

The Great Lakes Tunnel Project – Geotechnical Data Report



Geotechnical Data Report

The GDR is a compilation of data collected from the project's 2019 geotechnical investigation program. The 2019 field investigation covered a majority of the proposed project construction and work space areas, including private land owned by Enbridge on McGulpin Point (south side) and borings performed in the Straits of Mackinac. The report comprises over 3,000 pages of information on soil, rock, and groundwater conditions, including borehole logs, photographs, and field and laboratory test reports. Additionally, the GDR references historical information gathered during the construction of the Mackinac Bridge and previous geotechnical investigations in the area. This information combined was used to generate the geologic profile on the following page.

2019 Field Investigation

Subsurface conditions were confirmed by drilling a total of 27 vertical boreholes on-shore, near-shore, and in deep water, using a variety of equipment and techniques. Samples were classified, and testing performed—both down-hole and in the laboratory—to evaluate the character and properties necessary to design the tunnel. The locations of these borings are shown on the plan on the next page (Note: Two additional borings from 2018 are also shown).

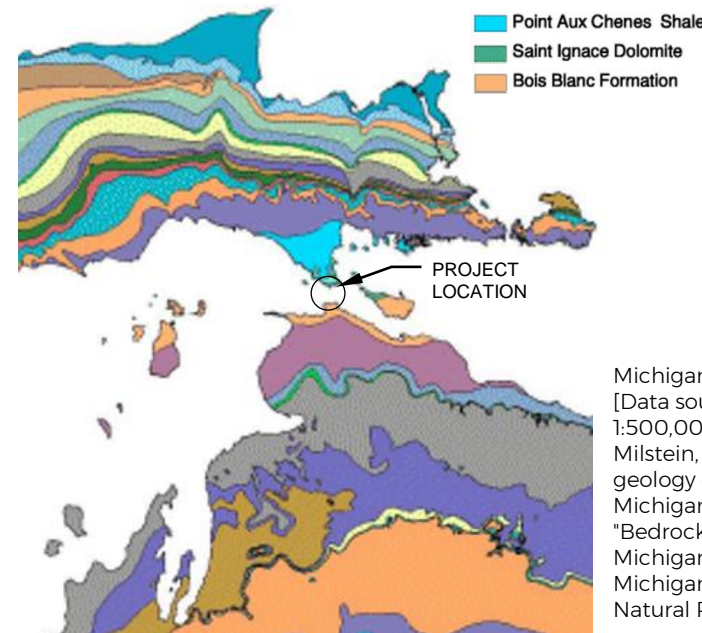


Photograph of Field Investigations in the Straits of Mackinac in 2019

Geologic Conditions

The geologic rock formations that will be encountered during construction include the Bois Blanc, St. Ignace and Pointe Aux Chenes. The formations are described in

published literature including state geologic maps (see excerpt below).



These formations comprise very old sedimentary rocks and together are part of the greater Mackinac Breccia, which was formed about 400 million years ago when nearly all the salt deposits in the Point Aux Chenes dissolved to create voids. These voids then collapsed, resulting in a jumbled mass of broken rock that was subsequently infilled by various sediment and recemented into the Mackinac Breccia by secondary limestone deposition. Later periods of glaciation imposed the weight of retreating ice sheets several miles thick. The glaciers also deposited and compacted overburden soils, referred to as glacial till, on top of the rock.

The processes that led to their formation are integral to the character of each geologic unit. The appearance of each formation as encountered in project field investigations is briefly described below:

- Bois Blanc: White/gray to brown/blue dolomite and limestone, often sandy with occasional nodules of chert;

- St. Ignace: Evenly bedded, light gray, cream colored, and light buff dolomite; and
- Pointe Aux Chenes: Green and red shale and claystone, thin beds of dolomite, and small irregular clasts and thin beds of gypsum.



Photograph of St. Anthony's Rock, an Example of Mackinac Breccia

Locations on the St. Ignace Peninsula where the breccia is observed in outcrops or exposures include Gros Cap, St. Anthony's Rock, Castle Rock, and the road cuts north of the toll plaza for the Mackinac Bridge. These exposed features have resisted erosion and the harsh climate for many thousands of years.

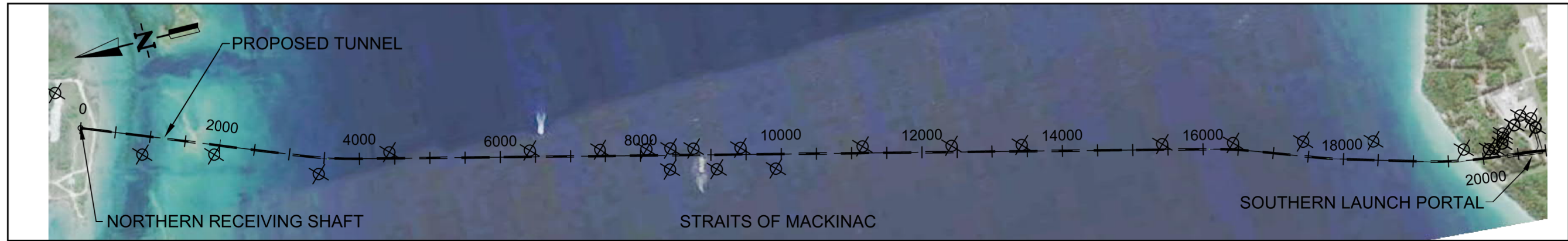
Tunnel Alignment and Design

The vertical alignment of the tunnel has been designed to remain within the bedrock and will cross all three geologic formations discussed.

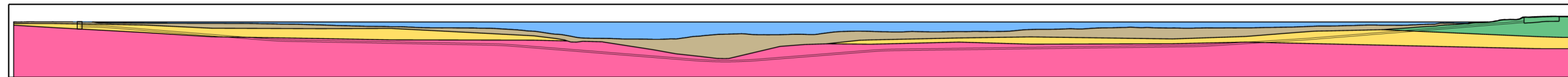
Geologic conditions along the tunnel alignment are summarized in the geologic tunnel profile on the next page. The tunnel will be excavated using a custom Tunnel Boring Machine (TBM) designed specifically for the geologic conditions found during the field investigations performed.

Construction of the tunnel will require a launch portal on the south side of Mackinac Straits and a receiving shaft on the north side, both of which will house permanent access structures for the tunnel. The TBM will launch into the Bois Blanc, transition into the St. Ignace and then the Point Aux Chenes as it advances northward. The alignment lowers to pass below an ancient channel that has been filled with glacial till deposits, then rises back into the St. Ignace to enter the receiving shaft on the north side of the Straits.

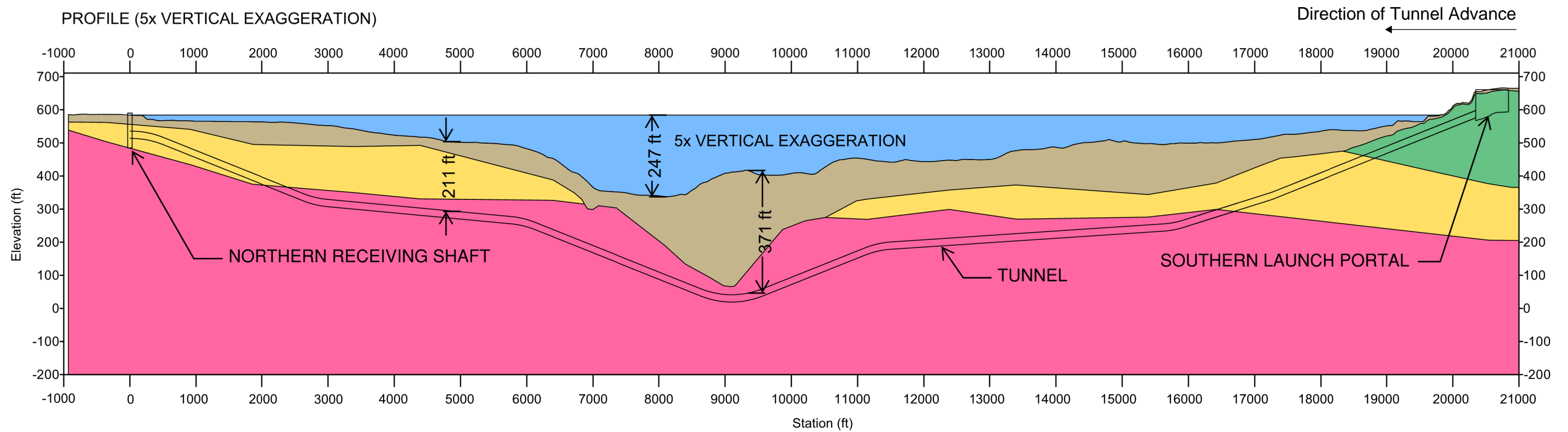
PLAN



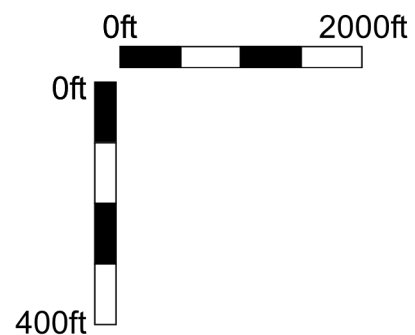
PROFILE (TRUE SCALE)



PROFILE (5x VERTICAL EXAGGERATION)



- Borehole
- Water
- Overburden
- Bois Blanc Rock Formation
- St. Ignace Rock Formation
- Pointe Aux Chenes Rock Formation



GREAT LAKES TUNNEL PROJECT
TUNNEL GEOLOGIC PROFILE

