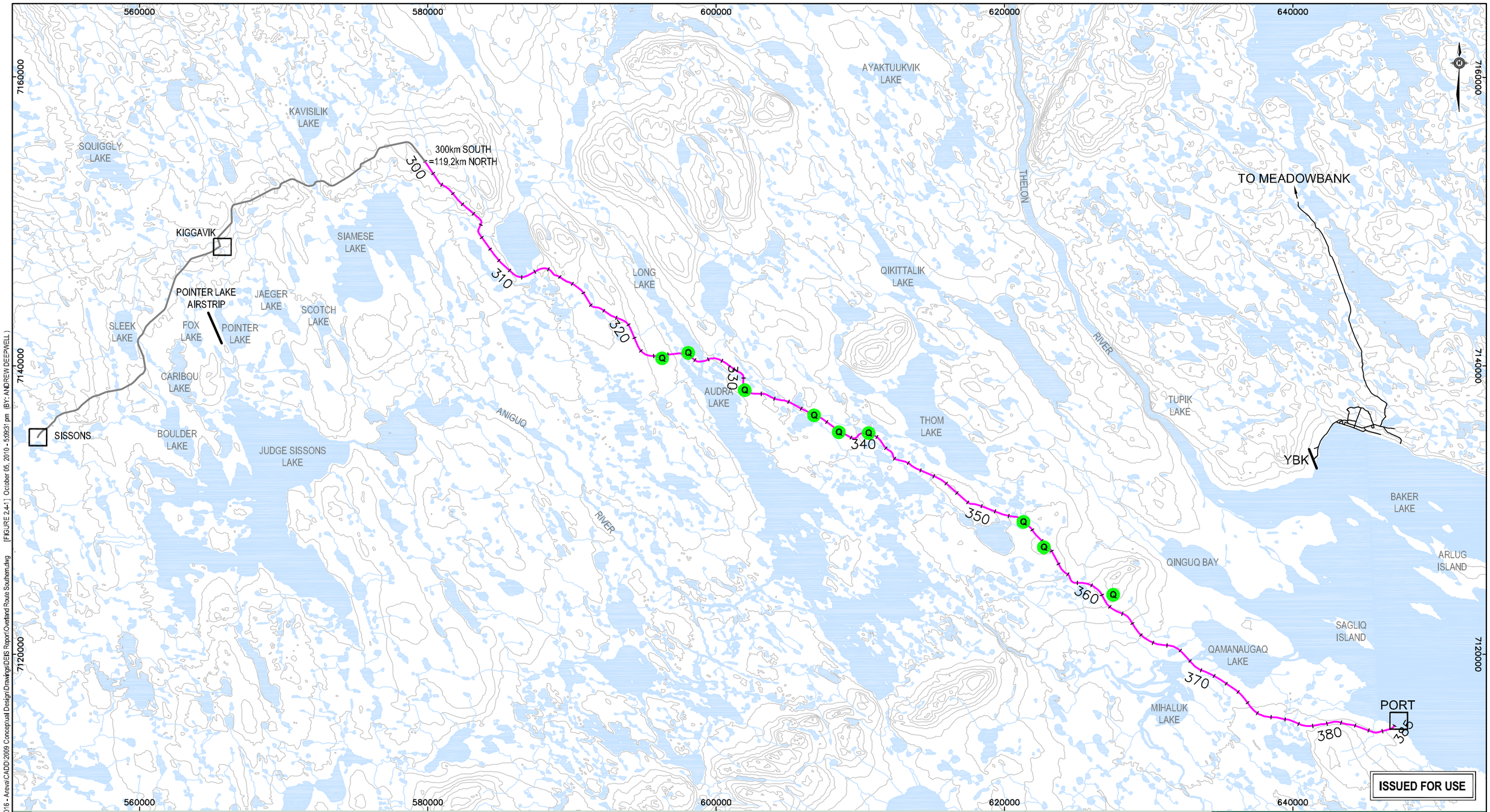

LEGEND

- Northern All Season Road
- Southern All Season Road
- 20m Contour - NTS Base Data
- km Marker
- Existing Roads
- Q Potential Quarry

SCALE 1:250,000

2 0 2 6 10km

PROJECTION: UTM Zone 14
DATUM: NAD 83

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KIGGAVIK PROJECT
CIVIL INFRASTRUCTURE REPORT

SOUTHERN ALL SEASON ROAD

PROJECT NO.	DWN	CKD	REV
V33101016	AJD	DCD	-
OFFICE: VANC	DATE: March 26, 2010		

Figure 2.4-1

Q:\Vancouver\Transportation\V331\Projects\V33101016 - Areva\CADD\2009 Conceptual Design\Drawings\DEIS Report\Overland Route Southern.dwg [FIGURE 2.4-1] October 05, 2010 - 5:08:31 pm (BY: ANDREW DEEPWELL)

of the water crossings can be accommodated with culverts. Additional bridges may be required if fisheries issues dictate the need for a bridge rather than a culvert.

The road will be a 10 meter wide gravel road, built with rock embankment (fill). There will be no earth cuts along the alignment, and the only cut sections will be through rock. The same approach as discussed for the Northern All Season Road.

Material for the road embankment and road surfacing material will be derived from rock quarries developed along the road and granular deposits at the southern end of the route.

It should be noted that this route has not been investigated and designed to the same level Lidar data and detailed orthophotography are not available for the southern route.

2.4.2 Geotechnical Route Description

Generalized terrain and topographic conditions observed along the proposed Southern All Season Road beginning at the northwest end of the route (Km 300) and traveling east-southeast towards a proposed port location along the shoreline of Baker Lake (Km 385) are described in Table 2.4-2 below. Generalized Design cross sections for the varying subsurface conditions were not developed for this road.

TABLE 2.4-2: GENERALIZED TERRAIN CONDITIONS ALONG SOUTHERN ALL SEASON ROAD ALIGNMENT

Kilometre		Description of Terrain Conditions
300	313	The route travels along the west and south side of a large unnamed lake, crossing two stream channels along the away, which would both require bridge structures (Km 307 and Km 313).
313	315	The route parallels along the base of a bedrock controlled slope, which has potential to be developed into a quarry for constructing the road.
315	320	The route crosses onto a morainal (till) blanket that slopes to the northeast and is generally wet with many small lakes. The route crosses an area of undefined flow at Km 317.5 and ribbed moraine terrain at Km 320. A suitable quarry may be developed at a rock outcrop at Km 318.
320	326.5	From about Km 320 to Km 326.5, the route travels along relatively level till blanket and veneer terrain with surface boulders.
326.5		This crossing will require a bridge structure. At 326.5, the route crosses a major stream crossing with a wetted perimeter of about 50 m and a 15 m wide open channel. The stream separates the north end of Long Lake from a chain of unnamed lakes that extend further north (effectively an extension of Long Lake).
326.5	332	The route travels along a blanket and veneer of till skirting between bedrock outcrops. A potential quarry site was identified at Km 332.
332	347	The alignment continues along relatively level, wet till terrain with areas of alluvial deposits. The entire area between Long Lake and Thom Lake is relatively low-lying and irregular with several bedrock outcrops. A prospect quarry site exists to the northeast of the alignment at Km 335. The terrain appeared especially wet at Km 339 and Km 342 and ribbed terrain was observed at Km 346. There are numerous water bodies and signs of thermokarst activity between Km 341 and Km 345.

TABLE 2.4-2: GENERALIZED TERRAIN CONDITIONS ALONG SOUTHERN ALL SEASON ROAD ALIGNMENT		
Kilometre		**Description of Terrain Conditions**
347	354	The alignment parallels a bedrock outcrop and a deposit of sand between Km 347 and Km 349, and crosses both ribbed till and relatively smooth terrain between Km 349 and Km 354. This bedrock out crop would provide a suitable quarry site; however, may provide limited supply. Surficial mapping also shows a small bedrock outcrop at Km 353.
354	364	The route leaves the till terrain and crosses a widespread area of marine reworked sediments derived from the reworking of glacial deposits by wave and current action during marine regression (refer to surficial geology mapping). The route descends in elevation from Km 355 to Km 360 and descends further from Km 360 to Km 365 as it crosses linear strandlines of marine reworked beach ridges. Surficial mapping shows a small bedrock outcrop at Km 361. Beyond this location to Km 385, there were no bedrock exposures identified, which supports the surficial geology mapping of the area. Rock quarry material from this location to the proposed port location is in short supply. Road embankment material would need to be hauled long distances from rock quarries further west or more likely be sourced from the marine reworked sands (littoral sediments)
364	368	The route travels along till terrain to Km 368 where it approaches the largest stream crossing along the route and extensive deposits of alluvial outwash sands and gravels mapped along its south bank. The open channel width varies from 75 m to 110 m depending on the location of the crossing. An intermediate pier structure would be required for the bridge crossing.
368	373	The route traverses aeolian and modified/reworked till terrain, which is likely ice-rich and sensitive to disturbance.. The terrain is relatively smooth and level as it approaches Baker Lake.
373	385	The route transitions back onto another widespread area of marine reworked sediments derived from reworking of glacial deposits during marine regression. The route follows beach ridges on its way to the proposed port location. Along the alignment the route crosses several small, ephemeral drainage channels that will require cross-drainage structures(culverts). Between Km 374 and Km 376, the terrain becomes wet with signs of thermokarst activity. A bridge structure will be required to cross the stream channel at Km 375.

2.4.2.1 Geometrics

Horizontal and vertical alignments have not been developed for this route other than general field routing. Lidar and orthophography is not available for this route.

In the field, the grades have been noted to be fairly gentle.

General field observations indicate that this route will provide acceptable operating characteristics for the chosen design vehicle.

2.4.2.2 Water Crossings and Drainage

There are 5 bridges (less than 50 meters in length) along the route, one bridge at approximately 60 meters and one bridge at about 120 meters in length. The remainder of

the water crossings can be accommodated with culverts. Additional bridges may be required if fisheries issues dictate the need for a bridge rather than a culvert.

The following table 2.4.2.2 summarizes the water crossings and proposed crossing methods.

TABLE 2.4.2.2: WATER CROSSINGS SOUTHERN ALL SEASON ROAD

Crossing #	Northing	Easting	Crossing Type	Bridge Length
S1	7149397	583541	Bridge	21.0
S2	7146514.351	587357.867	Bridge	11.0
S3	7144050.278	591653.59	rockfill	
S4	7142484.971	594106.311	culvert	
S5	7142127.326	594251.434	culvert	
S6	7140853.184	597522.042	rockfill	
S7	7140290.462	598854.119	Bridge	18.0
S8	7140318.775	599073.193	Bridge	55.0
S9	7139195.776	601888.895	multiple culverts	
S10	7137330.97	605337.031	culvert	
S11	7135209.5	609893.264	rockfill	
S12	7134450.696	611635.326	rockfill	
S13	7133483.128	612571.235	culvert	
S14	7132647.364	614328.108	rockfill	
S15	7129799.929	619634.207	rockfill	
S16	7129546.139	620658.976	culvert	
S17	7124982.761	624728.203	culvert	
S18	7120465.308	631900.135	culvert	
S19	7119625.407	632773.057	Bridge	112.0
S20	7118690.602	634140.535	culvert	-
S21	7115508.357	639323.843	Bridge	5.0
S22	7115341.366	640083.733	culvert	
S23	7115041.523	641419.614	culvert	
S24	7115241.439	642494.146	culvert	
S25	7115259.577	642552.268	culvert	
S26	7115284.066	642716.672	culvert	
S27	7115187.518	643603.767	culvert	
S28	7115072.253	644280.019	culvert	
S29	7114883.772	644861.155	culvert	
S30	7114646.177	645475.113	multiple culverts	
S31	7114619.021	645530.391	culvert	

The photo below shows the long 120 meter crossing at km 369.

2.4.2.3 Borrow Sources and Quarry Locations

Bedrock outcrops (possible quarry locations) available along the route present the best available materials for construction of the road. Quarry sites are available inland along the route and prospect locations have been identified between km 300 and km 360; however, the final 25 km of road and the proposed port causeway do not have nearby quarry sites. This poses the primary limitation/disadvantage of the Southern All Season Road. Potential Quarry locations have been previously shown on Figure 2.4-1.

Marine deposits near Baker Lake consist of materials deposited in a postglacial sea, which have been mainly derived from reworking of glacial deposits by wave and current action during marine regression. The deposits are dominantly comprised of well-sorted sands with a percentage of gravel and cobbles. These materials could be used for embankment construction, but risk erosion and road rutting issues which will need to be addressed during design. The following photos show the quality, quantity and surficial appearance of these deposits.

Marine Deposits near Baker Lake- (well-sorted sands with a percentage of gravel and cobbles)

Representative photo showing well sorted sands

2.4.2.4 ARD and ML Potential

ARD and ML potential has not been evaluated for the Southern All Season Road.

2.4.3 Alternatives Considered

Alternatives were not considered to the same level of detail for the Southern All Season Road as the Northern Road. Issues related to the environment, maintenance, construction staging and cost estimates were not developed for this route.

2.5 COMPARISON OF NORTHERN AND SOUTHERN ALL SEASON ROADS

A direct comparison of the Northern and Southern All Season Roads in terms of quantities and overall geometric design can not be made because the two routes were not developed to the same level of investigation and design. Only the Northern Alignment had a preliminary alignment designed meeting specific horizontal and vertical geometrics.. The field investigation for the Northern Alignment looked in greater detail at the specific stream/river crossings and potential rock quarries. This detail of data was not collected for the Southern All Season Road. However, having explained the above, there are several differences between the two routes including some obvious and less obvious advantages

and disadvantages. Table 2.5 summarizes the physical components and compares the two roads.

TABLE 2.5: COMPARISON BETWEEN NORTHERN AND SOUTHERN ROADS

Item		Northern	Southern
1	length of road	114 km	104 km
2	# of bridges	14, not including the 400 meter long Thelon River Crossing	6
3	# of culverts	13	19
3	Quarries	good rock quarries spaced evenly throughout alignment	no rock quarries for final 25 km of alignment. Only potential for borrow is well sorted sands. Will require either a very long haul if rock is to be used or sand can be used for embankment but rutting and erosion issues must be addressed.
4	Construction Staging	favourable construction staging. Can be built out of the Baker Lake community. Multiple headings possible.	Difficult construction staging. None of the route can be directly connected to the community of Baker Lake. Port Facility would have to be constructed to allow for heading to start from the southern end of the project.
5	Terrain	Terrain is generally dry, located on higher areas where possible.	Terrain is not as favourable as the northern road as a significant portion of the road is in lower, wetter areas. Will result in a greater degree of maintenance.
6	Geometrics	some gradients in the order of 5 to 6 %	gradients relatively gentle- in the order of 2-3 %

3.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Yours truly,
EBA Engineering Consultants Ltd.

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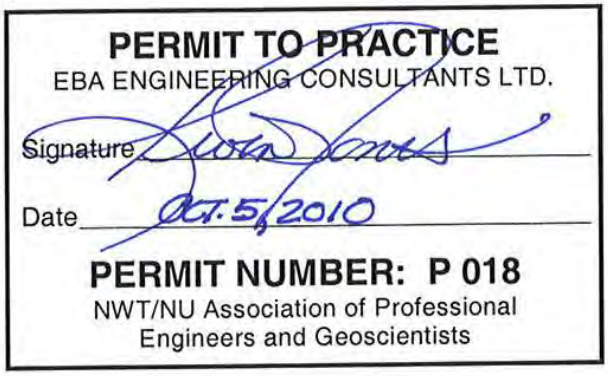

APPENDIX

APPENDIX A REFERENCE DRAWINGS AND SUPPORTING DOCUMENTATION

List of Data in Appendix A:

A1 – LiDAR Survey Report

A2 – Baker Lake Sonar Report

A3 – Mill Site and Sik Sik Lake Geophysics Survey

A4 – Andrew Lake Dyke Geophysics Survey

A5 – Thelon Crossing – Geophysics Survey

A6 – Winter Road Geophysics Survey

A7 – North Port Site Bathymetric Data

A8 – 2009 Mill Site Borehole Logs

A9 – Summary of Activities Thelon ice Observations

A10 – Project Photo Log

Note:

Appendix A is a large compilation of reference drawings and documents that contains information common to all of the other Reports as well. To avoid unnecessary duplication, it has not been attached to each Report, but has been submitted as a separate document.

APPENDIX

APPENDIX B NORTHERN ROAD PLAN PROFILES

CIVIL INFRASTRUCTURE REPORT
APPENDIX B

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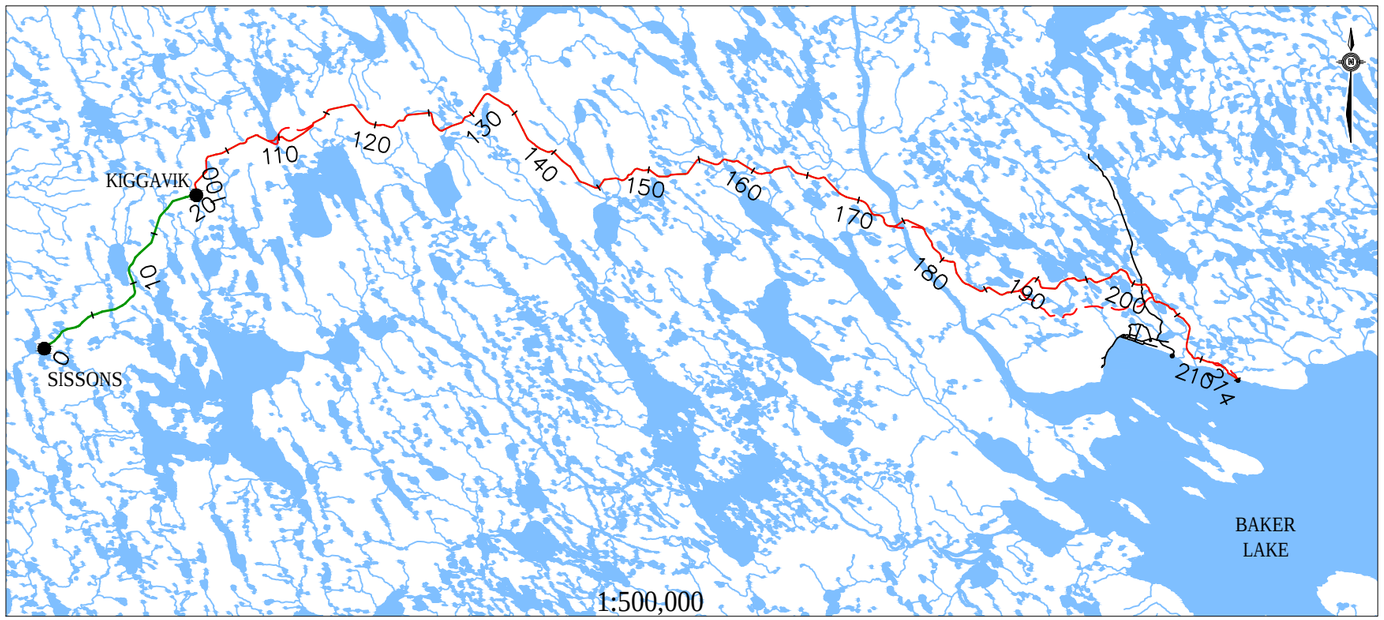

NORTHERN ALL SEASON ROAD
DEIS PLAN / PROFILE
KIGGAVIK PROJECT

V33101016

March 2010

CREATING AND DELIVERING BETTER SOLUTIONS

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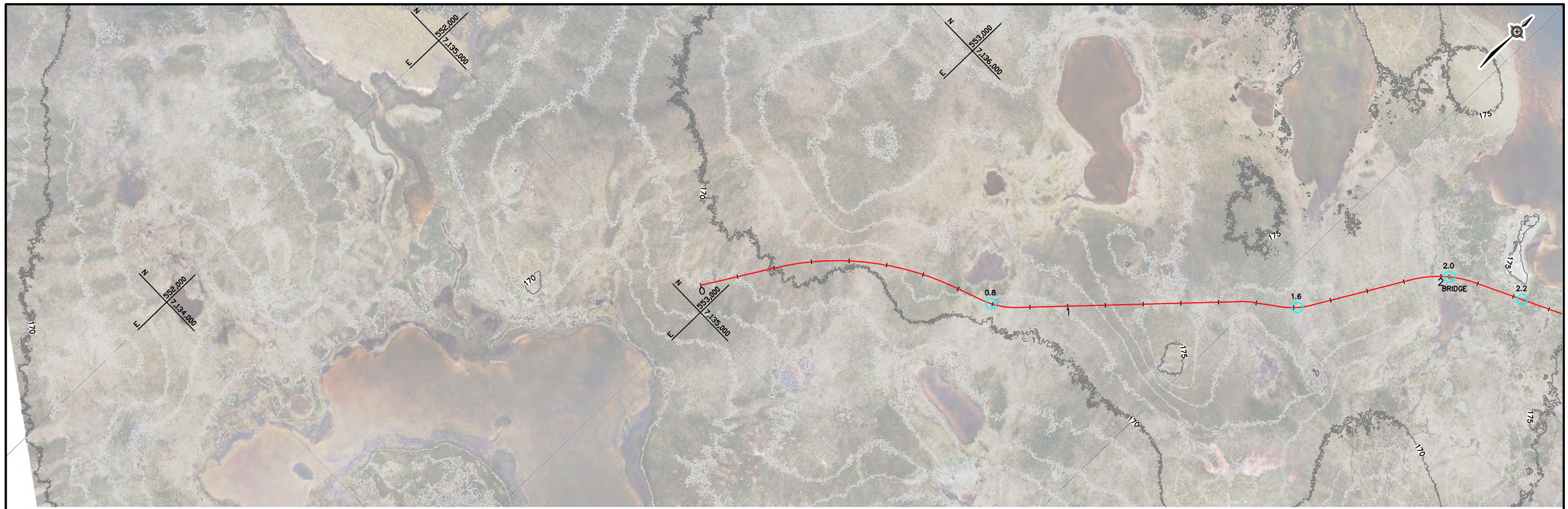

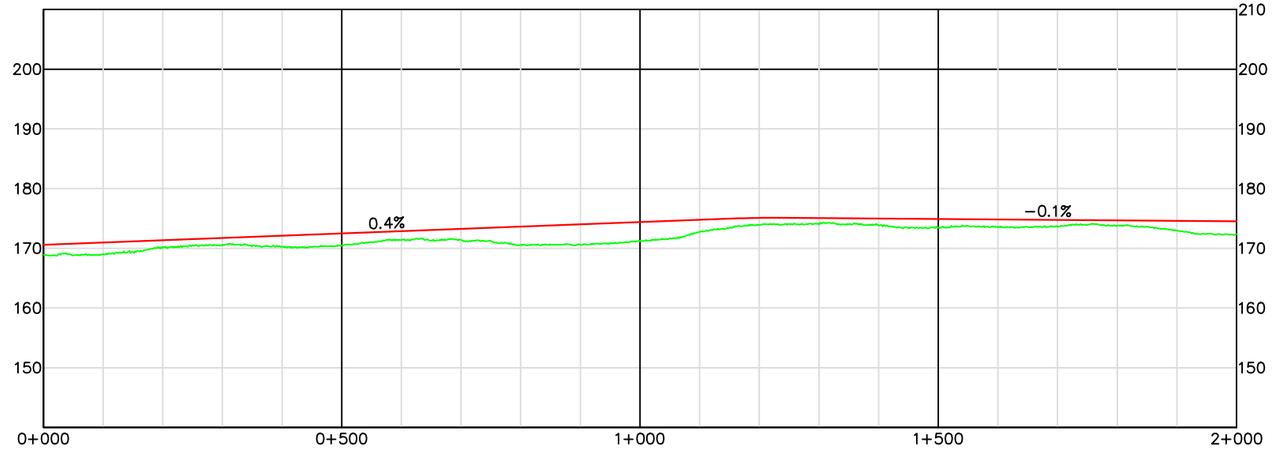

LEGEND

- Alignment/Profile
- Existing Ground
- Stream Crossing
- Bridge
- Quarry

Ortho photo & Contour data provided by LSI, Summer 2009

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V 1:500 10 0 10 20 40m

HALF SIZE

NUM	DATE	DWN	CKD	APR	DESCRIPTION

REVISIONS

NUM	DATE	APR	DESCRIPTION

DRAWING STATUS

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CLIENT

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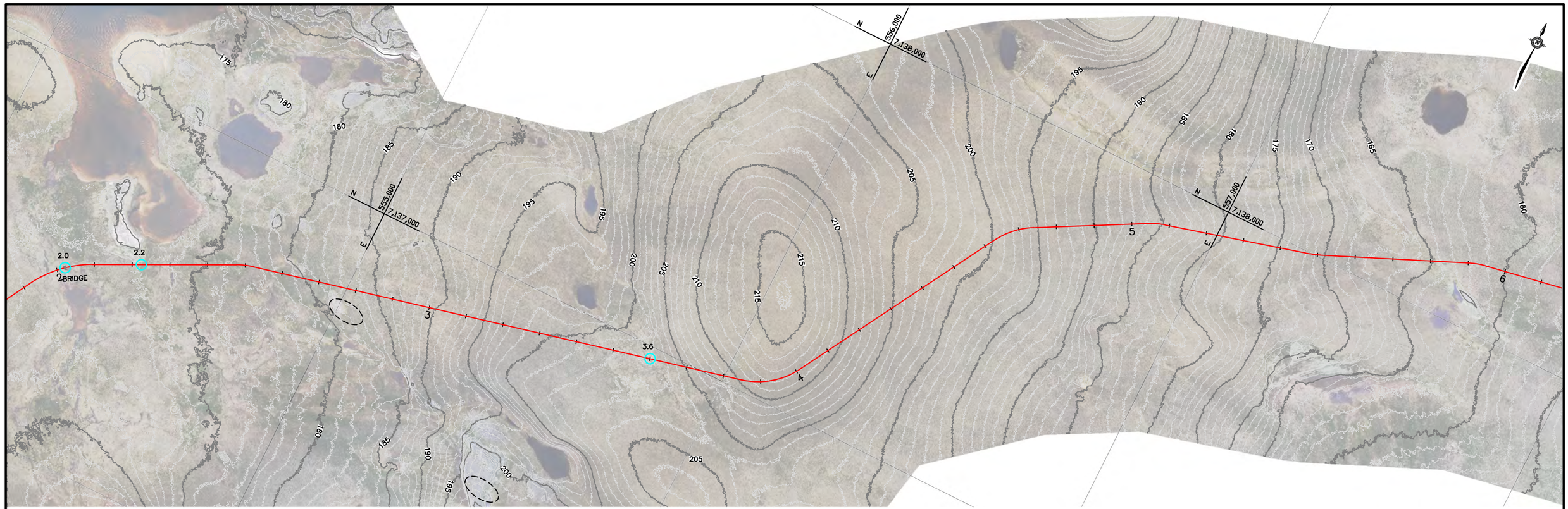

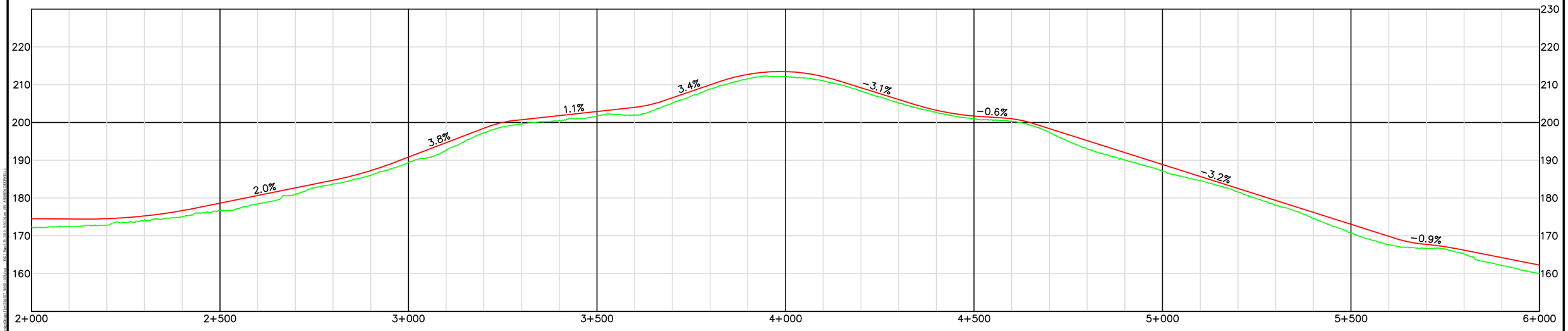

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- Existing Ground
- Stream Crossing
- Bridge
- Quarry

Ortho photo & Contour data provided by LSI, Summer 2009

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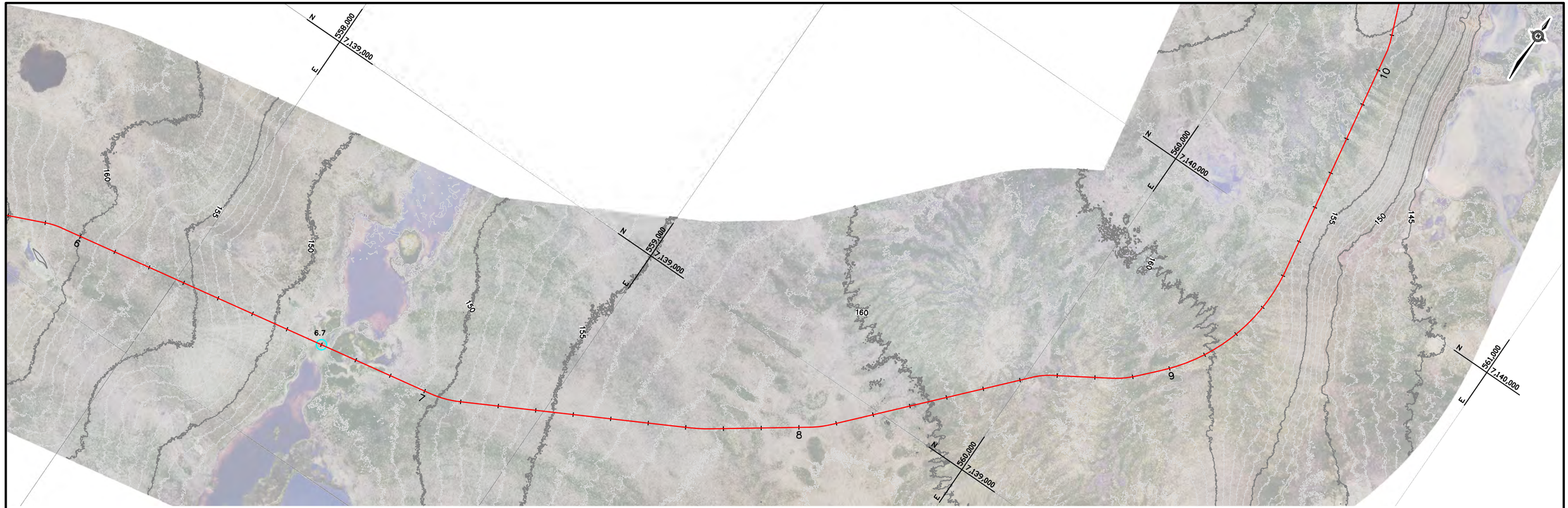

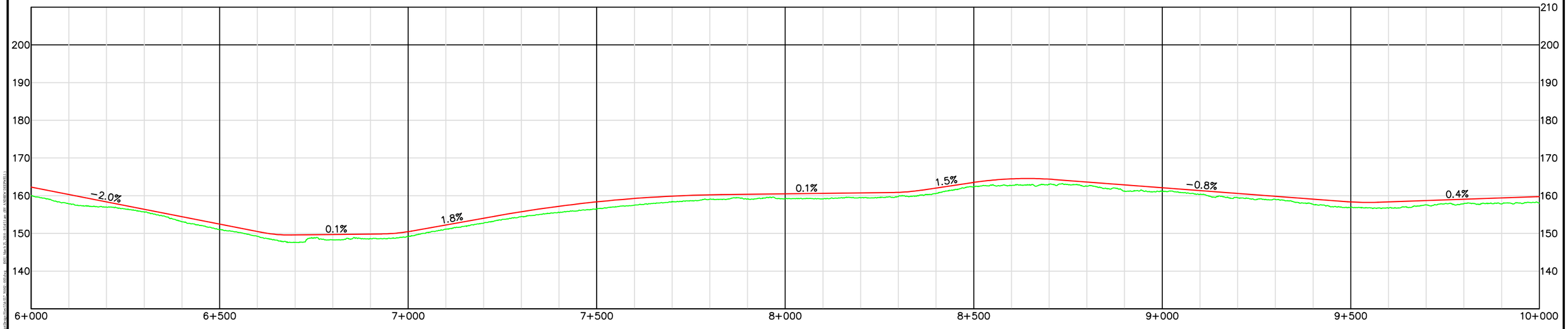

LEGEND

- Alignment/Profile
- Existing Ground
- Stream Crossing
- Bridge
- Quarry

Ortho photo & Contour data provided by LSI, Summer 2009

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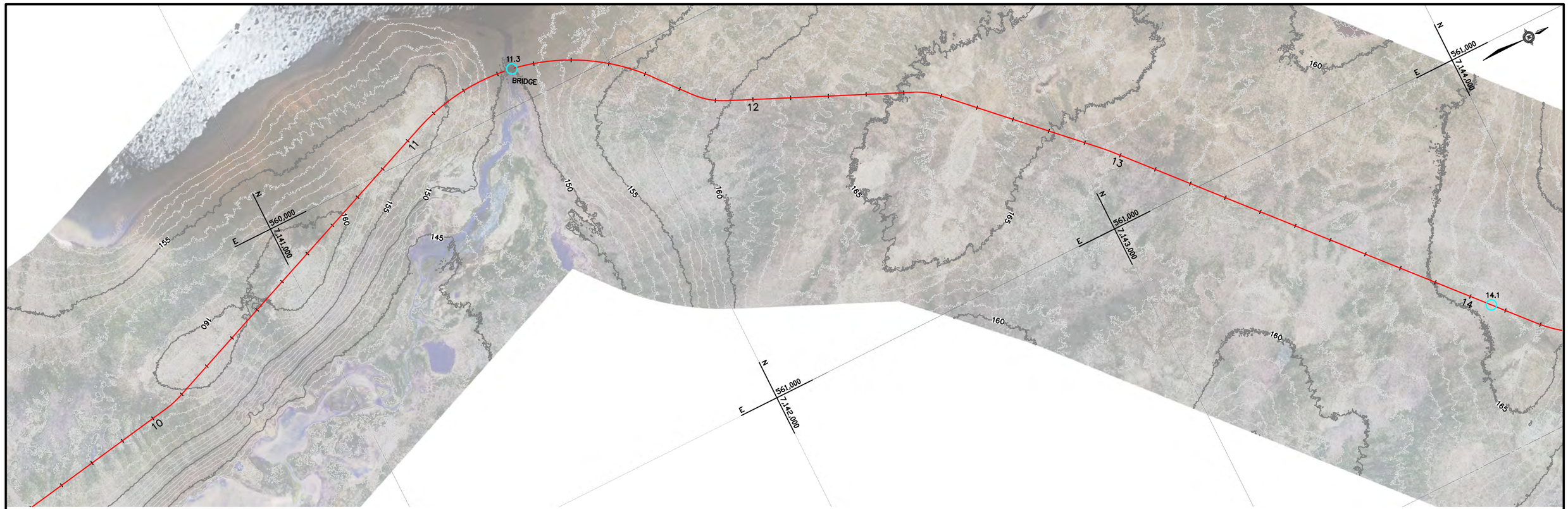

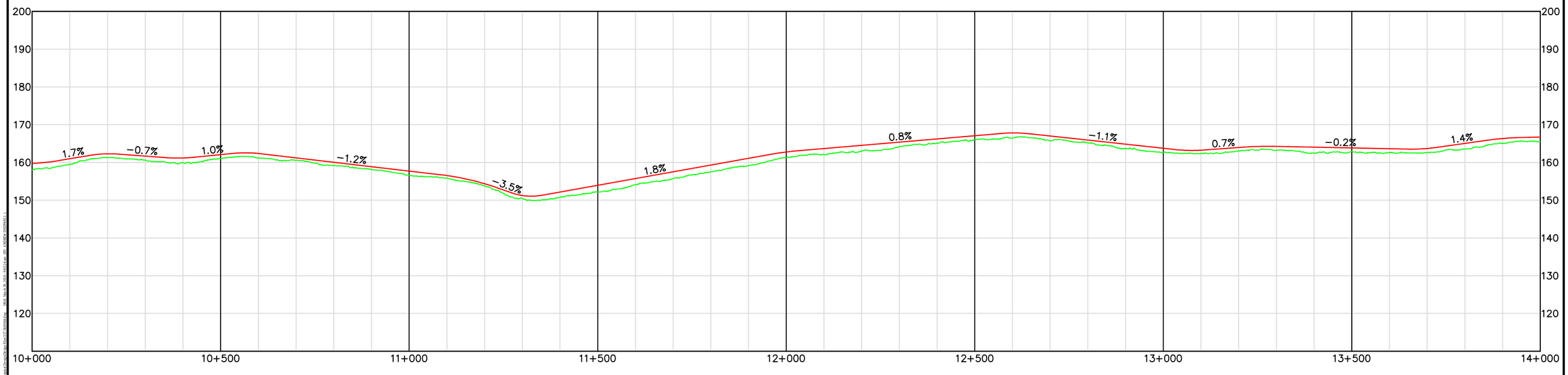

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- Alignment/Profile
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- Quarry

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CIVIL INFRASTRUCTURE REPORT

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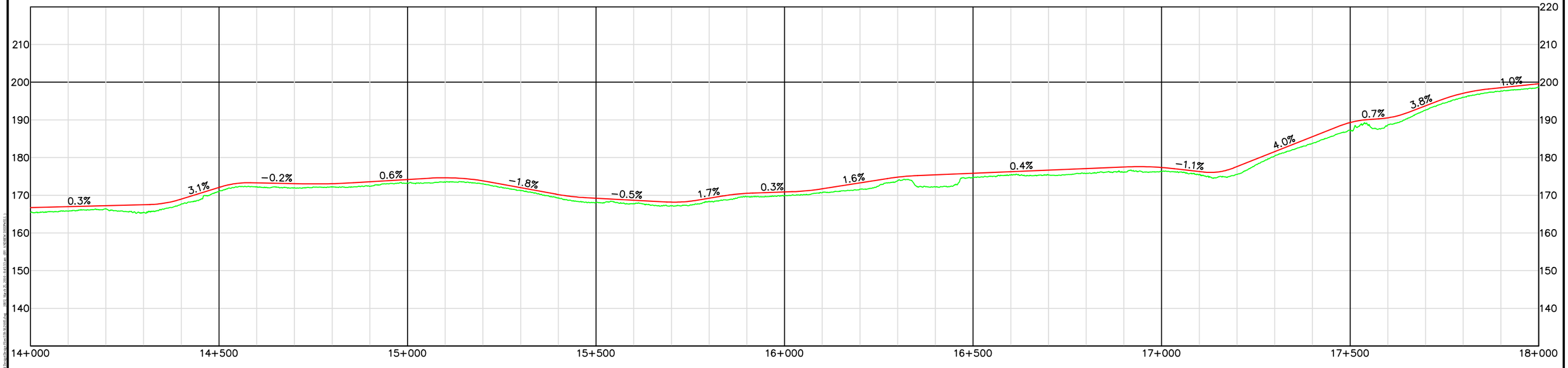

LEGEND

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- Stream Crossing
- Bridge
- Quarry

Ortho photo & Contour data provided by LSI, Summer 2009

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