


Kvígindisdalur, Arctic Sea Farm B-bottom pre-survey, May 2019



Information client			
Titel	Kvígindisdalur, Arctic Sea Farm. B-bottom pre-survey, may 2019		
Report number	APN-61207.01		
Site name	Kvígindisdalur	Coordinates site	65°34.663 N 24°02.052 V
County	Vesturbyggð	Municipality	Patreksfjörður
MTB-or estimated max biomass	6800 tonn	Site manager/contact	Stein Ove Tveiten
Client name	Arctic Sea Farm		

Biomass/production/status at date of survey			
Biomass at date of survey	0 ton	Feed use	0 ton
Fish type	Salmon	Amount produced	0 ton
Type/time of survey	Mark with X	Comments	
At maximal biomass see kap 7.9	<input type="checkbox"/>		
A follow up survey	<input type="checkbox"/>		
Half maximal biomass	<input type="checkbox"/>		
Survey prior to putting out smolt	<input type="checkbox"/>		
A pre-survey new site	<input checked="" type="checkbox"/>		
Other	<input type="checkbox"/>		
Last following period:			

Results from B-survey iht. NS 9410:2016 (main results)			
Parameters and indexes		Parameters and site status	
Gr. II. pH/Eh	0,00	Gr. II. pH/Eh	1
Gr. III. Sensory	0,37	Gr. III. Sensory	1
GR. II + III	0,19	GR. II+ III	1
Date field work	03.05 2019	Date report	23.07.19
Site status (NS 9410:2016):			1

Report writing and project leader	Snorri Gunnarsson	Signature	
Quality control		Signature	

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Preface

The survey is carried out according to guidelines in NS 9410:2016 which includes evaluation of sediment, faunal investigation and bottom topography. The environmental survey is regulated by § 35 in the Norwegian «akvakulturdriftsforskriften. The survey also fullfills the requirements regarding bottom surveys in the standard ISO 12878.

The primary objective of a B-survey is to fulfil the requirements regarding pre-surveys (forundersøkelse) as they are defined in NS9410:2016. There is a requirement of at least 10 sampling stations within the mooring lines of the fish farm. The estimated max biomass for first generation farmed salmon at the site Kvígindisdalur is 6.800 MTB ton. The methods applied in this pre-survey follow guidelines in chapter 5 (NS6410:216) and fulfil the requirements described in ISO 12878. The survey deviates though from chapter 7.6 in NS9410:2016 regarding sampling. Requirements that samplings stations should be placed just beside the cages or under cages that have been used is not fulfilled. The reason is that this is a new site that has not been used before and cages are not installed at the time of this survey.

The following have participated in the survey:


Snorri Gunnarsson	Akvaplan-niva AS	Prosjektleder.
Snorri Gunnarsson	Akvaplan-niva AS	Feltarbeid. Kart (Olex). Rapport.

The date for sampling at the Kvígindisdalur was done 03.05 2019.

Accredited survey:

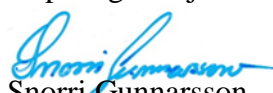
The following parts of the survey are done in accordance to accreditation methods:

Sampling and treatment of sediment samples, analysis of samples and evaluations of the results. It should be pointed out that as Icelandic officials have not set standards regarding different parameters based on samplings at Icelandic conditions so the site characters in this report should be interpreted with that disclaimer in mind.

	Akvaplan-niva AS er akkreditert av Norsk Akkreditering for prøvetaking og faglig vurderinger og fortolkninger, akkrediteringsnummer TEST 079. Akkrediteringen er iht. NS-EN ISO/IEC 17025 Akkrediteringen omfatter bla. NS 9410, NS-EN ISO 5667-19 og NS-EN ISO 16665.
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Akvaplan-niva AS thanks Arctic Sea Farm their personnel for the cooperation during the conductance of this site survey.

Kópavogi 23. juli 2019



Snorri Gunnarsson
Project manager

1 Introduction

The sampling date for the present site survey was the 03.05 2019 and done by Akvaplan-niva AS contracted by Arctic Sea Farm in relation to the companies fish farming activity at the site Kvígindisdalur in Patreksfjörður, Vesturbyggð.

The objective of the B-survey is to document the environmental condition of the local impact zone of the fish farm according to NS 9410:2016 (and ISO 12878) which includes condition of the seabed, faunal evaluation and bottom topography registration.

The survey gives an estimate and evaluation of the site condition with regard to organic load and suitability assessment of the site for fish farming activity.

Figure 1 shows map of the fjord system Vestfirðir where the site Kvígindisdalur is placed.

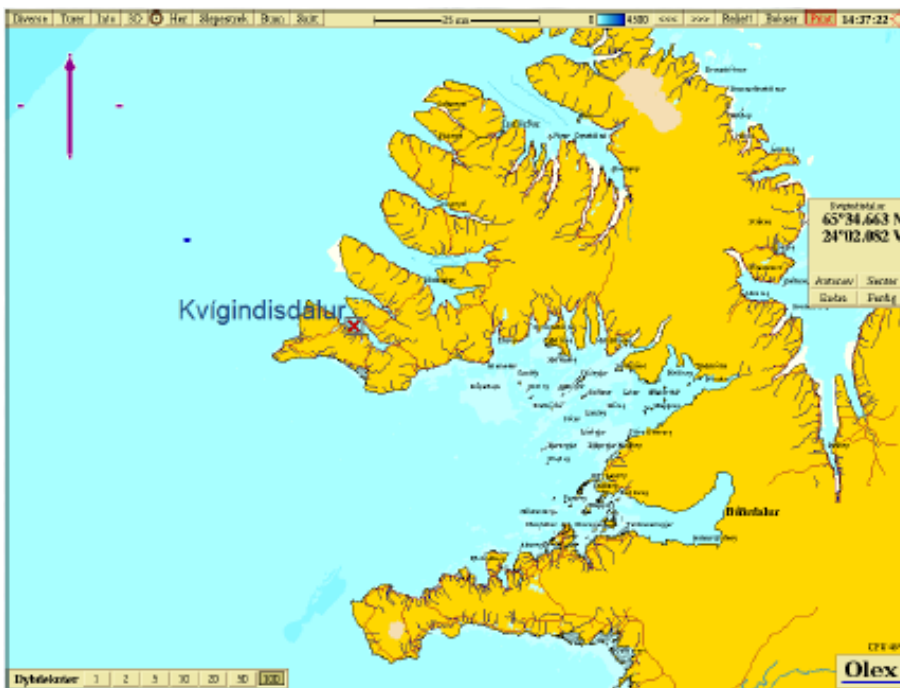


Figure 1. An overview map with the Kvígindisdalur site marked by its name.

2 Professional program and methods

Environmental monitoring of the impact from the fish farming activities on the seabed is a standardised system. All fish farming sites in the sea are to be regularly assessed. The methods for monitoring is in Iceland based on description in the ISO 12878 standard and we also follow the methodology described in the NS 9410:2016. The Icelandic Umhverfisstofnun can also set forward specific requirements regarding frequency of samplings for different fish farming sites that can overrule the requirements in the above mentioned standards.

The B-survey is a trend study of the benthic conditions at or in close proximity to the fish farming site (local impact zone). Sediment is collected by use of grab (min 250 cm²). Each grab sample is investigated with regard to three observation types of benthic characters; faunal parameters, chemical parameters (pH and redox-potential) and a sensory evaluation (gas bobbles, smell, texture, colour and the thickness of the precipitated slam layer in the sediment). The different benthic parameters are given a character on the scale from 1 to 4, according to the scale of the impact on the benthic conditions from organic load, see criteria in table 1. The number of sampling stations are decided based on the estimated max standing biomass for the given year class for farmed fish at the site and it is the weighted average for all the sampling stations that gives the sites condition.

Table 1. Frekvens for B-undersøkelse i lokalitetens anleggssone i forhold til lokalitetstilstand på lokaliteten.

Site condition at the time of sampling	Overvåkingsfrekvens for B-undersøkelse (NS 9410:2016)
1-very good	At next max biomass
2-good	Prior to putting nex generation into sea and again at next max biomass.
3-bad	Prior to putting next generataion into sea. Based on the site condition prior to putting next generation into sea: <ul style="list-style-type: none">- Condition 1 – next site survey at next max biomass- Condition 2 – next site survey at next halv max biomass and at max biomass- Condition 3 – next site survey at next halv max biomass and at max biomass. Some conditions should apply for farming of next generation at the site If any of the samples result in character 4 it is a sign of overload.
4-very bad	Overload

2.1 Field equipment

The following field equipment was used during the site survey:

Grab: Van Veen grab (0,025 m²)

Sieve 1 mm: Akvaplan-niva

pH meter: Electrode, YSI Professional Plus

Redox-meter: Electrode, YSI Professional Plus

Position determination– Garmin GPS mapping tool.

Digital camera

3 Site description and bottom topography

3.1 Info site operation

The Kvígindisdalur site is a new site where there has not been any prior fish farming activity. The planned fish farm at the site will be a two frame mooring system, each frame having 5 cages total 10 cages each with 160 m circumference. The planned timing for putting the first smolts into sea is May/June 2019.

Table 2 shows the production and feed usage for the present and past generations.

Table 2. Production and feed usage at the site Kvígindisdalur, data is based on info given from the fish farmer.

Generation of fish (G)	Production (ton)	Feed usage (ton)
Present generation	0 ton (new site)	0 ton (new site)

3.2 Present and past site surveys

Data from previous not available as this is the first time with fish put into fish cages on the site.

3.3 Dispersing current

Measurement of dispersing current has not been done at the site so we use data from current measurements at 15 m depth (Heggem, 2018). Dominating current (15 m) is in direction north-west (330-345 degrees) with a small counter current to south-east (150 degrees). Average current speed is measured to be 5.2 cm/s. Highest current speed is measured to be 23 cm/s and 3.4 % of the measurements are < 1 cm/s.

3.4 Position of sampling stations

Description of the stations in the survey is given in figure 2 and table 3. Positioning of the stations was chosen based guidance and perimeters described in NS 9410:2016 and the bottom topography and planned configuration of the farm. The farming company has informed that there has not been any previous farming activity at the site. The planned fish farming site is to be placed in the fjord where the bottom depth is the range from 35 – 57 m, with the shallowest parts in the south-west part (closest to land) and more depth in direction into the middle of the fjord. The placement of sampling stations were chosen to give a good picture of the whole local impact zone. It is important to evaluate the status in both the deeper and shallower parts of the local impact zone of the fish farm. The sampling stations had a depth varying from 51 m (st. 5) to 57 m. The placement of the sampling stations is regarded to be in accordance with the descriptions for survey of local impact zone given in NS 9410:2016.

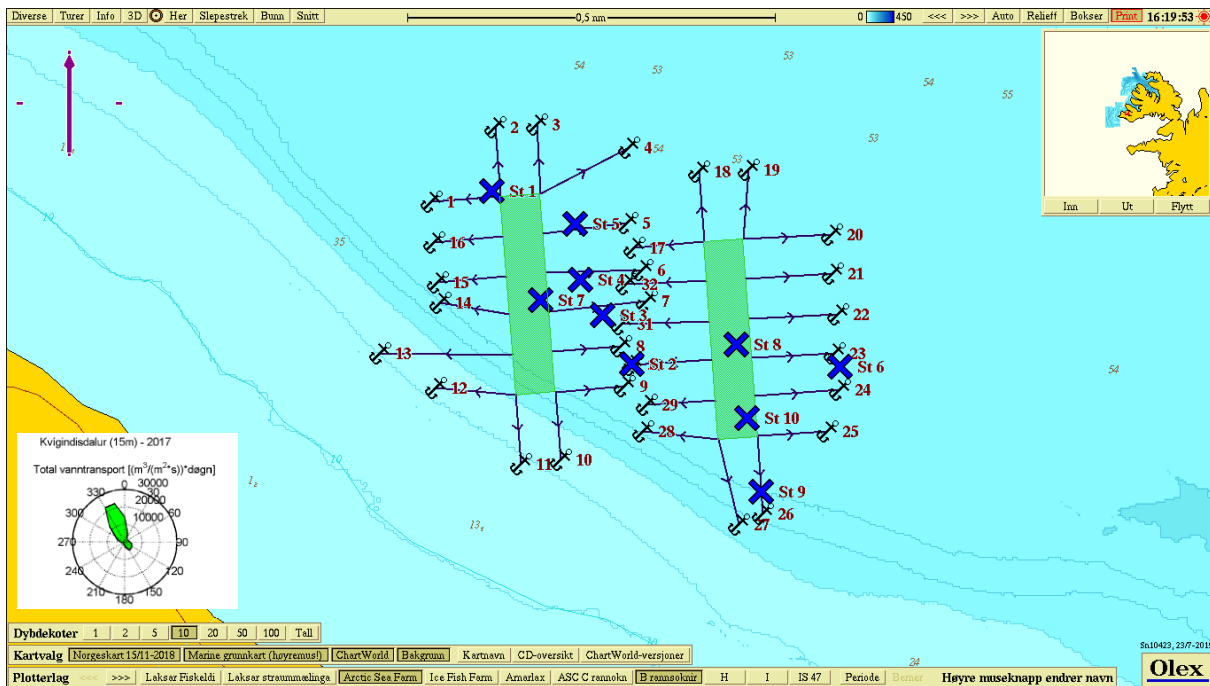


Figure 2. Chart showing depths at the site Kvígindisdalur. Sampling stations st. 1 – 10 are marked with color codes that describe the condition according to NS 9410:2016, chapter 7.11. Color codes: Blue = very good condition, green = good condition, yellow = bad condition, red = very bad condition. (Current rose from Heggem, 2018)

Table 3. Placement and depth of the sampling stations in the B-survey.

Station number	North	Vest	Depth (m)
St 1	65°34,863	24°02,684	57,2
St 2	65°34,628	24°02,224	57,3
St 3	65°34,694	24°02,320	56,8
St 4	65°34,743	24°02,394	56,4
St 5	65°34,818	24°02,411	51,3
St 6	65°34,624	24°02,541	57,0
St 7	65°34,715	24°02,526	57,1
St 8	65°34,654	24°01,881	56,5
St 9	65°34,455	24°01,798	48,5
St 10	65°34,555	24°01,847	56,8

4 Results

Results for the different parameters are given in Table 4. A complete filled sampling sheet with calculations for each parameter is attached in appendix.

Table 4. Results from the classifications of the local impact zone of the fish farm.

Parameter	Condition
Group II - parameters (pH/Eh)	1
Group III – parameters, (sensory)	1
Group II + III – parameters (middelveirdi)	1
Site condition	1

There were collected valid sediment samples at all stations in the first grab taken except for station 3 (3 grabs needed) and station 5 (2 grabs needed). This indicates that in general there is soft bottom in the whole local impact zone. The sediment type consisted mainly of clay and silt. For the group I and II parameters, all ten station had conditions 1 «very good». For sensory parameters (group III) all stations had condition 1 «very good» except station 8 which had condition 2 «very good». For combined parameters I, II and III (animals, pH/redox and sensory) all stations had condition 1 «very good». Animals were present in all samples.

5 Conclusion

Based on the criteria given in NS 9410:2016 the fish farming site has been assigned a site condition 1 «Very Good» at the date of sampling. A total of 13 samples were taken with Van Veen grab (0,025 m²), divided on 10 stations placed around the ten cages that are planned to be use at the site. All ten stations were assigned condition 1 «very good».

Measurement of dispersing current has not been done at the site so we use data from current measurements at 15 m depth (Heggem, 2018). Dominating current (15 m) is in direction north-vest (330-345 degrees) with a small counter current to south-east (150 degrees). Average current speed is measured to be 5.2 cm/s. Highest current speed is measured to be 23 cm/s and 3.4 % of the measurements are < 1 cm/s.

The planned timing for putting the first smolts into sea at Kvígindisdalur is May/June 2019. The results from the study indicate that in general there is soft bottom in the whole local impact zone.

The site is assigned a condition factor 1 "Very good" according to calculations based on methodology described in NS 9410:2016 and sample sheet Table B.1 and B.2 (se chapter 7 Appendix).

6 References

Forskrift om drift av akvakulturanlegg (akvakulturdriftsforskriften) §§ 35 og 36.

Heggem, T. 2018. Arctic Sea Farm hf, lokalitetsrapport Kvígindisdalur. Akvaplan-niva AS rapport nr. 9170.02. 16 s.

ISO 5667-19:2004. Guidance on sampling of marine sediments.

ISO 12878:2012. Environmental monitoring of the impacts from marine finfish farms on soft bottom..

Norsk Standard NS 9410:2016. Miljøovervåking av bunnpåvirkning fra marine akvakulturanlegg.

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7 Appendix:

7.1 Sheet (B.1 og B.2) NS 9410:2016


Prøveskjema B.1														
Firma:		Arctic Sea Farm						Dato:		03.05 2019				
Lokalitet:		Kvigindisdalur						Lokalitetsnr:						
Prøvetakingsansvarlig:		Snorri Gunnarsson												
Gr	Parameter	Poeng	Prøvepunkt										Indeks	
	Bunntype: B (bløt) eller H (hard)		1	2	3	4	5	6	7	8	9	10	B%	H%
			B	B	B	B	B	B	B	B	B	B	100	0
I	Dyr > 1mm	Ja (0) Nei (1)	0	0	0	0	0	0	0	0	0	0		
II	pH	verdi	7,6	7,7	7,7	7,6	7,6	7,7	7,6	7,7	7,6	7,6		
	Eh (mV)	ORP	47	64	-20	25	70	73	87	-24	57	74		
		med ref. verdi	247	264	180	225	270	273	287	176	257	274		
	pH/Eh	fra figur	0	0	0	0	0	0	0	0	0	0	0,00	
	Tilstand prøve			1	1	1	1	1	1	1	1	1	1	
Tilstand, gruppe II			1	Buffer-temp 10,0 C			Sjø-temp 4,6 C			Sediment-temp 3,6 C				
pH sjø		8,1	ORP sjø 67 mV			Eh sjø 267 mV			Referanse-elektrode 200 mV					
III	Gassbobler	Ja (4) Nei (0)	0	0	0	0	0	0	0	0	0	0		
	Farge	Lys/grå (0)	0	0	0	0	0	0	0	0	0	0		
		Brun/sort (2)									2			
	Lukt	Ingen (0)	0	0	0	0	0	0	0	0	0	0		
		Noe (2)									2			
		Sterk (4)												
	Konsistens	Fast (0)	0	0	0	0	0	0	0	0	0	0		
		Myk (2)												
		Løs (4)												
	Grabb- volum (v)	v < 1/4 (0)										0	0	
1/4 < v < 3/4 (1)				1				1		1				
v > 3/4 (2)		2	2		2	2		2						
Tykkelse på slamlag	t < 2 cm (0)	0	0	0	0	0	0	0	0	0	0	0		
	2 < t < 8 cm (1)													
	t > 8 cm (2)													
Sum			2,0	2,0	1,0	2,0	2,0	1,0	2,0	5,0	0,0	0,0		
Korrigeret (**0,22)			0,4	0,4	0,2	0,4	0,4	0,2	0,4	1,1	0,0	0,0	0,37	
Tilstand prøve			1	1	1	1	1	1	1	2	1	1		
Tilstand gruppe III			1											
Middelverdi gruppe II og III			0,2	0,2	0,1	0,2	0,2	0,1	0,2	0,6	0,0	0,0	0,19	
Tilstand prøve			1	1	1	1	1	1	1	1	1	1		
Tilstand gruppe II og III			1											
pH/Eh														
Korr.sum														
Indeks														
Middelverdi														
< 1,1													1	
1,1 - <2,1													2	
2,1 - <3,1													3	
≥3,1													4	
LOKALITETSTILSTAND:												1		
Grabb ID		K-22												
pH / Eh ID		Ysi professional plus												
												side 1 av 2 sider		



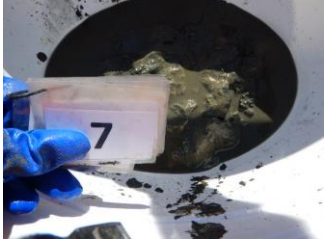
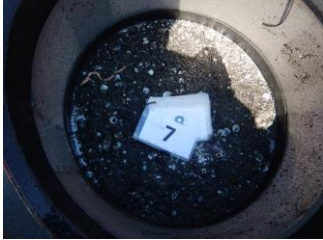
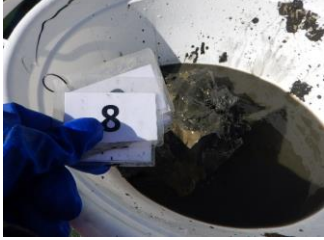





Prøveskjema B.2

Firma:	Arctic Sea Farm					Dato	03.05 2019				
Lokalitet:	Kvígindisdalur					Lokalitetsnr:	0				
Prøvetakingsansvarlig:	Snorri Gunnarsson										

Prøvepunkt	1	2	3	4	5	6	7	8	9	10
Dyp (m)	55	57	57	56	51	57	57	57	49	57
Antall forsøk	1	1	3	1	2	1	1	1	1	1
Bobling (i prøve)	No	No	No	No	No	No	No	No	No	No
Sedimenttype	Leire	X	X	X	X	X		X	X	X
	Silt	X	X	X	X	X	X	X	X	X
	Sand								X	
	Grus									
	Skjellsand						X			
Fjellbunn										
Steinbunn										
Pigghuder, antall										
Krepsdyr, antall										
Skjell, antall			>50	>10	>10				>10	>10
Børstemark, antall	>50	>5	>5	>5	>10	>10	>5	>5	>5	>10
Andre dyr, total antall										
Beggiatoa										
För										
Fekalier										
Kommentar	En del sorte tare rester alle prøver untatt prøver 6 og 9.									
Grabb	Areal [m²]	0,025			Grabb ID	K-22				
Signatur prøvetakingsansvarlig:						side 2 av 2 sider				

7.2 Pictures of samples at Kvígindisdalur

<p><i>St 1</i></p>		
<p><i>St 2</i></p>		
<p><i>St 3</i></p>		
<p><i>St 4</i></p>		<p>NA</p>
<p><i>St 5</i></p>		

<i>St 6</i>		
<i>St 7</i>		
<i>St 8</i>		
<i>St 9</i>		
<i>St 10</i>		

7.3 Bottom topography and 3D view

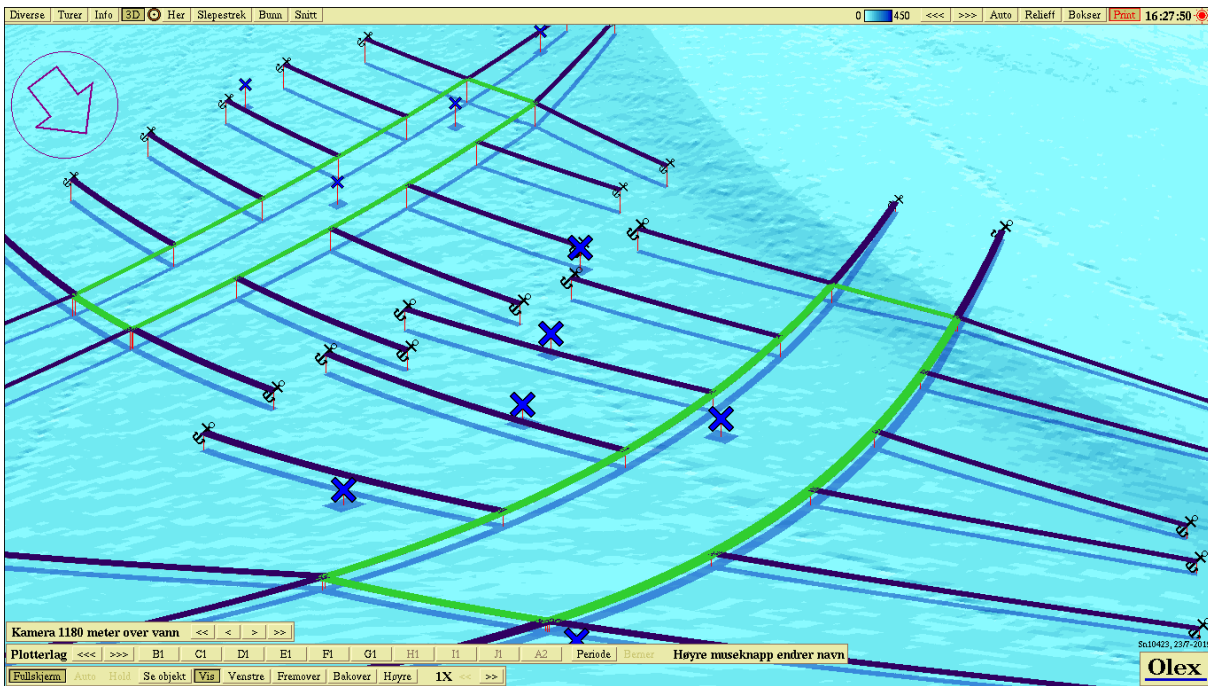


Figure 3. Showing bottom topography 3D at Kvígindisdalur with each station numbered according to info in figure 2 and Table 4.