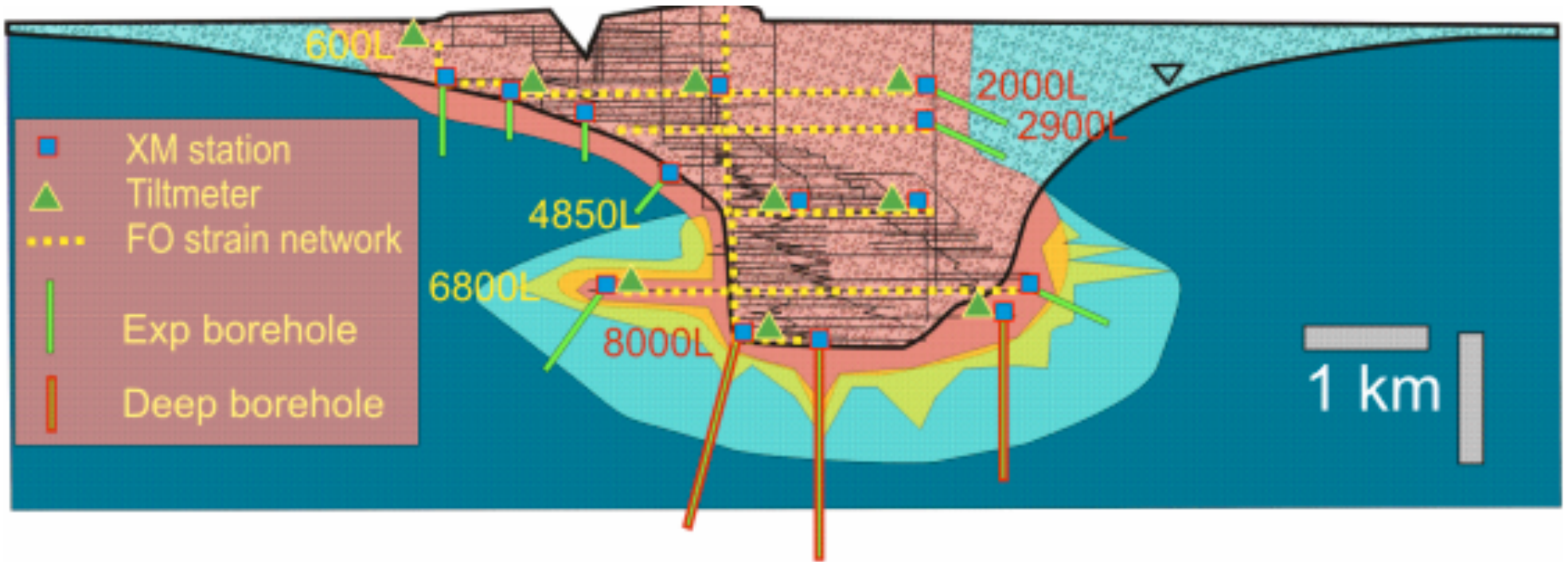


Ecohydrology

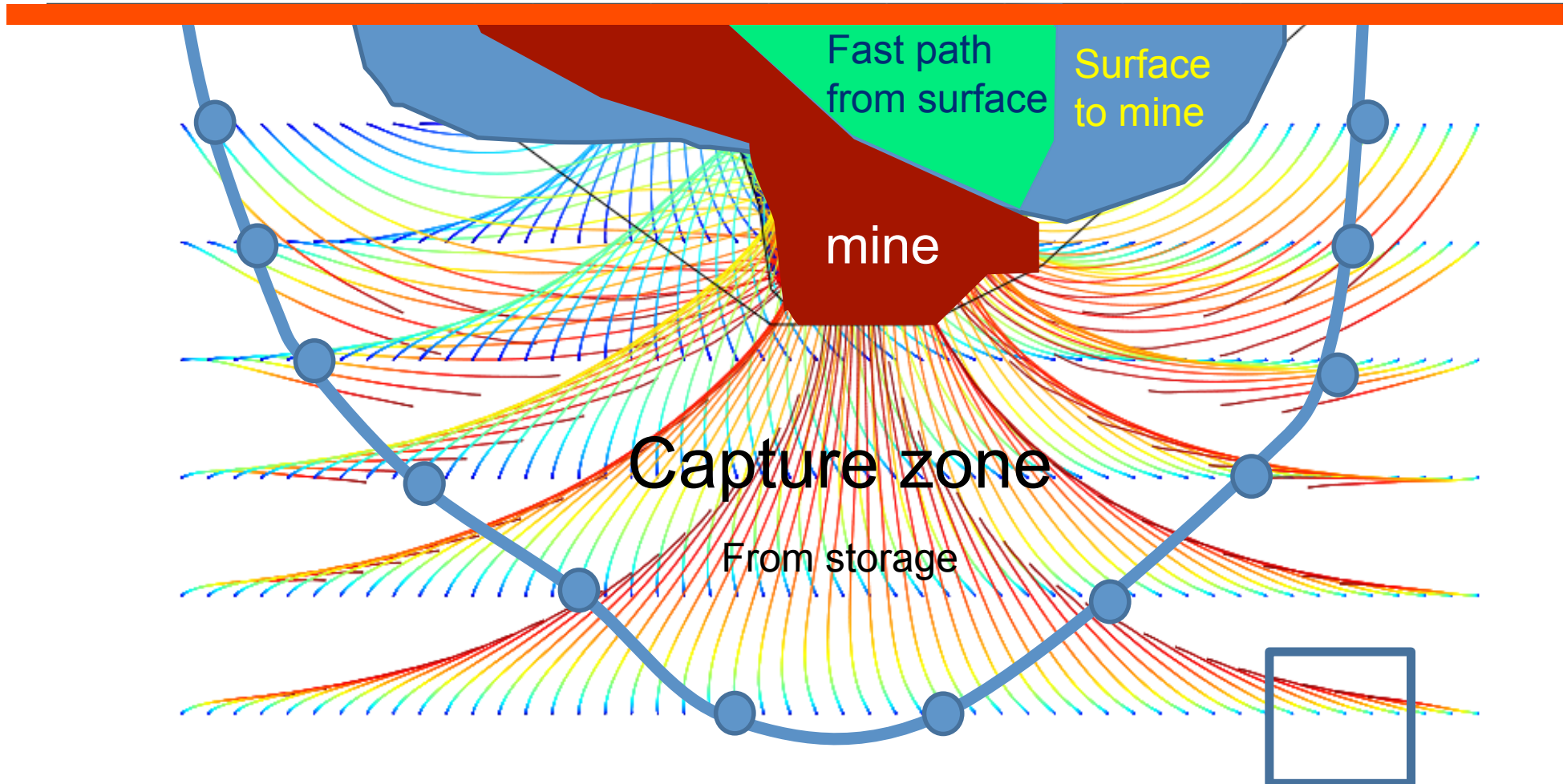
Integrated geohydrology, geophysics, geomicrobiology



Pathlines

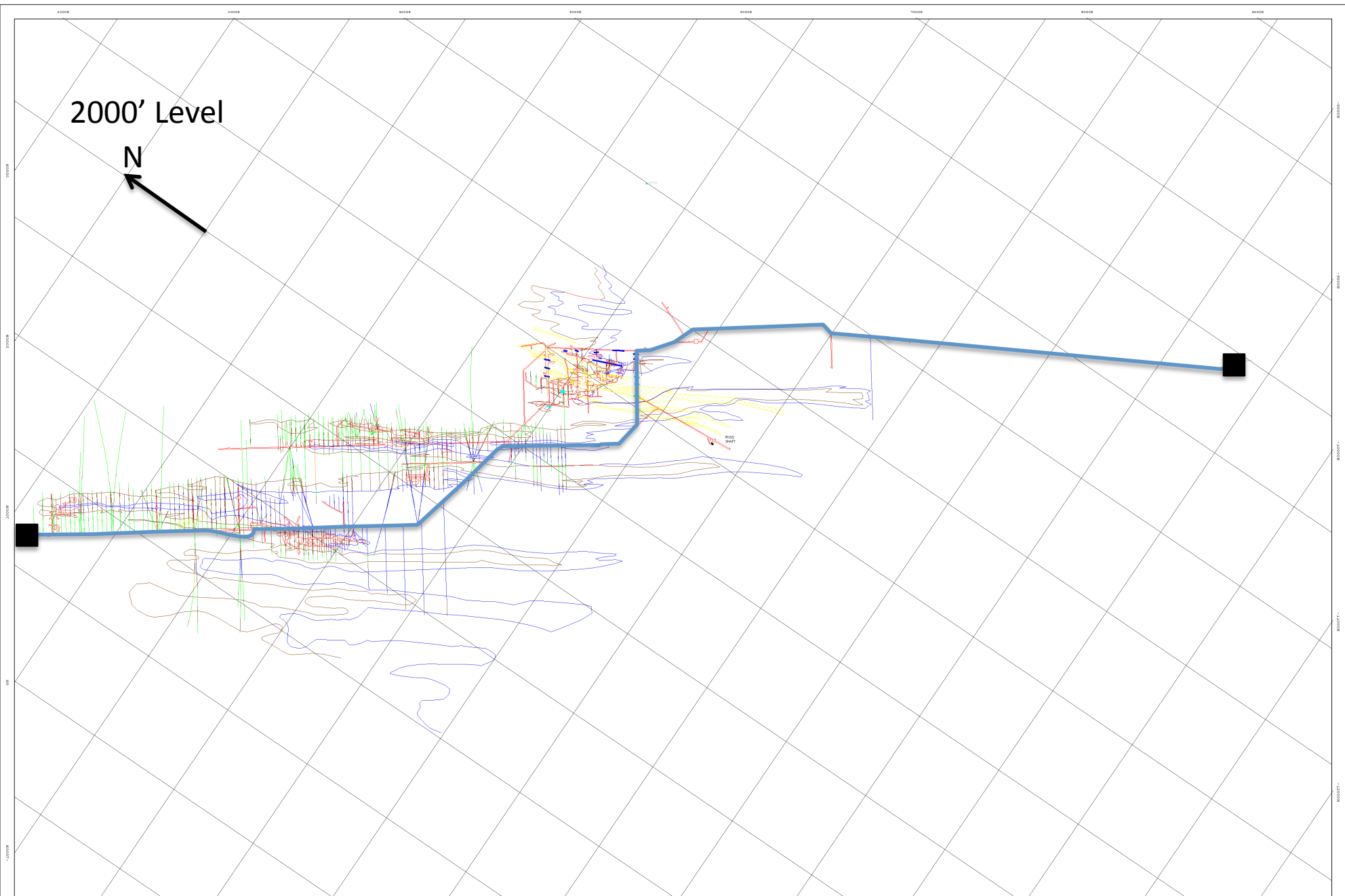
Particles released from storage at start of mining

Shallow hydrologic system



Ecohydrology facilities

Facility	Level	Sites/drill holes
Exploratory	2000L	2 sites, 3 holes each
Exploratory	4100L	3 sites, 3 holes each
Observatory	4850L	2 sites, 3 holes each
Exploratory	5900	1 site, 3 holes each
Exploratory	6800L	2 sites, 3 holes each
Observatory	7400L	2 sites, 3 holes each



2000' Level

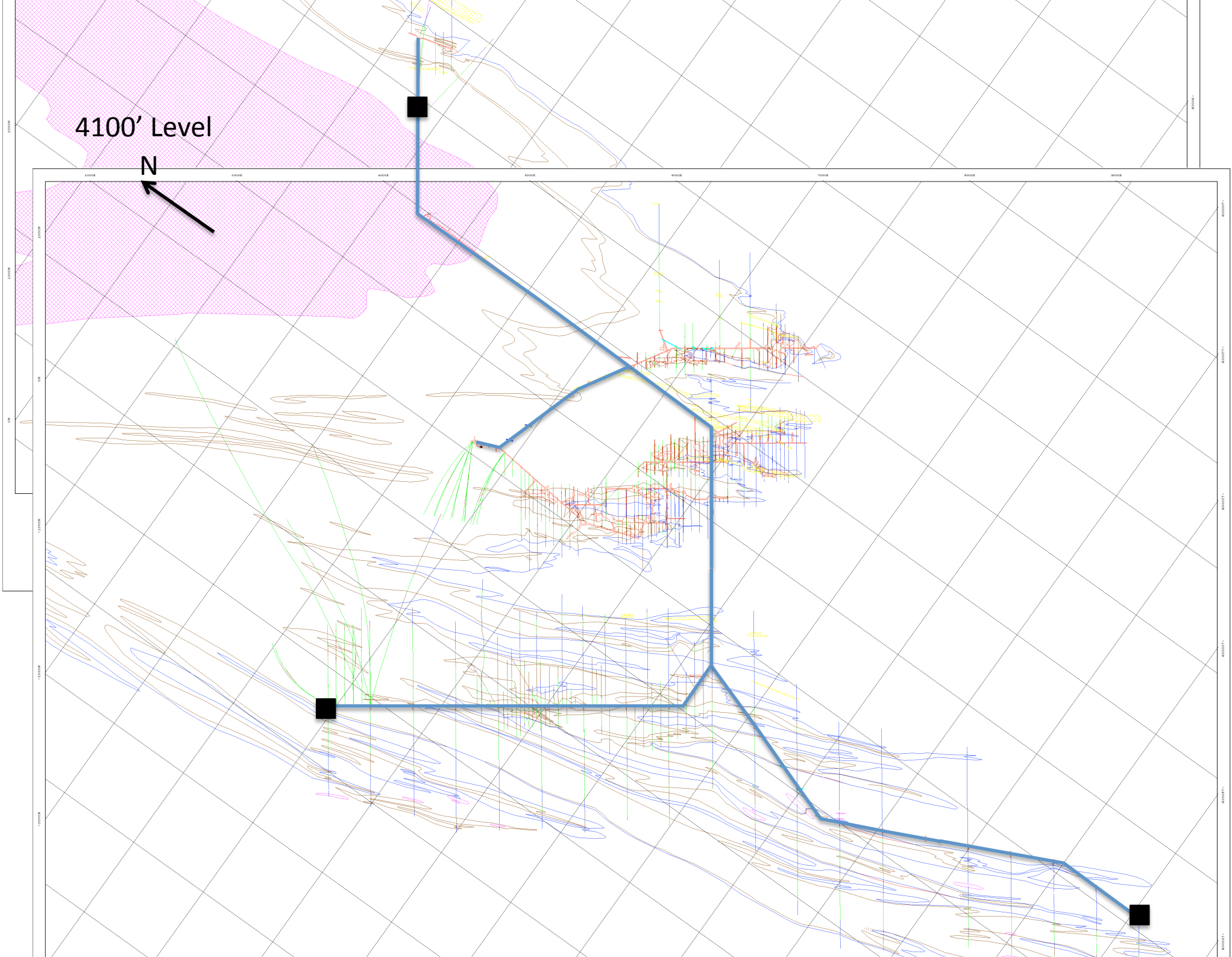
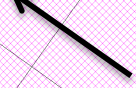
N

BOSS HART

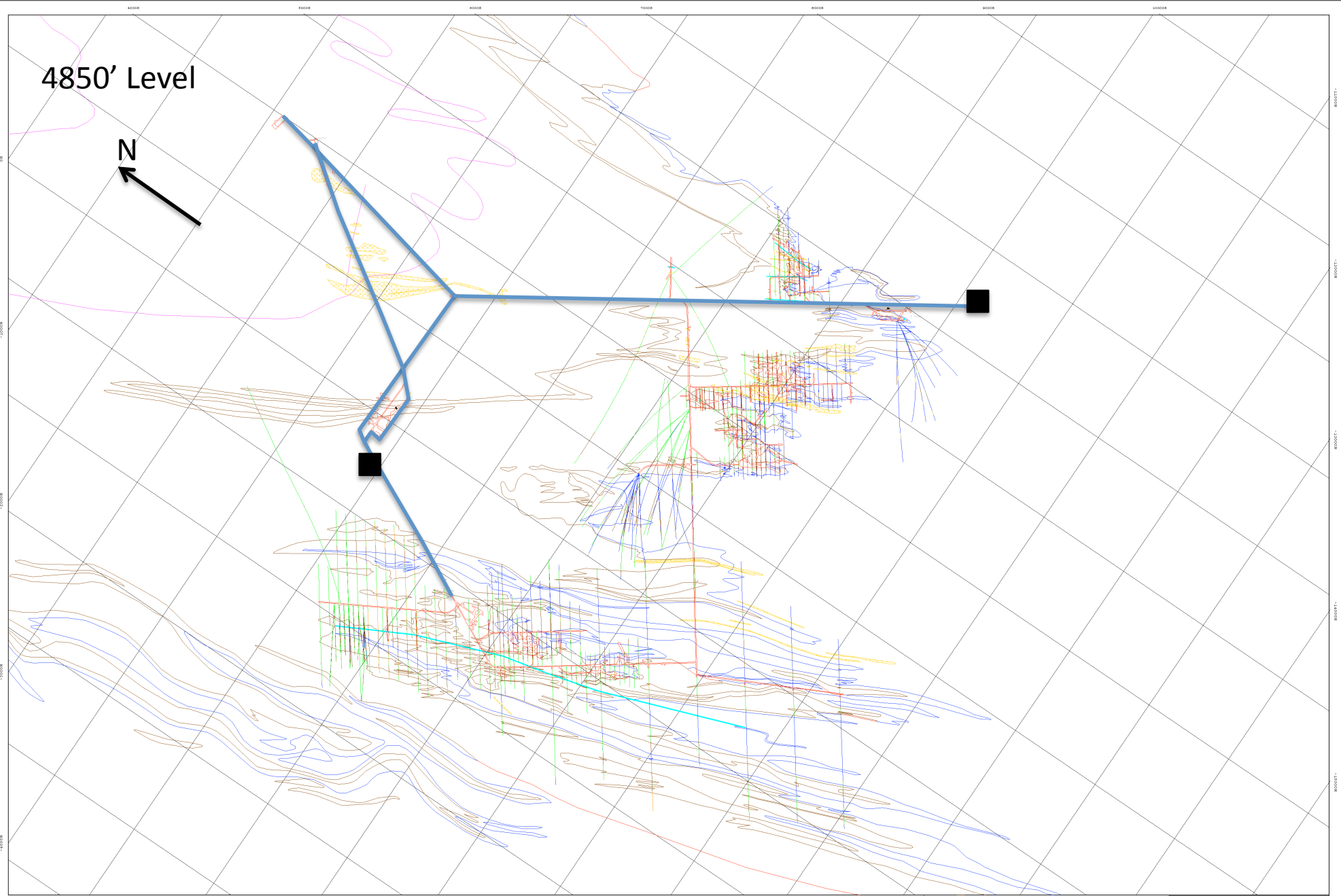
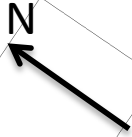
<p>SCALE: 1" = 100'</p>	<p>SOUTH DAKOTA SCIENCE AND TECHNOLOGY AUTHORITY Sanford Underground Science and Engineering Laboratory at Homestake</p>
	<p>2000 LEVEL DIAMOND DRILL HOLES GENERAL GEOLOGY</p>
<p>7/28/09 K. HART</p>	

4100' Level

N



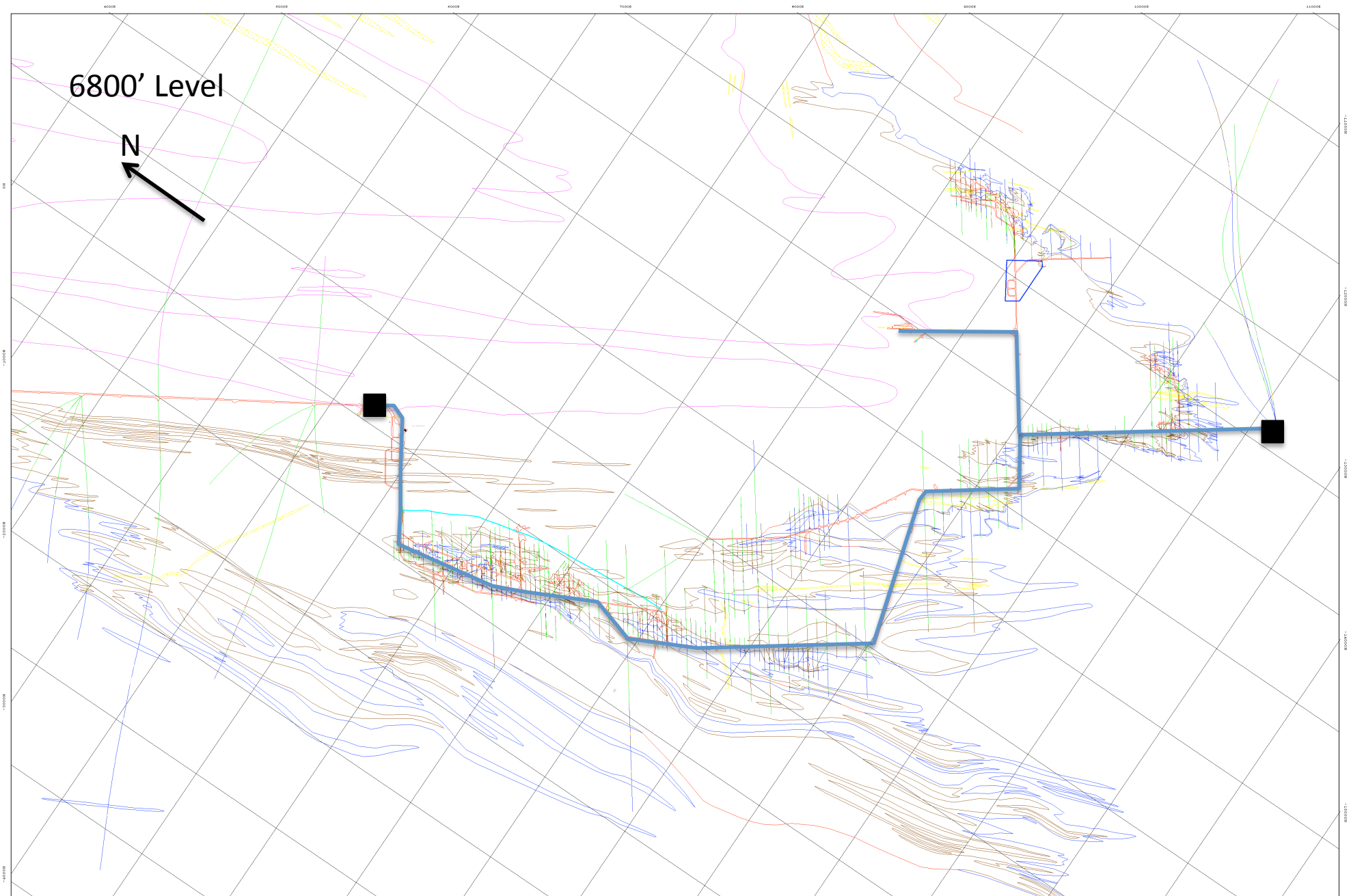
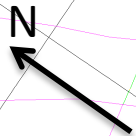
4850' Level



SCALE:

SOUTH DAKOTA SCIENCE AND TECHNOLOGY AUTHORITY
Sanford Underground Science and Engineering Laboratory and Engineering Laboratory at Homestake
4850 LEVEL
DIAMOND DRILL HOLES
GENERAL GEOLOGY
7/28/99 K. HART

6800' Level



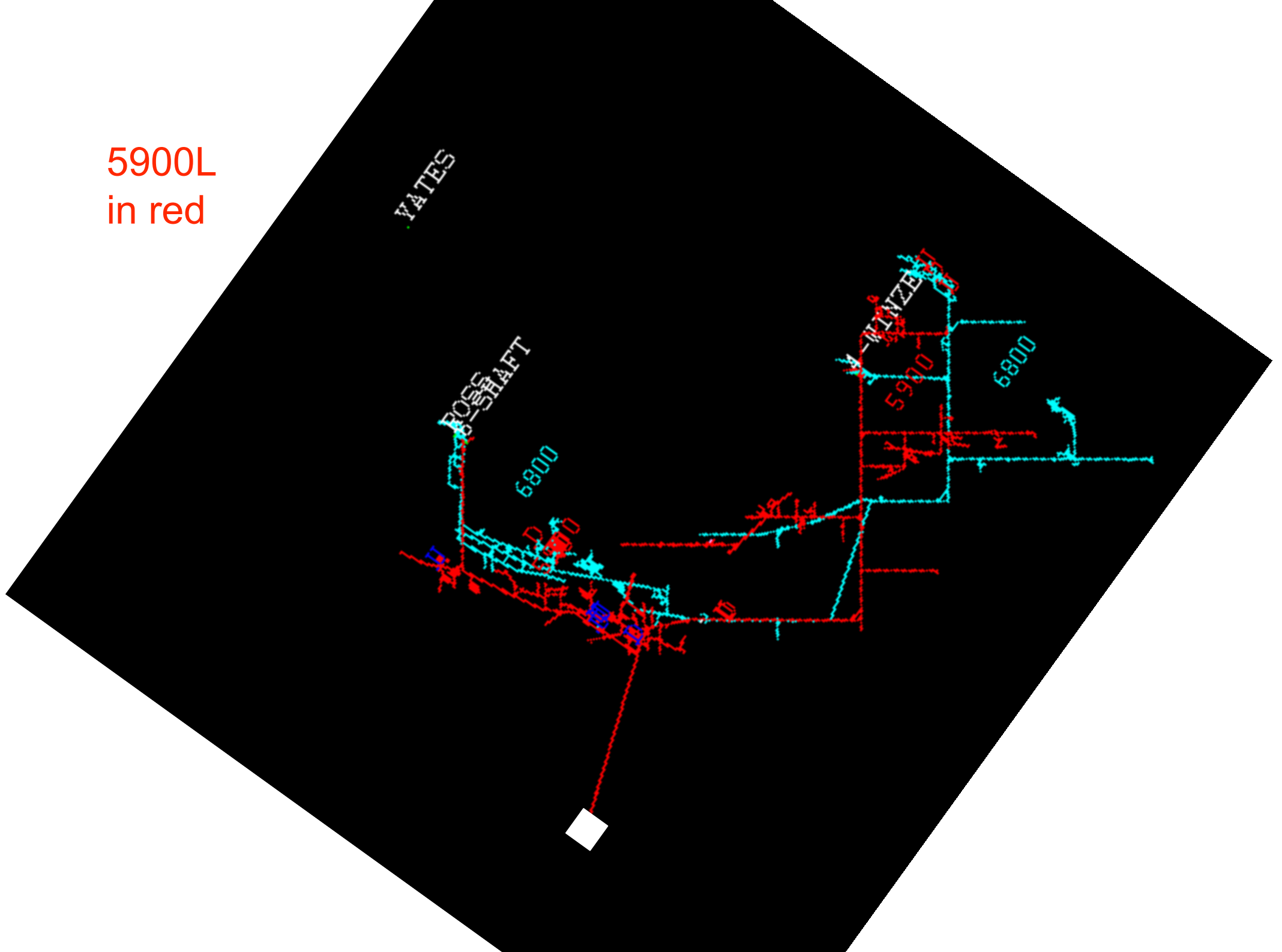
SCALE:

SOUTH DAKOTA SCIENCE AND
TECHNOLOGY AUTHORITY
Sourin Underground Science
and Engineering Laboratory
of Homestake

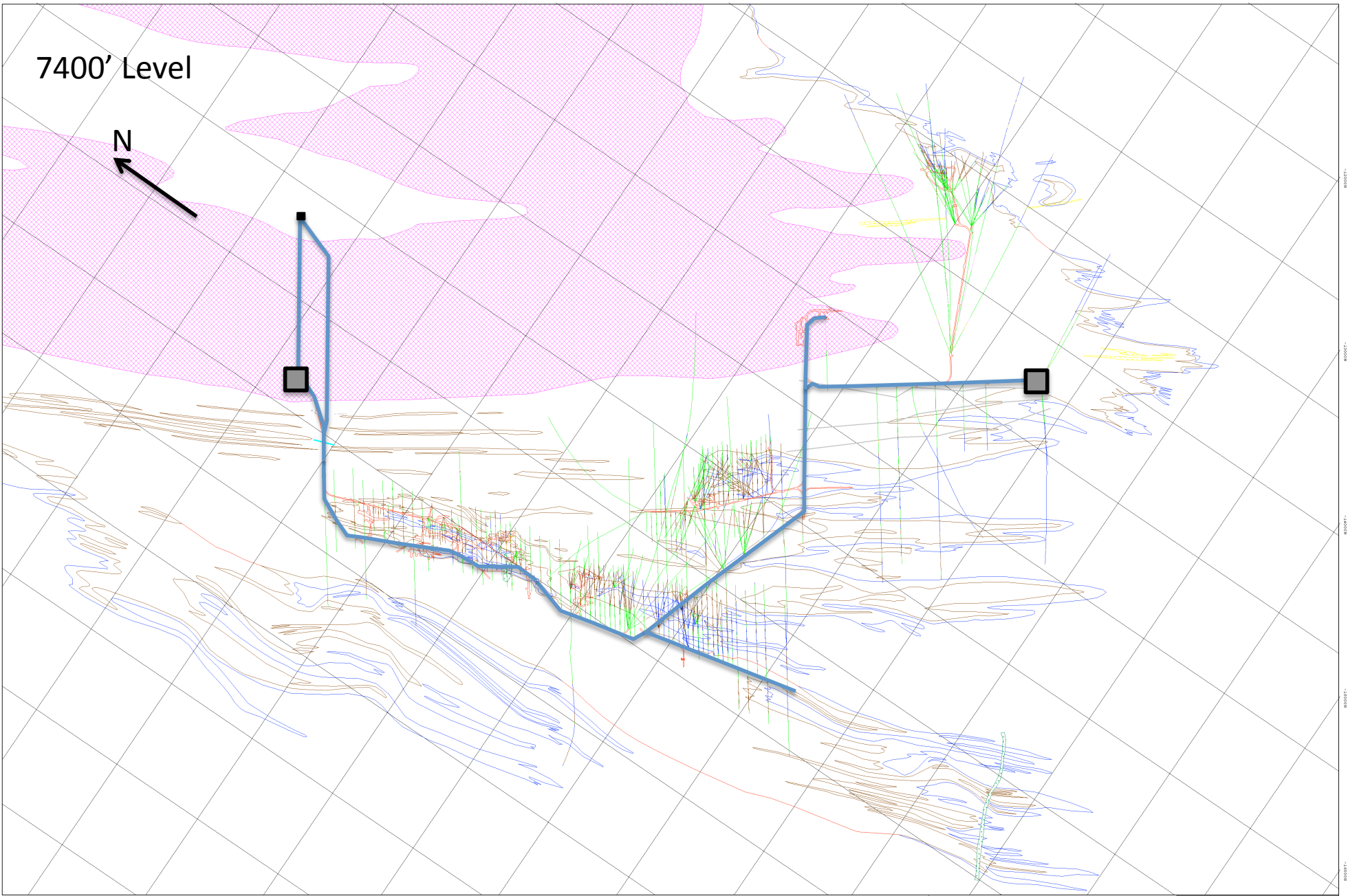
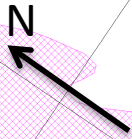
6800 LEVEL
DIAMOND DRILL HOLES
GENERAL GEOLOGY

7/28/09 K. HART

5900L
in red



7400' Level



SCALE:

SOUTH DAKOTA SCIENCE AND
TECHNOLOGY AUTHORITY
Sanford Underground Science
and Engineering Laboratory
at Homestake
7400 LEVEL
DIAMOND DRILL HOLES
GENERAL GEOLOGY
7/28/99 K. HART

Facility Requirements - underground

- Exploratory sites
 - 5-m headspace
 - 100-m² area
 - Ventilation
 - Communication
 - 110 & 220 V power
 - MULE (1)
 - Access for ~3 mos. initially, sporadic visits later
 - Drilling/coring, 1-2 km lengths
 - Drilling and testing when fracture water is intersected
 - Borehole completion
- Observatory sites
 - 10-m headspace
 - 200-m² area
 - Ventilation
 - Communication
 - 110 & 220 V power
 - MULEs (2-3)
 - Permanent access
 - Drilling/coring, ~4 km lengths
 - Borehole completion

Facility Requirements - surface

Surface boreholes -- characterize near-surface hydrology

Surface laboratory

staging and storage area for field equipment including bench for electronic repair

packers/pumps/groundwater field probes/core liners miscellaneous drilling related equipment

Two anaerobic glovebags -- oversize for cores rock core processing equipment (i.e. core cutter, rock crushing)

tracer introduction and analysis equipment/GC epifluorescence/phase contrast microscope for FISH w CCD

media and tracer chemical storage autoclaves

pH, Eh, ion specific meters, balances

milli-Q water supply

gas chromatograph with TCD, FID, ECD, RGD detectors

ion chromatograph

HPLC fluorometer

nanodrop spectrophotometer

UV-VIS spec

flow cytometer

high pressure equipment

gas and vacuum on line

gassing station and gas handling/storage

laminar flow through hoods/HEPA filters

wetbench with acid sinks

fume hoods/chemical cabinets/acid/flammable

lab safety equipment - eye wash/shower/

centrifuges and ultracentrifuge

gel rigs, gel documentation system

PCR machines, real-time PCR

liquid scintillation counter/low-level radiation bench/room

computer room - computer and server for processing and visualization of experimental data and computers and software for

phylogenetic analyses

access to machine shop

(-80°C freezers

minus 20°C freezers

explosion proof freezer/refrigerator

walk-in cold room (5°C)

refrigerators

drying ovens (600oC+)

Schedule for Occupancy

Experiment	Level	Occupancy
Observatory	4850L	Develop first, i.e., 2013
Exploratory	2000L	After drilling at 4850 completed, ~2014
Exploratory	4100L	After drilling at 4850 completed, ~2014
Observatory	7400L	Dependent upon pumping and development of ventilation, ~2015
Exploratory	6800L	Dependent upon pumping and development of ventilation, ~2016

R&D needs

- Access to selected existing boreholes – at available levels, including 8000L -- geohydrological, geochemical characterization, instrumentation, etc.
- Selection of packers, casing (?) materials and fluid samplers that are stable at high temperature, do not alter water geochemistry. Drilling fluid selection and aseptic protocols.
- Drilling technology with logging capability (LWD?).