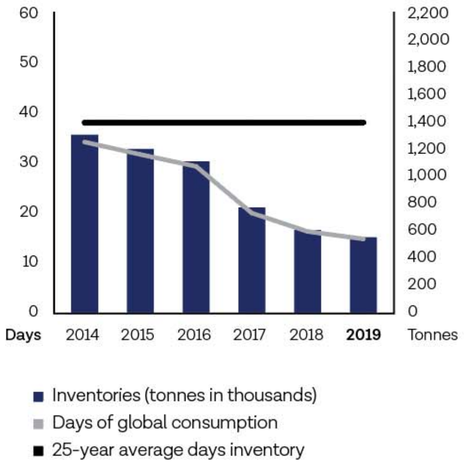
Zinc Price and LME Inventory
Source: LME



Global Demand for Zinc
Source: Wood Mackenzie



Global Zinc Inventories
Source: ILZSG, LME, SHFE



Outlook

We expect zinc in concentrate production in 2020, including co-product zinc production from our copper business unit, to be in the range of 600,000 to 640,000 tonnes. We expect lead production in 2020 from Red Dog to be in the range of 95,000 to 100,000 tonnes.

In 2020, we expect our zinc total cash unit costs to be in the range of US$0.55 to US$0.60 per pound before margins for by-products and net cash unit costs to be US$0.40 to US$0.45 per pound after cash margins for by-products based on current production plans, by-product prices and exchange rates. Net cash unit costs at

Red Dog are expected to increase in 2020, primarily due to lower production and increased smelter processing charges for both zinc and lead, as well as lower expected by-product prices. Net cash unit costs are expected to vary significantly throughout the year, in line with normal seasonal patterns, with higher costs in the first half, as sales of Red Dog lead, our main by-product, are typically completed in the third and fourth quarters.

For the 2021 to 2023 period, we expect total zinc in concentrate production to be in the range of 590,000 to 640,000 tonnes.

Energy

Our energy business unit includes a 21.3% interest in the Fort Hills oil sands mine, a 100% interest in the Frontier oil sands project and a 50% interest in various other oil sands leases in the exploration phase, including the Lease 421 Area. All these assets are located in the Athabasca oil sands region of northeastern Alberta. Our share of production at the Fort Hills oil sands mine was 12.3 million bitumen barrels in 2019.

In 2019, our energy business unit accounted for 8% of revenue and 3% of our gross profit before depreciation and amortization.

Fort Hills [1]

($ in millions)	2019	2018[2]
Blended bitumen price (realized US$/bbl)[3][4]	**$ 45.20**	$ 35.12
Bitumen price (realized CAD$/bbl)[3][4]	**$ 52.21**	$ 32.81
Operating netback (CAD$/bbl)[3][4]	**$ 11.85**	$ (10.95)
Production (million bitumen barrels)	**12.3**	6.8
Production (average barrels per day)	**33,593**	31,955
Sales (million blended bitumen barrels)	**16.0**	8.8
Gross profit (loss) before depreciation and amortization[3][4]	**$ 144**	$ (106)
Gross profit (loss)	**$ 10**	$ (165)

Notes:

[1] Fort Hills figures presented at our ownership interest of 21.3%.

[2] Fort Hills financial results included from June 1, 2018.

[3] Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.

[4] See “Use of Non-GAAP Financial Measures” section for reconciliation.

Fort Hills

The Fort Hills oil sands mine is located in northern Alberta. We hold a 21.3% interest in the Fort Hills Energy Limited Partnership (Fort Hills Partnership), which owns the Fort Hills oil sands mine, with Total E&P Canada Ltd. (Total) and Suncor Energy Inc. (Suncor) holding the remaining interest. An affiliate of Suncor is the operator of the project.

Our gross profit was $10 million in 2019, compared with a loss of $165 million in 2018, with the improved results primarily due to higher realized prices and sales volumes, and a full year of production following the start-up of operations in 2018. Our gross profit before depreciation and amortization from Fort Hills was $144 million in 2019, compared with a loss of $106 million in 2018.

Our 21.3% share of bitumen production from Fort Hills was 33,593 barrels per day in 2019. This compares to 31,955 barrels per day produced in 2018 from when Fort Hills became operational, effective June 1, 2018. Although higher than 2018, production continues to be lower than design capacity due to the Government of Alberta mandatory production curtailments that came into effect on January 1, 2019, which are expected to continue until December 31, 2020. The effect of the curtailments was partially offset by the purchase of 1,502 barrels per day of curtailment credits from other producers during the year.

Adjusted operating costs were $29.24 per barrel in 2019, compared to $32.89 per barrel in 2018, reflecting the effect of higher volumes year over year.

In the fourth quarter of 2019, we recorded a non-cash pre-tax impairment of our interest in Fort Hills of $1.24 billion as a result of lower market expectations for future Western Canadian Select (WCS) heavy oil prices. The economic model for determining the amount of impairment of our interest in Fort Hills assumes a current WCS heavy oil price in 2020 and increases to a long-term WCS price of US$50 per barrel in 2024. The long-term Canadian to U.S. dollar foreign exchange rate assumption used in the analysis was CAD$1.30 to US$1.00. A 5.4% real, 7.5% nominal, post-tax discount rate was used to discount our cash flow projections based on an oil sands weighted average cost of capital.

Fort Hills continues to assess the potential to debottleneck and expand its production capacity. The focus on debottlenecking opportunities will be on those that would require minimal or no capital expenditure. This, along with longer-term opportunities, has the potential to increase Fort Hills' production capacity by up to 20,000 to 40,000 barrels per day of bitumen on a 100% basis.

Our share of Fort Hills' capital expenditures in 2019 was $165 million, primarily related to tailings infrastructure projects.

Markets

Export pipeline capacity for Canadian crude oil versus overall supply was in deficit through 2019 and is expected to remain that way until new long-term capacity is developed. Adding to the imbalance was a slower-than-expected ramp-up of rail takeaway capacity of crude oil. Once contracted for, committed rail capacity will be utilized on a regular basis to ship heavy blends.

Fort Hills' bitumen production is delivered via pipeline to the East Tank Farm blend facility and ultimately sold as a blended bitumen product known as Fort Hills Reduced Carbon Life Cycle Dilbit Blend (FRB). We sell our share of FRB to a variety of customers at the Hardisty market hub and the U.S. Gulf Coast. Approximately 80% of our FRB sales are at Hardisty, with the remainder at the U.S. Gulf Coast.

Our blended bitumen price realizations are influenced by the monthly calendar New York Mercantile Exchange (NYMEX) light sweet crude oil (WTI) and Canadian heavy crude oil differentials at Hardisty, and the U.S. Gulf Coast for WCS. Price realizations are also marginally affected by the specific quality of our blended bitumen.

In 2019, NYMEX WTI averaged US$57.03 per barrel. The WCS price for our Hardisty deliveries of blended bitumen were indexed at an average of NYMEX WTI less US$12.76 per barrel, for a WCS blend value of US$44.27 per barrel. U.S. Gulf Coast deliveries were priced at an average of NYMEX WTI minus US$4.58 per barrel, for a WCS blend value of US$52.38 per barrel.

Global crude oil markets were volatile in 2019, due to slowing demand growth, strong production growth and geopolitical influences. NYMEX WTI prices ranged between US$46.34 and US$66.30. The benchmark monthly contracted index price for blended bitumen at Hardisty ranged from NYMEX WTI minus US$8.43 per barrel to minus US$20.69 per barrel.

According to industry summaries, global demand growth of crude oil and associated liquids in 2019 was a modest 850,000 barrels per day. Overall global inventories declined by 300,000 barrels per day as a voluntary production curtailment of 1.2 million barrels per day from the Organization of Petroleum Exporting Countries (OPEC), and reduced supplies from Iran and Venezuela compensated for a marked increase in non-OPEC production.

Throughout 2019, in response to improved market conditions, the Government of Alberta gradually relaxed the level of curtailments, increasing production by approximately 250,000 barrels per day by year-end. The incremental Alberta production was readily accepted into the market, based on strong demand for heavy oil, and an increase in crude by rail capability, up to 500,000 barrels per day.

Operating Netback

The following table summarizes our Fort Hills operating netback for the year.

(Amounts reported in CAD$ per barrel of bitumen sold)	**2019**	2018[3]
Bitumen price realized[1][2][4]	**$ 52.21**	$ 32.81
Crown royalties[5]	**(1.50)**	(2.04)
Transportation costs for FRB[6]	**(9.62)**	(8.83)
Adjusted operating costs[1][2][7]	**(29.24)**	(32.89)
Operating netback[1][2]	**$ 11.85**	$ (10.95)

Notes:
(1) Non-GAAP measure. See “Use of Non-GAAP Financial Measures” section for further information.
(2) See “Use of Non-GAAP Financial Measures” section for reconciliation.
(3) Fort Hills financial results included from June 1, 2018.
(4) Bitumen price realized represents the realized petroleum revenue (blended bitumen sales revenue) net of diluent expense, expressed on a per barrel basis. Blended bitumen sales revenue represents revenue from our share of the heavy crude oil blend known as Fort Hills Reduced Carbon Life Cycle Dilbit Blend (FRB), sold at the Hardisty and U.S. Gulf Coast market hubs. FRB is comprised of bitumen produced from the Fort Hills oil sands mining and processing operations blended with purchased diluent. The cost of blending is affected by the amount of diluent required and the cost of purchasing, transporting and blending the diluent. A portion of diluent expense is effectively recovered in the sales price of the blended product. Diluent expense is also affected by Canadian and U.S. benchmark pricing and changes in the value of the Canadian dollar relative to the U.S. dollar.
(5) The royalty rate applicable to pre-payout oil sands operations starts at 1% of gross revenue and increases for every dollar by which the WTI crude oil price in Canadian dollars exceeds $55 per barrel, to a maximum of 9% when the WTI crude oil price is $120 per barrel or higher. Fort Hills is currently in the pre-payout phase.
(6) Transportation costs represent pipeline and storage costs downstream of the East Tank Farm blending facility. We use various pipeline and storage facilities to transport and sell our blend to customers throughout North America. Sales to the U.S. markets require additional transportation costs, but realize higher selling prices.
(7) Adjusted operating costs represent the costs to produce a barrel of bitumen from the Fort Hills mine and processing operation.

Outlook

The Government of Alberta maintained its mandatory production curtailment to the end of December 2020, with the option to terminate earlier. Due to wider Canadian heavy crude oil differentials and higher than expected inventory levels at the beginning of the year, there continues to be uncertainty around the effect and duration of the mandatory production curtailments. We therefore expect our 2020 share of bitumen production to be the same as 2019 at 33,000 to 38,000 barrels per day (12 to 14 million barrels annualized).

Adjusted operating costs are expected to be $26 to $29 per barrel for 2020 and are also impacted by the continued mandatory production curtailments.

Frontier Project

We hold a 100% interest in the Frontier oil sands project, which is located in northern Alberta. On February 23, 2020, we announced that we were withdrawing the Frontier project from the regulatory review process. As a result of this decision, we have recorded a non-cash, pre-tax impairment of $1.13 billion in relation to the project.

Exploration

Throughout 2019, we conducted exploration around our existing operations and globally through our six regional offices. Expenditures for the year of $67 million were focused on copper, zinc and gold.

Exploration plays three critical roles at Teck: discovery of new orebodies through early stage exploration and acquisition; pursuit, evaluation and acquisition of development opportunities; and delivery of geoscience solutions and services to create value at our existing mines and development projects.

In 2019, we drilled 80 kilometres in 10 drill programs across five coal operations in the Elk Valley.

Early stage copper exploration continued to focus primarily on advancing porphyry-style projects in Chile, Peru and the United States in 2019. In addition, significant exploration was carried out in and around our existing operations and advanced projects, including approximately 17 kilometres at QB2 and QB3, where we continue to define mineralization beneath and to the east of the current resource. In 2020, we plan to drill several early stage copper projects, and we will continue to explore around our existing operations and advanced projects, with a program to support QB3 studies.

Zinc exploration has been concentrated in four areas: the Red Dog mine district in Alaska, western Canada, northeastern Australia, and Ireland. In Alaska, Australia and Canada, the targets are large, high-grade, sediment-hosted deposits similar to major world-class deposits. In 2019, we continued to drill on 100% state-owned lands near our Red Dog mine (completing approximately 10 kilometres), and at our Reward project (Teena Deposit) in the McArthur district of Australia (completing approximately 11 kilometres), to better define external limits and internal continuity to mineralization.

We have ongoing exploration for, and partnerships in, gold opportunities. Our current exploration efforts and drill testing for gold are primarily focused in Chile, Peru and Turkey.

RACE21™

Performance

In May 2019, we began implementing RACE21™, our innovation-driven business transformation program. RACE21™ is a company-wide approach to **R**enewing our technology infrastructure, **A**ccelerating and scaling automation and robotics, **C**onnecting data systems to enable broad application of advanced analytics and artificial intelligence, and **E**mpowering our employees, all with a focus on improving our operating results and EBITDA[1] between now and 2021.

We announced an initial target for RACE21™ to implement projects that would generate $150 million in annualized EBITDA improvements by the end of 2019 using commodity prices in effect at the end of May 2019. We exceeded that initial target and have implemented projects at the end of 2019 aimed at achieving $184 million in annualized EBITDA improvements based on commodity prices in effect on May 31, 2019[2]. This is equivalent to annualized EBITDA improvements of $160 million if December 31, 2019[2] commodity prices are used, which were substantially lower than May 31, 2019 prices.

RACE21™ currently includes approximately 30 projects, distributed across our operations, which is larger than initially planned due to the success of early initiatives. These projects are primarily focused on the development and implementation of data analytics to improve throughput and yield at our processing plants as well as mining analytics and predictive maintenance programs to improve the performance and cycle times of our mobile equipment fleets. The contribution of these projects to the total annualized EBITDA improvement is approximately 65% from the application of data analytics at our processing facilities, 25% from analytics of our mining processes and 10% from improvements in maintenance through the application of machine learning. The value for these projects is approximately 75% from our copper and zinc business units and 25% from our steelmaking coal business unit.

Major applications of technology to realize value include:

- At our Highland Valley Copper Operations and our Red Dog Operations, we implemented artificial intelligence to analyze sensor data from the processing plant and provide automated recommendations to plant operators to maximize efficiency across grinding and flotation, leading to improved throughput and recoveries. At Highland Valley Copper, this, together with blasting improvements, resulted in throughput improvement of approximately 2.5% and copper recovery improvement of approximately 2%, which is expected to result in an estimated annual increase in copper production of approximately 8,000 tonnes from 2020 onward. At Red Dog, this resulted in throughput improvements of approximately 5%, which is expected to result in an estimated annual increase in zinc production of approximately 24,000 tonnes from 2020 onward.

  Moving forward, these digital innovations are expected to be more broadly implemented across Teck's base metals and steelmaking coal processing facilities.

[1] Non-GAAP Financial Measure. See "Use of Non-GAAP Financial Measures" section for further information.

[2] At prices in effect when the program was implemented on May 31, 2019, the annualized EBITDA improvements associated with these initiatives would have been $184 million, in consideration of commodity prices of US$204 per tonne for steelmaking coal, US$2.62 per pound for copper, US$1.22 per pound for zinc and a US/CDN exchange rate of 1.35. Based on December 31, 2019 commodity prices of US$136.50 per tonne for steelmaking coal, US$2.79 per pound for copper, US$1.04 per pound for zinc and a US/CDN exchange rate of 1.30, the equivalent annualized EBITDA improvement is $160 million.

- At our steelmaking coal operations, we implemented machine learning algorithms to analyze haul truck data to improve haul truck cycle times. This project gathers sensor data from trucks to identify factors affecting cycle times including road conditions, operator performance, truck speeds, queues and other metrics in order to provide data-driven recommendations to improve cycle times. This results in additional truck hours and could increase our steelmaking coal production.

- At our steelmaking coal operations, we are analyzing data from digitally connected drill platforms to improve the efficiency of blasting. This results in optimized drill hole placement, a 10-15% reduction in explosives use, and material that is easier for shovels to move. We are using a similar process at our base metals operations to optimize the size of the ore and improve mill throughput.

These EBITDA improvements are reflected in our 2020 guidance.

The one-time investment for implementation of RACE21™ in 2019 was $55 million, of which approximately $10 million of the spend is attributed to positioning the program for growth in 2020. The annualized benefits are expected to be ongoing. This is an increase from the expected one-time investment of $45 million announced in the second quarter, reflecting the additional value creation and expansion of the program.

Outlook

In 2020, we plan to expand the projects implemented already more broadly across our operations, as appropriate, and to identify and implement additional projects to generate new value in our business.

Based on the success of the initial implementation, we are targeting an additional $350 million in annualized EBITDA improvements by the end of 2020, based on commodity prices at December 31, 2019, and a further $500 million of annualized EBITDA through 2021, for a cumulative total of $1.0 billion in ongoing annualized EBITDA improvements by the end of 2021.

The approach to capturing this value will be based on aligning investment with expected EBITDA improvements. Our next phase of investment is expected to require an investment of $140 million to support our value improvement targets. Individual RACE21™ projects will be evaluated and advanced based on their potential value creation merits and considered in the context of our capital allocation framework.

Our ability to achieve the expected EBITDA improvements from the RACE21™ projects depends on the projects achieving the expected production and operating results, including cost reductions, the ability of our transportation service providers to move additional product to market, future commodity prices and exchange rates, and various other factors.

Financial Overview

Financial Summary

($ in millions, except per share data)	**2019**	2018	2017
Revenues and profit			
Revenues	**$ 11,934**	$ 12,564	$ 11,910
Gross profit before depreciation and amortization(1)(2)	**$ 4,959**	$ 6,104	$ 6,059
Gross profit	**$ 3,340**	$ 4,621	$ 4,567
EBITDA(1)(2)	**$ 1,352**	$ 6,174	$ 5,589
Profit (loss) attributable to shareholders	**$ (605)**	$ 3,107	$ 2,460
Cash flow			
Cash flow from operations	**$ 3,484**	$ 4,438	$ 5,049
Property, plant and equipment expenditures	**$ 2,788**	$ 1,906	$ 1,621
Capitalized production stripping costs	**$ 680**	$ 707	$ 678
Investment expenditures	**$ 178**	$ 284	$ 309
Balance sheet			
Cash balances	**$ 1,026**	$ 1,734	$ 952
Total assets	**$ 39,350**	$ 39,626	$ 37,028
Debt and lease liabilities, including current portion	**$ 4,834**	$ 5,519	$ 6,369
Per share amounts			
Profit (loss) attributable to shareholders	**$ (1.08)**	$ 5.41	$ 4.26
Dividends declared	**$ 0.20**	$ 0.30	$ 0.60

Notes:

(1) Non-GAAP Financial Measures. See “Use of Non-GAAP Financial Measures” section for further information.

(2) See “Use of Non-GAAP Financial Measures” section for reconciliation.

Our revenue and profit depend on the prices for the commodities we produce, sell and use in our production processes. Commodity prices are determined by the supply of and demand for those commodities, which are influenced by global economic conditions. We normally sell the products that we produce at prevailing market prices or, in the case of steelmaking coal, through an index-linked pricing mechanism or on a spot basis. Prices for our products can fluctuate significantly and that volatility can have a material effect on our financial results.

Foreign exchange rate movements can also have a significant effect on our results and cash flows, as a substantial portion of our operating costs are incurred in Canadian and other currencies, and most of our revenue and debt are denominated in U.S. dollars. We determine our financial results in local currency and report those results in Canadian dollars and, accordingly, our reported operating results and cash flows are affected by changes in the Canadian dollar exchange rate relative to the U.S. dollar, as well as the Peruvian sol and Chilean peso.

In 2019, our loss attributable to shareholders was $605 million, or $1.08 loss per share. This compares with a profit attributable to shareholders of $3.1 billion or $5.41 per share in 2018 and $2.5 billion or $4.26 per share in 2017. The significant decrease compared to the prior year is primarily due to after-tax impairments of $2.1 billion recorded in 2019 on our interest in Fort Hills, our Frontier oil sands project, our Cardinal River Operations and the remaining assets of Quebrada Blanca. In addition, decreases in commodity prices and variances in sales volumes and exchange rates movements negatively affected our profitability in 2019. Our profit attributable to shareholders in 2018 included a gain on the sale of the Waneta Dam.

Our profit over the past three years has included items that we segregate for presentation to investors so that the ongoing profit of the company may be more clearly understood. Our adjusted profit attributable to shareholders,[1, 2] which takes these items into account, was $1.6 billion in 2019, $2.4 billion in 2018 and $2.5 billion in 2017, or $2.77, $4.13 and $4.36 per share, respectively. These items are described below and summarized in the table that follows.

In 2019, we recorded non-cash pre-tax impairments of $1.2 billion on our interest in Fort Hills as a result of lower market expectations for future WCS heavy oil prices, $1.1 billion on our Frontier oil sands project as a result of our decision to withdraw the project from the regulatory review process, $289 million on our Cardinal River Operations and $31 million on our Quebrada Blanca cathode operations, both of which have short remaining mine lives. We also redeemed US$600 million of outstanding 8.5% notes due in 2024 and recorded a $224 million pre-tax charge on the transaction, of which $174 million was non-cash. This charge was partially offset by a $105 million pre-tax gain on the debt pre-payment option in the 8.5% 2024 notes up to the date of redemption.

In 2018, we completed the sale of our two-thirds interest in the Waneta Dam to BC Hydro for $1.2 billion cash and recorded a pre-tax gain of $888 million, with no cash taxes payable on the transaction. We redeemed US$1.0 billion principal amount of our near-term debt maturities, reducing the outstanding balance to US$3.8 billion and recorded a $26 million pre-tax charge on the transaction. We also recorded a non-cash pre-tax asset impairment of $41 million, of which $31 million related to capitalized exploration expenditures that are not expected to be recovered, and $10 million related to Quebrada Blanca assets that would not be recovered through use because mining operations ended in the fourth quarter of 2018.

In 2017, due to the improvement in steelmaking coal prices and future operating cost estimates, we recorded a $207 million non-cash pre-tax reversal of an impairment charge that we took against our steelmaking coal operations in 2015. This was partially offset by a non-cash pre-tax asset impairment of $44 million recorded against our Quebrada Blanca assets that will not be recovered through use. We also recorded an $82 million charge related to increased provincial tax rates in B.C., and the reduction in tax rates in the U.S. resulted in a $101 million non-cash credit to our 2017 tax expense. We incurred a $216 million pre-tax loss on the redemption of certain of our outstanding notes in 2017.

[1] Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.
[2] See “Use of Non-GAAP Financial Measures” section for reconciliation.

The following table shows the effect of these items on our profit (loss).

($ in millions, except per share data)	2019	2018	2017
Profit (loss) attributable to shareholders	**$ (605)**	$ 3,107	$ 2,460
Add (deduct):			
Asset impairments (reversals)	**2,052**	30	(100)
Debt redemption or purchase loss	**166**	19	159
Debt prepayment option loss (gain)	**(77)**	31	(38)
Gain on sale of Waneta Dam	**–**	(812)	–
Taxes and other	**16**	(3)	39
Adjusted profit attributable to shareholders[(1)(2)]	**$ 1,552**	$ 2,372	$ 2,520
Adjusted basic earnings per share[(1)(2)]	**$ 2.77**	$ 4.13	$ 4.36
Adjusted diluted earnings per share[(1)(2)]	**$ 2.75**	$ 4.07	$ 4.30
Weighted average diluted shares outstanding (millions)	**565.3**	582.1	586.4

Notes:
(1) Non-GAAP Financial Measures. See "Use of Non-GAAP Financial Measures" section for further information.
(2) See "Use of Non-GAAP Financial Measures" section for reconciliation.

Cash flow from operations in 2019 was $3.5 billion, compared with $4.4 billion in 2018 and $5.0 billion in 2017. The changes in cash flow from operations are mainly due to varying commodity prices and sales volumes, offset to some extent by changes in foreign exchange rates.

At December 31, 2019, our cash balance was $1.0 billion. Total debt was $4.8 billion and our net debt to net-debt-plus-equity ratio[1] was 15% at December 31, 2019, compared with 14% at December 31, 2018 and 21% at the end of 2017.

Gross Profit

Our gross profit is made up of our revenue less the operating expenses at our producing operations, including depreciation and amortization. Income and expenses from our business activities that do not produce commodities for sale are included in our other operating income and expenses or in our non-operating income and expenses.

Our principal commodities are steelmaking coal, copper, zinc and blended bitumen, which accounted for 46%, 18%, 17% and 8% of revenue, respectively, in 2019. Silver and lead are significant by-products of our zinc operations, each accounting for 3% of our 2019 revenue. We also produce a number of other by-products, including molybdenum, various specialty metals, and chemicals and fertilizers, which in total accounted for 5% of our revenue in 2019.

Our revenue is affected by sales volumes, which are determined by our production levels and by demand for the commodities we produce, commodity prices and currency exchange rates.

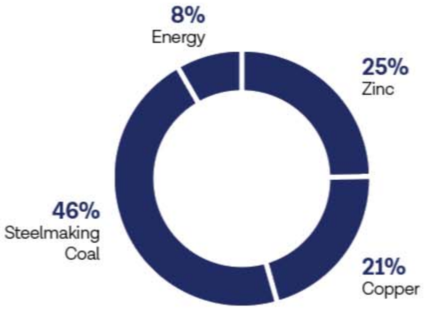
Our revenue was $11.9 billion in 2019, compared with $12.6 billion in 2018 and $11.9 billion in 2017. The decrease in 2019 revenue from 2018 was due to lower steelmaking coal, copper and zinc prices and reduced steelmaking sales volumes, partially offset by a full year of revenue from the sale of blended bitumen from our Fort Hills oil sands mine. Average prices for steelmaking coal, copper and zinc were 12%, 8% and 13% lower in 2019 than in 2018, while blended bitumen prices were up 29%.

[1] Non-GAAP Financial Measure. See "Use of Non-GAAP Financial Measures" section for further information.

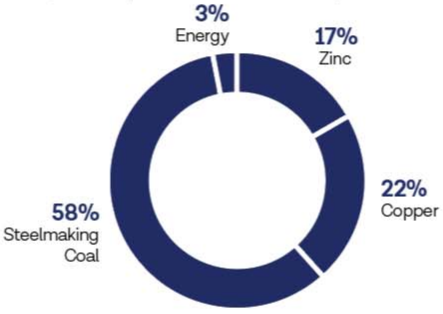
The increase in 2018 revenue from 2017 was mainly due to higher steelmaking coal and copper prices and the addition of revenue from the sale of blended bitumen from our Fort Hills oil sands mine, partially offset by lower sales volumes of refined lead and silver from our Trail Operations. Average prices for steelmaking coal and copper were 7% and 6% higher in 2018 than in 2017.

Our cost of sales includes all of the expenses required to produce our products, such as labour, energy, operating supplies, concentrates purchased for our Trail Operations' refining and smelting activities, diluent purchased for our Fort Hills oil sands mine to transport our bitumen by pipeline, royalties, and marketing and distribution costs required to sell and transport our products to various delivery points. Our cost of sales also includes depreciation and amortization expense. Due to the geographic locations of many of our operations, we are highly dependent on third parties for the provision of rail, port, pipeline and other distribution services. In certain circumstances, we negotiate prices and other terms for the provision of these services where we may not have viable alternatives to using specific providers, or may not have access to regulated rate-setting mechanisms or appropriate remedies for service failures. Contractual disputes, demurrage charges, availability of vessels and railcars, weather problems, other factors and rail, port and pipeline capacity issues can have a material effect on our ability to transport materials from our suppliers and to our customers in accordance with schedules and contractual commitments.

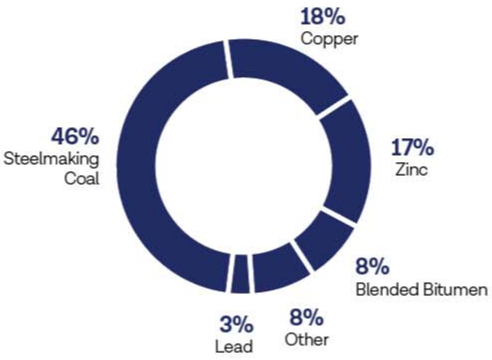
2019 Revenue by Business Unit



2019 Gross Profit by Business Unit
(Before depreciation and amortization)



2019 Revenue by Commodity



Our costs are dictated mainly by our production volumes, by the costs for labour, operating supplies, concentrate purchases and diluent purchases, and by strip ratios, haul distances, ore grades, distribution costs, commodity prices, foreign exchange rates, costs related to non-routine maintenance projects, and our ability to manage these costs. Production volumes mainly affect our variable operating and our distribution costs. In addition, production affects our sales volumes and, when combined with commodity prices, affects profitability and our royalty expenses.

Our cost of sales was $8.6 billion in 2019, compared with $7.9 billion in 2018 and $7.3 billion in 2017. The increase in cost of sales in 2019 compared with 2018 is partially due to Fort Hills being operational for the full year, which accounted for approximately $400 million of the increase. In addition, depreciation and amortization rose by approximately $60 million at our steelmaking coal operations and electricity costs increased by approximately $45 million at Trail Operations, following the sale of the Waneta Dam in 2018.

In 2018, in our steelmaking coal business, unit cost increases were partially driven by our decision to increase mining activity to capture margin in a favourable steelmaking coal price environment. In addition, increased diesel and operating supplies costs also resulted in increased unit costs. Costs were higher at our

Trail Operations due to maintenance issues, the effect of wildfires in southeast British Columbia and the increase in power costs resulting from the sale of the Waneta Dam to BC Hydro in July 2018. Cost of sales in 2018 also included costs from Fort Hills, which produced its first bitumen in January and achieved commercial production on June 1, 2018.

Other Expenses

($ in millions)	**2019**	2018	2017
General and administration	**$ 161**	$ 142	$ 116
Exploration	**67**	69	58
Research and innovation	**67**	35	55
Asset impairments (impairment reversal)	**2,690**	41	(163)
Other operating expense (income)	**505**	(450)	230
Finance income	**(48)**	(33)	(17)
Finance expense	**266**	252	229
Non-operating expense	**97**	52	151
Share of losses (income) of associates and joint ventures	**3**	3	(6)
	$ 3,808	$ 111	$ 653

We must continually replace our reserves as they are depleted in order to maintain production levels over the long term. We try to do this through our exploration and development programs and through acquisition of interests in new properties or in companies that own them. Exploration for minerals, steelmaking coal and oil is highly speculative and the projects involve many risks. The vast majority of exploration projects are unsuccessful and there are no assurances that current or future exploration programs will find deposits that are ultimately brought into production.

Our research and innovation expenditures are primarily focused on advancing our proprietary CESL hydrometallurgical technology, the development of internal and external growth opportunities, RACE21™, and the development and implementation of process and environmental technology improvements at operations, such as the saturated rock fill project.

In 2019, we recorded asset impairments of $2.7 billion, of which $1.2 billion related to our interest in Fort Hills due to lower market expectations for future WCS oil prices and $1.1 billion related to our Frontier oil sands project due to our decision to withdraw the project from the regulatory review process. In addition, we recorded impairments of $289 million related to our Cardinal River Operations as a result of our decision not to proceed with the MacKenzie Redcap extension and the short remaining mine life and a reduction in short-term steelmaking coal prices and $31 million related to remaining Quebrada Blanca assets as we near the end of operations.

In 2018, we recorded asset impairments of $41 million, of which $31 million related to capitalized exploration expenditures that are not expected to be recovered, and $10 million related to our Quebrada Blanca assets that would not be recovered through use because mining operations ended in the fourth quarter of 2018 as reserves were depleted.

In 2017, due to the improvement in steelmaking coal prices and future operating cost estimates, we recorded a $207 million reversal of an impairment charge that we took against our steelmaking coal operations in

2015. This was partially offset by an impairment of $44 million recorded on our Quebrada Blanca assets that would not be recovered through use.

The key inputs used in determining the magnitude of asset impairments and reversals are outlined on pages 53 to 56 in this Management's Discussion and Analysis.

The impairment charges and (reversals) were as follows:

($ in millions)	**2019**	2018	2017
Fort Hills	**$ 1,241**	$ –	$ (207)
Frontier project	**1,129**	**–**	**–**
Cardinal River Operations	**289**	–	–
Other	**31**	41	44
	$ 2,690	$ 41	$ (163)

Other operating income and expenses include items we consider to be related to the operation of our business, such as final pricing adjustments (which are further described in the following paragraph), share-based compensation, gains or losses on commodity derivatives, gains or losses on the sale of operating or exploration assets, and provisions for various costs at our closed properties. Significant items in 2019 included $49 million of negative pricing adjustments, $197 million for environmental costs primarily relating to additional decommissioning and restoration provisions at certain closed operations, and $123 million for take-or-pay contract costs. Significant items in 2018 included an $888 million gain on the sale of our two-thirds interest in the Waneta Dam to BC Hydro, $117 million of negative pricing adjustments, $20 million for environmental costs, $59 million for share-based compensation and a $106 million charge for take-or-pay contracts. Significant items in 2017 included $190 million of positive pricing adjustments, $186 million for environmental costs, $125 million for share-based compensation, an $81 million charge for take-or-pay contracts and a $28 million break fee related to the sale of the Waneta Dam that was paid to Fortis.

Sales of our products, including by-products, are recognized in revenue at the point in time when the customer obtains control of the product. Control is achieved when a product is delivered to the customer, we have the present right to payment for the product, significant risks and rewards of ownership have transferred to the customer according to contract terms, and there is no unfulfilled obligation that could affect the customer's acceptance of the product. For sales of steelmaking coal and copper, zinc and lead concentrates, control of the product generally transfers to the customer when an individual shipment parcel is loaded onto a carrier accepted or directly contracted by the customer. For sales of refined metals, chemicals and fertilizers, control of the product transfers to the customer when the product is loaded onto a carrier specified by the customer. For blended bitumen, control of the product generally transfers to the customer when the product passes the delivery point specified in the sales contract.

The majority of our base metal concentrates and refined metals are sold under pricing arrangements where final prices are determined by quoted market prices in a period subsequent to sale. For these sales, revenue is recognized based on the estimated consideration to be received at the date of sale with reference to relevant commodity market prices. Our refined metals are sold under spot or average pricing contracts. For all steelmaking coal sales under average pricing contracts where pricing is not finalized when revenue is recognized, revenue is recorded based on the estimated consideration to be received at the date of sale with reference to steelmaking coal price assessments. The majority of our blended bitumen is sold under pricing arrangements where final prices are determined based on commodity price indices that are finalized at or near the date of sale. Our revenue for blended bitumen is net of royalty payments to governments.

Adjustments are made to settlement receivables in subsequent periods based on movements in quoted market prices or published price assessments (for steelmaking coal) up to the date of final pricing. These pricing adjustments result in gains in a rising price environment and losses in a declining price environment, and are recorded as other operating income or expense. The extent of the pricing adjustments also takes into account the actual price participation terms as provided in certain concentrate sales agreements. It should be noted that these effects arise on the sale of concentrates, as well as on the purchase of concentrates at our Trail Operations.

The following table outlines our outstanding receivable positions, which were provisionally valued at December 31, 2019 and 2018, respectively.

	Outstanding at December 31, 2019		Outstanding at December 31, 2018	
(payable pounds in millions)	**Pounds**	**US$/lb.**	Pounds	US$/lb.
Copper	**65**	**$ 2.80**	93	$ 2.70
Zinc	**239**	**$ 1.04**	208	$ 1.12

Our finance expense includes the interest expense on our debt, advances to QBSA from SMM/SC and lease liabilities, letters of credit and standby fees, interest components of our pension obligations and accretion on our decommissioning and restoration provisions, less any interest that we capitalize against the cost of our development projects. Debt interest expense decreased in 2019, mainly due to lower outstanding debt balances. This was partially offset by an increase in interest on lease liabilities relating to the adoption of IFRS 16, Leases (IFRS 16) on January 1, 2019 and interest on advances to QBSA from SMM/SC relating to the QB2 partnering transaction. Further detail is provided in Note 10 to our 2019 audited annual consolidated financial statements.

Non-operating income (expense) includes items that arise from financial and other matters, and includes such items as foreign exchange gains or losses, debt refinancing costs, gains or losses on the revaluation of debt prepayment options, and gains or losses on the sale of investments. In 2019, non-operating expenses included a $224 million charge on the redemption of our 8.5% notes due in 2024 and foreign exchange losses of $4 million. These charges were partially offset by a $105 million gain on the debt prepayment option in the 8.5% 2024 notes up to the date of redemption and a gain of $37 million on the revaluation of the financial liability for the preferential dividend stream relating to ENAMI's interest in QBSA due to the effect of changes in interest rates. In 2018, other non-operating expenses included $42 million of losses on debt prepayment options, $16 million of foreign exchange gains and a $26 million charge on debt repurchased during the year. In 2017, other non-operating expenses included $51 million of gains on debt prepayment options, $5 million of foreign exchange gains, $9 million of gains on sale of investments and a $216 million charge on debt repurchased during the year.

Profit (loss) attributable to non-controlling interests relates to the ownership interests that are held by third parties in our Quebrada Blanca, Carmen de Andacollo and Elkview operations, and Compañia Minera Zafranal S.A.C.

Income Taxes

Provision for income and resource taxes was $120 million, or 26% of pre-tax loss. Our effective tax rate this year was significantly impacted by the asset impairment charges recorded. Excluding these charges, we would have a provision for income and resource taxes of $749 million, or 34% of pre-tax profit. This rate is higher than the Canadian statutory income tax rate of 27% as a result of resource taxes and higher taxes in some foreign jurisdictions, and partially offset by the deferred tax recovery from the enacted Alberta income tax rate reduction. Due to available tax pools, we are currently shielded from cash income taxes in Canada. We remain subject to cash resource taxes in Canada and cash taxes in foreign jurisdictions.

In 2019, Antamina received income tax assessments and determinations from the Peruvian tax authority, La Superintendencia Nacional de Aduanas y de Administración Tributaria (SUNAT) for its 2013 and 2014 taxation years, denying accelerated depreciation claimed by Antamina in respect of a mill expansion and certain other assets on the basis that the expansion was not covered by Antamina's tax stability agreement. Antamina intends to pursue the issue in the Peruvian courts. Based on opinions of counsel, we have provided for the tax on this issue for all years possibly affected, but not for associated penalties and interest. The denial of accelerated depreciation claimed is a timing issue in our tax provision. Accordingly, we have recorded current tax expense, partially offset by a deferred tax recovery, resulting in a net $2 million total tax expense increase in 2019. If the interest and penalties were upheld, the charge to our earnings could reach $65 million (US$50 million). Antamina has paid all amounts in issue for its 2013 and 2014 taxation years. Teck's share of additional amounts that might be payable for assessments which we expect will be raised for the balance of the years in issue (2015 to 2017) is currently estimated to be $78 million (US$60 million).

Financial Position and Liquidity

Our liquidity remained strong at $6.2 billion as at December 31, 2019 including $1.0 billion of cash, of which $529 million is in Chile for the development of the QB2 project. At December 31, 2019, the principal balance of our term notes was US$3.2 billion and we maintained a US$4.0 billion undrawn revolving credit facility. Based on our strong financial position, we expect to be able to maintain our operations and fund our development activities as planned.

Our outstanding debt was $4.8 billion at December 31, 2019, compared with $5.5 billion at the end of 2018 and $6.4 billion at the end of 2017. The decrease is due to the redemption during 2019 of our 8.5% notes due in 2024. In total, since September 2015, our term notes have been reduced by US$4 billion.

During 2019, we regained investment grade ratings with three major U.S. credit rating agencies. Moody's, Fitch and S&P upgraded our credit ratings to Baa3, BBB- and BBB- respectively, all with stable outlooks. In addition, DBRS upgraded our credit rating to BBB with a stable trend. As a result of regaining investment grade credit ratings, financial security requirements under various take-or-pay contracts have fallen away and we terminated $1.1 billion in letters of credit related to long-term power purchase contracts for the QB2 project and long-term transportation service agreements for our share of Fort Hills production.

Our debt positions and credit ratios are summarized in the following table:

	2019	2018	2017
Term notes face value	**$ 3,209**	$ 3,809	$ 4,831
Unamortized fees and discounts	**(31)**	(31)	(40)
Other	**544**	268	286
Debt (US$ in millions)	**$ 3,722**	$ 4,046	$ 5,077
Debt (CAD$ equivalent)[1] (A)	**$ 4,834**	$ 5,519	$ 6,369
Less cash balances	**(1,026)**	(1,734)	(952)
Net debt[2] (B)	**$ 3,808**	$ 3,785	$ 5,417
Equity (C)	**$ 22,074**	$ 23,018	$ 19,993
Debt to debt-plus-equity ratio[2] (A/(A+C))	**18%**	19%	24%
Net debt to net-debt-plus-equity ratio[2] (B/(B+C))	**15%**	14%	21%
Debt to EBITDA ratio[2][3]	**3.6x**	0.9x	1.1x
Net debt to EBITDA ratio[2][3]	**2.8x**	0.6x	1.0x
Average interest rate	**5.6%**	6.1%	5.7%

Notes:

(1) Translated at year-end exchange rates.

(2) Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.

(3) Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for reconciliation.

At December 31, 2019, the weighted average maturity of our term notes is approximately 17 years and the weighted average coupon rate is approximately 5.6%.

Our primary sources of liquidity and capital resources are our cash and temporary investments, cash flow provided from operations, and funds available under our committed and uncommitted bank credit facilities, of which approximately US$4.0 billion is currently available. Further information about our liquidity and associated risks is outlined in Notes 29 and 31 to our 2019 audited annual consolidated financial statements.

Cash flow from operations was $3.5 billion in 2019. Our cash position decreased from $1.7 billion at the end of 2018 to $1.0 billion at December 31, 2019. Significant outflows included $2.8 billion of capital expenditures, $680 million of capitalized stripping costs, $835 million to purchase and cancel US$600 million of notes, $111 million on returns to shareholders through dividends, $661 million on share buybacks and $386 million of interest and finance charges, primarily on our outstanding debt. Significant inflows during 2019 included $938 million of advances from SMM/SC on closing of the QB2 partnering transaction and $797 million of equity contributions from SMM/SC.

We maintain various committed and uncommitted credit facilities for liquidity and for the issuance of letters of credit, including a US$4.0 billion committed revolving credit facility, which was undrawn at December 31, 2019. The maturity date of this facility was extended during 2019 to November 2024.

With our return to investment grade credit ratings during the year, the US$600 million revolving credit facility maturing November 2021 was terminated.

During the fourth quarter of 2019, the US$2.5 billion limited recourse project financing to fund the development of QB2 closed. With funding from the project financing and the partnering transaction with SMM/SC, our next contributions to project capital are not expected until early 2021.

Borrowing under our primary committed revolving credit facility is subject to our compliance with the covenants in the agreement and our ability to make certain representations and warranties at the time of the borrowing request. The only financial covenant under our credit agreements is a requirement for our net debt to capitalization ratio[1, 2] not to exceed 60%. That ratio was 15% at December 31, 2019.

In addition to our primary revolving committed credit facility, we maintain uncommitted bilateral credit facilities with various banks and with Export Development Canada for the issuance of letters of credit, stand-alone letters of credit and surety bonds, all primarily to support our future reclamation obligations. At December 31, 2019, we had $1.6 billion of letters of credit issued on the $1.9 billion of bilateral credit facilities that we have. In addition to the letters of credit outstanding under these uncommitted credit facilities, we also had stand-alone letters of credit of $453 million outstanding as at December 31, 2019, which were not issued under a credit facility. We also had surety bonds of $450 million outstanding as at December 31, 2019 to support our current and future reclamation obligations.

Under the terms of the silver streaming agreement relating to Antamina, if there is an event of default under the agreement or Teck insolvency, Teck Base Metals Ltd., our subsidiary that holds our interest in Antamina, is restricted from paying dividends or making other distributions to Teck to the extent that there are unpaid amounts under the agreement.

Early repayment of borrowings under our revolving credit facility and outstanding public debt may be required if an event of default under the relevant agreement occurs. In addition, we are required to offer to repay indebtedness outstanding under our revolving credit facility and certain of our public debt in the event of a change of control, as determined under the relevant agreement.

On January 1, 2019, we adopted IFRS 16 prospectively and, as a result, we recorded additional lease liabilities of $342 million on our balance sheet. We did not restate comparative financial information on transition to IFRS 16. The financial statement effects of adoption of IFRS 16 are outlined in the “Adoption of New Accounting Standards and Accounting Developments” section and in Note 33 to our audited annual consolidated financial statements.

Capital Allocation Framework

During 2019, we returned $111 million to shareholders through our annual base dividend of $0.20 per share. We also purchased approximately 24.4 million Class B subordinate voting shares under our normal course issuer bid. Of the $600 million for share repurchases announced in 2019, approximately $393 million was completed in 2019 with the balance of approximately $207 million expected to be completed in 2020.

[1] Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information.
[2] See “Use of Non-GAAP Financial Measures” section for reconciliation.

In 2019, we released our updated capital allocation framework, which describes how we allocate funds to sustaining and growth capital, maintaining solid investment grade credit metrics and returning excess cash to shareholders. This updated framework reflects our intention to make additional returns to shareholders by supplementing our base dividend with at least an additional 30% of available cash flow after certain other repayments and expenditures have been made. For this purpose, we define available cash flow as cash flow from operating activities after cash taxes, cash interest and distributions to non-controlling interests less: (i) sustaining capital and capitalized stripping; (ii) committed enhancement and growth capital; (iii) any cash required to adjust the capital structure to maintain solid investment grade credit metrics; and (iv) our $0.20 per share annual base dividend. Proceeds from any divestment and partnering proceeds may also be used to supplement available cash flow. Any additional cash returns will be made through share repurchase and/or supplemental dividends, depending on market conditions at the relevant time.

Based on available cash flow in 2019 as defined under the capital allocation framework, we do not plan to make any further supplemental shareholder distributions related to 2019 performance, other than the share repurchases previously announced.

Our results can be highly variable, as they are dependent on commodity prices and various other factors. Investors should not assume that there will be available cash or any supplemental returns in any given year.

Operating Cash Flow

Cash flow from operations was $3.5 billion in 2019, compared with $4.4 billion in 2018 and $5.0 billion in 2017. The decrease in 2019 was primarily due to lower commodity prices and reduced coal sales volumes. The decrease in 2018 as compared to 2017 was primarily associated with the changes in non-cash working capital items due to the buildup of inventories with the ramp-up of Fort Hills, along with a reduction of accounts payable early in the year following a significant increase in the fourth quarter of 2017 related to Red Dog's seasonality of sales.

Investing Activities

Expenditures on property, plant and equipment were $2.8 billion in 2019, including $1.2 billion on the QB2 project, $786 million on sustaining capital and $594 million on major enhancement projects. Capitalized production stripping costs were $680 million. Capital expenditures for 2019 are summarized in the table on pages 48 to 49. Expenditures on the QB2 project were reduced in 2019 as a result of the weaker Chilean peso.

The largest components of sustaining capital included $403 million at our steelmaking coal operations, $84 million for our share of spending at Antamina mine, $74 million at Red Dog Operations, $60 million at Trail Operations and $45 million for our share of Fort Hills spending.

Major enhancement expenditures included $347 million at our steelmaking coal operations for the development of new pits and the upgrades to Neptune Bulk Terminals, $105 million for our share of tailings infrastructure spending at Fort Hills, $89 million on the mill upgrade project at Red Dog Operations and $42 million to complete the installation of an additional ball mill to increase grinding circuit capacity at Highland Valley Copper Operations.

New mine development included $1.2 billion for QB2, of which $1.035 billion was funded by the contributions from SMM/SC, and $78 million on Project Satellite.

Expenditures on investments in 2019 were $178 million and included $67 million for NuevaUnión, which is held as an equity investment, $71 million for intangibles and other assets, and $16 million for marketable securities.

In 2018, we paid US$112.5 million — US$52.5 million on closing and US$60 million upon receipt of the regulatory approvals received in August — to acquire Inversiones Mineras S.A. to bring our ownership share of Quebrada Blanca to 90%. Other investments include $44 million for the 1.3% increase in our ownership interest in Fort Hills, and $48 million on NuevaUnión.

Cash proceeds from the sale of assets and investments were $80 million in 2019, $1.3 billion in 2018 and $126 million in 2017. There were no significant items in 2019, and 2018 included the $1.2 billion of proceeds from the sale of our two-thirds interest in the Waneta Dam. Significant items in 2017 were proceeds of $59 million from the sale of our 49% interest in the Wintering Hills Wind Power Facility and $30 million from the sale of marketable securities and various royalty interests.

Financing Activities

On March 29, 2019, the transaction through which SMM/SC subscribed for a 30% indirect interest in QBSA closed. On closing, SMM/SC contributed $1.3 billion (US$966 million) to the QB2 project and a further $444 million (US$336 million) was contributed over the remainder of 2019. These contributions are made in the form of shareholder loans and share subscriptions for equity in Quebrada Blanca Holdings SPA, which holds a 90% interest in QBSA. Further capital contributions for the project from Teck and SMM/SC are not expected until early 2021, as funding for project spending will come from the project financing facility described below. We retain control of QBSA and consequently continue to consolidate its results.

In November 2019, we closed our US$2.5 billion limited recourse project financing facility to fund the development of the QB2 project. Amounts drawn under the facility will bear interest at LIBOR plus applicable margins that vary over time and will be repaid in 17 semi-annual instalments starting the earlier of six months after project completion or June 2023. These project finance loans are guaranteed pre-completion on a several basis by Teck, SMM and SC pro-rata to their respective interests in the Series A shares of QBSA. We have provided security in the form of QBSA's assets, which consist primarily of QB2 project assets. At December 31, 2019, the facility was undrawn.

In 2019, we redeemed US$600 million of our 8.5% notes that were due in 2024 for US$638 million of cash, which included the premium paid on redemption. We recorded a pre-tax charge of $224 million on the redemption, of which $174 million was non-cash.

In 2018, we redeemed US$1.0 billion aggregate principal amount of our outstanding notes pursuant to cash tender offers. The principal amount of notes purchased was US$103 million of 4.50% notes due January 2021, US$471 million of 4.75% notes due 2022 and US$426 million of 3.75% notes due 2023. The total cost of the purchases, which was funded from cash on hand, including the premiums, was US$1.01 billion. We recorded a pre-tax accounting charge of $26 million ($19 million after tax) in non-operating income (expense) in connection with these purchases.

Debt interest and finance charges paid during 2019 were $386 million compared with $430 million in 2018, primarily as a result of lower outstanding debt balances.

During 2019, we paid $111 million in respect of our regular annual base dividend of $0.20 per share.

In 2019, we purchased and cancelled approximately 24.4 million Class B subordinate voting shares at a cost of $654 million under our normal course issuer bids. Our current normal course issuer bid allows us to purchase up to 40 million Class B subordinate voting shares during the period starting October 28, 2019 and ending October 27, 2020. As of February 26, 2020, we have purchased approximately 6.9 million shares under the current normal course issuer bid for $148 million, all of which were purchased and cancelled in 2019.

Teck is making the normal course issuer bid because it believes that the market price of its Class B subordinate voting shares may, from time to time, not reflect their underlying value and that the share buyback program may provide value by reducing the number of shares outstanding at attractive prices. All repurchased shares will be cancelled. During Teck's prior normal course issuer bid, which commenced on October 10, 2018 and ended October 9, 2019, Teck purchased 22,466,152 Class B subordinate voting shares on the open market at a volume-weighted average price of $28.69 per Class B subordinate voting share. Shareholders may obtain a copy of Teck's normal course issuer bid notice by contacting our Corporate Secretary.

Quarterly Profit and Cash Flow

($ in millions except per share data)	**2019**				2018			
	Q4	**Q3**	**Q2**	**Q1**	Q4	Q3	Q2	Q1
Revenue	**$ 2,655**	**$ 3,035**	**$ 3,138**	**$ 3,106**	$ 3,247	$ 3,209	$ 3,016	$ 3,092
Gross profit	**460**	**787**	**1,051**	**1,042**	1,011	1,009	1,241	1,360
EBITDA (loss)[1]	**(1,884)**	**1,032**	**808**	**1,396**	1,152	2,064	1,403	1,555
Profit (loss) attributable to shareholders	**(1,835)**	**369**	**231**	**630**	433	1,281	634	759
Basic earnings (loss) per share	**$ (3.33)**	**$ 0.66**	**$ 0.41**	**$ 1.11**	$ 0.75	$ 2.23	$ 1.10	$ 1.32
Diluted earnings (loss) per share	**$ (3.33)**	**$ 0.66**	**$ 0.41**	**$ 1.10**	$ 0.75	$ 2.20	$ 1.09	$ 1.30
Cash flow from operations	**$ 782**	**$ 1,062**	**$ 1,120**	**$ 520**	$ 1,337	$ 877	$ 1,105	$ 1,119

Notes:

[1] Non-GAAP Financial Measure. See "Use of Non-GAAP Financial Measures" section for further information.

[2] See "Use of Non-GAAP Financial Measures" section for reconciliation.

Gross profit in the fourth quarter from our steelmaking coal business unit was $241 million, compared with $819 million a year ago. Gross profit before depreciation and amortization for our steelmaking coal business unit in the fourth quarter declined by $552 million compared to a year ago, primarily due to a US$60 per tonne decrease in steelmaking coal prices, which reduced revenue and resulted in inventory write-downs of $28 million, and partially due to lower sales volumes.

Sales volumes for steelmaking coal of 6.3 million tonnes in the fourth quarter were 5% lower than the same period a year ago. Our sales in the fourth quarter were affected by several delayed vessel arrivals, primarily due to rough Pacific sea conditions, and lower Ridley Terminals port performance towards the end of December, with challenging weather and operational issues.

Gross profit from our copper business unit was $130 million in the fourth quarter, compared with $138 million a year ago. Gross profit before depreciation and amortization from our copper business unit decreased by $20 million, compared with a year ago due to lower prices for copper, reduced by-product contributions from molybdenum and zinc due to lower prices and reduced sales volumes, and the impact of the labour strike at Carmen de Andacollo. These items were partially offset by increased production from Highland Valley Copper, reduced unit operating costs and lower inventory write-downs compared to the same period last year.

Copper production in the fourth quarter decreased by 3% from a year ago primarily due to the labour action at Carmen de Andacollo. The strike caused the suspension of operations between October 14 and December 5, 2019, resulting in approximately 9,000 tonnes of lost production. This was offset by higher production from Highland Valley Copper as a result of higher copper grades and recoveries. Our total cash unit costs before by-product credits in the fourth quarter decreased by US$0.18 per pound to US$1.58 per pound due to a greater proportion of production from Highland Valley Copper compared to a year ago. Lower molybdenum and zinc sales volumes and prices resulted in substantially lower by-product credits. As a result, net cash unit costs after by-product credits of US$1.34 per pound compared with US$1.28 per pound in the fourth quarter last year.

Gross profit from our zinc business unit was $120 million in the fourth quarter, compared with $206 million a year ago. Gross profit before depreciation and amortization from our zinc business unit decreased by $93 million compared with a year ago due to lower zinc prices, higher treatment charges and reduced refined zinc volumes from Trail Operations. The electrical equipment failure contributed to a 10% reduction in zinc production and negatively affected profit at Trail Operations in the fourth quarter.

At Red Dog, zinc and lead production in the fourth quarter declined by 18% and 2%, respectively, compared to a year ago. The lower production was mainly due to reduced mill throughput as a result of planned mill shutdowns related to work to increase the installed power of the SAG mill motors as part of the ongoing VIP2 mill enhancement project. At our Trail Operations, production of refined zinc was 10% lower than a year ago as a result of the electrical equipment failure in the zinc refinery earlier this year, while lead production increased to 17,000 tonnes compared with 10,000 tonnes last year. Lead production was higher this year due to the planned major maintenance shutdown of the KIVCET smelter, which affected lead production in the same period last year.

We incurred a gross loss of $31 million from our energy business unit in the fourth quarter compared with $152 million a year ago. Gross profit before depreciation and amortization from our energy business increased by $129 million from a loss of $126 million a year ago primarily due to higher realized prices offset slightly by lower sales volumes. Despite the Government of Alberta’s mandatory production curtailments being in place throughout 2019, both production and unit operating costs remained within our annual guidance for the year.

Realized prices and operating results for our energy business unit in the fourth quarter of 2018 were significantly affected by a material decline in global benchmark crude oil prices and the widening of Canadian heavy blend differentials for WCS. As a result, we recorded inventory write-downs of approximately $34 million during the fourth quarter of 2018. In addition, the Government of Alberta announced mandatory production curtailments that came into effect on January 1, 2019.

In the fourth quarter, we had a loss attributable to shareholders of $1.8 billion, or $3.33 loss per share, compared with profit attributable to shareholders of $433 million, or $0.75 per share in the same period last year.

Cash flow from operations was $782 million in the fourth quarter, compared to $1.3 billion a year ago, reflecting a substantial decline in steelmaking coal prices in the fourth quarter of 2019. During the fourth quarter, changes in working capital items provided a source of cash of $210 million compared with $436 million a year ago. In the fourth quarter of each year, we typically realize a substantial source of cash from working capital decreases due to the seasonality of sales at our Red Dog Operations. Changes to working capital in the fourth quarter last year were higher than normal due to the timing of sales and cash receipts from our steelmaking coal operations.

Outlook

The sales of our products are denominated in U.S. dollars while a significant portion of our expenses is incurred in local currencies, particularly the Canadian dollar and the Chilean peso. Foreign exchange fluctuations can have a significant effect on our operating margins, unless such fluctuations are offset by related changes to commodity prices.

Our U.S. dollar denominated debt is subject to revaluation based on changes in the Canadian/U.S. dollar exchange rate. As at December 31, 2019, $3.0 billion of our U.S. dollar denominated debt is designated as a hedge against our foreign operations that have a U.S. dollar functional currency. As a result, any foreign exchange gains or losses arising on that amount of our U.S. dollar debt are recorded in other comprehensive income, with the remainder being charged to profit.

Commodity markets are volatile. Prices can change rapidly and customers can alter shipment plans. This can have a substantial effect on our business and financial results. Continued uncertainty in global markets arising from the macroeconomic outlook and government policy changes, including tariffs and the potential for trade disputes, as well as pandemic concerns, may have a significant positive or negative effect on the prices of the various products we produce. While price volatility will remain a significant factor in our industry, we have taken steps to insulate our company from its effects, including strengthening our balance sheet and credit ratings by reducing debt. Further, we believe the long-term supply and demand balance for our products is favourable.

We remain confident in the longer-term outlook for our major commodities, however, global economic uncertainty has had a significant negative effect on the prices for our products this year. The extent and duration of impacts that the Coronavirus may have on the demand and prices for our commodities, on our suppliers and employees, and on global financial markets is not known at this time, but could be material. We are monitoring developments in order to be in a position to take appropriate action.

Commodity Prices and Sensitivities

Commodity prices are a key driver of our profit and cash flows. On the supply side, the depleting nature of ore reserves, difficulties in finding new orebodies, the permitting processes and the availability of skilled resources to develop projects, as well as infrastructure constraints, political risk and significant cost inflation, may continue to have a moderating effect on the growth in future production for the industry as a whole.

The sensitivity of our annual profit attributable to shareholders and EBITDA to changes in the Canadian/U.S. dollar exchange rate and commodity prices, before pricing adjustments, based on our current balance sheet, our expected 2020 mid-range production estimates, current commodity prices and a Canadian/U.S. dollar exchange rate of $1.32, is as follows:

	2020 Mid-Range Production Estimates[1]	Change	Estimated Effect of Change On Profit[2] ($ in millions)	Estimated Effect on EBITDA[2] ($ in millions)
US$ exchange		CAD$0.01	$ 37	$ 58
Steelmaking coal (million tonnes)	24.0	US$1/tonne	$ 18	$ 28
Copper (thousand tonnes)	292.5	US$0.01/lb.	$ 5	$ 8
Zinc (thousand tonnes)[3]	930.0	US$0.01/lb.	$ 10	$ 13
WCS (million bbl)[4]	13.0	US$1/bbl	$ 12	$ 17
WTI[5]		US$1/bbl	$ 9	$ 12

Notes:

[1] All production estimates are subject to change based on market and operating conditions.

[2] The effect on our profit attributable to shareholders and on EBITDA of commodity price and exchange rate movements will vary from quarter to quarter depending on sales volumes. Our estimate of the sensitivity of profit and EBITDA to changes in the U.S. dollar exchange rate is sensitive to commodity price assumptions. EBITDA is a Non-GAAP Financial Measure. See “Use of Non-GAAP Financial Measures” section for further information and reconciliation.

[3] Zinc includes 310,000 tonnes of refined zinc and 620,000 tonnes of zinc contained in concentrate.

[4] Bitumen volumes from our energy business unit.

[5] Our WTI oil price sensitivity takes into account our interest in Fort Hills for respective change in revenue, partially offset by the effect of the change in diluent purchase costs as well as the effect on the change in operating costs across our business units, as our operations use a significant amount of diesel fuel.

Guidance

In light of uncertain economic conditions, we implemented a company-wide cost reduction program in the third quarter of 2019 to reduce our operating costs and planned capital spending for the balance of 2019 and 2020, targeting reductions of approximately $500 million from previously planned spending through the end of 2020. Our targeted cost reductions do not include initiatives that would result in a reduction in the production volumes of our commodities or that could adversely affect the health and safety of our people.

Our company-wide cost reduction program contributed approximately $210 million of reductions in planned spending in 2019. We expect approximately $400 million of reductions from previously planned spending in 2020, of which approximately 45% is capital spending. This will increase our total targeted reductions to approximately $610 million, compared to the $500 million previously disclosed.

To achieve our targeted cost reductions, we are eliminating approximately 500 full-time equivalent positions, some of which we expect to come from attrition, the expiry of temporary or contract positions, and current job vacancies.

The following guidance for 2020 includes targeted reductions and deferrals of expenditures to be implemented under our company-wide cost reduction program.

We plan to complete some of our annual maintenance major plant outages earlier in 2020, reducing our steelmaking coal production in the first half of the year and increasing production in the second half of the year. The Neptune Bulk Terminals' extended construction outage from May to September will also affect our quarterly cost of sales. As a result, we expect quarterly cost of sales per tonne to be higher in the first quarter of 2020 compared to the fourth quarter of 2019 with the lower production rates, and then decreasing in the fourth quarter of 2020 when we are back to near-full production levels. We expect our 2020 adjusted site cost of sales for our steelmaking coal business unit to be between $63 to $67 per tonne reflecting the extended construction outages to progress the Neptune Bulk Terminal facility upgrades combined with the logistics chain challenges in January and early February.

Production Guidance

Our steelmaking coal production in 2020 is expected to be in the range of 23.0 to 25.0 million tonnes, compared with 25.7 million tonnes produced in 2019. Our actual production will depend primarily on customer demand for deliveries of steelmaking coal. Depending on market conditions and the sales outlook, we may adjust our production plans.

Our copper production for 2020 is expected to be in the range of 285,000 to 300,000 tonnes, compared with 297,300 tonnes produced in 2019. Improving throughput and recoveries at Highland Valley Copper, as well as the resumption of operations at Carmen de Andacollo, are expected to largely offset declines at Antamina and Quebrada Blanca.

Our zinc in concentrate production in 2020 is expected to be in the range of 600,000 to 640,000 tonnes, compared with 640,100 tonnes produced in 2019. Red Dog's production is expected to be between 500,000 to 535,000 tonnes, compared with 552,400 tonnes in 2019. Our share of Antamina's zinc production in 2020 is expected to increase to between 100,000 to 105,000 tonnes. Refined zinc production in 2020 from our Trail Operations is expected to be in the range of 305,000 to 315,000 tonnes, compared with 287,400 tonnes produced in 2019.

Our share of bitumen production in 2020 is expected to be in the range of 12 to 14 million barrels (33,000 to 38,000 barrels per day), including estimated production curtailments. The high end of our guidance reflects the Government of Alberta's production curtailments being lifted in the first quarter. The low end of our production guidance assumes the curtailments will remain in place at current levels for the full year.

Production Guidance

The table below shows our share of production of our principal products for 2019, our guidance for production in 2020 and our guidance for production for the following three years.

Units in thousand tonnes (excluding steelmaking coal, bitumen, molybdenum and refined silver)	**2019**	2020 Guidance	Three-Year Guidance 2021–2023
Principal Products			
Steelmaking coal (million tonnes)	**25.7**	23.0–25.0	26.0–27.0
Copper(1)(2)(3)			
Highland Valley Copper	**121.3**	133–138	155–165
Antamina	**100.9**	88–92	90
Carmen de Andacollo	**54.0**	57–62	55–60
Quebrada Blanca(5)	**21.1**	7–8	–
	297.3	285–300	300–315
Zinc(1)(2)(4)			
Red Dog	**552.4**	500–535	500–540
Antamina	**68.3**	100–105	90–100
Pend Oreille	**19.4**	–	–
	640.1	600–640	590–640
Refined zinc			
Trail Operations	**287.4**	305–315	310–315
Bitumen (million barrels)(2)(6)			
Fort Hills	**12.3**	12–14	14
Other Products			
Lead(1)			
Red Dog	**102.8**	95–100	80–90
Refined lead			
Trail Operations	**69.0**	60–70	65–70
Molybdenum (million pounds)(1)(2)			
Highland Valley Copper	**6.6**	4.5–5.5	3.5–5.0
Antamina	**1.8**	2.0	2.0–3.0
	8.4	6.5–7.5	5.5–8.0
Refined Silver (million ounces)			
Trail Operations	**14.0**	10–12	N/A

Notes:

(1) Metal contained in concentrate.

(2) We include 100% of production and sales from our Quebrada Blanca and Carmen de Andacollo mines in our production and sales volumes, even though we do not own 100% of these operations, because we fully consolidate their results in our financial statements. We include 22.5% and 21.3% of production and sales from Antamina and Fort Hills, respectively, representing our proportionate ownership interest in these operations.

(3) Copper production includes cathode production at Quebrada Blanca and Carmen de Andacollo.

(4) Total zinc includes co-product zinc production from our 22.5% proportionate interest in Antamina.

(5) Excludes production from QB2 for three-year guidance 2021–2023.

(6) The 2021–2023 bitumen production guidance does not include potential near-term debottlenecking opportunities. See energy business unit for more information.

Sales Guidance

The table below shows our sales for the last quarter of 2019 and our sales guidance for the first quarter of 2020 for selected primary products.

	Q4 2019	Q1 2020 Guidance
Steelmaking coal (million tonnes)	**6.3**	4.8–5.2
Zinc (thousand tonnes)[1]		
Red Dog	**174**	135–140

Note:

[1] Metal contained in concentrate.

Unit Cost Guidance

The table below reports our unit costs for selected principal products for 2019 and our guidance for unit costs for selected principal products in 2020.

(Per unit costs — CAD$/tonne)	2019	2020 Guidance
Steelmaking coal[1]		
Adjusted site cost of sales[5]	**$ 65**	$ 63–67
Transportation costs	**39**	40–43
Inventory write-down	**1**	–
Unit costs[5]	**$ 105**	$ 103–110
Copper[2]		
Total cash unit costs[5] (US$/lb.)	**$ 1.68**	$ 1.55–1.65
Net cash unit costs[3][5] (US$/lb.)	**$ 1.39**	$ 1.25–1.35
Zinc[4]		
Total cash unit costs[5] (US$/lb.)	**$ 0.51**	$ 0.55–0.60
Net cash unit costs[3][5] (US$/lb.)	**$ 0.34**	$ 0.40–0.45
Energy (bitumen)		
Adjusted operating costs[5] (CAD$/barrel)	**$ 29.24**	$ 26–29

Notes:

[1] Steelmaking coal unit costs are reported in Canadian dollars per tonne. Steelmaking coal unit cost of sales include site costs, transport costs, and other and does not include capitalized stripping or capital expenditures. See "Use of Non-GAAP Financial Measures" section for further information and reconciliation.

[2] Copper unit costs are reported in U.S. dollars per payable pound of metal contained in concentrate. Copper net cash unit costs include adjusted cash cost of sales and smelter processing charges, less cash margins for by-products including co-products. Assumes a zinc price of US$1.05 per pound, a molybdenum price of US$11 per pound, a silver price of US$16.00 per ounce, a gold price of US$1,300 per ounce and a Canadian/U.S. dollar exchange rate of $1.32. See "Use of Non-GAAP Financial Measures section" for further information and reconciliation.

[3] After co-product and by-product margins.

[4] Zinc unit costs are reported in U.S. dollars per payable pound of metal contained in concentrate. Zinc net cash unit costs are mine costs including adjusted cash cost of sales and smelter processing charges, less cash margins for by-products. Assumes a lead price of US$0.90 per pound, a silver price of US$16.00 per ounce and a Canadian/U.S. dollar exchange rate of $1.32. By-products include both by-products and co-products. See "Use of Non-GAAP Financial Measures" section for further information and reconciliation.

[5] Non-GAAP Financial Measure. See "Use of Non-GAAP Financial Measures" section for further information.

Capital Expenditure Guidance

The table below reports our capital expenditures for 2019 and our guidance for capital expenditures in 2020.

(Teck's share in $ millions)	2019	2020 Guidance
Sustaining		
Steelmaking coal[1]	**$ 403**	$ 475
Copper	**184**	175
Zinc	**138**	160
Energy	**45**	100
Corporate	**16**	10
	$ 786	$ 920
Major Enhancement		
Steelmaking coal[3]	**$ 347**	$ 530
Copper	**46**	50
Zinc	**90**	15
Energy	**105**	50
RACE21™ [2]	**6**	85
	$ 594	$ 730
New Mine Development		
Copper[4]	**$ 115**	$ 50
Zinc	**32**	5
Energy	**41**	25
	$ 188	$ 80
Total		
Steelmaking coal	**$ 750**	$ 1,005
Copper	**345**	275
Zinc	**260**	180
Energy	**191**	175
Corporate	**16**	10
RACE21™ [2]	**6**	85
	$ 1,568	$ 1,730
QB2 capital expenditures	**1,220**	2,420
Total before SMM/SC contributions	**$ 2,788**	$ 4,150
Estimated SMM/SC contributions to capital expenditures[5]	**(1,035)**	(660)
Estimated QB2 project financing draw	**–**	(1,760)
Total Teck spend	**$ 1,753**	$ 1,730

Notes:

[1] Steelmaking coal sustaining capital includes Teck's share of water treatment capital of $290 million in 2020. 2019 includes $176 million of water treatment capital.

[2] RACE21™ capital expenditures for 2020 include $65 million relating to steelmaking coal, $5 million relating to copper, $5 million relating to zinc and the remainder relating to corporate projects. We also expect to spend approximately $70 million on RACE21™ for research and innovation expenses and intangible assets in 2020.

[3] Steelmaking coal major enhancement capital guidance includes $390 million relating to the facility upgrade at Neptune Bulk Terminals.

[4] Copper new mine development guidance for 2020 includes early scoping studies for QB3, Zafranal, San Nicolás and Galore Creek.

[5] Total SMM/SC contributions were $1.7 billion.

Capital Expenditure Guidance — Capitalized Stripping

(Teck's share in CAD$ millions)	2019	2020 Guidance
Capitalized Stripping		
Steelmaking coal	**$ 443**	$ 370
Copper	**192**	200
Zinc	**45**	55
	$ 680	$ 625

Other Information

Carbon Pricing Policies and Associated Costs

Across our operations, the most significant carbon pricing action has taken place in Canada. In 2019, British Columbia increased its existing carbon tax to $40 per tonne of carbon dioxide-equivalent (CO_2e). The B.C. carbon tax is expected to continue to increase by $5 per tonne of CO_2e per year until reaching $50 per tonne of CO_2e. In 2019, British Columbia also implemented the CleanBC Program for Industry to address impacts to emissions-intensive, trade-exposed industries to ensure that B.C. operations maintain their competitiveness and that carbon leakage is avoided. In April 2019, the Government of Canada introduced the *Greenhouse Gas Pollution Pricing Act,* which establishes a federal carbon levy for any province or territory that has not implemented a compliant carbon-pricing regime. Federal carbon tax rates began at $20 per tonne of CO_2e in 2019, increasing $10 per year to $50 per tonne of CO_2e by 2022. Alberta repealed its *Climate Leadership Act* effective as of May 29, 2019 and, as a result, became subject to the *Greenhouse Gas Pollution Pricing Act* as of January 1, 2020. B.C.'s *Carbon Tax Act* is considered substantially similar to the federal requirements; therefore, B.C. will not be subject to the *Greenhouse Gas Pollution Pricing Act*. In addition, Alberta's Carbon Competitiveness Incentive Regulation was replaced by Alberta's Technology, Innovation and Emissions Reduction system as of January 1, 2020. This is an industry-specific carbon pricing policy requiring large emitters, and other facilities that have opted in, to reduce their emissions intensity below a prescribed level, or to purchase emissions credits in concert with or as an alternative to physical abatement, with significant penalties for failure to achieve compliance.

While climate change regulations continue to evolve in most jurisdictions in which we operate, we expect that regional, national or international regulations, which seek to reduce greenhouse gas emissions, will continue to be established or revised. The cost of reducing our emissions or of obtaining the equivalent amount of credits or offsets in the future, if regulations permit this, remains highly uncertain. The cost of compliance with various climate change regulations will ultimately be determined by the regulations themselves and by the markets that evolve for carbon credits and offsets. Teck's direct greenhouse gas emissions attributable to our operations for 2019 are estimated to be approximately 3.3 million tonnes (CO_2e). The most material indirect emissions associated with our activities are those from the use of our steelmaking coal by our customers. Based on our 2019 sales volumes, emissions from the use of our steelmaking coal would have been approximately 73 million tonnes of CO_2.

For 2019, our B.C.-based operations incurred $72.8 million in British Columbia provincial carbon tax, and our Cardinal River Operations in Alberta paid $0.8 million in carbon costs, primarily from our use of coal, diesel fuel and natural gas. As a result of the CleanBC Program for Industry, in late 2019 we received back $5.4 million of the $58.8 million we paid under the British Columbia provincial carbon tax in 2018 and anticipate that we will receive a similar portion of our 2019 expenditures back in late 2020. We may in the future face similar taxation for our activities in other jurisdictions. Similarly, customers of some of our products may also be subject to new carbon costs or taxation in the future in the jurisdictions where the products are ultimately used.

We will continue to assess the potential implications of the updated policies on our operations and projects.

Financial Instruments and Derivatives
We hold a number of financial instruments, derivatives and contracts containing embedded derivatives, which are recorded on our consolidated balance sheet at fair value with gains and losses in each period included in other comprehensive income (loss) in the year and profit for the period on our consolidated statements of income and consolidated statements of other comprehensive income, as appropriate. The most significant of these instruments are investments in marketable equity and debt securities, commodity swap contracts, metal-related forward contracts, settlement receivables and payables, and gold stream and silver stream embedded derivatives. Some of our gains and losses on metal-related financial instruments are affected by smelter price participation and are taken into account in determining royalties and other expenses. All are subject to varying rates of taxation, depending on their nature and jurisdiction. Further information about our financial instruments, derivatives and contracts containing embedded derivatives and associated risks is outlined in Note 29 to our 2019 audited annual consolidated financial statements.

Areas of Judgment and Critical Accounting Estimates

In preparing our consolidated financial statements, we make judgments in applying our accounting policies. The judgments that have the most significant effect on the amounts recognized in our financial statements are outlined below. In addition, we make assumptions about the future in deriving estimates used in preparing our consolidated financial statements. We have outlined below information about assumptions and other sources of estimation uncertainty as at December 31, 2019 that have a risk of resulting in a material adjustment to the carrying amounts of assets and liabilities within the next year.

a) Areas of Judgment

Assessment of Impairment Indicators
Judgment is required in assessing whether certain factors would be considered an indicator of impairment or impairment reversal. We consider both internal and external information to determine whether there is an indicator of impairment or impairment reversal present and, accordingly, whether impairment testing is required. The information we consider in assessing whether there is an indicator of impairment or impairment reversal includes, but is not limited to, market transactions for similar assets, commodity prices, interest rates, inflation rates, our market capitalization, reserves and resources, mine plans and operating results.

As at December 31, 2019, as a result of lower market expectations for WCS heavy oil prices, we reviewed our energy assets for impairment. For our interest in Fort Hills, we determined that the reduction in WCS heavy oil prices was an indicator of impairment under the requirements of IAS 36, Impairment of Assets and accordingly, we performed an impairment test, as outlined below.

The remainder of our energy assets are oil sands properties, the most significant of which is our Frontier oil sands project. These assets are considered exploration and evaluation assets and accordingly, our assessment of impairment indicators is performed under the requirements of IFRS 6, Exploration for and Evaluation of Mineral Resources.

We determined that our withdrawal of our Frontier oil sands property from the regulatory review process was an indicator of impairment and consequently, we recorded an impairment of Frontier as at December 31, 2019, as outlined below.

Refer to the impairment testing section below for further detail on our assessment of impairment indicators in 2019 and 2018.

Property, Plant and Equipment — Determination of Available for Use Date
Judgment is required in determining the date that property, plant and equipment is available for use. An asset is available for use when it is in the location and condition necessary to operate in the manner intended by management. At that time, we commence depreciation of the asset and cease capitalization of borrowing costs. We consider a number of factors in making the determination of when an asset is available for use including, but not limited to, design capacity of the asset, production levels achieved, capital spending remaining and commissioning status. Fort Hills produced first oil in January 2018 and was considered available for use as at June 1, 2018. When concluding that these assets were available for use at June 1, 2018, we considered whether all three secondary extraction trains were running as expected, whether the production and product quality were consistent with expectations, and the status of asset commissioning. We have included the operating results for Fort Hills in our consolidated statements of income from that date forward.

Joint Arrangements
We are a party to a number of arrangements over which we do not have control. Judgment is required in determining whether joint control over these arrangements exists and, if so, which parties have joint control and whether each arrangement is a joint venture or joint operation. In assessing whether we have joint control, we analyze the activities of each arrangement and determine which activities most significantly affect the returns of the arrangement over its life. These activities are determined to be the relevant activities of the arrangement. If unanimous consent is required over the decisions about the relevant activities, the parties whose consent is required would have joint control over the arrangement. The judgments around which activities are considered the relevant activities of the arrangement are subject to analysis by each of the parties to the arrangement and may be interpreted differently. When performing this assessment, we generally consider decisions about activities such as managing the asset while it is being designed, developed and constructed, during its operating life and during the closure period. We may also consider other activities including the approval of budgets, expansion and disposition of assets, financing, significant operating and capital expenditures, appointment of key management personnel, representation on the Board of Directors and other items. When circumstances or contractual terms change, we reassess the control group and the relevant activities of the arrangement.

If we have joint control over the arrangement, an assessment of whether the arrangement is a joint venture or joint operation is required. This assessment is based on whether we have rights to the assets, and obligations for the liabilities, relating to the arrangement or whether we have rights to the net assets of the arrangement. In making this determination, we review the legal form of the arrangement, the terms of the contractual arrangement and other facts and circumstances. In a situation where the legal form and the terms of the contractual arrangement do not give us rights to the assets and obligations for the liabilities, an assessment of other facts and circumstances is required, including whether the activities of the arrangement are primarily designed for the provision of output to the parties and whether the parties are substantially the only source of cash flows contributing to the arrangement. The consideration of other facts and circumstances may result in the conclusion that a joint arrangement is a joint operation. This conclusion requires judgment and is specific to each arrangement. Other facts and circumstances have led us to conclude that Antamina and Fort Hills are joint operations for the purposes of our 2018 audited annual consolidated financial statements. The other facts and circumstances considered for both of these arrangements include the provisions of output to the parties of the joint arrangements and the funding obligations. For both Antamina and Fort Hills, we will take our share of the output from the assets directly over the life of the arrangement. We have concluded that this gives us direct rights to the assets and obligations for the liabilities of these arrangements proportionate to our ownership interests.

Streaming Transactions

When we enter into a long-term streaming arrangement linked to production at specific operations, judgment is required in assessing the appropriate accounting treatment for the transaction on the closing date and in future periods. We consider the specific terms of each arrangement to determine whether we have disposed of an interest in the reserves and resources of the respective operation or executed some other form of arrangement. This assessment considers what the counterparty is entitled to and the associated risks and rewards attributable to them over the life of the operation. These include the contractual terms related to the total production over the life of the arrangement as compared to the expected production over the life of the mine, the percentage being sold, the percentage of payable metals produced, the commodity price referred to in the ongoing payment and any guarantee relating to the upfront payment if production ceases.

For our silver and gold streaming arrangements entered into in 2015, there is no guarantee associated with the upfront payment. We have concluded that control of the rights to the silver and gold mineral interests were transferred to the buyer when the contracts came into effect at Antamina and Carmen de Andacollo, respectively. Therefore, we consider these arrangements a disposition of a mineral interest.

Based on our judgment, control of the interest in the reserves and resources transferred to the buyer when contracts were executed. At that time, we recognized the amount of the gain related to the disposition of the reserves and resources, as we had the right to payment, the customer was entitled to the commodities, the buyer had no recourse in requiring Teck to mine the product, and the buyer had significant risks and rewards of ownership of the reserves and resources.

We recognize the amount of consideration related to refining, mining and delivery services as the work is performed.

Deferred Tax Assets and Liabilities

Judgment is required in assessing whether deferred tax assets and certain deferred tax liabilities are recognized on the balance sheet and what tax rate is expected to be applied in the year when the related temporary differences reverse, particularly in regard to the utilization of tax loss carryforwards. We also evaluate the recoverability of deferred tax assets based on an assessment of our ability to use the underlying future tax deductions before they expire against future taxable income. Deferred tax liabilities arising from temporary differences on investments in subsidiaries, joint ventures and associates are recognized unless the reversal of the temporary differences is not expected to occur in the foreseeable future and can be controlled. Judgment is also required on the application of income tax legislation. These judgments are subject to risk and uncertainty and could result in an adjustment to the deferred tax provision and a corresponding credit or charge to profit.

b) Sources of Estimation Uncertainty

Impairment Testing
When impairment testing is required, discounted cash flow models are used to determine the recoverable amount of respective assets. These models are prepared internally with assistance from third-party advisors when required. When market transactions for comparable assets are available, these are considered in determining the recoverable amount of assets. Significant assumptions used in preparing discounted cash flow models include commodity prices, reserves and resources, mine production, operating costs, capital expenditures, discount rates, foreign exchange rates and inflation rates. These inputs are based on management's best estimates of what an independent market participant would consider appropriate. Changes in these inputs may alter the results of impairment testing, the amount of the impairment charges or reversals recorded in the statement of income and the resulting carrying values of assets.

We allocate goodwill arising from business combinations to the cash-generating unit (CGU) or group of CGUs acquired that is expected to receive the benefits from the business combination. When performing annual goodwill impairment tests, we are required to determine the recoverable amount of each CGU or group of CGUs to which goodwill has been allocated. Our Quebrada Blanca CGU and steelmaking coal CGU have goodwill allocated to them. The recoverable amount of each CGU or group of CGUs is determined as the higher of its fair value less costs of disposal and its value in use.

Asset Impairments and Impairment Reversals

($ in millions)	**2019**	2018
Steelmaking coal CGU	**$ 289**	$ –
Fort Hills CGU	**1,241**	–
Frontier Oil Sands Project	**1,129**	–
Other	**31**	41
Total	**$ 2,690**	$ 41

Steelmaking Coal CGU
In 2019, we announced that we would not proceed with the MacKenzie Redcap extension at our Cardinal River Operations and that the operation will close in the second half of 2020. As a result of this decision and the short remaining mine life of Cardinal River, combined with a reduction in short-term steelmaking coal prices, we recorded a pre-tax impairment of $289 million (after-tax $184 million) as at December 31, 2019.

In 2018, there were no indicators of impairment or impairment reversal relating to our steelmaking coal CGU. We performed our annual goodwill impairment testing for the steelmaking coal CGU as at October 31, 2018 and did not identify any impairments.

Fort Hills CGU
During the year ended, December 31, 2019 we recorded a pre-tax impairment of $1.2 billion (after-tax $910 million) related to our interest in the Fort Hills CGU. The estimated post-tax recoverable amount of Fort Hills of $3.1 billion was lower than our carrying value. This impairment arose as a result of lower market expectations for future WCS heavy oil prices. The impairment was determined using the key assumptions noted below.

Sensitivity Analysis

The recoverable amount of Fort Hills is most sensitive to changes in WCS oil prices, the Canadian/U.S. dollar exchange rates and discount rates. In isolation, a US$1 decrease in the long-term WCS oil price would result in a reduction in the recoverable amount of $135 million. A $0.01 strengthening of the Canadian dollar against the U.S. dollar would result in a reduction in the recoverable amount of approximately $50 million. A 25-basis point increase in the discount rate would result in a reduction in the recoverable amount of approximately $110 million.

Frontier Oil Sands Project

During the year ended, December 31, 2019 we recorded a pre-tax impairment of $1.1 billion (after-tax $944 million) related to our Frontier oil sands project. This impairment arose as a result of our decision to withdraw Frontier from the regulatory review process. We have written down the full carrying value of our interest in the Frontier oil sands project.

Other

During the year ended December 31, 2019, we recorded other asset impairments of $31 million related to Quebrada Blanca and the short remaining life of the cathode operation.

During the year ended December 31, 2018, we recorded other asset impairments of $41 million, of which $31 million was related to capitalized exploration expenditures that are not expected to be recovered and $10 million was related to Quebrada Blanca assets that would not be recovered through use.

Annual Goodwill Impairment Testing

In 2019, we performed our annual goodwill impairment testing at October 31 and did not identify any goodwill impairment losses.

Given the nature of expected future cash flows used to determine the recoverable amount, a material change could occur over time, as the cash flows are significantly affected by the key assumptions described as follows.

Sensitivity Analysis

Our annual goodwill impairment test carried out at October 31, 2019 resulted in the recoverable amount of our steelmaking coal CGU exceeding its carrying value by approximately $4.8 billion. The recoverable amount of our steelmaking coal CGU is most sensitive to the long-term Canadian dollar steelmaking coal price assumption. In isolation, a 10% decrease in the long-term Canadian dollar steelmaking coal price would result in the recoverable amount of the steelmaking coal CGU being equal to the carrying value.

Our annual goodwill impairment test for the Quebrada Blanca CGU carried out at October 31, 2019 resulted in a recoverable amount exceeding its carrying value by approximately $798 million. The recoverable amount of our Quebrada Blanca CGU is most sensitive to the long-term copper price assumption. In isolation, a 5% decrease in the long-term copper price would result in a recoverable amount of the Quebrada Blanca CGU being equal to the carrying value.

Key Assumptions

The following are the key assumptions used in our impairment testing calculations during the years ended December 31, 2019 and 2018:

	2019	2018
Steelmaking coal prices	**Current price used in initial year, increased to a long-term price in 2024 of US$150 per tonne**	Current price used in initial year, decreased to a long-term price in 2023 of US$150 per tonne
Copper prices	**Current price used in initial year, increased to a long-term price in 2024 of US$3.00 per pound**	Current price used in initial year, increased to a long-term price in 2023 of US$3.00 per pound
WCS oil prices	**Current price used in initial year, increased to a long-term price in 2024 of US$50 per barrel**	N/A
Discount rate	**5.4%–6.0%**	6.0%
Long-term foreign exchange rate	**1 U.S. to 1.30 Canadian dollars**	1 U.S. to 1.25 Canadian dollars
Inflation rate	**2%**	2%

Commodity Prices

Commodity price assumptions are based on a number of factors, including forward curves in the near term, and are benchmarked with external sources of information, including information published by our peers and market transactions, where possible, to ensure they are within the range of values used by market participants.

Discount Rates

Discount rates are based on a mining weighted average cost of capital for all mining operations and an oil sands weighted average cost of capital for our interest in the Fort Hills mining and processing operation. For the year ended December 31, 2019, we used a discount rate of 6.0% real, 8.1% nominal post-tax (2018 — 6.0% real, 8.1% nominal post-tax) for mining operations and goodwill. For the year ended December 31, 2019, we used a discount rate of 5.4% real, 7.5% nominal post-tax for oil sands operations.

Foreign Exchange Rates

Foreign exchange rates are benchmarked with external sources of information based on a range used by market participants. Long-term foreign exchange assumptions are from year 2024 onwards for analysis performed in the year ended December 31, 2019.

Inflation Rates

Inflation rates are based on average historical inflation for the location of each operation and long-term government targets.

Reserves and Resources

Future mineral and oil production is included in projected cash flows based on mineral and oil reserve and resource estimates, and on exploration and evaluation work undertaken by appropriately qualified persons or qualified reserves evaluators.

Operating Costs and Capital Expenditures

Operating costs and capital expenditures are based on life of mine plans and internal management forecasts. Cost estimates incorporate management experience and expertise, current operating costs, the nature and location of each operation, and the risks associated with each operation. Future capital expenditures are based on management's best estimate of expected future capital requirements, which are generally for the extraction and processing of existing reserves and resources. All committed and anticipated capital expenditures based on future cost estimates have been included in the projected cash flows. Operating cost and capital expenditure assumptions are continuously subjected to ongoing optimization and review by management.

Recoverable Amount Basis

In the absence of a relevant market transaction, we estimate the recoverable amount of our CGUs on a fair value less costs of disposal (FVLCD) basis using a discounted cash flow methodology and taking into account assumptions likely to be made by market participants unless it is expected that the value-in-use methodology would result in a higher recoverable amount. For the asset impairment, impairment reversal and goodwill impairment analyses performed in 2019 and 2018, we have applied the FVLCD basis.

Estimated Recoverable Reserves and Resources

Mineral and oil reserve and resource estimates are based on various assumptions relating to operating matters as set forth in National Instrument 43-101 — Standards of Disclosure for Mineral Projects and National Instrument 51-101 — Standards of Disclosure for Oil and Gas Activities. Assumptions used include production costs, mining and processing recoveries, cut-off grades, sales volumes, long-term commodity prices, exchange rates, inflation rates and capital costs. Cost estimates are based on prefeasibility or feasibility study estimates or operating history. Estimates are prepared by, or under the supervision of, appropriately qualified persons, or qualified reserves evaluators, but will be affected by forecasted commodity prices, inflation rates, exchange rates, capital and production costs, and recoveries, among other factors. Estimated recoverable reserves and resources are used to determine the depreciation of property, plant and equipment at operating mine sites, in accounting for capitalized production stripping costs, in performing impairment testing, and in forecasting the timing of the settlement of decommissioning and restoration costs. Therefore, changes in the assumptions used could affect the carrying value of assets, depreciation and impairment charges recorded in the statement of income, and the carrying value of the decommissioning and restoration provision.

Decommissioning and Restoration Provisions

The decommissioning and restoration provision (DRP) is based on future cost estimates using information available at the balance sheet date that are developed by management’s experts (Note 23(a)). The DRP represents the present value of estimated costs of future decommissioning and other site restoration activities including costs associated with the management of water and water quality in and around each closed site. The DRP is adjusted at each reporting period for changes to factors such as the expected amount of cash flows required to discharge the liability, the timing of such cash flows and the credit-adjusted discount rate. The DRP requires other significant estimates and assumptions, including the requirements of the relevant legal and regulatory framework and the timing, extent and costs of required decommissioning and restoration activities. Our estimates of the cost associated with the management of water and water quality in and around each closed site includes assumptions with respect to the volume and location of water to be treated, the methods used to treat the water and the related water treatment costs. To the extent the actual costs differ from these estimates, adjustments will be recorded and the income statement may be affected.

Provision for Income Taxes

We calculate current and deferred tax provisions for each of the jurisdictions in which we operate. Actual amounts of income tax expense are not final until tax returns are filed and accepted by the relevant authorities. This occurs subsequent to the issuance of our financial statements, and the final determination of actual amounts may not be completed for a number of years. Therefore, profit in subsequent periods will be affected by the amount that estimates differ from the final tax return.

Deferred Tax Assets and Liabilities

Assumptions about the generation of future taxable profits and repatriation of retained earnings depend on management’s estimates of future production and sales volumes, commodity prices, reserves and resources, operating costs, decommissioning and restoration costs, capital expenditures, dividends and other capital management transactions. These estimates could result in an adjustment to the deferred tax provision and a corresponding credit or charge to profit.

Adoption of New Accounting Standards and Accounting Developments

Adoption of New Accounting Standards

Effective January 1, 2019, we adopted IFRS 16 and IFRIC 23, *Uncertainty over Income Tax Treatments* (IFRIC 23). The effect of adoption of these new pronouncements is outlined below and in more detail in Note 33 to our audited annual consolidated financial statements as at December 31, 2019.

Leases

We adopted IFRS 16 as at January 1, 2019 in accordance with the transitional provisions outlined in the standard, using a cumulative catch-up approach where we have recorded leases prospectively from that date forward and have not restated comparative information. We recorded right-of-use assets of $280 million within property, plant and equipment, measured at either an amount equal to the lease liability or their carrying amount as if IFRS 16 had been applied since the commencement date, discounted using our incremental borrowing rate on January 1, 2019. These right-of-use assets related to lease liabilities continue to be recorded in property, plant and equipment. We recorded lease liabilities of $342 million as at January 1, 2019 and reclassified $338 million of lease liabilities that were previously presented as debt on the balance sheet. The net of tax difference between right-of-use assets and lease liabilities recognized on the transition was recorded as a $43 million retained earnings adjustment on January 1, 2019.

IFRS 16 eliminates the classification of leases as either operating or finance leases for a lessee, and all leases will be recorded on the balance sheet for the lessee. As a lessee, we recognize a right-of-use asset, which is included in property, plant and equipment, and a lease liability at the commencement date of a lease.

We have elected not to recognize right-of-use assets and lease liabilities for short-term leases that have a lease term of 12 months or less and leases of low-value assets. The lease payments associated with these leases are charged directly to profit on a straight-line basis over the lease term.

Uncertainty over Tax Treatments

We adopted IFRIC 23 on January 1, 2019 with retrospective application. IFRIC 23 clarifies the recognition and measurement requirements when there is uncertainty over income tax treatments. The effect of uncertain tax treatments are recognized at the most likely amount or expected value. The adoption of IFRIC 23 did not affect our financial results or disclosures.

Outstanding Share Data

As at February 26, 2020, there were approximately 539.5 million Class B subordinate voting shares and 7.8 million Class A common shares outstanding. In addition, there were approximately 20.1 million employee stock options outstanding, with exercise prices ranging between $5.34 and $58.80 per share. More information on these instruments, and the terms of their conversion, is set out in Note 24 to our 2019 audited annual consolidated financial statements.

Contractual and Other Obligations

($ in millions)	Less than 1 Year	2–3 Years	4–5 Years	More than 5 Years	Total
Debt – Principal and interest payments	$ 264	$ 858	$ 696	$ 6,595	**$ 8,413**
Leases – Principal and interest payments[(1)]	171	204	115	715	**1,205**
Minimum purchase obligations[(2)]					
Concentrate, equipment, supply and other purchases	677	465	58	34	**1,234**
Shipping and distribution	415	472	374	1,042	**2,303**
Energy contracts	290	674	1,028	5,343	**7,335**
NAB PILT and VIF payments[(7)]	40	86	86	88	**300**
Pension funding[(3)]	24	–	–	–	**24**
Other non-pension post-retirement benefits[(4)]	13	27	30	334	**404**
Decommissioning and restoration provision[(5)]	90	203	101	1,840	**2,234**
Other long-term liabilities[(6)]	35	95	53	53	**236**
	$ 2,019	$ 3,084	$ 2,541	$ 16,044	**$ 23,688**

Notes:

(1) We lease road and port facilities from the Alaska Industrial Development and Export Authority, through which it ships metal concentrates produced at the Red Dog mine. Minimum lease payments are US$18 million for the next 2 years and US$6 million for the following 19 years and are subject to deferral and abatement for *force majeure* events.

(2) The majority of our minimum purchase obligations are subject to continuing operations and *force majeure* provisions.

(3) As at December 31, 2019, the company had a net pension asset of $259 million, based on actuarial estimates prepared on a going concern basis. The amount of minimum funding for 2020 in respect of defined benefit pension plans is $24 million. The timing and amount of additional funding after 2020 is dependent upon future returns on plan assets, discount rates and other actuarial assumptions.

(4) We had a discounted, actuarially determined liability of $404 million in respect of other non-pension post-retirement benefits as at December 31, 2019. Amounts shown are estimated expenditures in the indicated years.

(5) We accrue environmental and reclamation obligations over the life of our mining operations, and amounts shown are estimated expenditures in the indicated years at fair value, assuming credit-adjusted risk-free discount rates between 5.03% and 6.69% and an inflation factor of 2.00%.

(6) Other long-term liabilities include amounts for post-closure, environmental costs and other items.

(7) On April 25, 2017, Teck Alaska entered into a 10-year agreement with the Northwest Arctic Borough (NAB) for payments in lieu of taxes (PILT). Payments under the agreement are based on a percentage of land, buildings and equipment at cost less accumulated depreciation. The effective date of this agreement was January 1, 2016 and this agreement expires on December 31, 2025. On April 25, 2017, Teck Alaska entered into a 10-year agreement with the NAB for payments to a village improvement fund (VIF). Payments under the agreement are based on a percentage of earnings before income taxes, with 2017–2025 having minimum payments of $4 million and maximum payments of $8 million. The effective date of this agreement was January 1, 2016 and this agreement expires on December 31, 2025.

Disclosure Controls and Internal Control Over Financial Reporting

Disclosure Controls and Procedures

Disclosure controls and procedures are designed to provide reasonable assurance that information required to be disclosed in reports filed or submitted by us under U.S. and Canadian securities legislation is recorded, processed, summarized and reported within the time periods specified in those rules, and include controls and procedures designed to ensure that information required to be disclosed in reports filed or submitted by us under U.S. and Canadian securities legislation is accumulated and communicated to management, including the Chief Executive Officer and Chief Financial Officer, as appropriate, to permit timely decisions regarding required disclosure. Management, including the Chief Executive Officer and Chief Financial Officer, has evaluated the effectiveness of the design and operation of our disclosure controls and procedures, as defined in the rules of the U.S. Securities and Exchange Commission and the Canadian Securities Administrators, as at December 31, 2019. Based on this evaluation, the Chief Executive Officer and Chief Financial Officer have concluded that our disclosure controls and procedures were effective as at December 31, 2019.

Management's Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting. Any system of internal control over financial reporting, no matter how well-designed, has inherent limitations. Therefore, even those systems determined to be effective can provide only reasonable assurance with respect to financial statement preparation and presentation. Management has used the Committee of Sponsoring Organizations of the Treadway Commission (COSO) 2013 framework to evaluate the effectiveness of our internal control over financial reporting. Based on this assessment, management has concluded that as at December 31, 2019, our internal control over financial reporting was effective.

The effectiveness of our internal controls over financial reporting has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, who have expressed their opinion in their report included with our annual consolidated financial statements.

Use of Non-GAAP Financial Measures

Our financial results are prepared in accordance with International Financial Reporting Standards (IFRS). This document refers to a number of Non-GAAP Financial Measures, which are not measures recognized under IFRS in Canada and do not have a standardized meaning prescribed by IFRS or Generally Accepted Accounting Principles (GAAP) in the United States.

The Non-GAAP Measures described below do not have standardized meanings under IFRS, may differ from those used by other issuers, and may not be comparable to such measures as reported by others. These measures have been derived from our financial statements and applied on a consistent basis as appropriate. We disclose these measures because we believe they assist readers in understanding the results of our operations and financial position and are meant to provide further information about our financial results to investors. These measures should not be considered in isolation or used in substitute for other measures of performance prepared in accordance with IFRS.

Adjusted profit: For adjusted profit, we adjust profit attributable to shareholders as reported to remove the after-tax effect of certain types of transactions that in our judgment are not indicative of our normal operating activities or do not necessarily occur on a regular basis.

Adjusted basic earnings per share: Adjusted basic earnings per share is adjusted profit divided by average number of shares outstanding in the period.

Adjusted diluted earnings per share: Adjusted diluted earnings per share is adjusted profit divided by average number of fully diluted shares in a period.

EBITDA: EBITDA is profit attributable to shareholders before net finance expense, provision for income taxes, and depreciation and amortization.

Adjusted EBITDA: Adjusted EBITDA is EBITDA before the pre-tax effect of the adjustments that we make to adjusted profit attributable to shareholders as described above.

The above adjustments to profit attributable to shareholders and EBITDA highlight items and allow us and readers to analyze the rest of our results more clearly. We believe that disclosing these measures assists readers in understanding the ongoing cash generating potential of our business in order to provide liquidity to fund working capital needs, service outstanding debt, fund future capital expenditures and investment opportunities, and pay dividends.

Gross profit before depreciation and amortization: Gross profit before depreciation and amortization is gross profit with the depreciation and amortization expense added back. We believe this measure assists us and readers to assess our ability to generate cash flow from our business units or operations.

Gross profit margins before depreciation: Gross profit margins before depreciation are gross profit before depreciation and amortization expense, divided by revenue for each respective business unit. We believe this measure assists us and readers to compare margins on a percentage basis among our business units.

Unit costs: Unit costs for our steelmaking coal operations are total cost of goods sold, divided by tonnes sold in the period, excluding depreciation and amortization charges. We include this information as it is frequently requested by investors and investment analysts who use it to assess our cost structure and margins and compare it to similar information provided by many companies in the industry.

Adjusted site cost of sales: Adjusted site cost of sales for our steelmaking coal operations is defined as the cost of the product as it leaves the mine, excluding depreciation and amortization charges, outbound transportation costs and any one-time collective agreement charges and inventory write-down provisions.

Total cash unit costs: Total cash unit costs for our copper and zinc operations include adjusted cash costs of sales, as described below, plus the smelter and refining charges added back in determining adjusted revenue. This presentation allows a comparison of total cash unit costs, including smelter charges, to the underlying price of copper or zinc in order to assess the margin for the mine on a per unit basis.

Net cash unit costs: Net cash unit costs of principal product, after deducting co-product and by-product margins, are also a common industry measure. By deducting the co- and by-product margin per unit of the principal product, the margin for the mine on a per unit basis may be presented in a single metric for comparison to other operations. Readers should be aware that this metric, by excluding certain items and reclassifying cost and revenue items, distorts our actual production costs as determined under IFRS.

Adjusted cash costs of sales: Adjusted cash cost of sales for our copper and zinc operations is defined as the cost of the product delivered to the port of shipment, excluding depreciation and amortization charges, any one-time collective agreement charges or inventory write-down provisions, and by-product cost of sales. It is common practice in the industry to exclude depreciation and amortization, as these costs are non-cash, and discounted cash flow valuation models used in the industry substitute expectations of future capital spending for these amounts.

Adjusted operating costs: Adjusted operating costs for our energy business unit are defined as the costs of product as it leaves the mine, excluding depreciation and amortization charges, cost of diluent for blending to transport our bitumen by pipeline, cost of non-proprietary product purchased, and transportation costs of our product, and non-proprietary product and any one-time collective agreement charges or inventory write-down provisions.

Cash margins for by-products: Cash margins for by-products is revenue from by-products and co-products, less any associated cost of sales of the by-product and co-product. In addition, for our copper operations, by-product cost of sales also includes cost recoveries associated with our streaming transactions.

Adjusted revenue: Adjusted revenue for our copper and zinc operations excludes the revenue from co-products and by-products, but adds back the processing and refining charges to arrive at the value of the underlying payable pounds of copper and zinc. Readers may compare this on a per unit basis with the price of copper and zinc on the LME.

Adjusted revenue for our energy business unit excludes the cost of diluent for blending and non-proprietary product revenues, but adds back Crown royalties to arrive at the value of the underlying bitumen.

Blended bitumen revenue: Blended bitumen revenue is revenue as reported for our energy business unit, but excludes non-proprietary product revenue, and adds back Crown royalties that are deducted from revenue.

Blended bitumen price realized: Blended bitumen price realized is blended bitumen revenue divided by blended bitumen barrels sold in the period.

Operating netback: Operating netbacks per barrel in our energy business unit are calculated as blended bitumen sales revenue net of diluent expenses (also referred to as bitumen price realized), less Crown royalties, transportation and operating expenses divided by barrels of bitumen sold. We include this information, as investors and investment analysts use it to measure our profitability on a per barrel basis and to compare it to similar information provided by other companies in the oil sands industry.

The debt-related measures outlined below are disclosed as we believe they provide readers with information that allows them to assess our credit capacity and the ability to meet our short- and long-term financial obligations.

Net debt: Net debt is total debt, less cash and cash equivalents.

Debt to debt-plus-equity ratio: Debt to debt-plus-equity ratio takes total debt as reported and divides that by the sum of total debt plus total equity, expressed as a percentage.

Net debt to net debt-plus-equity ratio: Net debt to net debt-plus-equity ratio is net debt divided by the sum of net debt plus total equity, expressed as a percentage.

Debt to EBITDA ratio: Debt to EBITDA ratio takes total debt as reported and divides that by EBITDA for the 12 months ended at the reporting period, expressed as the number of times EBITDA needs to be earned to repay all of the outstanding debt.

Net debt to EBITDA ratio: Net debt to EBITDA ratio is the same calculation as the debt to EBITDA ratio, but using net debt as the numerator.

Net debt to capitalization ratio: Net debt to capitalization ratio is net debt divided by the sum of total debt plus equity attributable to shareholders. The ratio is a financial covenant under our revolving credit facility.

Reconciliation of Basic Earnings (Loss) per share to Adjusted Basic Earnings per share

(Per share amounts)	2019	2018
Earnings (loss) per share	**$ (1.08)**	$ 5.41
Add (deduct):		
Asset impairments	**3.67**	0.05
Debt redemption or purchase loss	**0.29**	0.03
Debt prepayment option loss (gain)	**(0.14)**	0.06
Gain on sale of Waneta Dam	**–**	(1.41)
Taxes and other	**0.03**	(0.01)
Adjusted basic earnings per share	**$ 2.77**	$ 4.13

Reconciliation of Diluted Earnings (Loss) per share to Adjusted Diluted Earnings per share

(Per share amounts)	2019	2018
Diluted earnings (loss) per share	**$ (1.08)**	$ 5.34
Add (deduct):		
Asset impairments	**3.63**	0.05
Debt redemption or purchase loss	**0.29**	0.03
Debt prepayment option loss (gain)	**(0.13)**	0.05
Gain on sale of Waneta Dam	**–**	(1.39)
Taxes and other	**0.04**	(0.01)
Adjusted diluted earnings per share	**$ 2.75**	$ 4.07

Reconciliation of Net Debt to EBITDA and Net Debt to Capitalization Ratio

($ in millions)	2019	2018
Profit (loss) attributable to shareholders	**$ (605)**	$ 3,107
Finance expense net of finance income	**218**	219
Provision for income taxes	**120**	1,365
Depreciation and amortization	**1,619**	1,483
EBITDA	**$ 1,352**	$ 6,174
Total debt at period end	**$ 4,834**	$ 5,519
Less: cash and cash equivalents at period end	**(1,026)**	(1,734)
Net debt	**$ 3,808**	$ 3,785
Debt to EBITDA ratio	**3.6**	0.9
Net Debt to EBITDA ratio	**2.8**	0.6
Equity attributable to shareholders of the company	**21,304**	22,884
Net debt to capitalization ratio	**0.15**	0.13

Reconciliation of EBITDA and Adjusted EBITDA

($ in millions)	2019	2018
Profit (loss) attributable to shareholders	**$ (605)**	$ 3,107
Finance expense net of finance income	**218**	219
Provision for income taxes	**120**	1,365
Depreciation and amortization	**1,619**	1,483
EBITDA	**$ 1,352**	$ 6,174
Add (deduct):		
Asset impairments	**2,678**	41
Debt redemption or purchase loss	**224**	26
Debt prepayment option (gains) losses	**(105)**	42
Gain on sale of Waneta Dam	**–**	(888)
Taxes and other	**104**	(5)
Adjusted EBITDA	**$ 4,253**	$ 5,390

Reconciliation of Gross Profit (Loss) Before Depreciation and Amortization

($ in millions)	2019	2018	2017
Gross profit	**$ 3,340**	$ 4,621	$ 4,567
Depreciation and amortization	**1,619**	1,483	1,492
Gross profit before depreciation and amortization	**$ 4,959**	$ 6,104	$ 6,059
Reported as:			
Steelmaking coal	**$ 2,904**	$ 3,770	$ 3,732
Copper			
Highland Valley Copper	**395**	343	213
Antamina	**614**	794	670
Quebrada Blanca	**(18)**	26	50
Carmen de Andacollo	**89**	193	222
Other	**–**	(1)	(1)
	$ 1,080	$ 1,355	$ 1,154
Zinc			
Trail Operations	**–**	91	209
Red Dog	**837**	990	971
Pend Oreille	**(4)**	(5)	19
Other	**(2)**	9	(26)
	$ 831	$ 1,085	$ 1,173
Energy[1]	**$ 144**	$ (106)	$ –
Gross profit before depreciation and amortization	**$ 4,959**	$ 6,104	$ 6,059

Note:

[1] Energy results for the year ended December 31, 2018 are included from June 1, 2018.

Steelmaking Coal Unit Cost Reconciliation

(CAD$ in millions, except where noted)	2019	2018
Cost of sales as reported	**$ 3,410**	$ 3,309
Less:		
Transportation	**(976)**	(975)
Depreciation and amortization	**(792)**	(730)
Inventory write-downs	**(32)**	–
Adjusted site cost of sales	**$ 1,610**	$ 1,604
Tonnes sold (millions)	**25.0**	26.0
Per unit amounts — CAD$/tonne		
Adjusted site cost of sales	**$ 65**	$ 62
Transportation	**39**	37
Inventory write-down	**1**	–
Unit costs — CAD$/tonne	**$ 105**	$ 99
US$ amounts[1]		
Average exchange rate (CAD$ per US$1.00)	**$ 1.33**	$ 1.30
Per unit amounts — US$/tonne		
Adjusted site cost of sales	**$ 49**	$ 47
Transportation	**29**	29
Inventory write-down	**1**	–
Unit costs — US$/tonne	**$ 79**	$ 76

Note:
[1] Average period exchange rates are used to convert to US$/tonne equivalent.

Copper Unit Cost Reconciliation

(CAD$ in millions, except where noted)	2019	2018
Revenue as reported	**$ 2,469**	$ 2,714
By-product revenue (A)	**(311)**	(472)
Smelter processing charges (B)	**164**	157
Adjusted revenue	**$ 2,322**	$ 2,399
Cost of sales as reported	**$ 1,852**	$ 1,837
Less:		
Depreciation and amortization	**(463)**	(478)
Inventory write-downs	**(24)**	(44)
Labour settlement and strike costs	**(35)**	(5)
By-product cost of sales (C)	**(58)**	(61)
Adjusted cash cost of sales (D)	**$ 1,272**	$ 1,249
Payable pounds sold (millions) (E)	**641.7**	622.9
Per unit amounts — CAD$/pound		
Adjusted cash cost of sales (D/E)	**$ 1.98**	$ 2.01
Smelter processing charges (B/E)	**0.26**	0.25
Total cash unit costs — CAD$/pound	**$ 2.24**	$ 2.26
Cash margins for by-products — ((A−C)/E)	**(0.39)**	(0.66)
Net cash unit costs — CAD$/pound	**$ 1.85**	$ 1.60
US$ amounts[1]		
Average exchange rate (CAD$ per US$1.00)	**$ 1.33**	$ 1.30
Per unit amounts — US$/pound		
Adjusted cash cost of sales	**$ 1.49**	$ 1.55
Smelter processing charges	**0.19**	0.19
Total cash unit costs — US$/pound	**$ 1.68**	$ 1.74
Cash margins for by-products	**(0.29)**	(0.51)
Net cash unit costs — US$/pound	**$ 1.39**	$ 1.23

Note:

[1] Average period exchange rates are used to convert to US$/pound equivalent.

Zinc Unit Cost Reconciliation (Mining Operations[(1)])

(CAD$ in millions, except where noted)	2019	2018
Revenue as reported	$ 2,968	$ 3,094
Less:		
Trail Operations revenues as reported	(1,829)	(1,942)
Other revenues as reported	(8)	(8)
Add back: Intra-segment revenues as reported	519	650
	$ 1,650	$ 1,794
By-product revenues (A)	(317)	(316)
Smelter processing charges (B)	308	255
Adjusted revenue	$ 1,641	$ 1,733
Cost of sales as reported	$ 2,367	$ 2,225
Less:		
Trail Operations cost of sales as reported	(1,915)	(1,926)
Other costs of sales as reported	(10)	1
Add back: Intra-segment purchases as reported	519	650
	961	950
Less:		
Depreciation and amortization	(144)	(141)
Severance charge	(4)	–
Royalty costs	(307)	(328)
By-product cost of sales (C)	(75)	(70)
Adjusted cash cost of sales (D)	$ 431	$ 411
Payable pounds sold (millions) (E)	1,094.2	1,035.5
Per unit amounts — CAD$/pound		
Adjusted cash cost of sales (D/E)	$ 0.40	$ 0.40
Smelter processing charges (B/E)	0.28	0.25
Total cash unit costs — CAD$/pound	$ 0.68	$ 0.65
Cash margins for by-products — ((A−C)/E)	(0.22)	(0.24)
Net cash unit costs — CAD$/pound	$ 0.46	$ 0.41
US$ amounts[(2)]		
Average exchange rate (CAD$ per US$1.00)	$ 1.33	$ 1.30
Per unit amounts — US$/pound		
Adjusted cash cost of sales	$ 0.30	$ 0.30
Smelter processing charges	0.21	0.19
Total cash unit costs — US$/pound	$ 0.51	$ 0.49
Cash margins for by-products	(0.17)	(0.18)
Net cash unit costs — US$/pound	$ 0.34	$ 0.31

Notes:

[(1)] Red Dog and Pend Oreille.

[(2)] Average period exchange rates are used to convert to US$/pound equivalent.

Energy Business Unit — Operating Netback, Bitumen and Blended Bitumen Price Realized Reconciliations[1] [2]

(CAD$ in millions, except where noted)	2019	2018
Revenue as reported	**$ 975**	$ 407
Less:		
Cost of diluent for blending	**(322)**	(181)
Non-proprietary product revenue	**(32)**	(18)
Add back: Crown royalties (D)	**18**	14
Adjusted revenue (A)	**$ 639**	$ 222
Cost of sales as reported	**$ 965**	$ 572
Less:		
Depreciation and amortization	**(134)**	(59)
Inventory write-downs	**–**	(34)
Cash cost of sales	**$ 831**	$ 479
Less:		
Cost of diluent for blending	**(322)**	(181)
Cost of non-proprietary product purchased	**(31)**	(12)
Transportation costs for FRB (C)	**(118)**	(60)
Operating cost adjustment[4]	**(2)**	(3)
Adjusted operating costs (E)	**$ 358**	$ 223
Blended bitumen barrels sold (thousands)	**16,023**	8,746
Less diluent barrels included in blended bitumen (thousands)	**(3,788)**	(1,965)
Bitumen barrels sold (thousands) (B)	**12,235**	6,781
Per barrel amounts — CAD$		
Bitumen price realized (A/B)[3]	**$ 52.21**	$ 32.81
Crown royalties (D/B)	**(1.50)**	(2.04)
Transportation costs for FRB (C/B)	**(9.62)**	(8.83)
Adjusted operating costs (E/B)	**(29.24)**	(32.89)
Operating netback — CAD$ per barrel	**$ 11.85**	$ (10.95)

Notes:

[1] Calculated per unit amounts may differ due to rounding.

[2] Fort Hills financial results included from June 1, 2018.

[3] Bitumen price realized represents the realized petroleum revenue (blended bitumen sales revenue) net of diluent expense, expressed on a per barrel basis. Blended bitumen sales revenue represents revenue from our share of the heavy crude oil blend known as Fort Hills Reduced Carbon Life Cycle Dilbit Blend (FRB), sold at the Hardisty and U.S. Gulf Coast market hubs. FRB is comprised of bitumen produced from Fort Hills blended with purchased diluent. The cost of blending is affected by the amount of diluent required and the cost of purchasing, transporting and blending the diluent. A portion of diluent expense is effectively recovered in the sales price of the blended product. Diluent expense is also affected by Canadian and U.S. benchmark pricing and changes in the value of the Canadian dollar relative to the U.S. dollar.

[4] Reflects adjustments for costs not directly attributed to the production of Fort Hills bitumen, including transportation for non-proprietary product purchased.

Blended Bitumen Price Realized Reconciliation[2]

(CAD$ in millions, except where noted)	2019	2018
Revenue as reported	**$ 975**	$ 407
Less: non-proprietary product revenue	**(32)**	(18)
Add back: Crown royalties	**18**	14
Blended bitumen revenue (A)	**$ 961**	$ 403
Blended bitumen barrels sold (thousands) (B)	**16,023**	8,746
Blended bitumen price realized — (CAD$/barrel) (A/B) = D[1]	**$ 59.97**	$ 46.14
Average exchange rate (CAD$ per US$1.00) (C)	**1.33**	1.31
Blended bitumen price realized — (US$/barrel) (D/C)[1]	**$ 45.20**	$ 35.12

Notes:

[1] Calculated per unit amounts may differ due to rounding.

[2] Results for the year ended December 31, 2018 are effective from June 1, 2018.

Quarterly Reconciliation

($ in millions)	**2019**				2018			
	Q4	**Q3**	**Q2**	**Q1**	Q4	Q3	Q2	Q1
Profit (loss) attributable to shareholders	**$ (1,835)**	**$ 369**	**$ 231**	**$ 630**	$ 433	$ 1,281	$ 634	$ 759
Finance expense, net of finance income	**46**	**56**	**62**	**54**	58	74	48	39
Provision for (recovery of) income taxes	**(510)**	**171**	**120**	**339**	261	329	368	407
Depreciation and amortization	**415**	**436**	**395**	**373**	400	380	353	350
EBITDA (loss)	**$ (1,884)**	**$1,032**	**$ 808**	**$1,396**	$ 1,152	$ 2,064	$ 1,403	$ 1,555

Cautionary Statement on Forward-Looking Statements

This document contains certain forward-looking information and forward-looking statements as defined in applicable securities laws (collectively referred to as forward-looking statements). These statements relate to future events or our future performance. All statements other than statements of historical fact are forward-looking statements. The use of any of the words “anticipate”, “plan”, “continue”, “estimate”, “expect”, “may”, “will”, “project”, “predict”, “potential”, “should”, “believe” and similar expressions is intended to identify forward-looking statements. These statements involve known and unknown risks, uncertainties and other factors that may cause actual results or events to differ materially from those anticipated in such forward-looking statements. These statements speak only as of the date of this document.

These forward-looking statements include, but are not limited to, statements concerning: corporate strategy; production, sales, unit costs and other cost guidance, expectations and forecasts for our products, business units and individual operations and our expectation that we will meet that guidance; expectations relating to the closure of Cardinal River and the timing thereof, including the statement that lost production is expected to be made up by our Elkview Operations; Elk Valley Water Quality Plan spending guidance, including projected 2020 capital spending and other capital spending guidance; timing of construction and completion of our proposed AWTFs and SRFs and expected treatment capacity thereof; our expectations regarding our water treatment capacity in the future; expectations regarding operating costs associated with water treatment; our expectation that Fording River AWTF will be the last full-scale AWTF and that future treatment facilities will be SRFs; timing of discussions in respect of potential charges under the *Fisheries Act*; anticipated benefits of our new long-term rail agreement with CN; expectations regarding the Neptune Bulk Terminals facility upgrade including costs, benefits and timing thereof; planned outages at Neptune Bulk Terminals including the expected frequency, length and benefits thereof; anticipated benefits of our expanded commercial agreement with Ridley Terminals; anticipated global and regional supply, demand and market outlook for our commodities; assumptions relating to future market prices of our commodities and future exchange rates; anticipated future production at our business units, products and individual operations (including our long-term production guidance); sales forecasts for our products and operations; all guidance and forecasts appearing in this document including but not limited to the production, sales, unit cost, capital expenditure, cost reduction and other guidance, forecasts or expectations under the headings “Outlook” and “Guidance”; mine lives and duration of operations at our various mines and operations; our ability to extend the lives of certain mines and to increase production to offset the closure of other operations; expectations regarding the plant expansion project at our Elkview Operations and the timing thereof; planned plant outages at their effects on our production; expectations regarding the Quebrada Blanca Phase 2 project, including expectations regarding capacity, mine life and potential for growth of mine life, reserve and resources, operating costs, projected expenditures, timing of contributions, project financing and first and full production and the statement that the project continues to support opportunities to more than double production capacity; the timing for an updated capital estimate in respect of QB2; expected receipt or completion of prefeasibility studies, feasibility studies and other studies and the expected timing thereof; the potential to debottleneck at Fort Hills and expand production capacity and potential to increase Fort Hills production generally; the effect and duration of production curtailment measures imposed by the Government of Alberta; our plans to continue to explore and evaluate our oil sands development properties; plans relating to tailings and water-related projects at Red Dog and their expected benefits; exploration activities in 2020; expected annualized EBITDA improvements and other benefits that will be generated from our RACE21^{TM} innovation-driven efficiency program and the associated implementation costs and timing; our intention to implement certain RACE21TM programs more broadly across other operations and to identify and implement additional RACE21TM projects; the impact of the Coronavirus; the amount of potential taxes, interest and penalties relating to the Antamina tax dispute and our share thereof; the availability of our credit facilities, sources of liquidity and capital resources; our expectation that we will receive a portion of our carbon tax expenditures back under the CleanBC program; our expectations that we will be able to maintain our operations and fund our development activities as planned; estimates and expectations regarding our decommissioning and restoration requirements; our expectations regarding the amount of Class B subordinate voting shares that might be purchased under the normal course issuer bid and the mechanics thereof; expectations regarding our dividend policy and our capital allocation framework; our expectations, projections and sensitivities under the heading "Commodity Prices and Sensitivities"; targeted cost reduction amounts and timing; expectations regarding carbon legislation and climate change regulations; and the impact of certain accounting initiatives and estimates.

These statements are based on a number of assumptions, including, but not limited to, assumptions regarding general business and economic conditions, interest rates, commodity and power prices, acts of foreign or domestic governments and the outcome of legal proceedings, the supply and demand for, deliveries of, and the level and volatility of prices of copper, coal, zinc and blended bitumen and our other metals and minerals, as well as oil, natural gas and other petroleum products, the timing of the receipt of regulatory and governmental approvals for our development projects and other operations, including mine extensions; positive results from the studies on our expansion and development projects; our ability to secure adequate transportation, including rail, pipeline and port service, for our products our costs of production and our production and productivity levels, as well as those of our competitors, continuing availability of water and power resources for our operations, our ability to secure adequate transportation, pipeline and port services for our products; changes in credit market conditions and conditions in financial markets generally, the availability of funding to refinance our borrowings as they become due or to finance our development projects on reasonable terms; our ability to procure equipment and operating supplies in sufficient quantities and on a timely basis; the availability of qualified employees and contractors for our operations, including our new developments and our ability to attract and retain skilled employees; the satisfactory negotiation of collective agreements with unionized employees; the impact of changes in Canadian-U.S. dollar and other foreign exchange rates on our costs and results; engineering and construction timetables and capital costs for our development and expansion projects; the benefits of technology for our operations and development projects, including the impact of our RACE21™ program; costs of closure, and environmental compliance costs generally, of operations; market competition; the accuracy of our mineral reserve and resource estimates (including with respect to size, grade and recoverability) and the geological, operational and price assumptions on which these are based; tax benefits and tax rates; the outcome of our coal price and volume negotiations with customers; the outcome of our copper, zinc and lead concentrate treatment and refining charge negotiations with customers; curtailment measures on oil production taken by the Government of Alberta; the resolution of environmental and other proceedings or disputes; the future supply of low-cost power to the Trail smelting and refining complex; our ability to obtain, comply with and renew permits in a timely manner; and our ongoing relations with our employees and with our business and joint venture partners.

In addition, assumptions regarding the Elk Valley Water Quality Plan include assumptions that additional treatment will be effective at scale, and that the technology and facilities operate as expected, as well as additional assumptions discussed under the heading "Management's Discussion and Analysis — Steelmaking Coal — Elk Valley Water Quality Management". Assumptions regarding QB2 include current project assumptions and assumptions regarding the final feasibility study. Assumptions regarding the costs and benefits of the Neptune Bulk Terminals expansion and other projects include assumptions that the relevant project is constructed and operated in accordance with current expectations. Expectations regarding our operations are based on numerous assumptions regarding the operations. Our Guidance tables include footnotes with further assumptions relating to our guidance. Expectations regarding the impact of foreign exchange rates are based on the assumptions set out in this document. Our anticipated RACE21^{TM} related EBITDA improvements and associated costs assume that the relevant projects are implemented in accordance with our plans and budget and that the relevant projects will achieve the expected production and operating results, and are based on current commodity price assumptions and forecast sale volumes. Statements regarding the availability of our credit facilities are based on assumptions that we will be able to satisfy the conditions for borrowing at the time of a borrowing request and that the credit facilities are not otherwise terminated or accelerated due to an event of default. Statements concerning future production costs or volumes are based on numerous assumptions of management regarding operating matters and on assumptions that demand for products develops as anticipated, that customers and other counterparties perform their contractual obligations, that operating and capital plans will not be disrupted by issues such as mechanical failure, unavailability of parts and supplies, labour disturbances, interruption in transportation or utilities, adverse weather conditions, and that there are no material unanticipated variations in the cost of energy or supplies. Statements regarding anticipated steelmaking coal sales volumes and average steelmaking coal prices depend on timely arrival of vessels and performance of our steelmaking coal-loading facilities, as well as the level of spot pricing sales. The foregoing list of assumptions is not exhaustive. Events or circumstances could cause actual results to vary materially.

Factors that may cause actual results to vary materially include, but are not limited to, changes in commodity and power prices, changes in market demand for our products, changes in interest and currency exchange rates, acts of governments and the outcome of legal proceedings, inaccurate geological and metallurgical assumptions (including with respect to the size, grade and recoverability of mineral reserves and resources), unanticipated operational difficulties (including failure of plant, equipment or processes to operate in accordance with specifications or expectations, cost escalation, unavailability of materials and equipment, government action or delays in the receipt of government approvals, changes in tax or royalty rates, industrial disturbances or other job action, adverse weather conditions and unanticipated events related to health, safety and environmental matters), union labour disputes, political risk, social unrest, failure of customers or counterparties (including logistics suppliers) to perform their contractual obligations, changes in our credit ratings, unanticipated increases in costs to construct our development projects, difficulty in obtaining permits, inability to address concerns regarding permits or environmental impact assessments, and changes or further deterioration in general economic conditions. The amount and timing of capital expenditures is depending upon, among other matters, being able to secure permits, equipment, supplies, materials and labour on a timely basis and at expected costs. Certain operations and projects are not controlled by us; schedules and costs may be adjusted by our partners, and timing of spending and operation of the operation or project is not in our control. Certain of our other operations and projects are operated through joint arrangements where we may not have control over all decisions, which may cause outcomes to differ from current expectation. Current and new technologies relating to our Elk Valley water treatment efforts may not perform as anticipated, and ongoing monitoring may reveal unexpected environmental conditions requiring additional remedial measures. Purchases of Class B subordinate voting shares under the normal course issuer bid may be affected by, among other things, availability of Class B subordinate voting shares, share price volatility and availability of funds to purchase shares. EBITDA improvements may be impacted by the effectiveness of our projects, actual commodity prices and sales volumes, among other matters. Further factors associated with our Elk Valley Water Quality Plan are discussed under the heading “*Management’s Discussion and Analysis — Steelmaking Coal — Elk Valley Water Quality Management*”. Declaration and payment of dividends is in the discretion of the Board, and our dividend policy will be reviewed regularly and may change.

We assume no obligation to update forward-looking statements except as required under securities laws. Further information concerning risks, assumptions and uncertainties associated with these forward-looking statements and our business can be found in our Annual Information Form for the year ended December 31, 2019, filed under our profile on SEDAR (www.sedar.com) and on EDGAR (www.sec.gov) under cover of Form 40-F, as well as subsequent filings that can also be found under our profile.

Scientific and technical information in this Management Discussion and Analysis regarding our coal properties was reviewed, approved and verified by Messrs. Don Mills P.Geo. and Robin Gold P.Eng., each employees of Teck Coal Limited and each a Qualified Person as defined under National Instrument 43-101. Scientific and technical information in this Management Discussion and Analysis regarding our other properties was reviewed, approved and verified by Rodrigo Alves Marinho, P.Geo., an employee of Teck and a Qualified Person as defined under National Instrument 43-101.