



**Borden Gold: 'Mine of the Future'**

***John Mullally***

**MDEC October 2<sup>nd</sup> 2018, Toronto**



**Agenda**

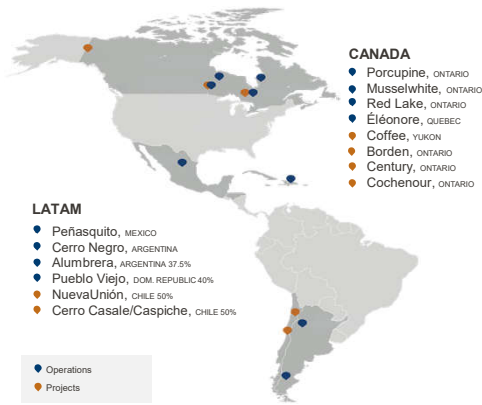
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- Safety share
- Overview of Goldcorp's global footprint
- Borden – Mine of the Future
- Partnering with First Nations communities
- First all-electric underground mine
- Significant safety benefits
- Lessons learned
- Future at Borden

**<https://www.youtube.com/watch?v=oV1CrL-L0ms>**

# Goldcorp's Portfolio

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Vision is gold production of 3 to 4 million ounces from six to eight large-scale camps  
Economies of scale and geological prospectivity are expected to drive low costs and value growth

Continued divestment of non-core assets reflects disciplined portfolio optimization and management focus on scale

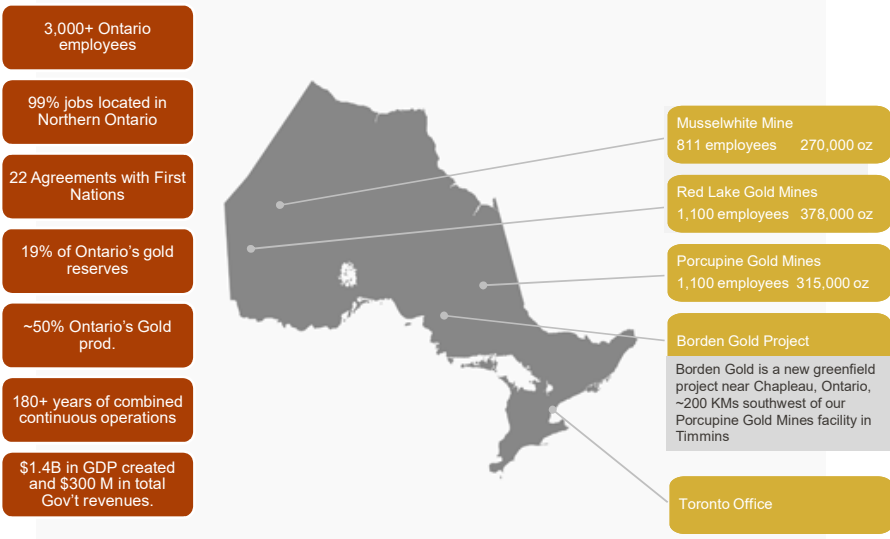
Employ over 15,000 people globally and more than 4,000 in Canada.

Focused on improving our environmental performance by reducing water and energy use, and driving down GHG emissions.

Safe, sustainable and responsible mining is a company-wide commitment rooted in our values as an organization.

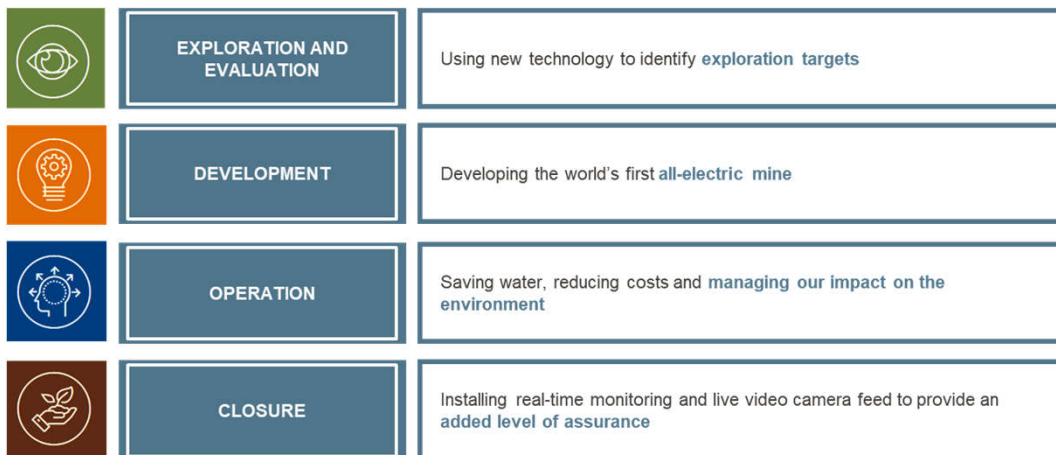
# Goldcorp in Ontario

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## Innovation approach

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TOGETHER. CREATING SUSTAINABLE VALUE

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## Chapleau: A clean slate to build the 'Mine of the Future'

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■ Our vision   ■ Our values   ■ Our six pillars

- In 1885, CP Rail came to town.
- Pulp and paper was a large employer but economic conditions led to many layoffs.
- At its peak, the town had a population of 5000 people.
- The town has been shrinking since 1950 and currently less than 2000.
- There is no history of mining in Chapleau so we're staying with a clean slate.
- 3 First Nations communities living in the surrounding area.
- A significant need for people to work at the mine. We would also expect 2 indirect jobs for every direct job at Borden Mine.

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## Borden Gold -Safe - Simple– Green – Silent – Invisible & Inclusive Project

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- A mine designed entirely on a concept of sustainable mining
- An efficient mine where innovation, digitization and automation will play a key role
- A laser focus on inclusion and consultation with local communities
- A low carbon footprint and robust economics
- All underground diesel equipment will be replaced with Battery Electric Vehicles (BEVs)
- No air compressed networks makes the mine more energy efficient
- No surface fans greatly reduces noise pollution
- First mine to adopt a 1000 volt standard for its equipment
- Fully connected mine, Ventilation On Demand, people tagging and tracking system, real time air quality/quantity monitoring
- No warehouse (VMI + consignment + local business)
- No camp – using existing facilities in Chapleau
- Remaining geological potential across 900 sq km of claims in a new mining region.
- First in North America to take 6 meter rounds

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## Borden Site – Pre Development (2015) and Post (2018)

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## Borden Gold Mine

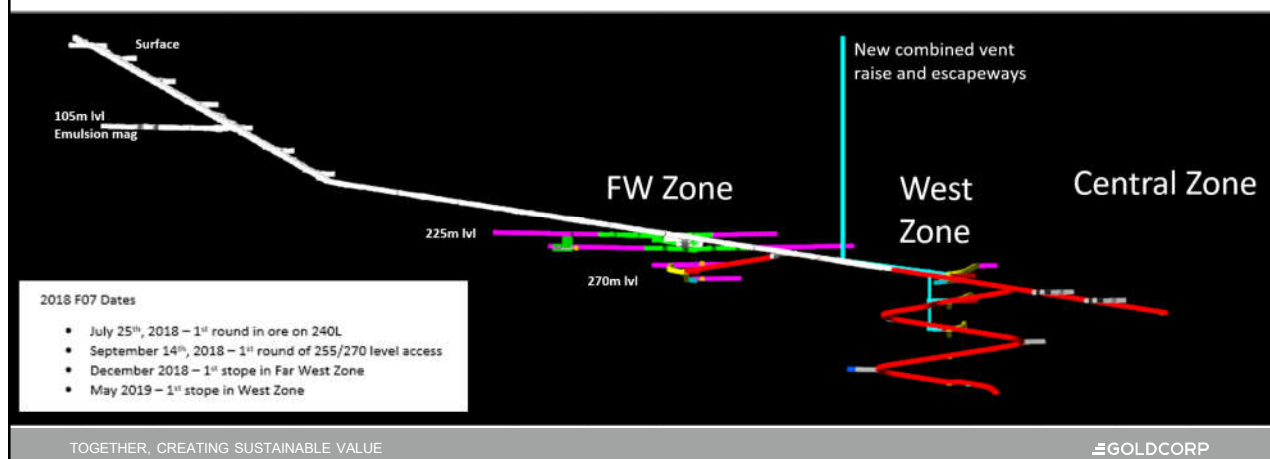
- The Borden Gold Mine will be an underground mine with no mill keeping and a small footprint
- Estimated Production of ore around 2,000tpd and 120,000 oz per year
- Reserve 1.2 M Oz of Gold at 6.8 g/T
- Ore from site will be loaded directly onto highway trucks to be processed in Timmins
- The non-economic rock will be returning underground progressively over the mine life
- Current forecast to complete the project is around 250M\$ cad
- Development currently at 15mpd with a transition toward 24mpd
- Ore body located between 200m and 600m below surface
- Ramp at 17% final approximative length of 4km
- Approximately 200 employees once in full production
- Mining method: sub level retreat
- Vertical level spacing 15m

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## Project progress

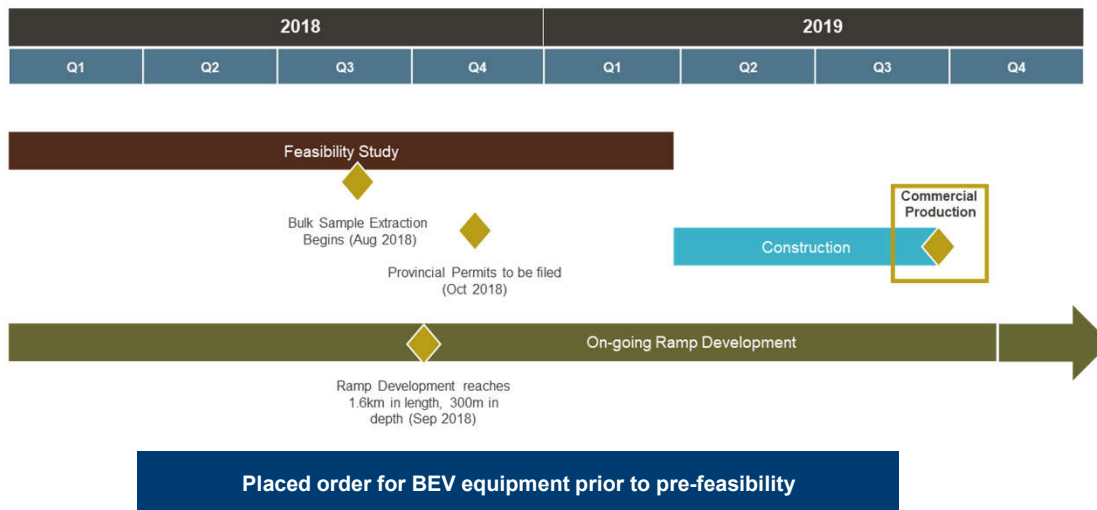
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- Exploration ramp at 1,500m and a depth of 260m
- Planning for bulk sample extraction to start in July
- Commercial production planned for second half of 2019



## Borden project schedule and milestones

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## Partnering with local First Nations communities

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- On June 5th Goldcorp and Chapleau Cree, Chapleau Ojibwe & Brunswick House First Nation signed an Impact and Benefits Agreement.

- IBA covers 3 essential elements:**

- Protection of the environment**

- Participation in the project design
- Common monitoring program
- Progressive rehabilitation

- Employment and training**

- Provide funds for training
- Job priority
- Job set-aside

- Business development**

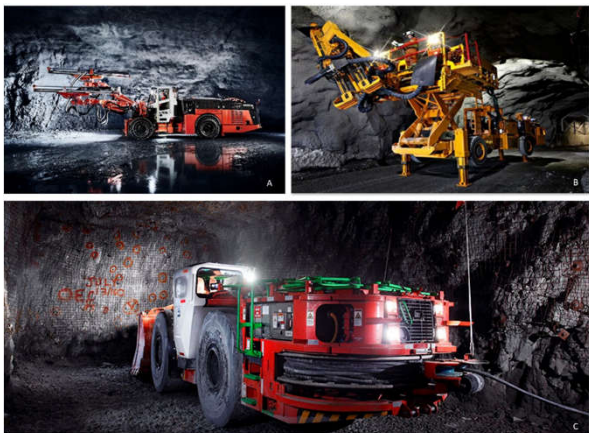
- Set-aside contracts
- Price/bid preference



ELEVATING SUSTAINABILITY PERFORMANCE THROUGH INNOVATION

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Borden: All-electric underground mine



Eliminate all greenhouse gases associated with the movement of ore and waste rock.

Reduce annual GHG emission by more than 7,000 tons or a 70% reduction over a baseline mine.

Eliminate the use of approximately 2M litres of diesel and over 1M litres of propane.

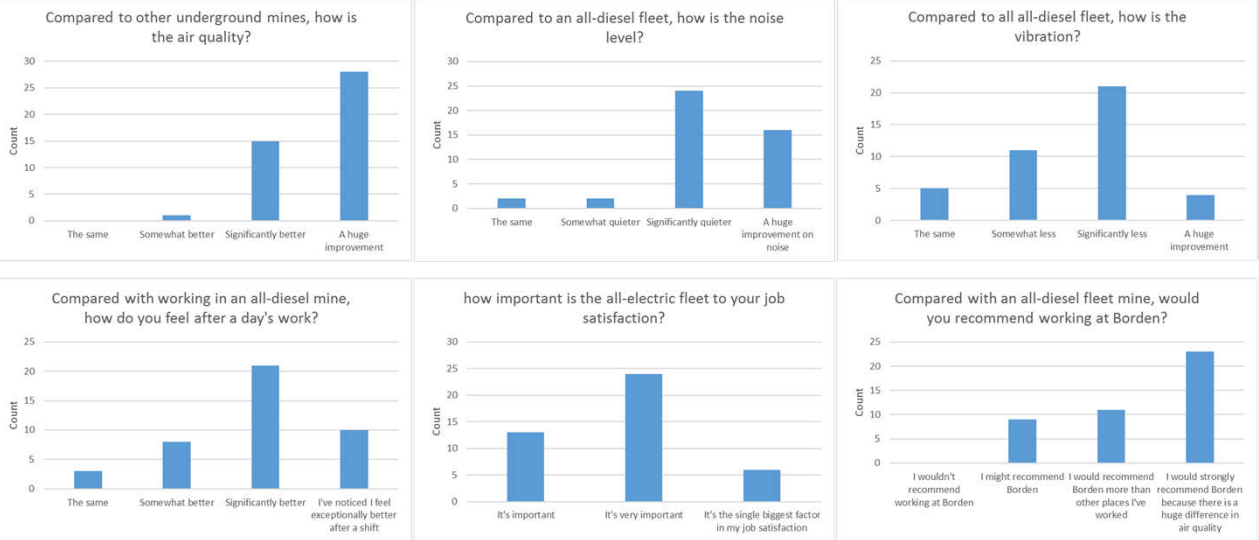
Eliminate 33,000 MWh of energy per year because of 50% reduction in ventilation requirements.

Total OPEX savings of \$9 Million not including health and safety benefits and productivity gains

In partnership with the Provincial Government

According to survey of 44 underground miners, all-electric fleet improves air, noise, vibration and makes Borden an employer of choice

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## ADVANCED EXPLORATION: SANDVIK EQUIPMENT

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### Scoops : Sandvik 14T LHD

- Teleoperated capable from surface via Wifi (100%)
- Tethered unit has no battery
- Will only perform when powered to the grid
- <https://vimeo.com/162330918>



### Drills Sandvik Drill

- On board charger, charges while drilling
- System has approx. 4 years of testing in Sandvik UG test mine
- Total tramping distance 14 km on flat ground 5 km on 1:7 ramp



### Trucks: Sandvik 40T truck

- Sandvik committed to delivering a 40T BEV truck by 2020
- In the meantime, diesel trucks



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## MACLEAN ENGINEERING EQUIPMENT

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### Advanced Exploration fleet:

- 2 x MacLean CS3 carrier
- Scissor lift
- 976 Bolters
- Converted Grader



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# SUMMARY OF VENTILATION REQUIREMENTS 17

- Challenging to establish engineering criteria
  - Hired AMC and Hatch
  - Benchmarked with other operations
  - Worked with suppliers
- Designed a system to deliver fresh air to the face
- Battery equipment will offer a ventilation reduction of more than 50% over a diesel fleet
- Velocity of 0.5 M/S for dust removal and heat
- Blast clearing found to be acceptable at 0.5 M/S
- Real time gas/DPM measure and monitor
- Conclusion: size the infrastructure to ventilate up to max of 0.5m/s, with nominal operations at 0.25m/s

### Ventilation Criteria for Electric

What determines requirement?

- No DPM/NOx
- No heat issues from estimation
- Dust – min./max. air velocities
- Other considerations?
- Benchmark vent. regulations for non-diesel (interprovincial, international)
  - 0.25 m/s under usual operation
  - Sized larger for blast clearing & VOD
  - Planned for VOD on contaminants

# Operational Planning & de-risking 18

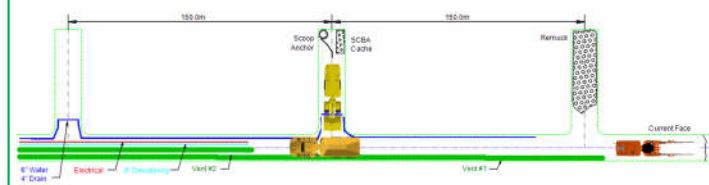
## 1. Operational redesign for equipment

- Tethered LHD
- Power reticulation (more lines, charging locations, 1kV, etc...)
- Cold climate parking (u/g, surface)

## 2. “Training Camp” at Hoyle Pond UG Mine



### Sketch of Standard Remuck Configuration



## Collaboration with suppliers

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### No manufacturer is currently offering a battery powered grader

- Goldcorp has experience with Caterpillar graders and they have proven to be very robust and reliable
- Caterpillar does not offer a battery version
- MacLean was prepared to offer a battery conversion

### Business reasons supporting this decision:

- Purchased a used grader
- Synergy with MacLean battery and charging technology design
- After sales support by MacLean / Caterpillar dealer



## Lessons learned

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- Gear worked relatively quickly and development rates have exceeded expectations
- Tremendous interest in all-electric mine
- Close collaboration with vendors, Government, First Nations very useful
- Equipment is quieter than expected
- Catalyst for other Goldcorp sites
- LHD is slower than expected
- New habits: plug in after shift!
- Difficulties with charging
- LHD cable challenges

## PROJECT CO-BENEFITS – TURNING THE PAGE ON MINING'S STEREOTYPE

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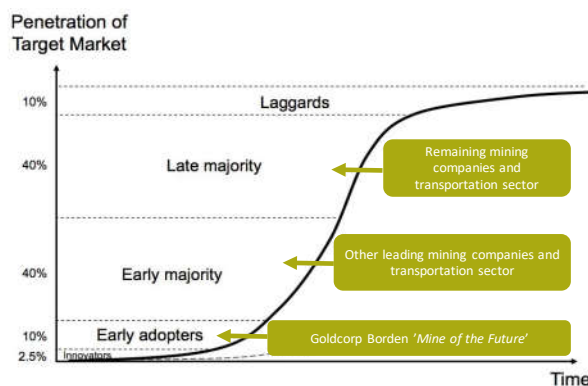
- **PARTNERING** Consortiums, Gov't, OEMs, non-traditional suppliers, other industries.
  - Partnering with Glencore and CMIC to push development of high capacity BEVs (14-18 LHDs and 40 Tonne trucks).
  - Exploring Battery Electric or Hydrogen trucks to move ore from Borden to mill in Timmins.
  - Supercluster application
- **EXISTING OPERATIONS**– Goldcorp transitioning off diesel equipment at existing Ops.
- **ANY NEW BUILD** should be based on the latest clean technologies
- **ESTABLISHING WIDELY ACCEPTED STANDARDS** and compatibility will further increase rate of adoption.
- **STRONGER EVIDENCE AND DATA SETS** knowledge transfer, piloting, data will push beyond tipping and prove BEVs are equivalent or superior to diesel will de-risk adoption.
- **TURN THE PAGE ON STEREOTYPE OF MINING** and jump into the 'mine of the future'
- **MEET SOCIETAL EXPECTATIONS** and recruit the next generation of talent.
- **FIRST NATIONS inclusion**

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## PROJECT IMPACT AND SCALABILITY

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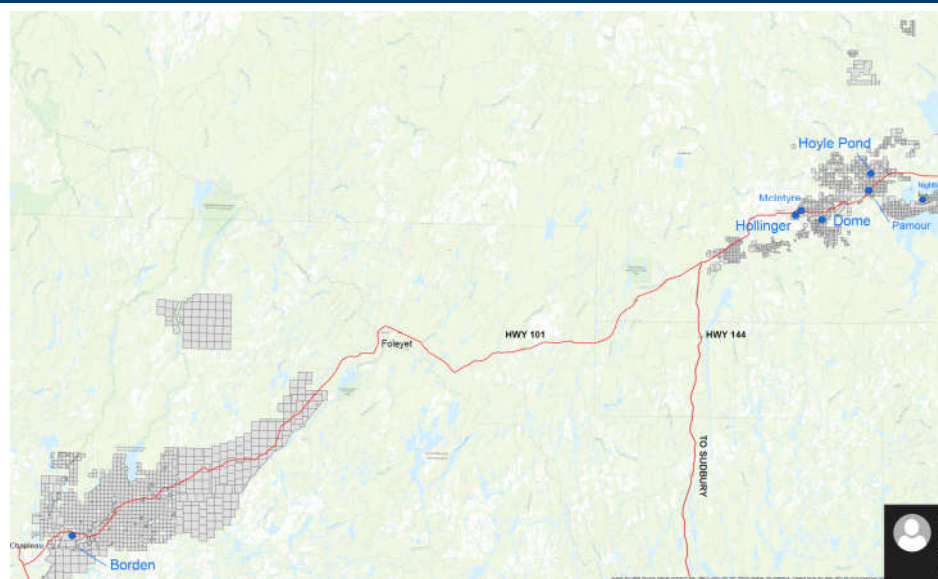
- Completely scalable within the mining industry for existing and new mines.
- Applicable to on-road transportation vehicles, construction vehicles, and farming equipment.
- We believe, conservatively, that at least 50% of new mines in Canada will be built with BEVs and that more than 50% of existing mines will replace their diesel powered vehicles with BEVs within 10 years.



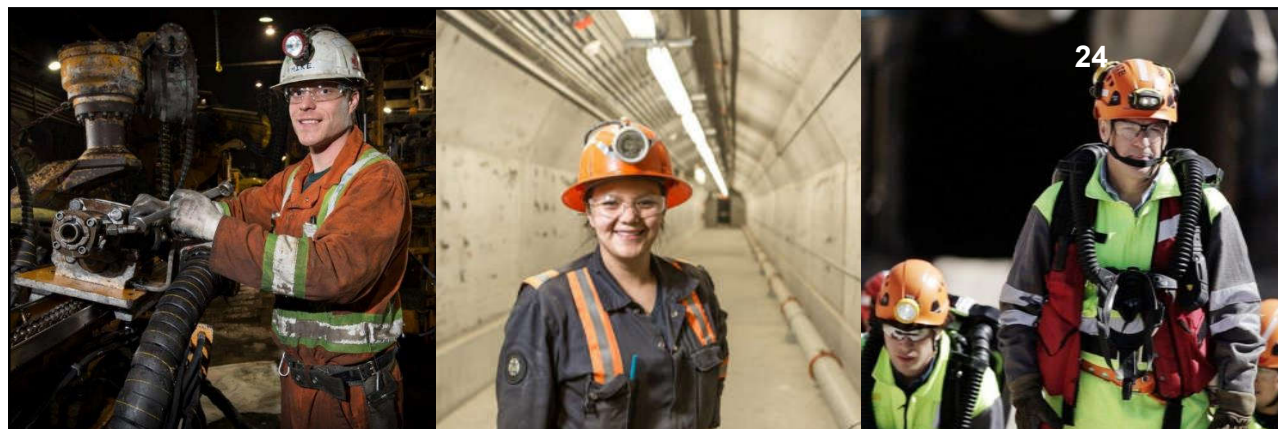
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## Significant long term economic potential at Borden Gold



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THANK YOU

John Mullally  
Vice President, Corporate Affairs and Energy  
[John.Mullally@Goldcorp.com](mailto:John.Mullally@Goldcorp.com)

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