



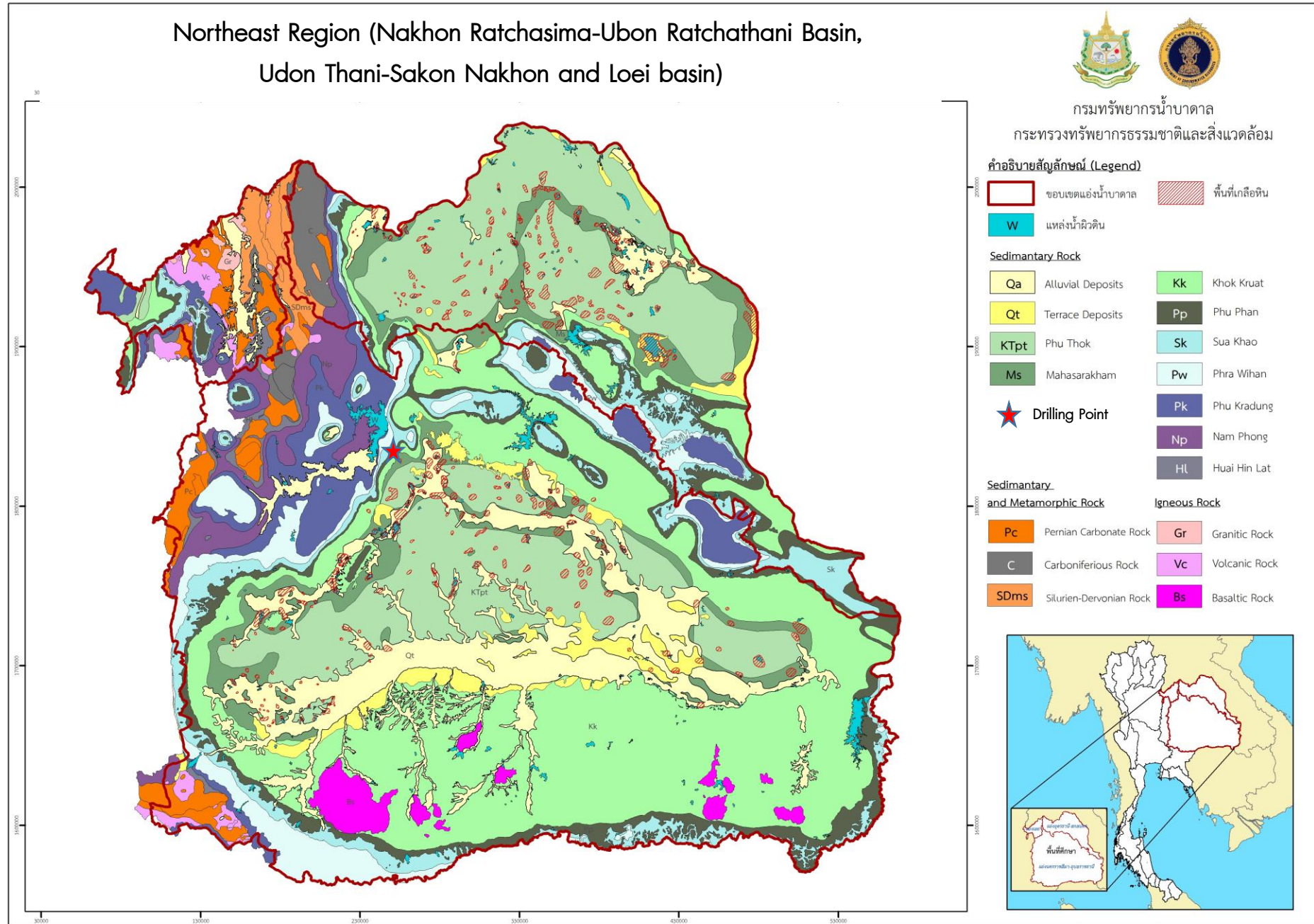
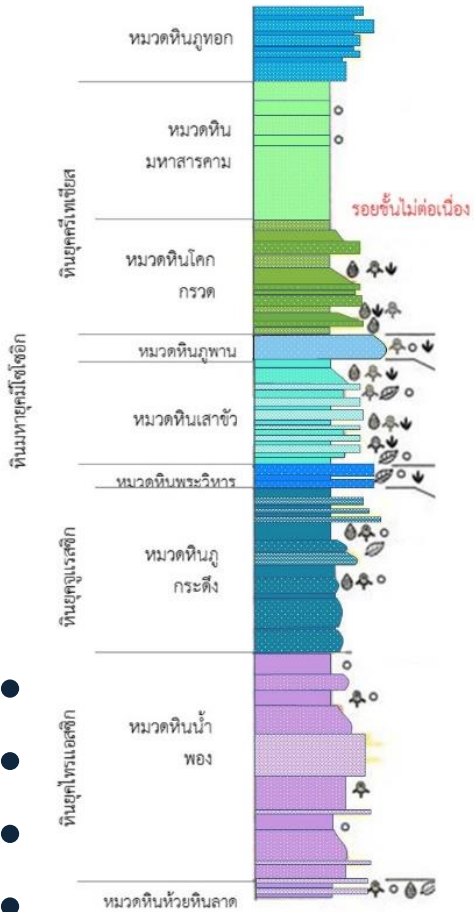
Hydrogeological Behaviour of Deep Groundwater Resources in the Northeast Region (Nakhon Ratchasima-Ubon Ratchathani Basin)

*Bureau of Groundwater Exploration and Potential Assessment,
Department of Groundwater Resources, Thailand*

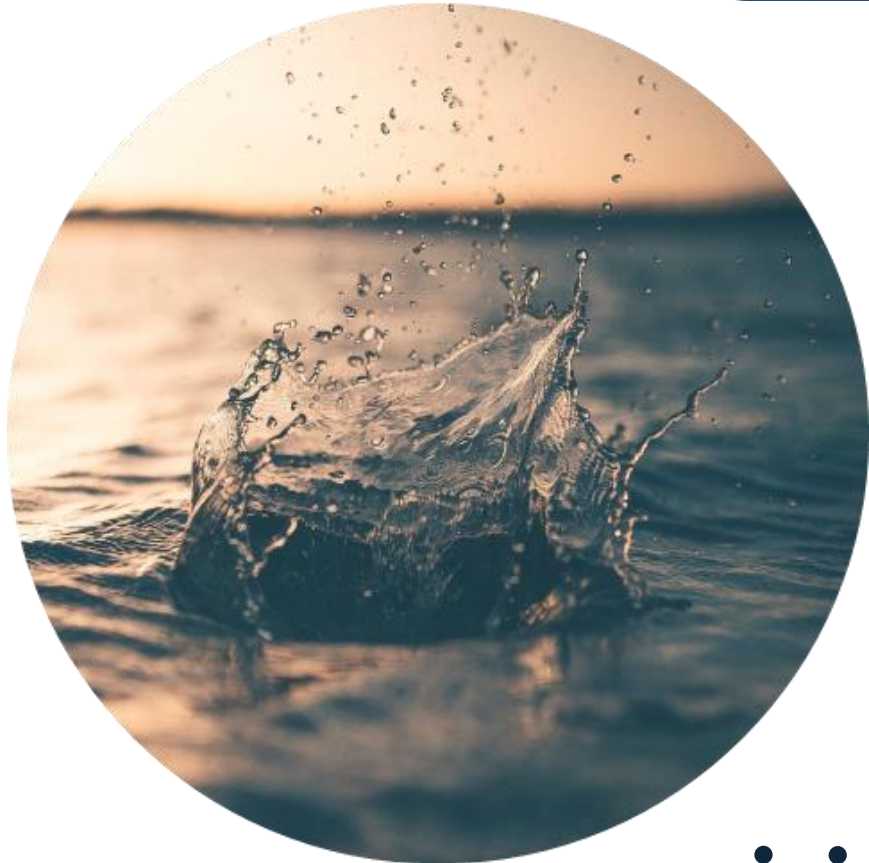


Geology

Most of the area is supported by the Korat group.



Why drill a deep groundwater well ?



Previously, Thailand had never drilled deep groundwater in hard rock (1,000 m).

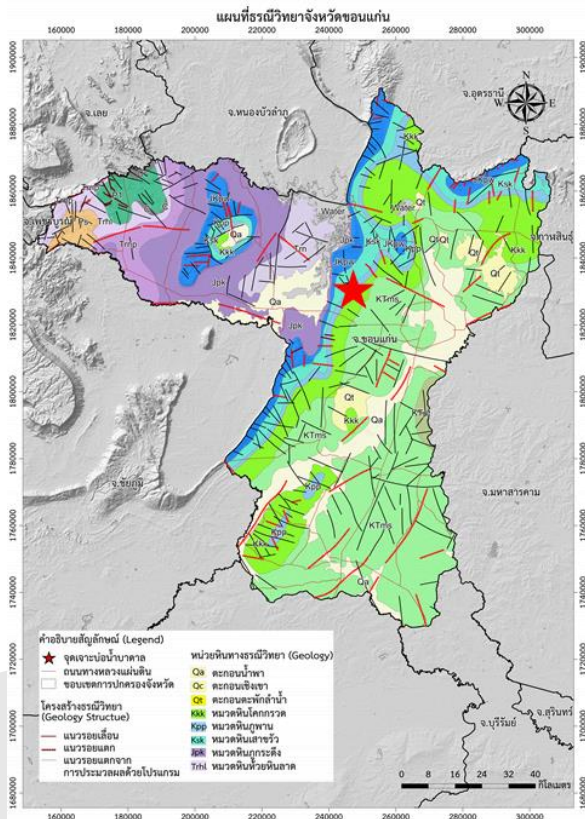
Requires knowledgeable and highly experienced people both domestic/international to carry out and transfer knowledge and technology to the staff of the Department of Groundwater Resources.

Support area Shale interspersed with dense sandstone. There are many cracks and some periods have saltwater interspersed with fresh water The development of artesian wells is therefore difficult.



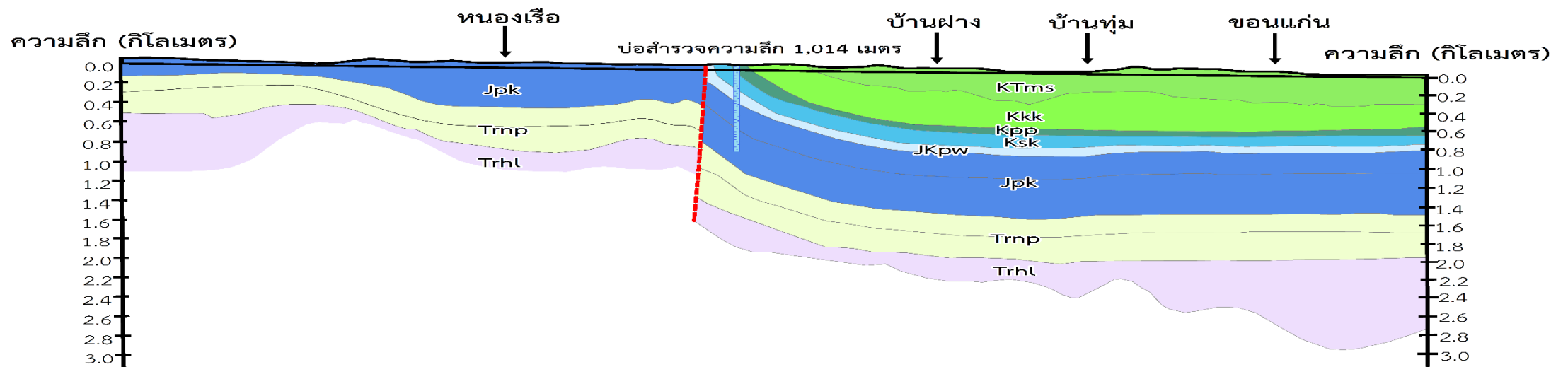
Drilling Operation Area

Ban Hin Khao area, Village No. 15,
Sawathi Sub-district, Mueang
District, Khon Kaen Province

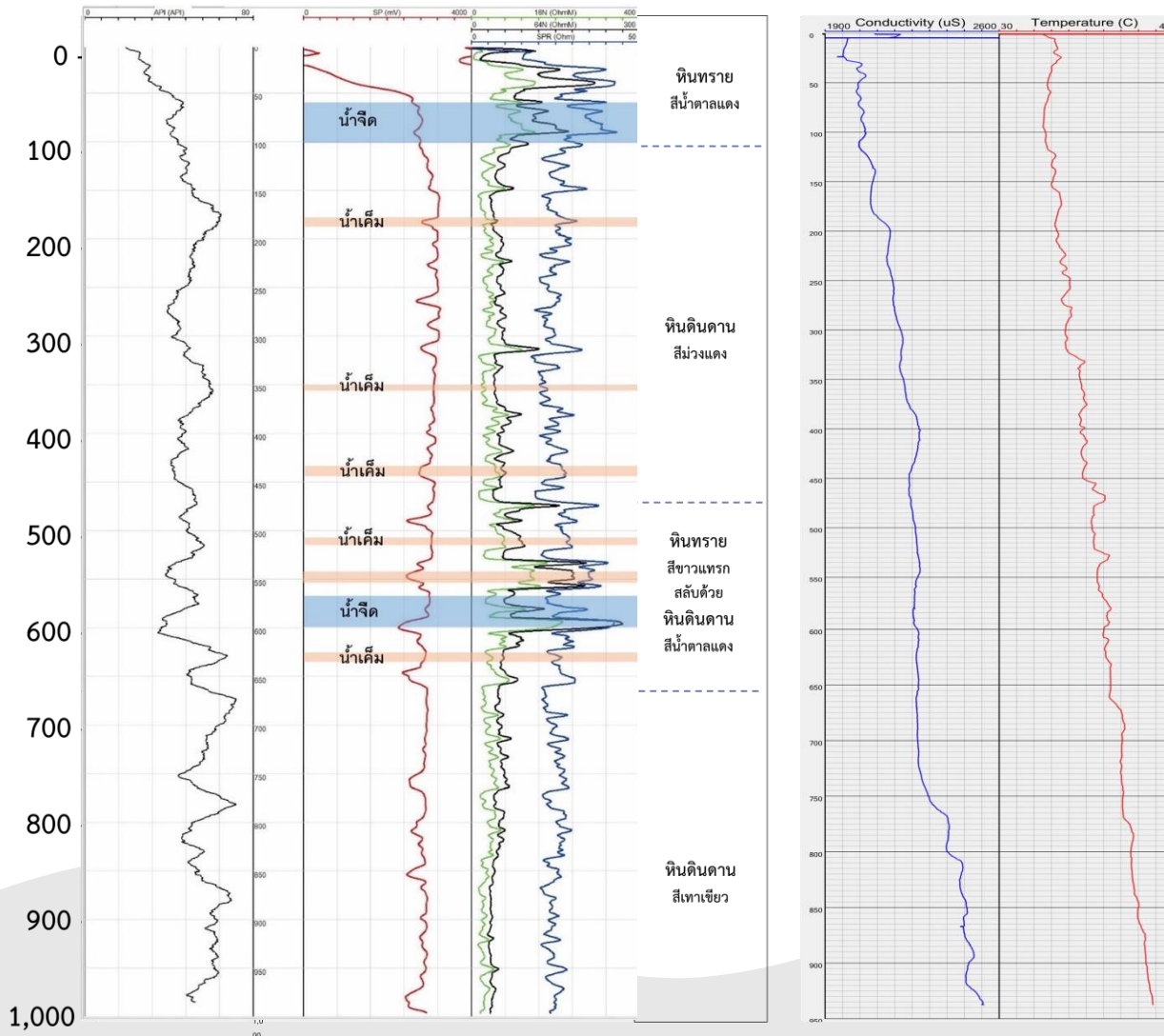
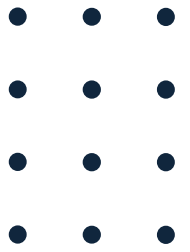


Groundwater Drilling

- At a depth of 0-600 meters, use the Direct Rotary Air Circulation Down the Hole Hammer method.
- At a depth of 600-1,014 meters, use the Direct Rotary Mud Circulation method.



Drilling results and borehole geophysical surveys



Drill at a depth of 1,014 meters

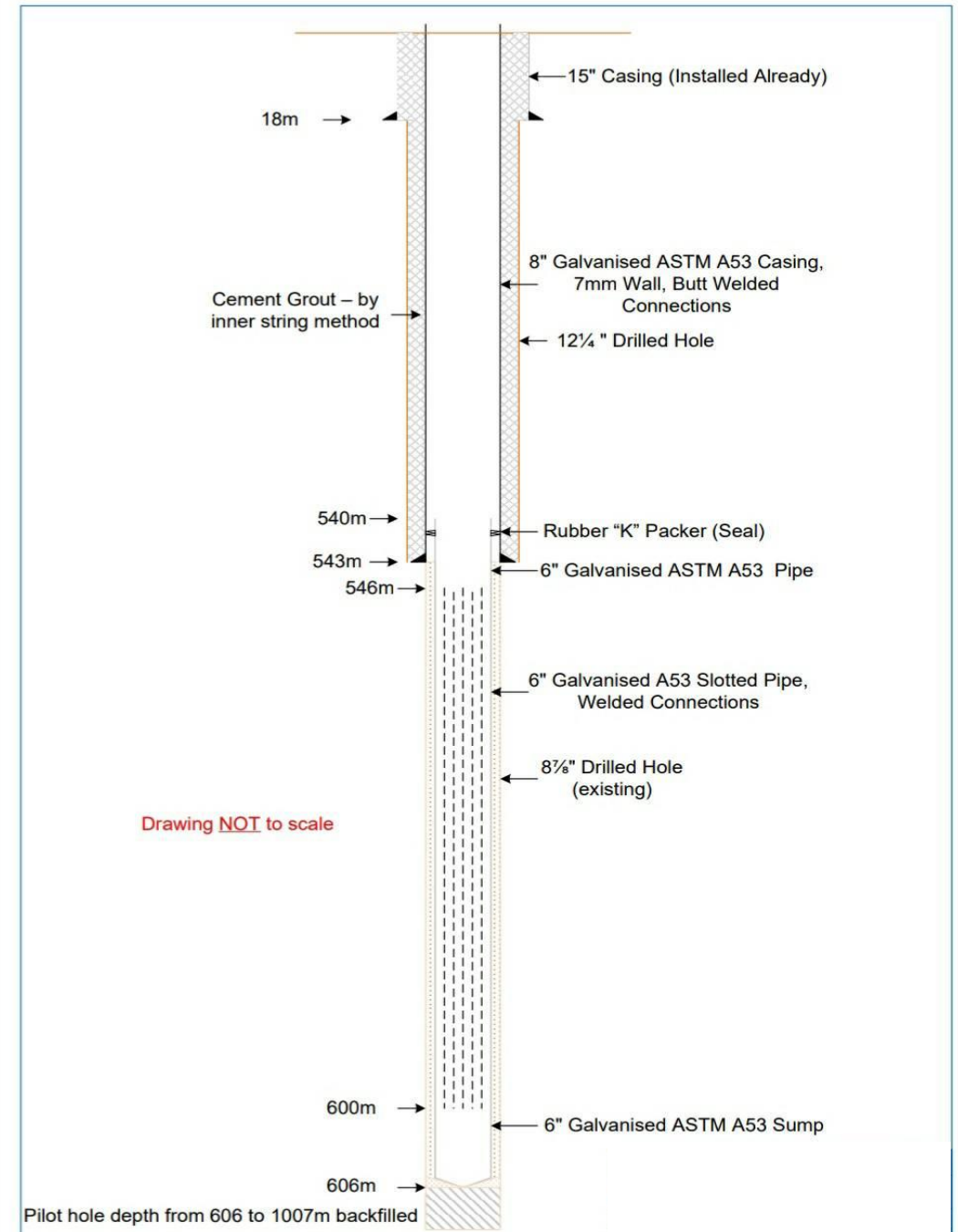
- Two layers of freshwater at a depth of 50-100 meters and 540-600 meters.
- 6 layers of brackish/salty layers at depth 160-180, 350-360, 430-450, 500-510, 520-530, 660-670 meters.
- Depth of 700 meters down, the groundwater layer is not found.

Develop an artesian well at a depth of 540 – 600 meters.

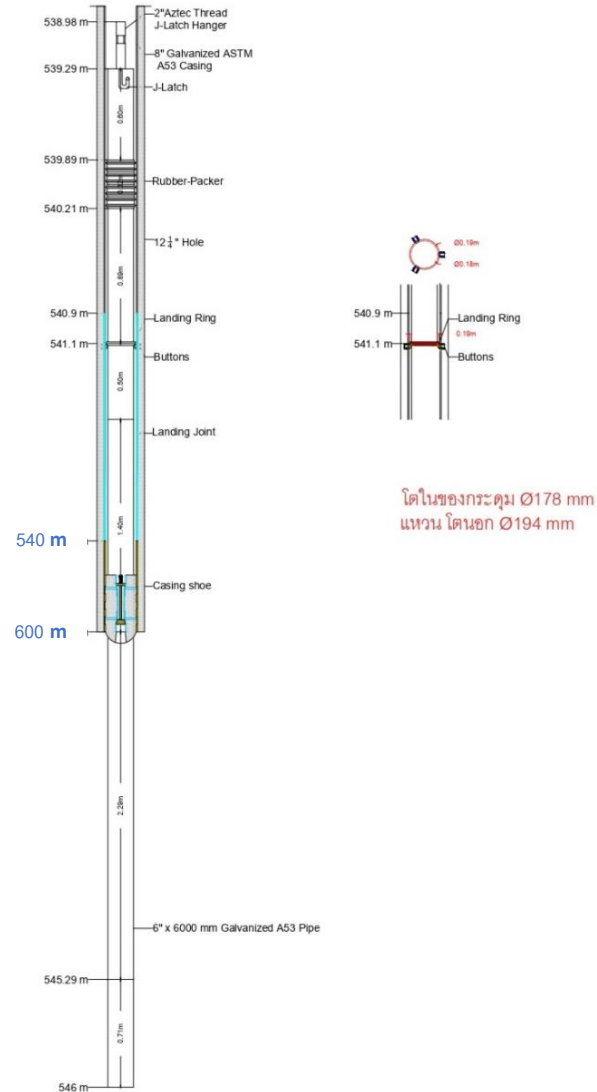
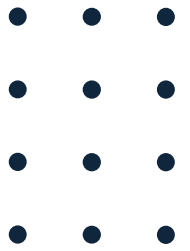


Design and construction of Groundwater well

1. Drill to expand the well from size $8\frac{7}{8}$ inches to size $12\frac{1}{4}$ inches at a depth of 0 - 543 meters.
2. Insert an eight inch steel pipe and install Sealing Sleeve adapter.
3. Sealing the well with cement to fill the gap between the steel pipe and the borehole wall to prevent saltwater mixing with the freshwater layer below.
4. Drill with a $7\frac{7}{8}$ inches at a depth of 540–606 m.
5. Insert a 6 inch water pipe with a depth of 540-600 meters, and a 6 inch sand pipe with a depth of 600-606 meters.
6. Blowing wells and developing groundwater wells.



Development of Groundwater well of 1,000 meters



- ❖ The maximum volume of water that can be pumped is not less than **12** cubic meters per hour.
- ❖ **Fresh water quality**
- ❖ The groundwater level is **12.38** meters deep from the surface level.

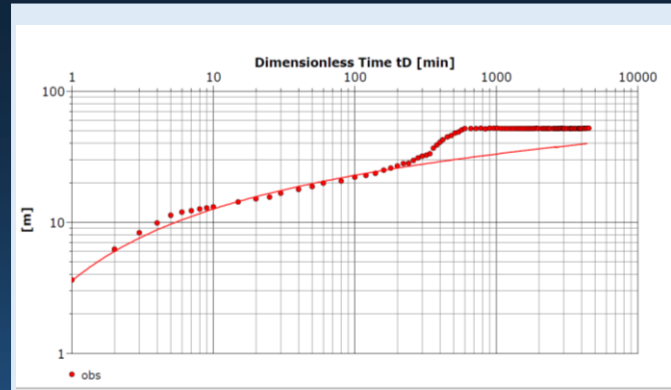
- ❖ **Groundwater quality analysis**
Total dissolved solids (TDS) **463** mg/L.

** Drinking water quality standards, not more than 600 milligrams per liter and shall not exceed 1,200 milligrams per liter.



Results of a hydrogeological study of Groundwater well at Ban Hin Khao

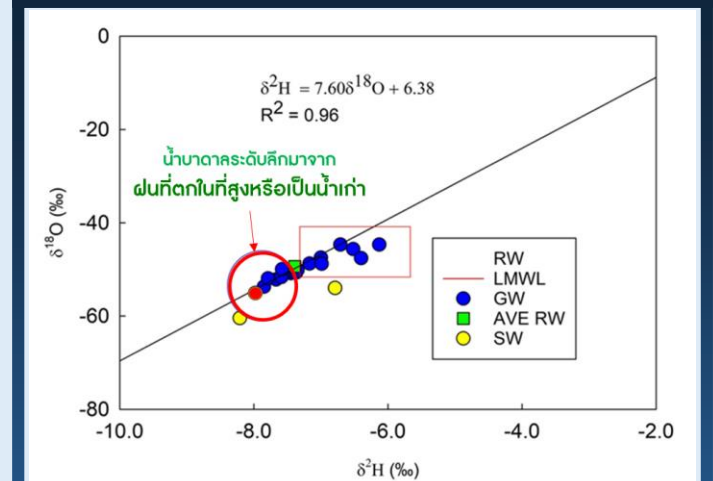
Pumping test



GW Well	Depth (m)	Maximum pumping capacity (m/hr.)	K (m^2/D)	T (m/D)
Well 1	66	60	2.96-3.59	0.082-0.099
Well 2	702	7	1.08	1.08
Well 3	1,014	12	3.78	3.78

Analysis of hydraulic characteristics of groundwater

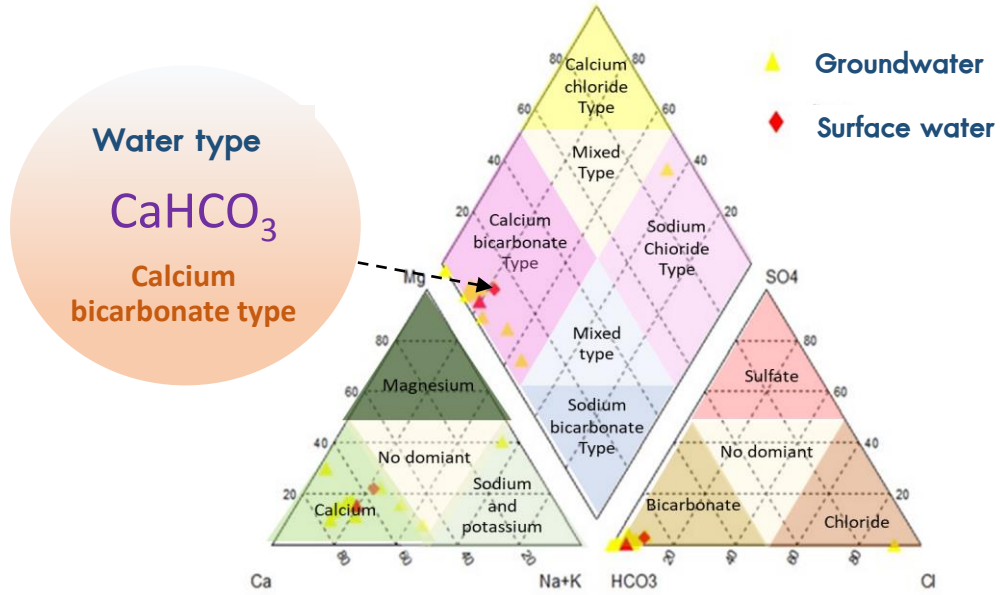
Groundwater isotope analysis



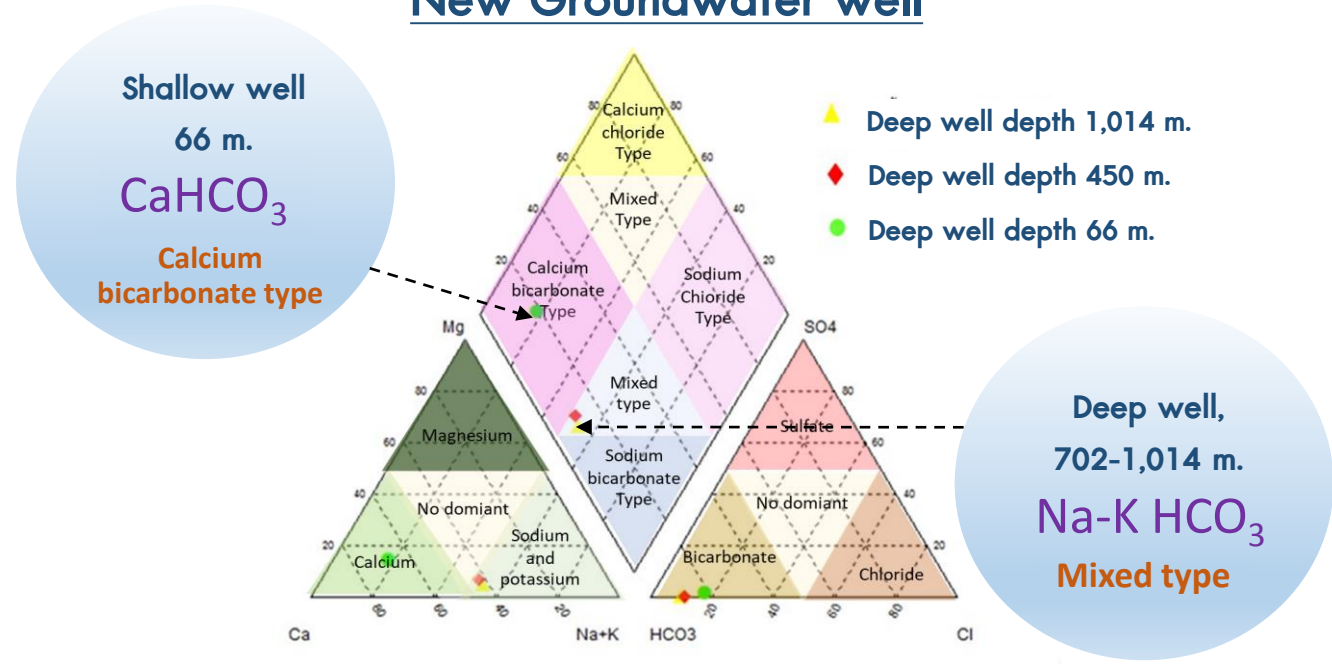
Determination of groundwater age using C-14

Groundwater Age $20,167 \pm 680$ year (B.P.)

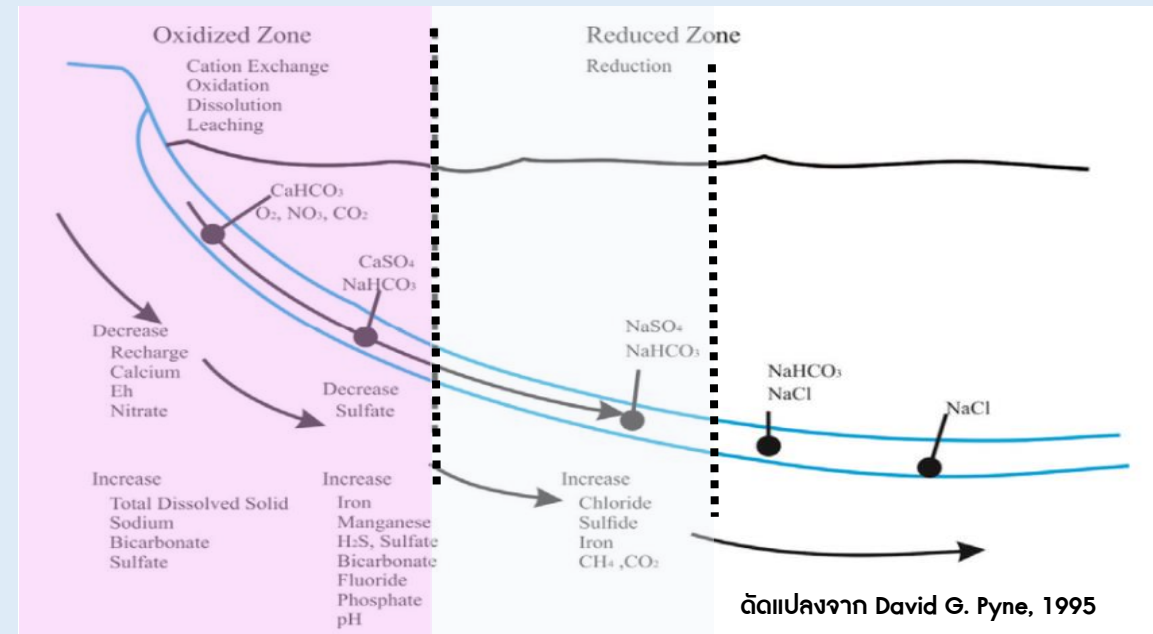
Groundwater and Surface water in the area



New Groundwater well

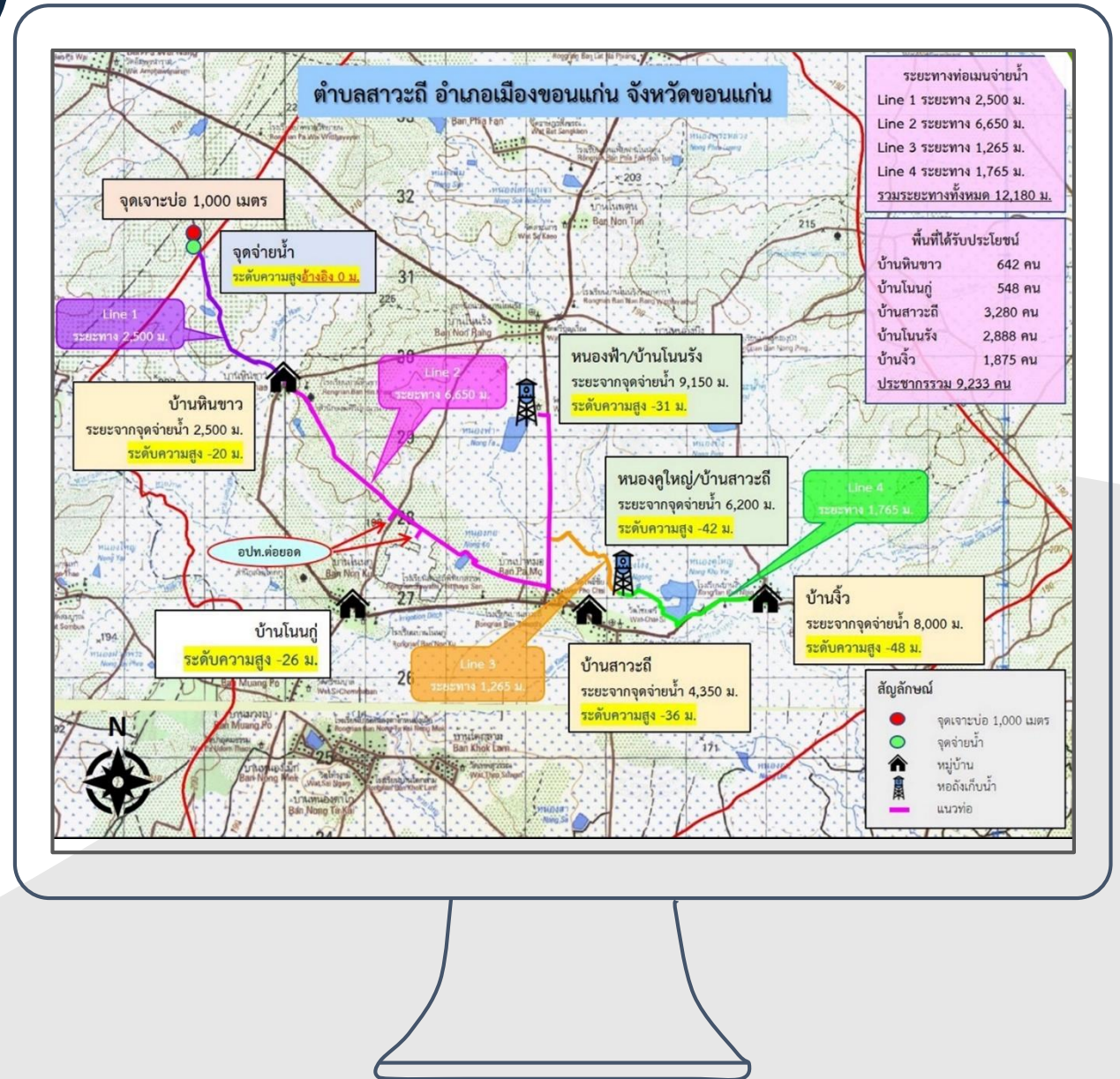
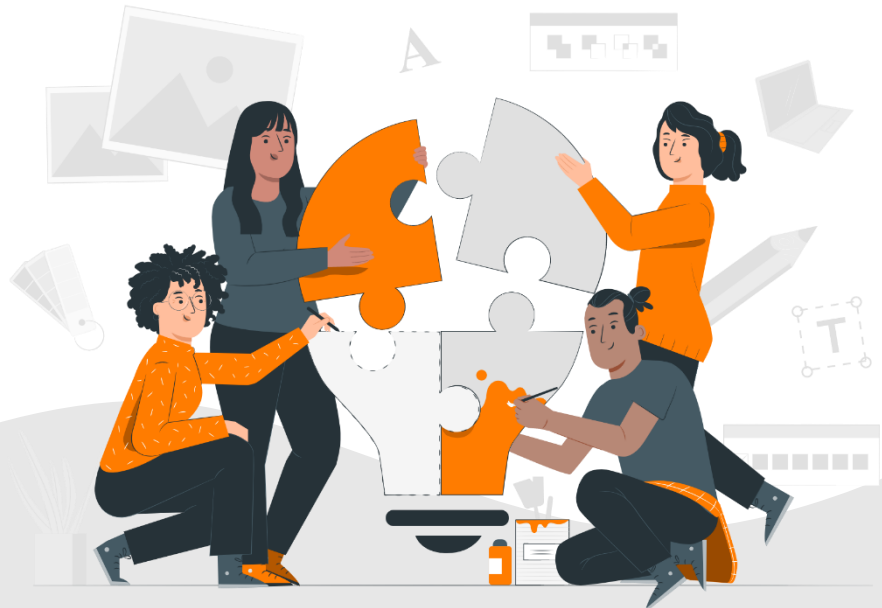


Results of a hydrogeological study of a Groundwater well at Ban Hin Khao



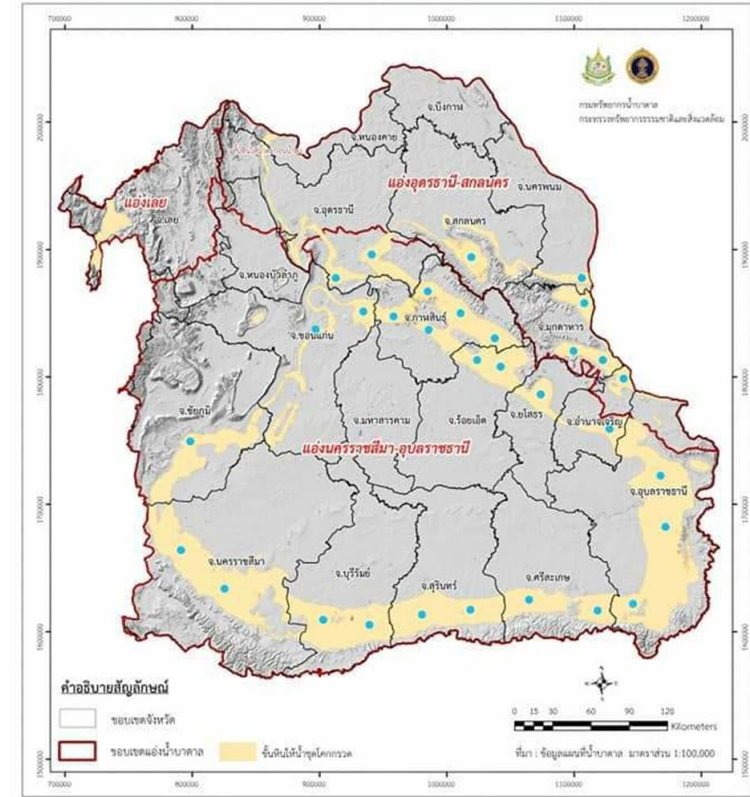
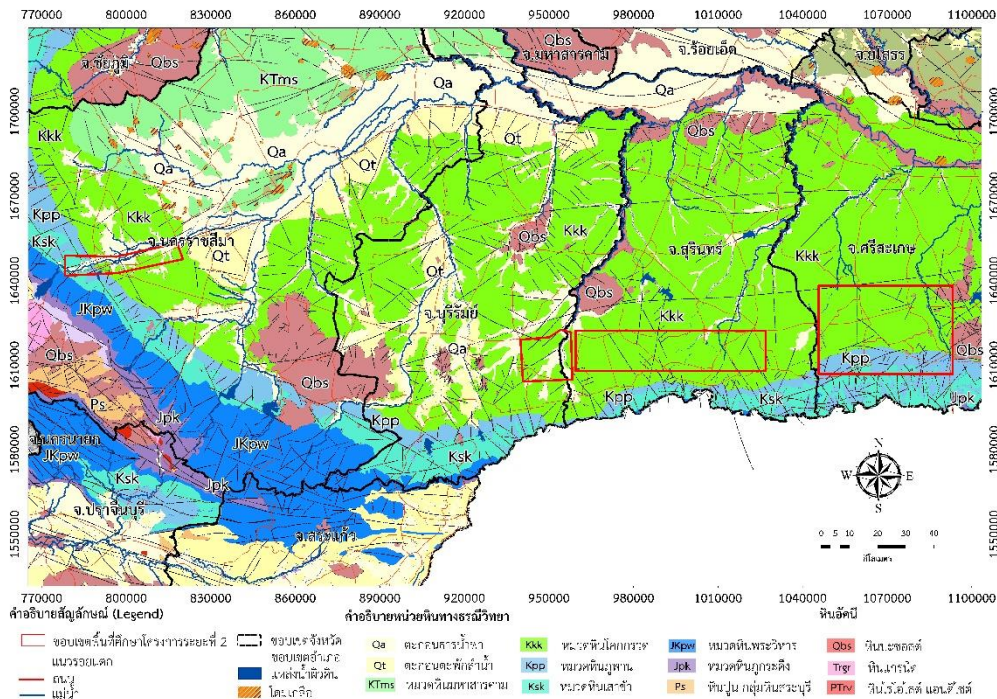
Next groundwater development plan

Groundwater Development Planning and Groundwater Management in Sawathi Subdistrict, Mueang District, Khon Kaen Province



Next Action Plan

Drilling of four wells
in 4 provinces.



Lower Northeast Region.

- Nakhon Ratchasima
- Buriram
- Surin
- Si Sa Ket

Thank you