

Progress of Landside Impermeable Wall freezing: Phase 2 of the first stage



December 22, 2016

Tokyo Electric Power Company Holdings, Inc.

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Landside impermeable wall

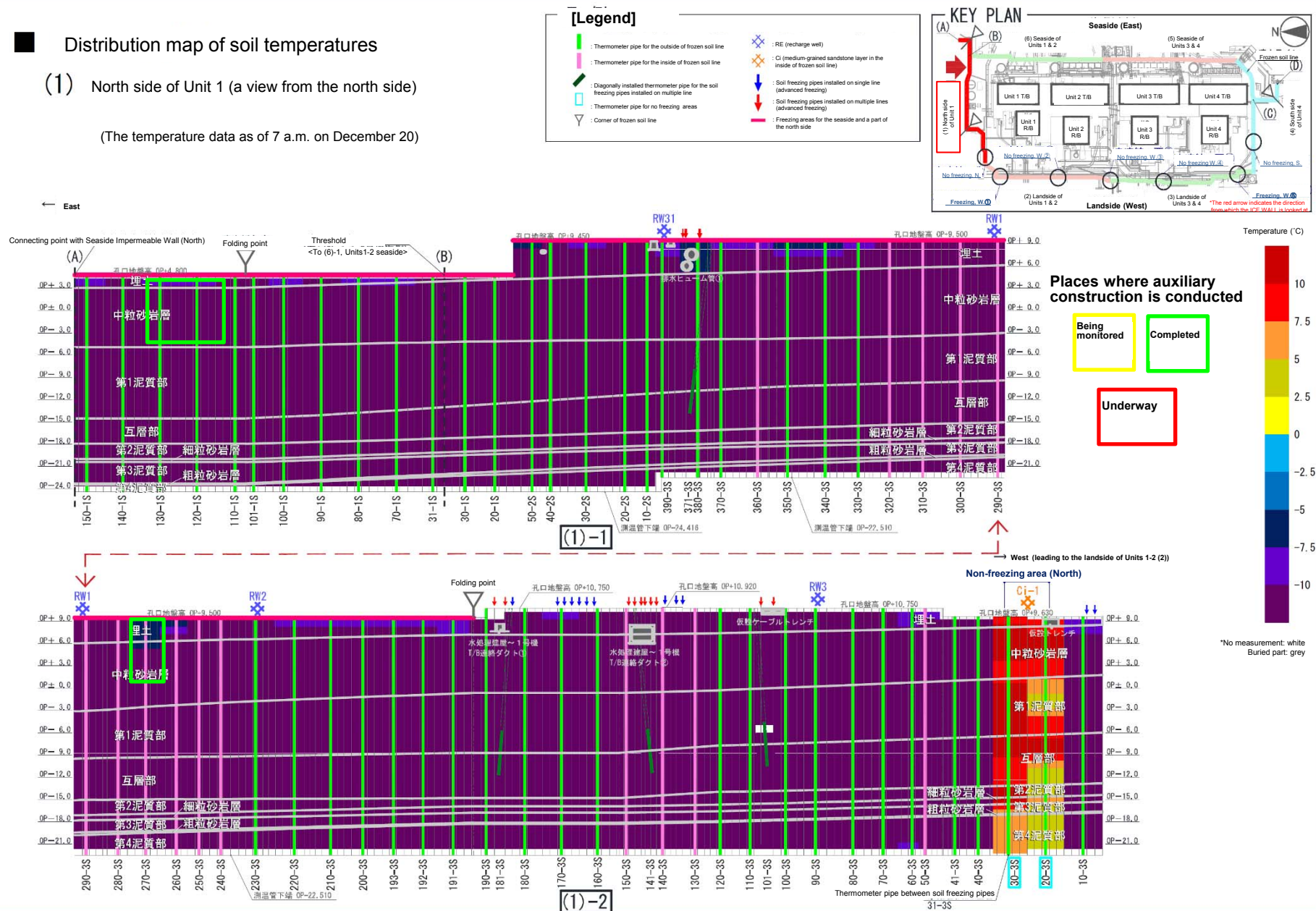
- The purpose of the Landside Impermeable Wall construction lies not in freezing soil to form an underground wall but in keeping groundwater from flowing into the reactor/turbine buildings and preventing new contaminated water from being generated.
- By closing less than 95 percent of the mountain side of the Landside Impermeable Wall in Phase 2 of the first stage, it is expected that the amount of groundwater flowing into the areas around the reactor/turbine buildings will be reduced. This will help keep groundwater from being contaminated during the first stage.
- Throughout the first stage, how freezing of the Landside Impermeable Wall has progressed will be checked by monitoring the difference in groundwater levels inside and outside of the wall and the amount of groundwater pumped up by the subdrain and groundwater drain systems and the well point system.

2-1 Distribution map of soil temperatures (north side of Unit 1)

Distribution map of soil temperatures

(1) North side of Unit 1 (a view from the north side)

(The temperature data as of 7 a.m. on December 20)



2-2 Distribution map of soil temperatures (west side of Units 1-2)

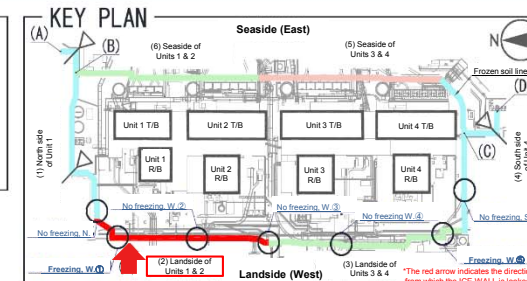
■ Distribution map of soil temperatures

(2) Landside of Units 1-2 (a view from the west side)

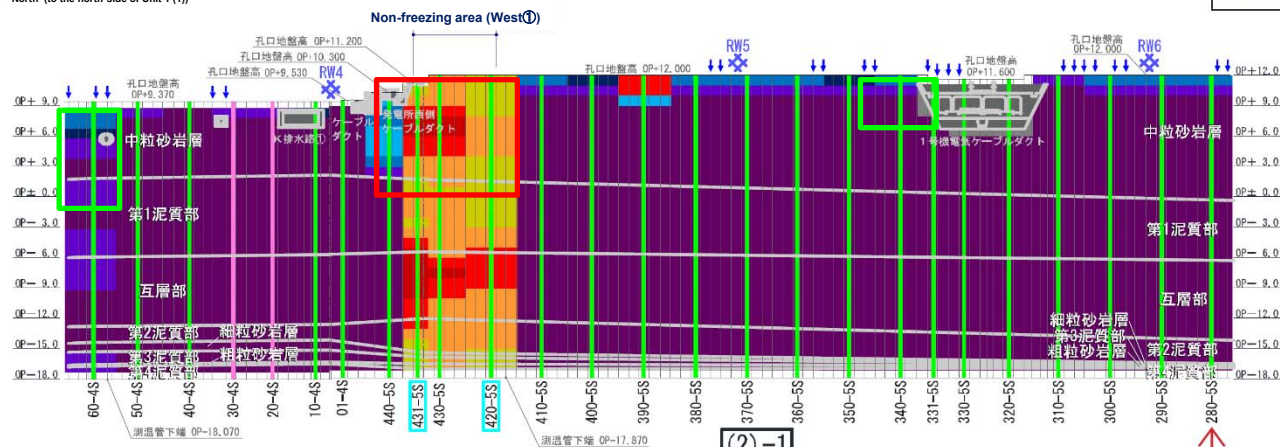
(The temperature data as of 7 a.m. on December 20)

[Legend]

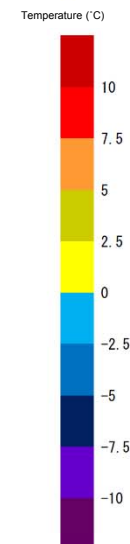
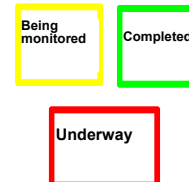
- Thermometer pipe for the outside of frozen soil line
- Thermometer pipe for the inside of frozen soil line
- Diagonally installed thermometer pipe for the soil freezing pipes installed on multiple line
- Thermometer pipe for no freezing areas
- Corner of frozen soil line
- RE (recharge well)
- Ci (medium-grained sandstone layer in the inside of frozen soil line)
- Soil freezing pipes installed on single line (advanced freezing)
- Soil freezing pipes installed on multiple lines (advanced freezing)
- Freezing areas for the seaside and a part of the north side



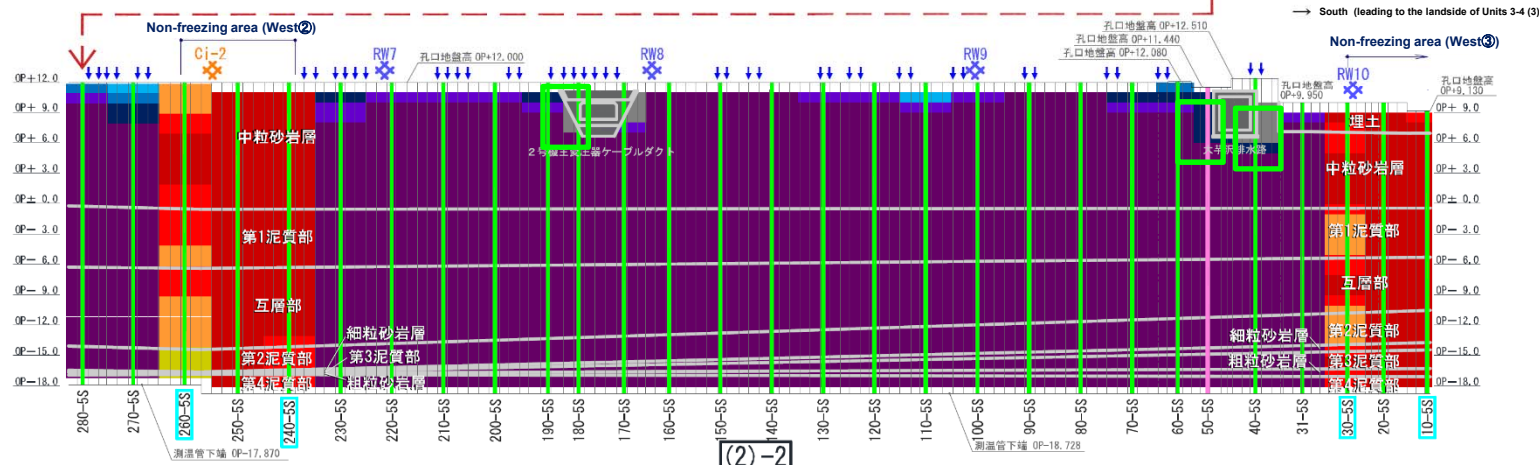
← North (to the north side of Unit 1 (1))



Places where auxiliary construction is conducted



*No measurement: white
Buried part: grey



2-3 Distribution map of soil temperatures (west side of Units 3-4)

■ Distribution map of soil temperatures

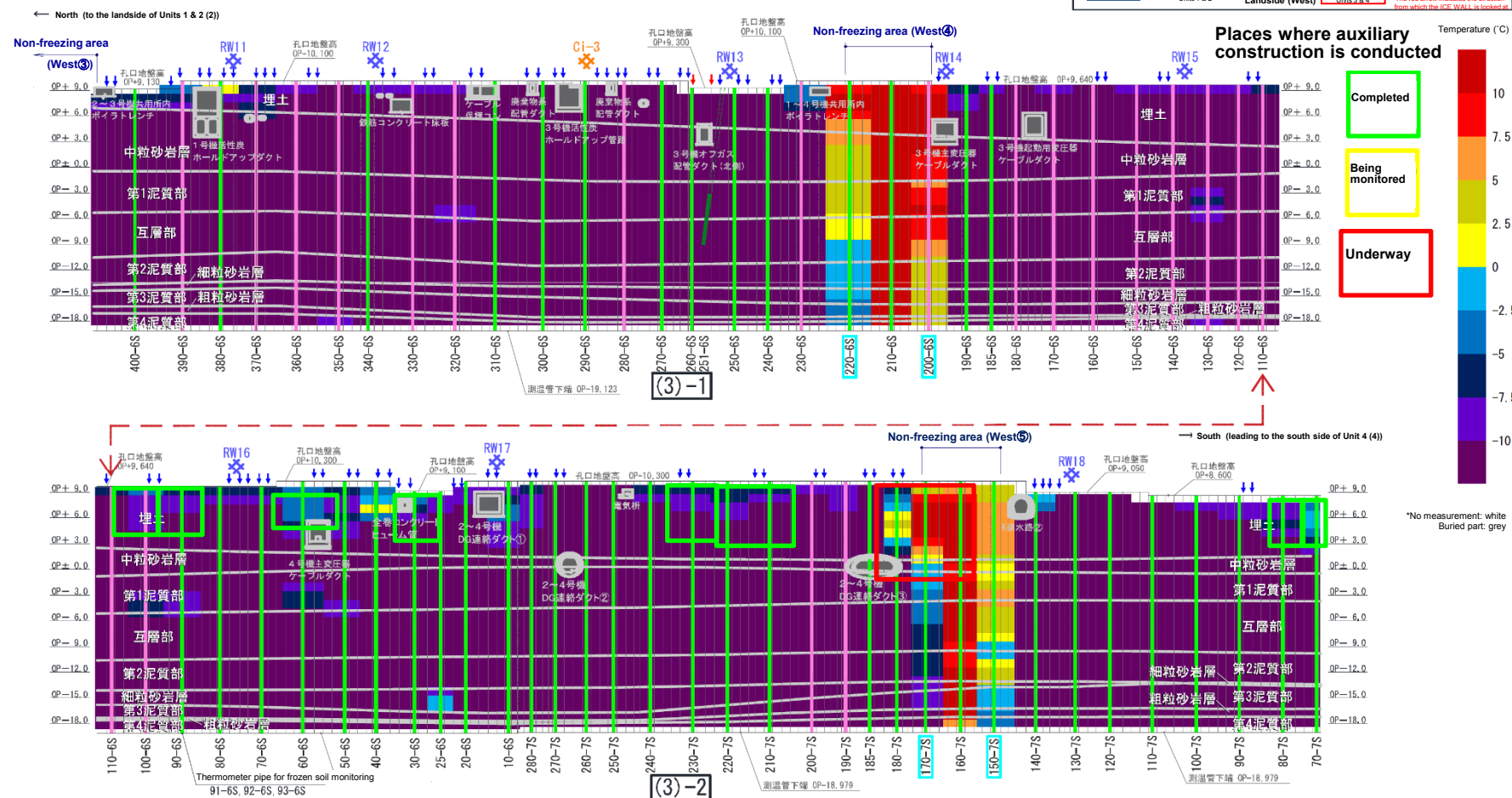
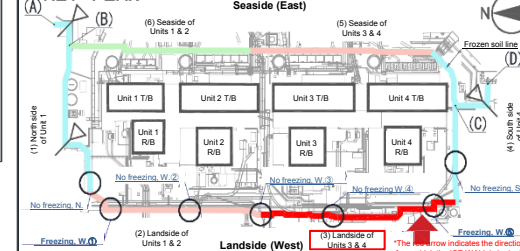
(3) Landside of Units 3-4 (a view from the west side)

(The temperature data as of 7 a.m. on December 20)

[Legend]

- Thermometer pipe for the outside of frozen soil line
- Thermometer pipe for the inside of frozen soil line
- Diagonally installed thermometer pipe for the soil freezing pipes installed on multiple line
- Thermometer pipe for no freezing areas
- Corner of frozen soil line
- RE (recharge well)
- C (medium-grained sandstone layer in the inside of frozen soil line)
- Soil freezing pipes installed on single line (advanced freezing)
- Soil freezing pipes installed on multiple lines (advanced freezing)
- Freezing areas for the seaside and a part of the north side

KEY PLAN



2-4 Distribution map of soil temperatures (south side of Unit 4)

■ Distribution map of soil temperatures

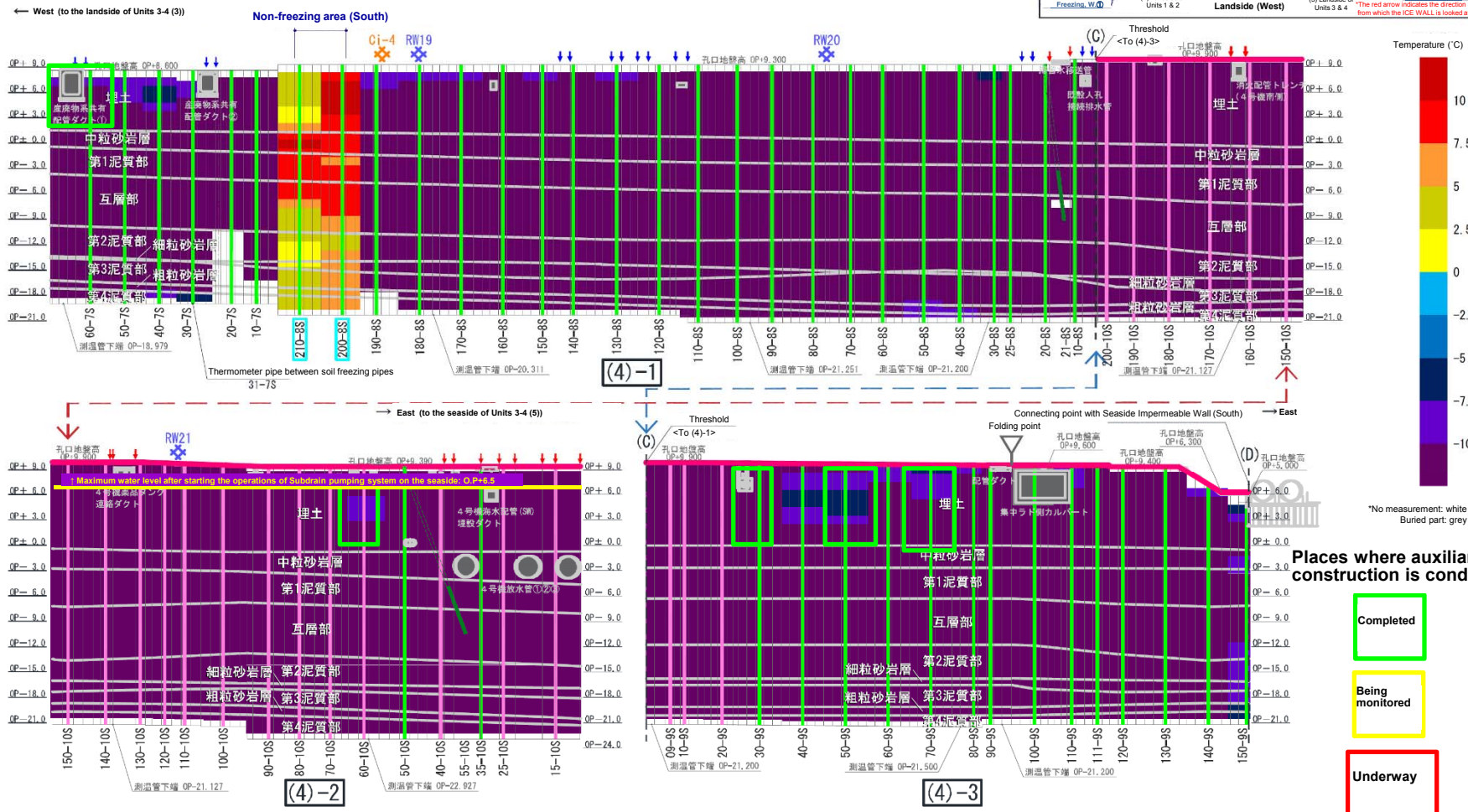
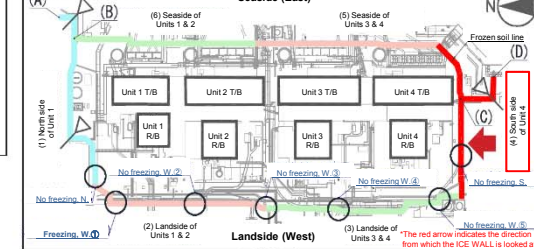
(4) South side of Unit 4 (a view from the south side)

(The temperature data as of 7 a.m. on December 20)

[Legend]

- Thermometer pipe for the outside of frozen soil line
- Thermometer pipe for the inside of frozen soil line
- Diagonally installed thermometer pipe for the soil freezing pipes installed on multiple line
- Thermometer pipe for no freezing areas
- Corner of frozen soil line
- RE (recharge well)
- CI (medium-grained sandstone layer in the inside of frozen soil line)
- Soil freezing pipes installed on single line (advanced freezing)
- Soil freezing pipes installed on multiple lines (advanced freezing)
- Freezing areas for the seaside and a part of the north side

KEY PLAN



2-5 Distribution map of soil temperatures (east side of Units 3-4)

■ Distribution map of soil temperatures

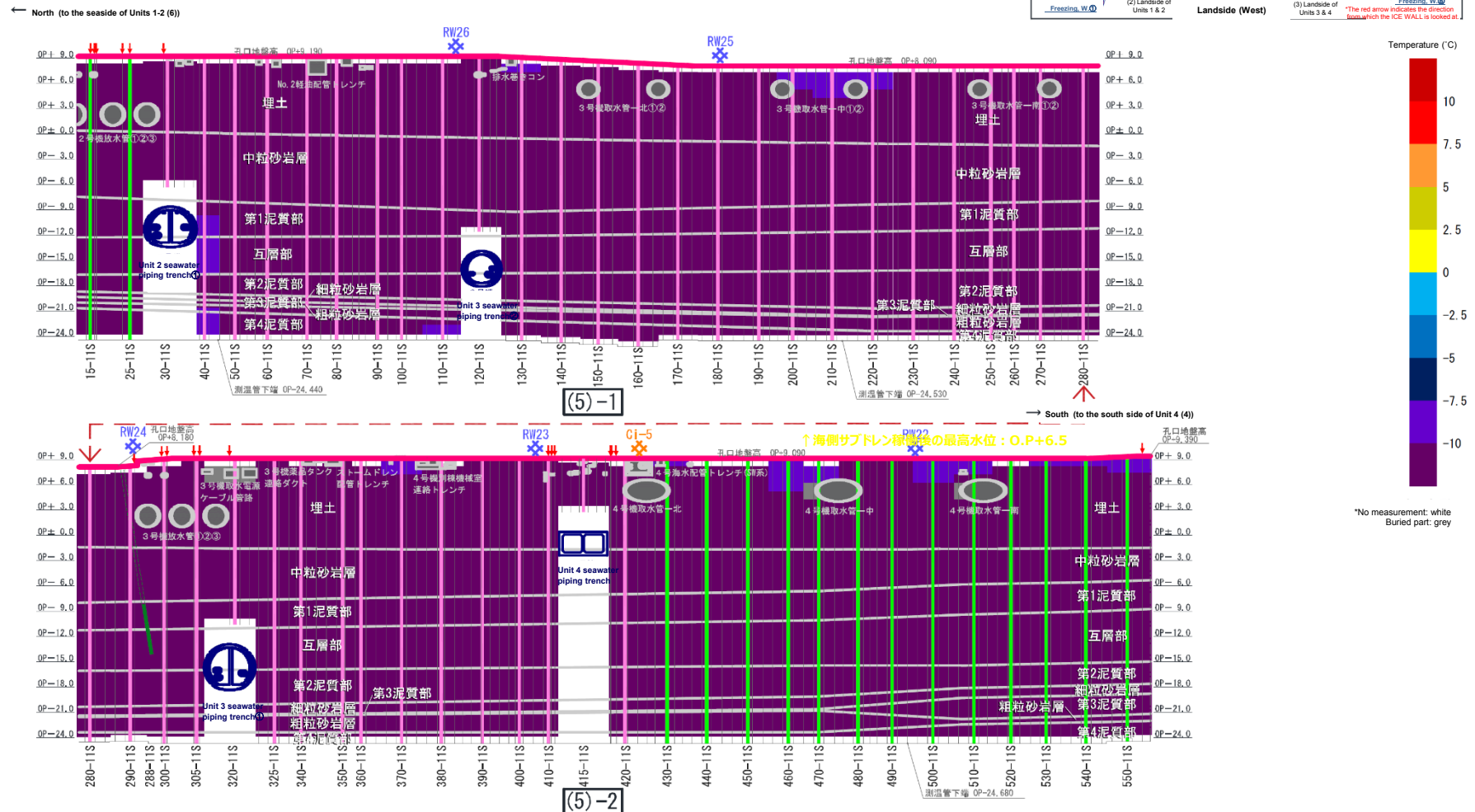
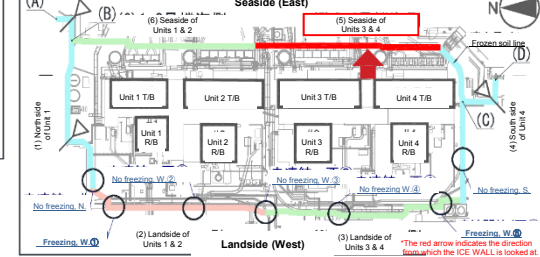
(5) Seaside of Units 3-4 (west side: a view from the inside of frozen soil)

(The temperature data as of 7 a.m. on December 22)

[Legend]

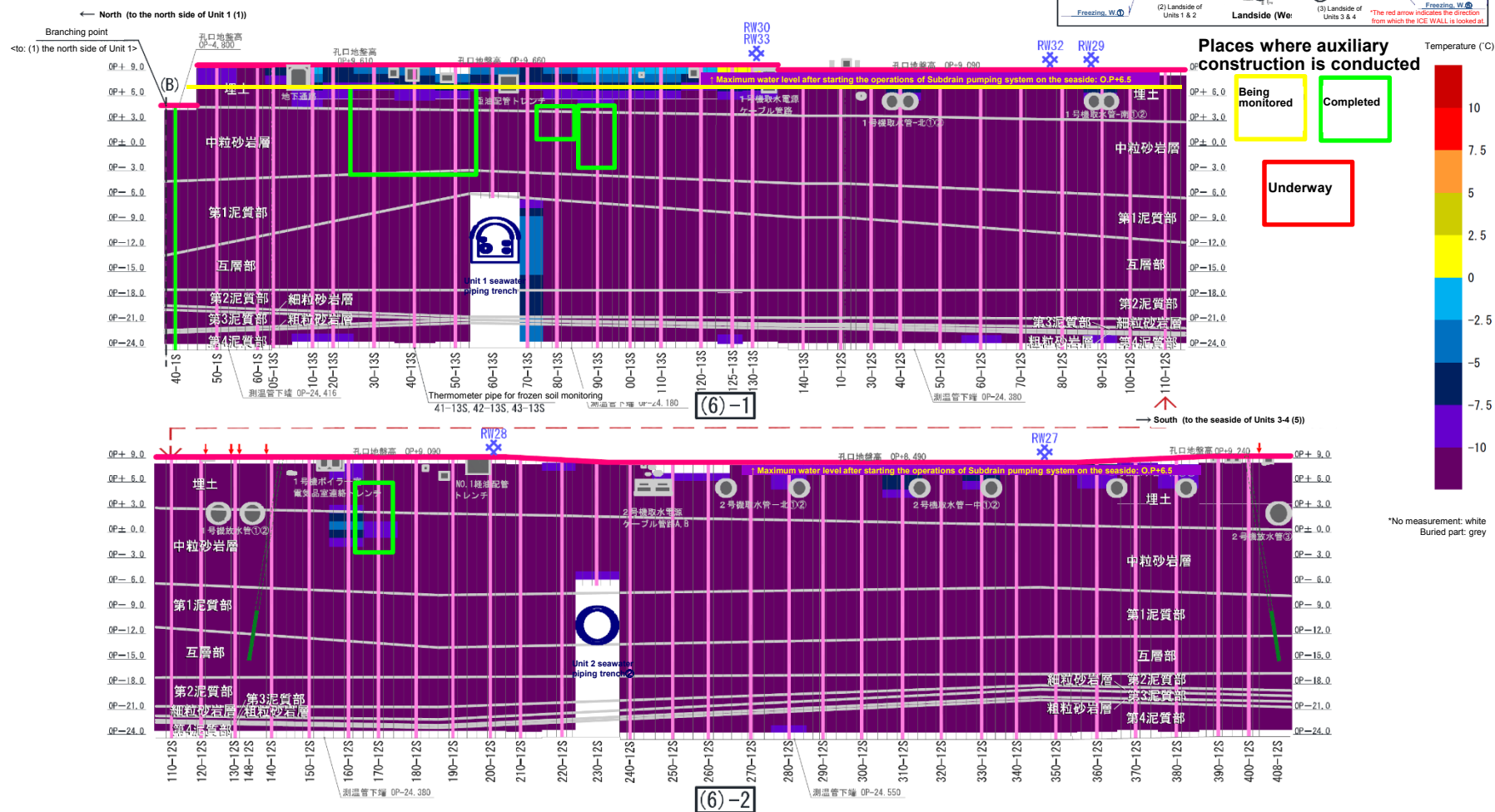
- Thermometer pipe for the outside of frozen soil line
- Thermometer pipe for the inside of frozen soil line
- Diagonally installed thermometer pipe for the soil freezing pipes installed on multiple line
- Thermometer pipe for no freezing areas
- Corner of frozen soil line
- RE (recharge well)
- Ci (medium-grained sandstone layer in the inside of frozen soil line)
- Soil freezing pipes installed on single line (advanced freezing)
- Soil freezing pipes installed on multiple lines (advanced freezing)
- Freezing areas for the seaside and a part of the north side

KEY PLAN



TEPCO

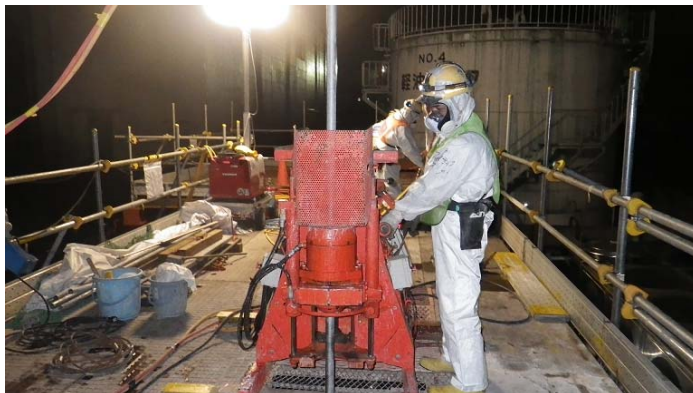
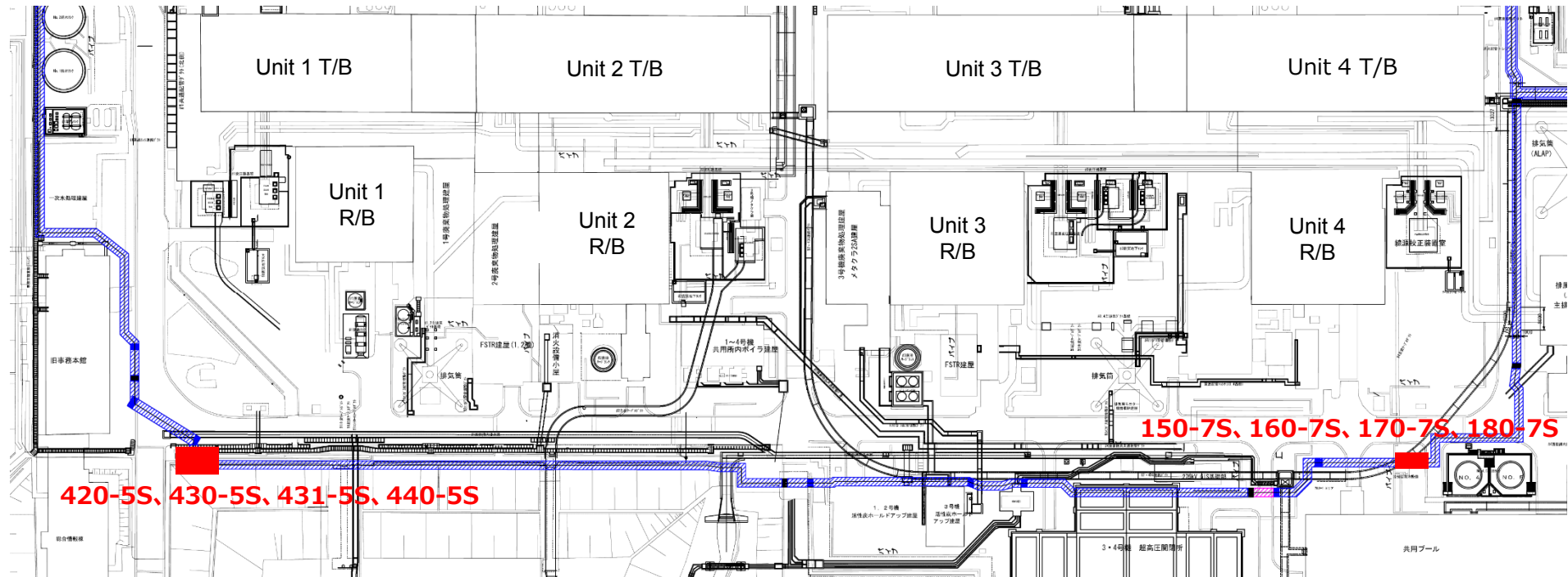
(The temperature data as of 7 a.m. on December 20)



3-1 Auxiliary construction to further freezing the areas where soil freezing began on December 3

(as of Wednesday, December 21) **TEPCO**

To further freezing the areas where soil freezing began on Dec. 3, 2016, auxiliary construction (chemical injection) will be applied to the points where soil temperatures are expected not to go below 0°C a month later.

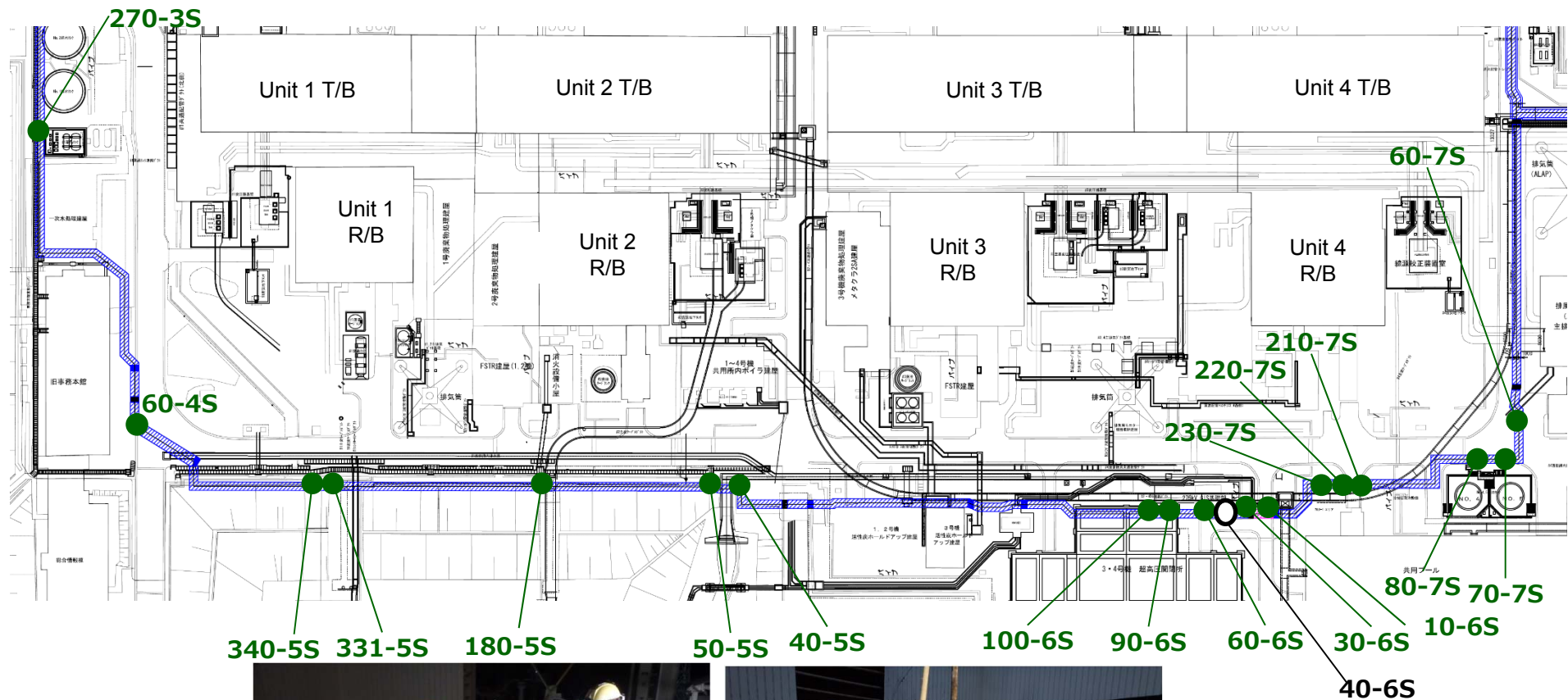


Legend
■ : Completed
■ : Being monitored
■ : In progress
□ : Yet to take place

3-2 Auxiliary construction on the landside except for the areas where soil freezing began on December 3

(as of Wednesday, December 21)

TEPCO



Legend	
●	: Completed
●	: Being monitored
●	: In progress
 	: Yet to take place

3-3 Schedule for auxiliary construction to further freezing the landside (based on the changes of soil temperatures from November 4 to December 8) and its progress (as of Wednesday, December 21)



(Areas where soil freezing began on December 3)

Areas where freezing began	Thermometer pipe	Progress status	December 2016			January 2017			February 2017			March 2017		
West ① Began on Dec. 3	420-5S	In progress												
	430-5S													
	431-5S													
	440-5S													
West ⑤ Began on Dec. 3	150-7S	In progress												
	160-7S													
	170-7S													
	180-7S													

(Other areas)

BLK	Thermom eter pipe	Progress status	December 2016			January 2017			February 2017			March 2017		
5BLK	331-5S	Completed	【2nd Highest Priority】			【Highest priority】→Completed. Currently no points categorized								
	340-5S	Completed				【3rd Highest Priority】→No points categorized								
	180-5S	Completed												
	50-5S	Completed												
	40-5S	Completed												
6 BLK	30-6S	Completed												
	10-6S	Completed												
	40-6S	Yet to be applied												
7 BLK	80-7S	Completed												
	70-7S	Completed												
3 BLK	270-3S	Completed												

* Some schedule changes (ex. moving forward) may occur depending on how auxiliary construction progresses in the areas where soil freezing began on December 3.

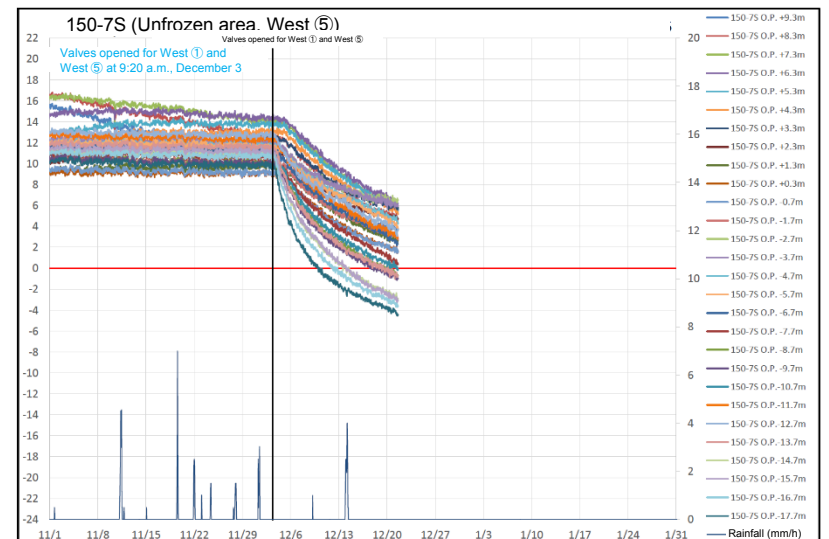
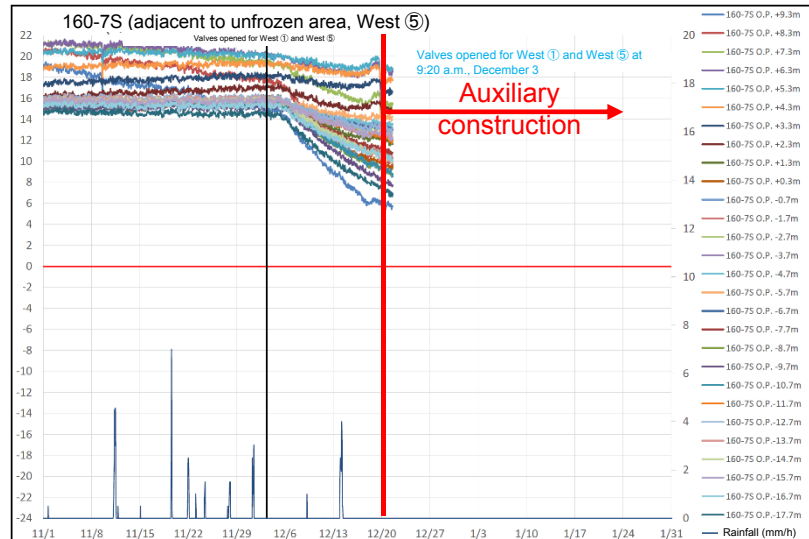
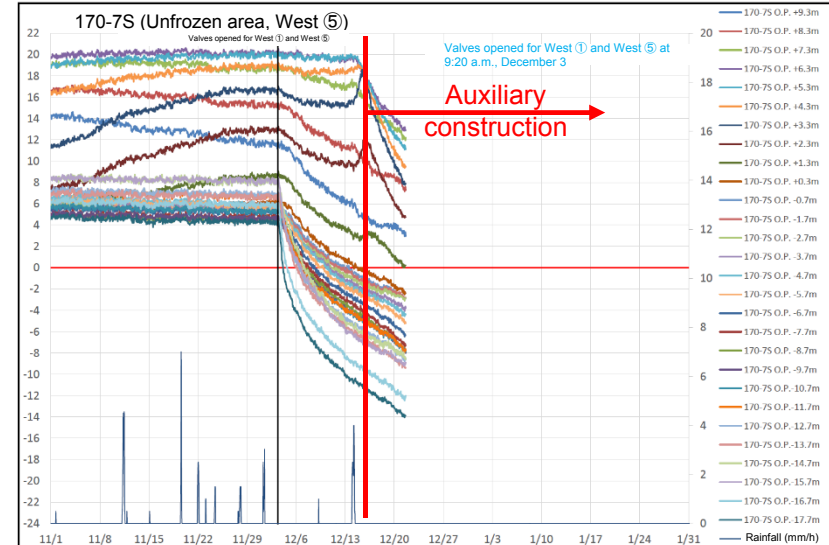
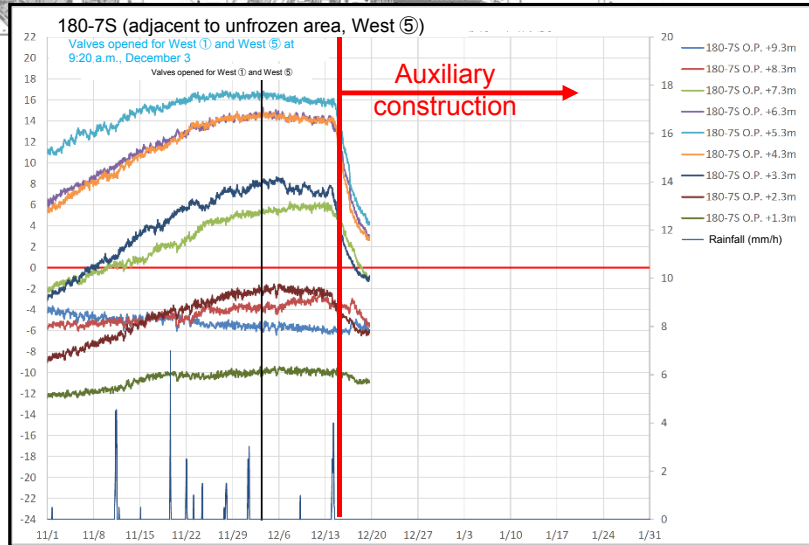
3-4 Auxiliary construction to further freezing the mountainside, soil temperature decrease

(Freezing began on December 3 West⑤)

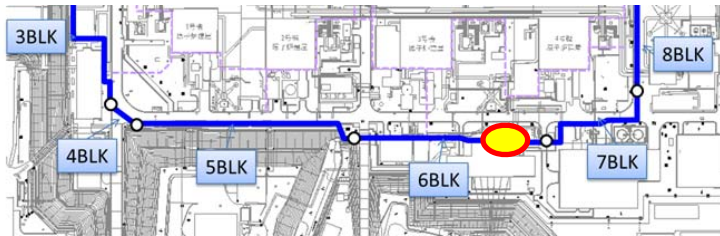
TEPCO



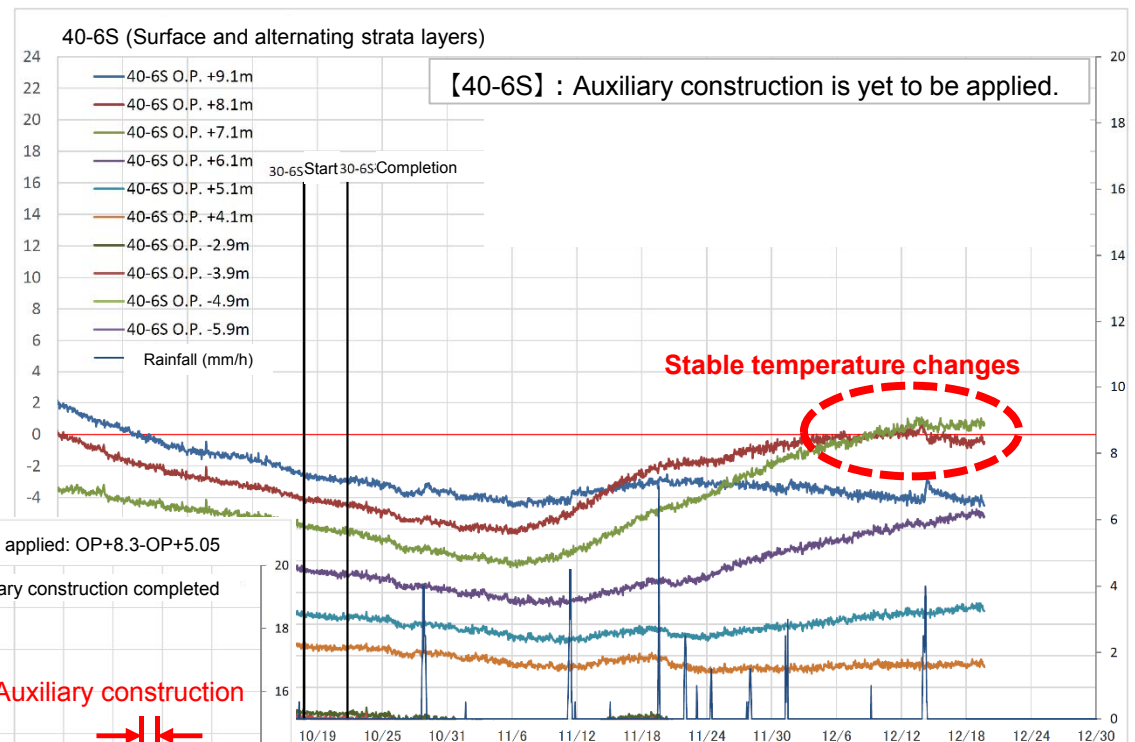
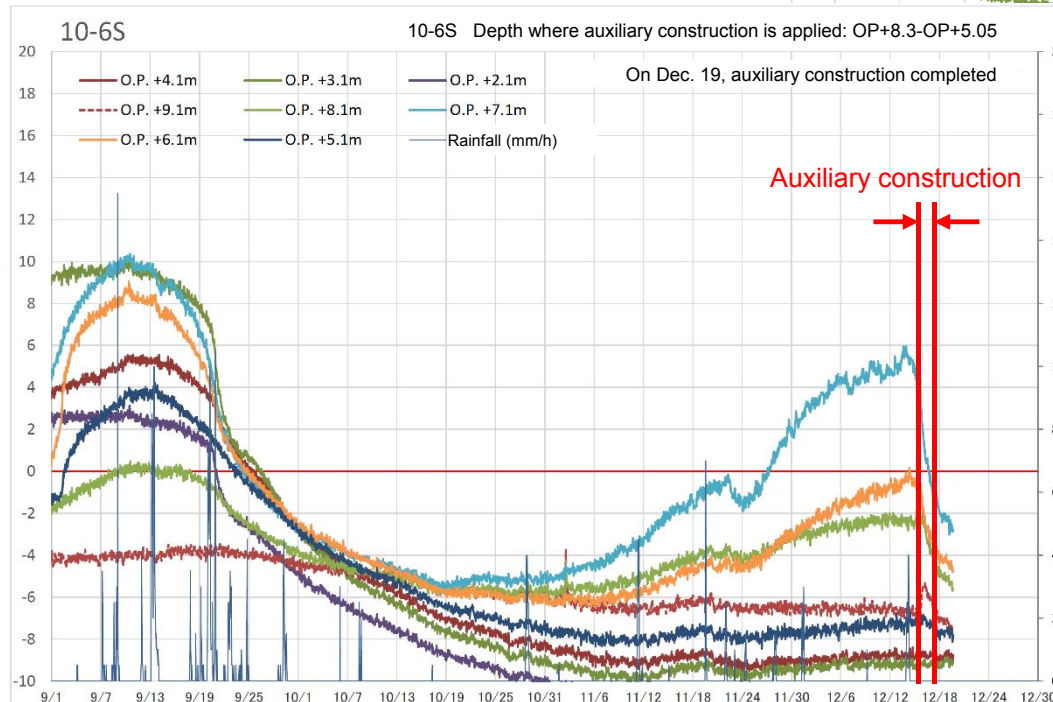
- 【180-7S】: Auxiliary construction is under way. Soil temperatures are decreasing relatively steadily.
- 【170-7S】: Auxiliary construction is under way. Soil temperatures are decreasing relatively steadily.
- 【160-7S】: Auxiliary construction is under way. Soil temperature decrease is being monitored.
- 【150-7S】: Auxiliary construction is yet to be applied. Soil temperatures are decreasing relatively steadily.



3-5 Auxiliary construction to further freezing the mountainside, soil temperature decrease (6BLK)



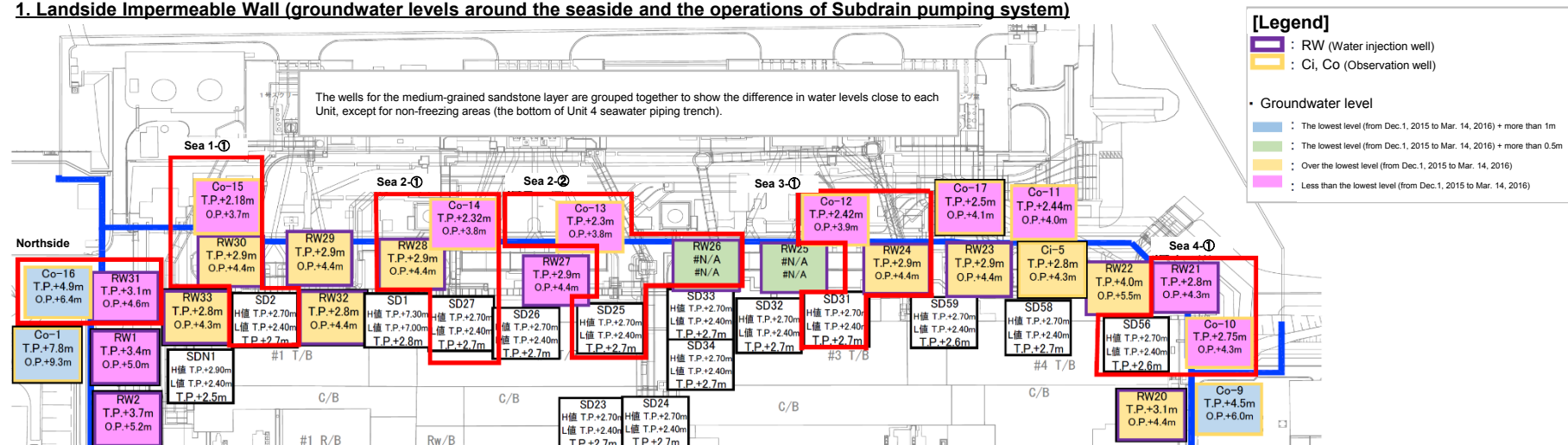
【10-6S】: Soil temperatures went below 0 °C.



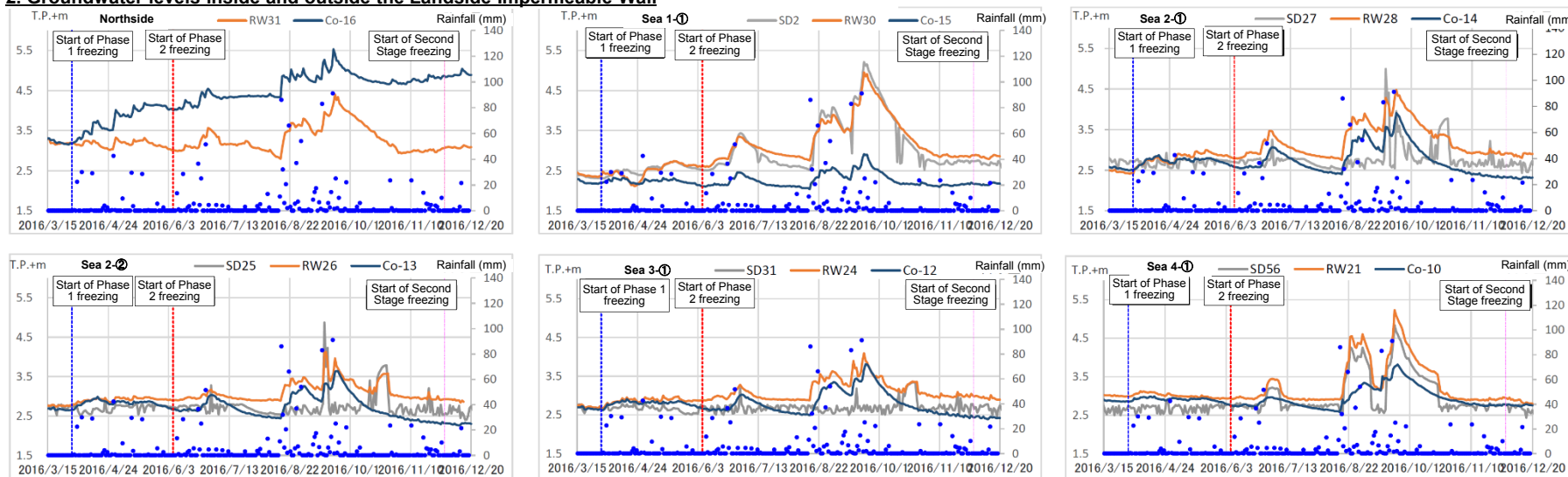
4-1 Groundwater levels and hydraulic heads (in the medium-grained sandstone layer 1 on the seaside)

Monitoring items in an early stage of the ice wall freezing (Second Stage, seaside, water levels in the medium-grained sandstone layer)

1. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)



2. Groundwater levels inside and outside the Landside Impermeable Wall

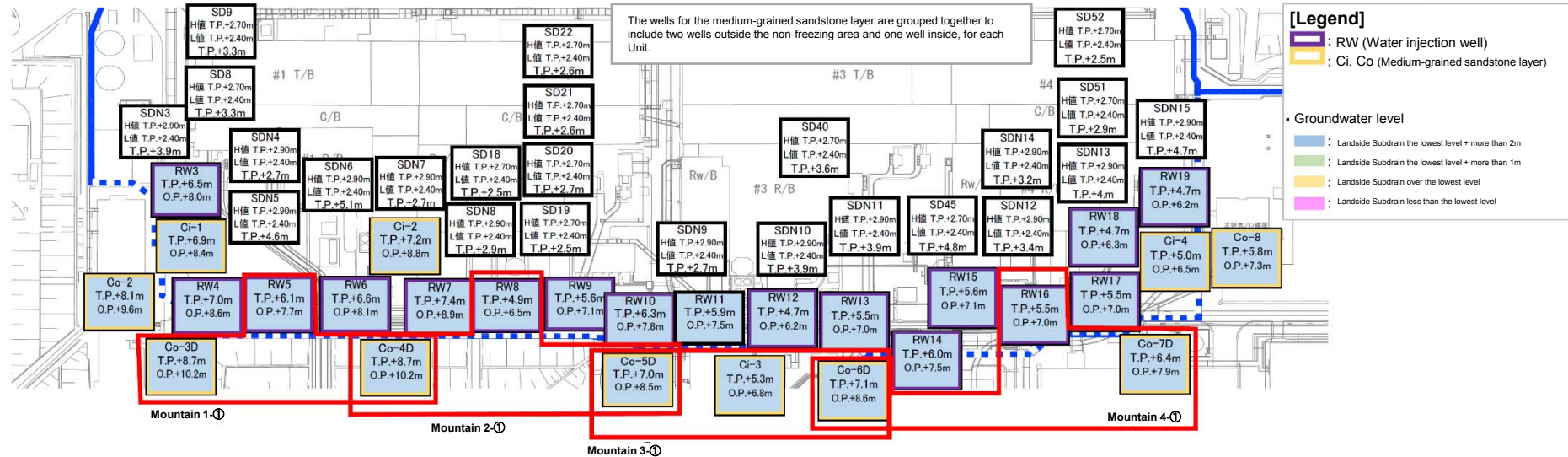


The data of groundwater levels as of 12 p.m. on December 20

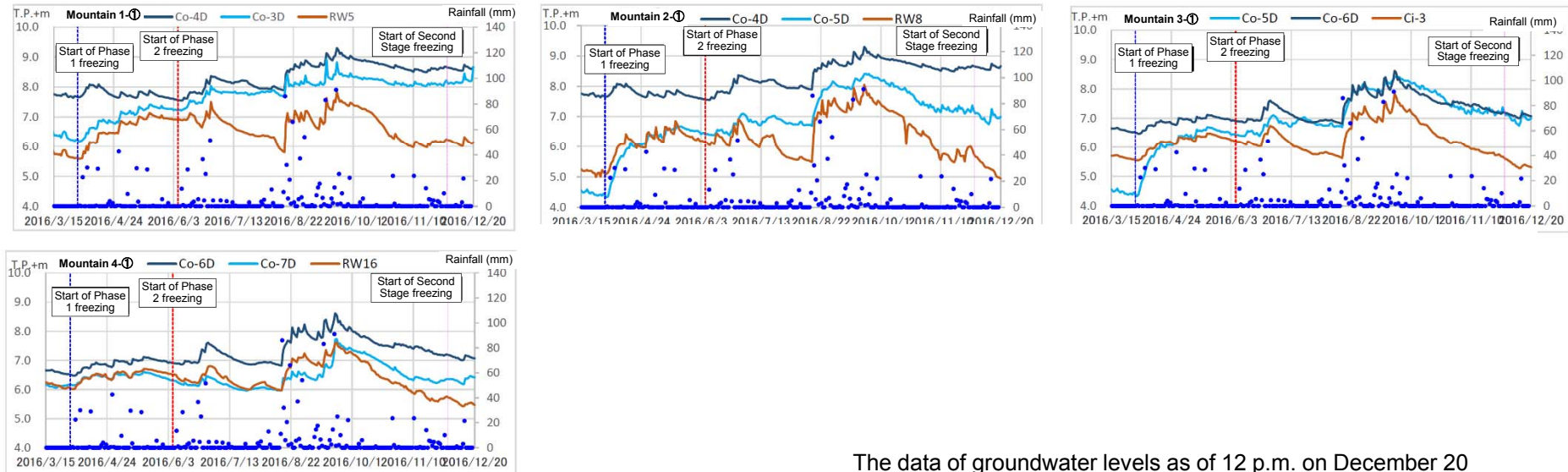
4-2 Groundwater levels and hydraulic heads (in the medium-grained sandstone layer 2 on the landside)

Monitoring items in an early stage of the ice wall freezing (Second Stage, seaside, water levels in the medium-grained sandstone layer)

3. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)



4. Groundwater levels inside and outside the Landside Impermeable Wall



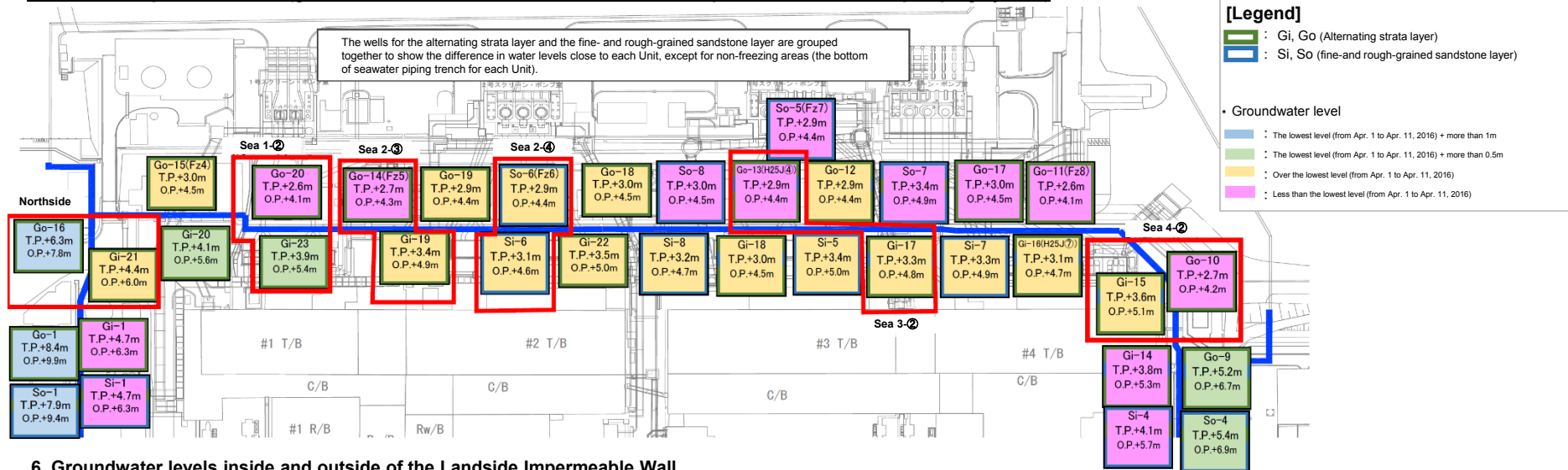
The data of groundwater levels as of 12 p.m. on December 20

4-3 Groundwater levels and hydraulic heads

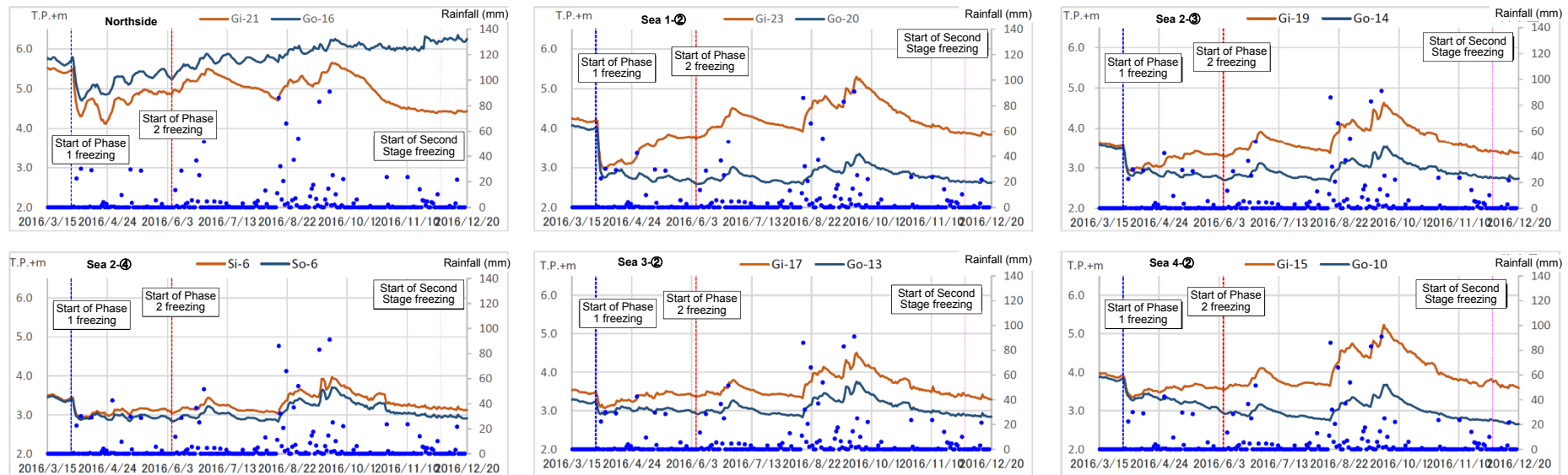
(in the alternating strata layer and the fine- and rough-grained sandstone layer 1 on the seaside)

Monitoring items in an early stage of the ice wall freezing (Phase 1 Stage 1, seaside, water levels in the middle-grained sandstone layer)

5. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)



6. Groundwater levels inside and outside the Landside Impermeable Wall



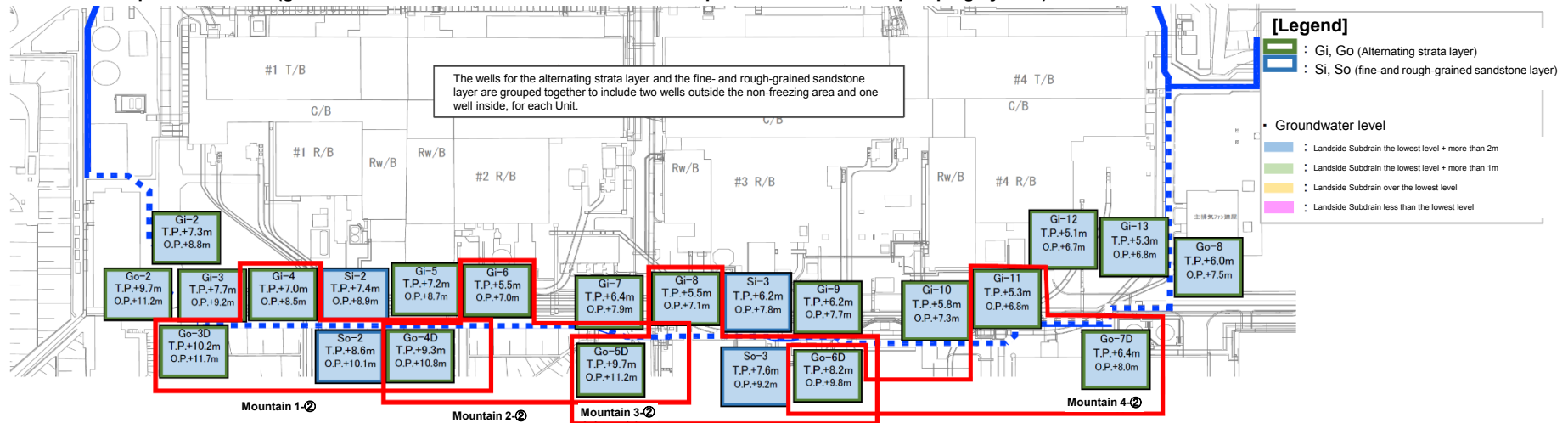
The data of groundwater levels as of 12 p.m. on December 20

4-4 Groundwater levels and hydraulic heads

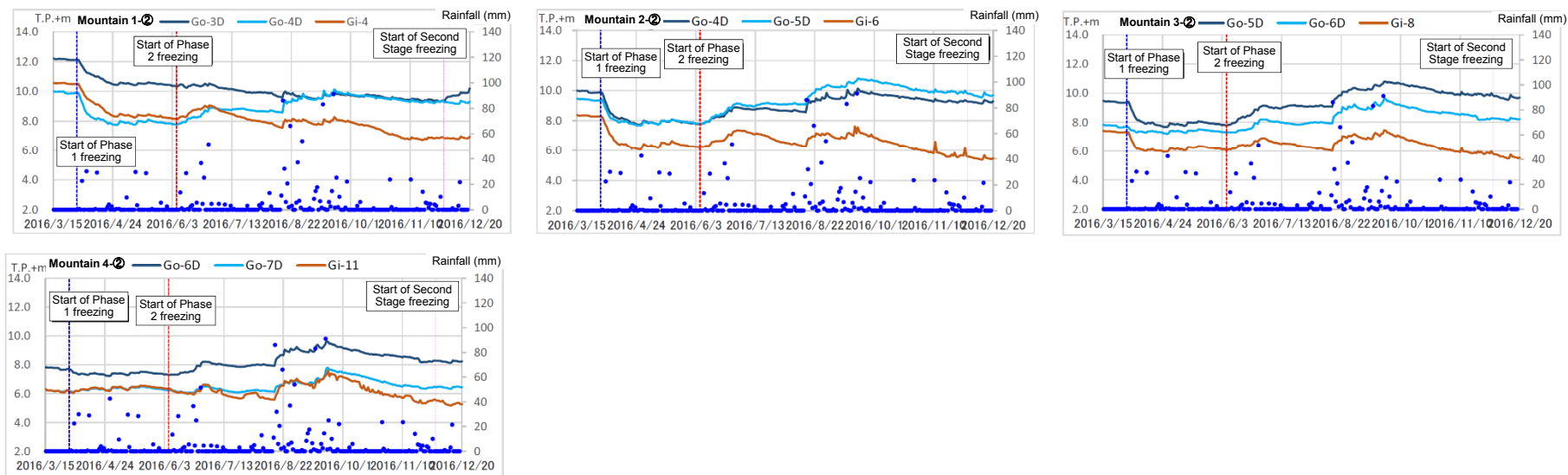
(in the alternating strata layer and the fine- and rough-grained sandstone layer 2 on the landside)

Monitoring items in an early stage of the ice wall freezing (Phase 1 Stage 1, seaside, water levels in the middle-grained sandstone layer)

7. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)

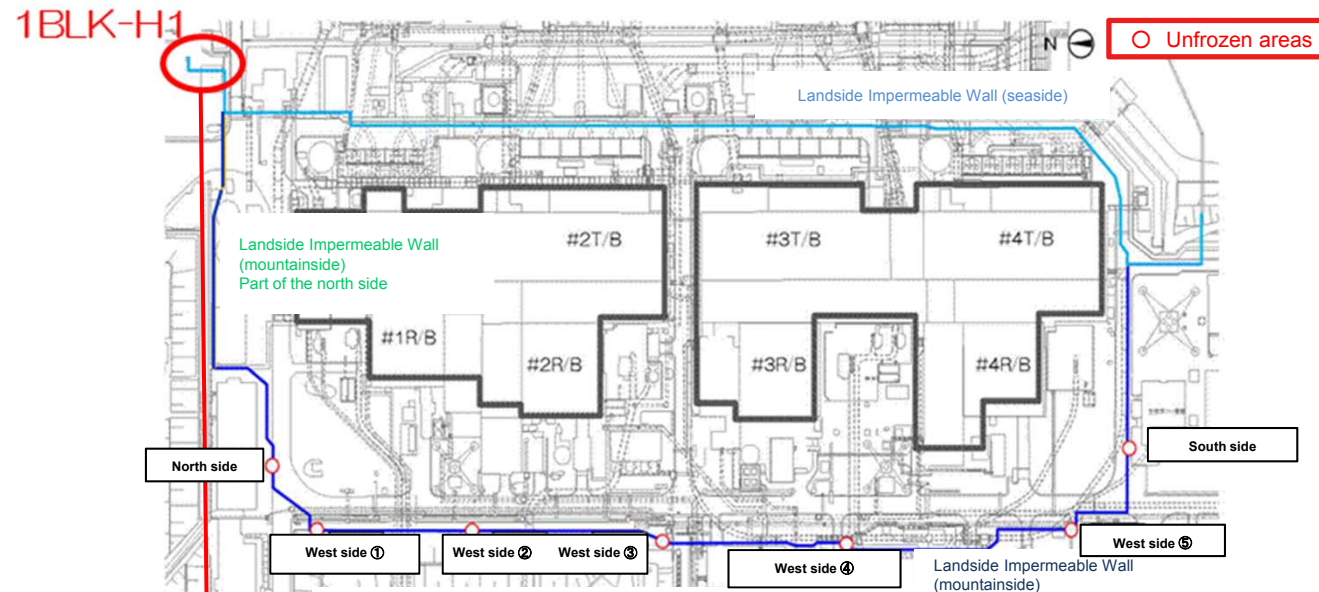


8. Groundwater levels inside and outside the Landside Impermeable Wall

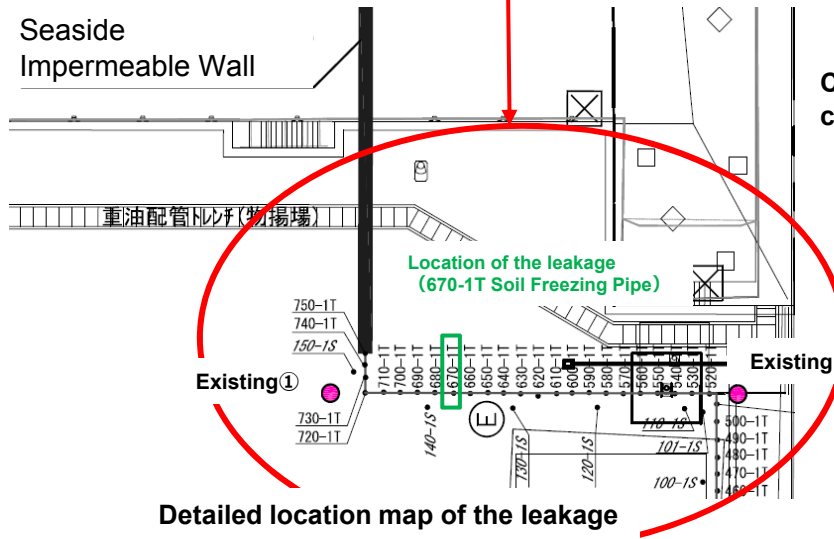


The data of groundwater levels as of 12 p.m. on December 20

5-1 Coolant leakage at 1BLK (1)

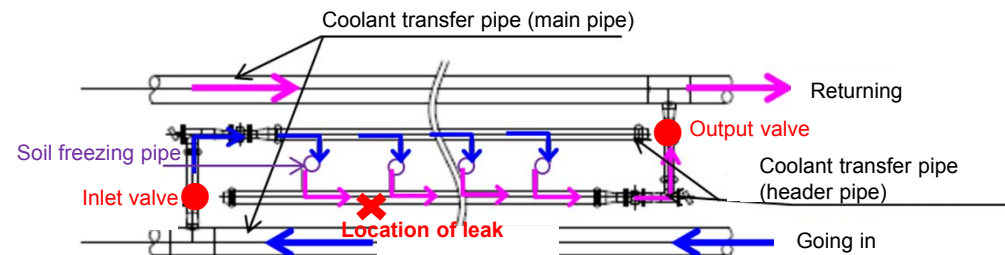


Map of Fukushima Daiichi Nuclear Power Station
Location of the leak



Detailed location map of the leakage

(Current situation)
Coolant supply has been suspended for 28 soil freezing pipes
connected to the header pipe.
(The supply continues for the other soil freezing pipes.)



Piping structure around the location of the leakage (image)

【Incident】

On December 19, 2016, a coolant leak was found around 1BLK-H1, one of the coolant header return pipes for the landside impermeable wall.

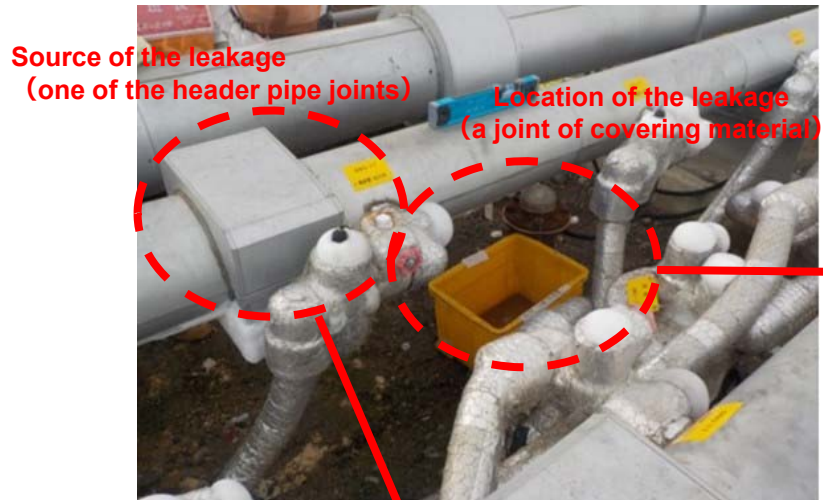
【Probable cause】

Under investigation

【Future action】

- Source of the leakage will be identified by removing insulators surrounding the pipe.
⇒ On Tuesday, December 20, source of the leakage was found at one of the header pipe joints.
- Repair will be carried out after removing coolant from the header pipe, dismantling the joint, and identifying the cause of the leak.

5-1 Coolant leakage at 1BLK (3)



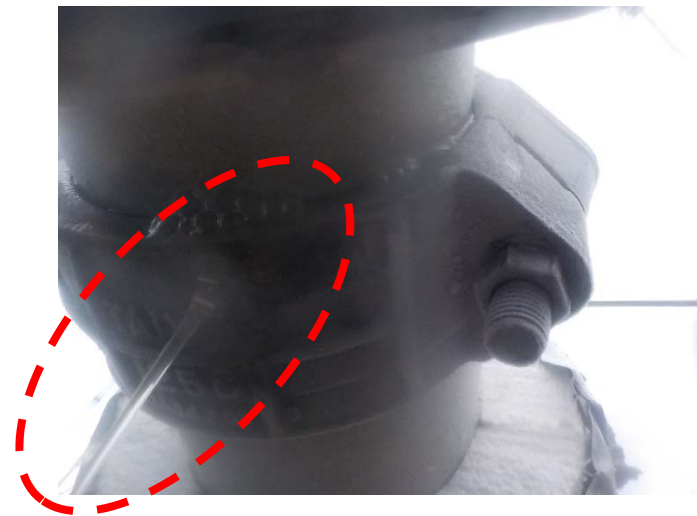
Location of the leakage on December 19
(around Soil Freezing Pipe 670-1T)



Coolant leakage on December 19
(a joint of covering material near the source of the leakage)



Source of the leakage identified on December 20
(one of the header pipe joints)



Leakage confirmed by adding pressure on December 20

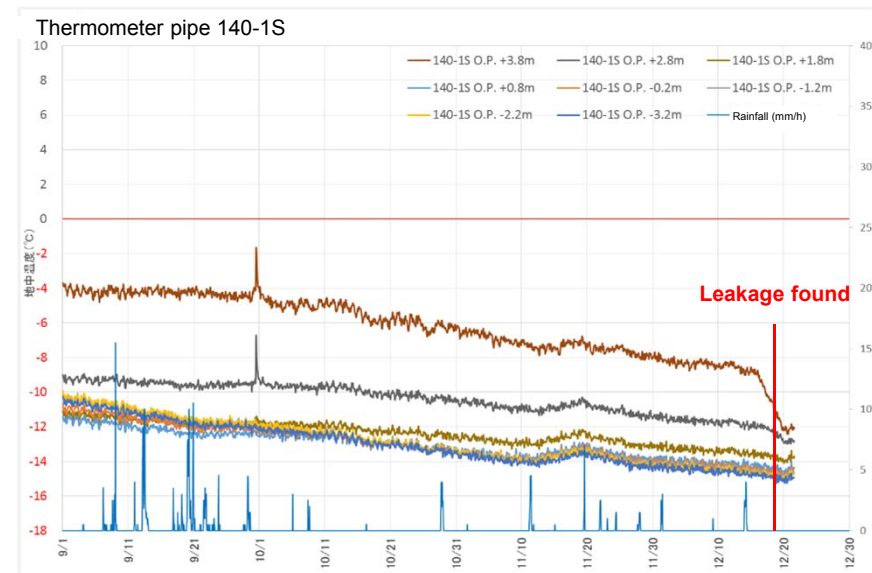
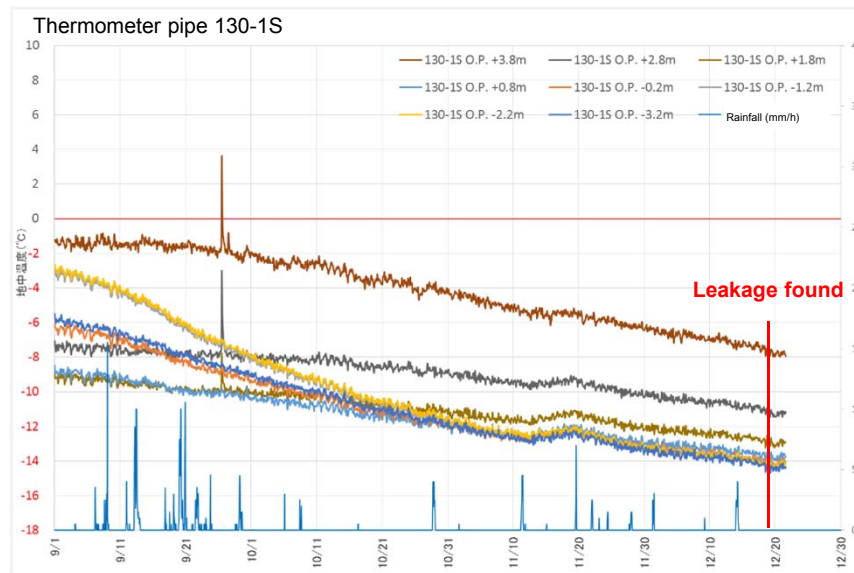
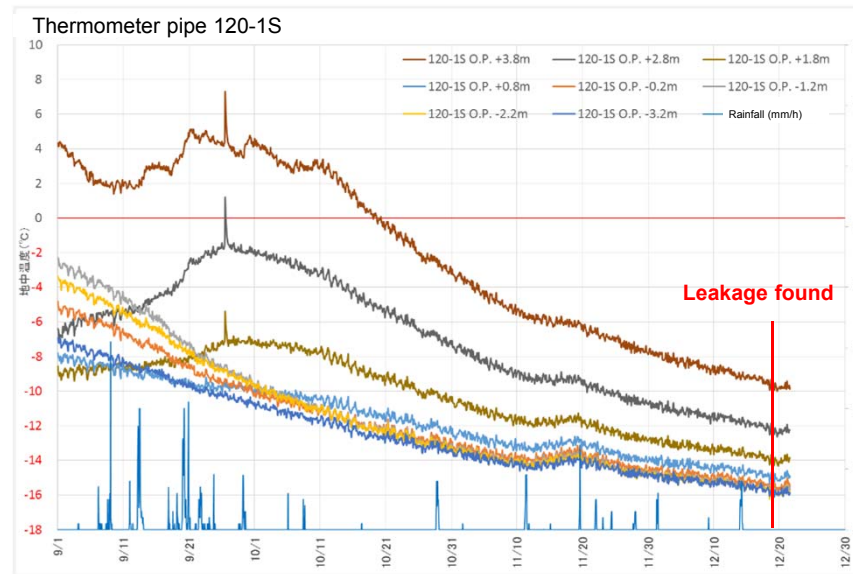
Location of the leakage at 1BLK-H1 header return pipe

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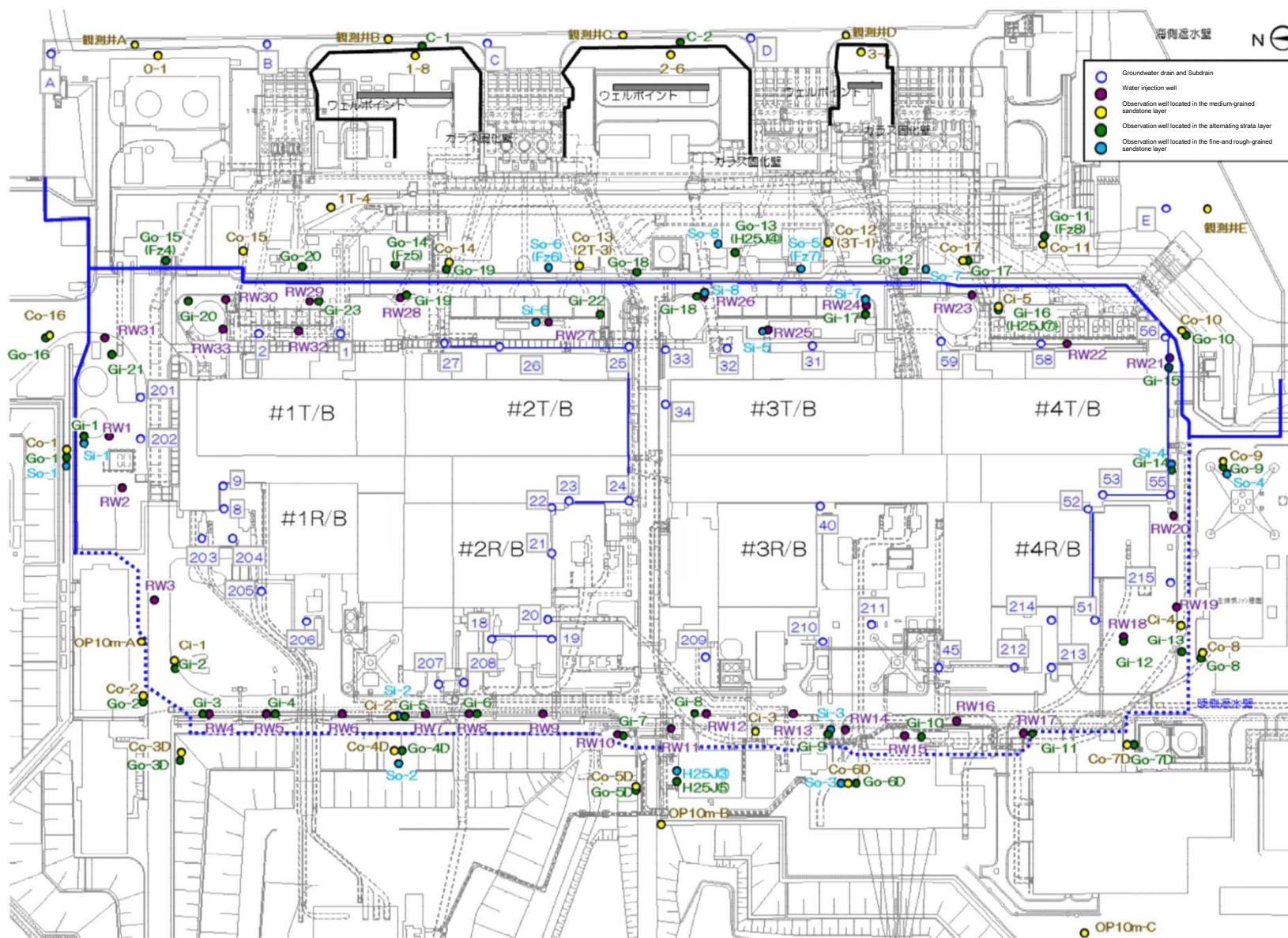
(The temperature data as of 7 a.m. on December 20)



5-1 Coolant leakage at 1BLK (5)



Reference: Location map of groundwater level observation wells



(Reference) Amount of groundwater pumped up from the ground 4m above sea level and changes in groundwater levels of the Landside Impermeable Wall on the seaside and of the reclaimed area **TEPCO**

