Locks Pre-Tender Meeting

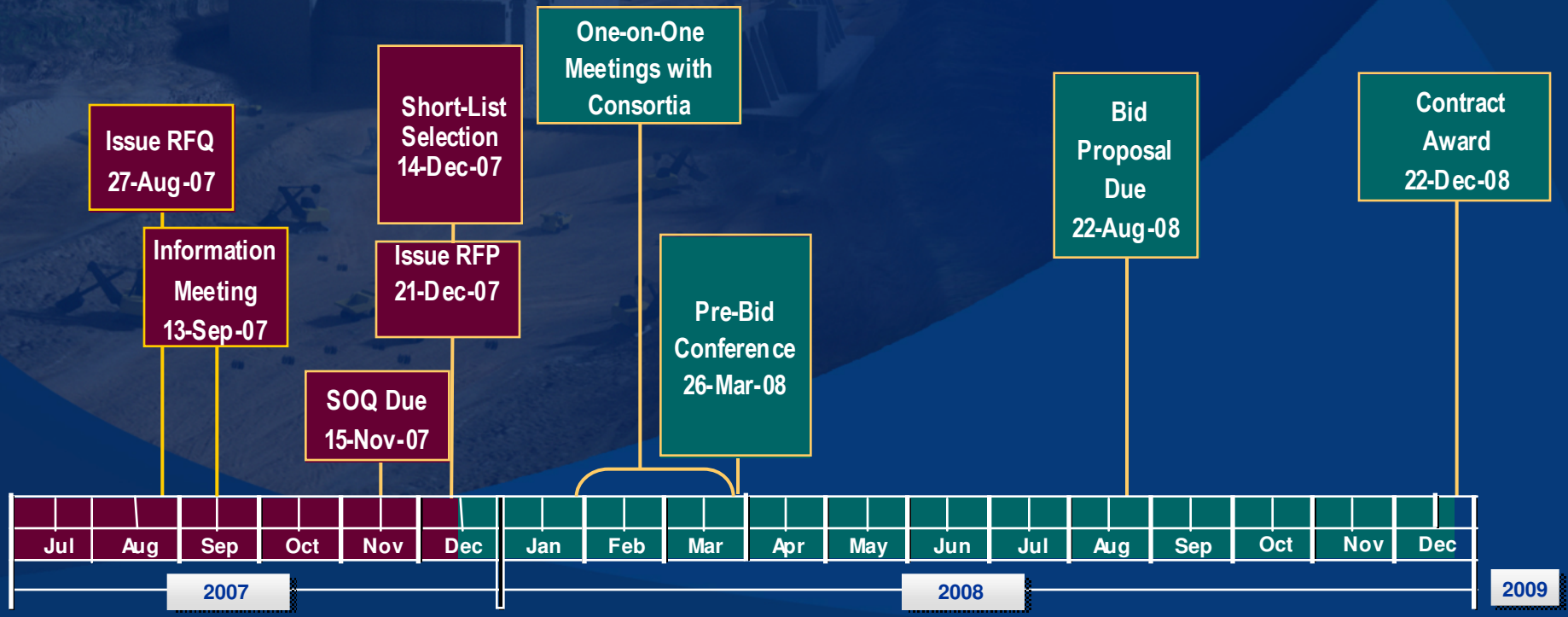
26Mar08

AGENDA

- Status of the process
- Headings of changes included in amendments 1 – 4
- Instructions to Tenderers Vol. I, Part I
- Key Changes Amendment # 5
- Geotechnical/Geological Investigations
- LOCKS RFP – Seismic Design Criteria
- Break
- Questions and Answers

Status

- Conducted the site visits
- Attended the individual meetings
- Answered more than 300 questions
- Issued 5 amendments



Amendment # 1

- Geotechnical Reference and Plates. Available in DVD format

Amendment # 2

- Vol. I, Part 1, Paragraph 8.a Improper contacts
- Vol. I, Part 1, Paragraph 8.b Meetings between Consortia and ACP
- Other minor changes throughout the RFP document

Amendment # 3

- Vol. I, Part 1, Paragraph A-5. Point of contact and coordination for visit to CNR laboratory
- Vol. I, Part 1, Paragraph A-8, Tender documents, ACQUISITION REGULATION OF THE PANAMA CANAL AUTHORITY – Art. 89C
- Vol. I, Part 1, Paragraph C-9, Format of tender, include electronic version of the financial proposal in the same envelope that contains the hard copy version
- Volume II, Part 1, Part 2 and Vol. III Part 3 various sections

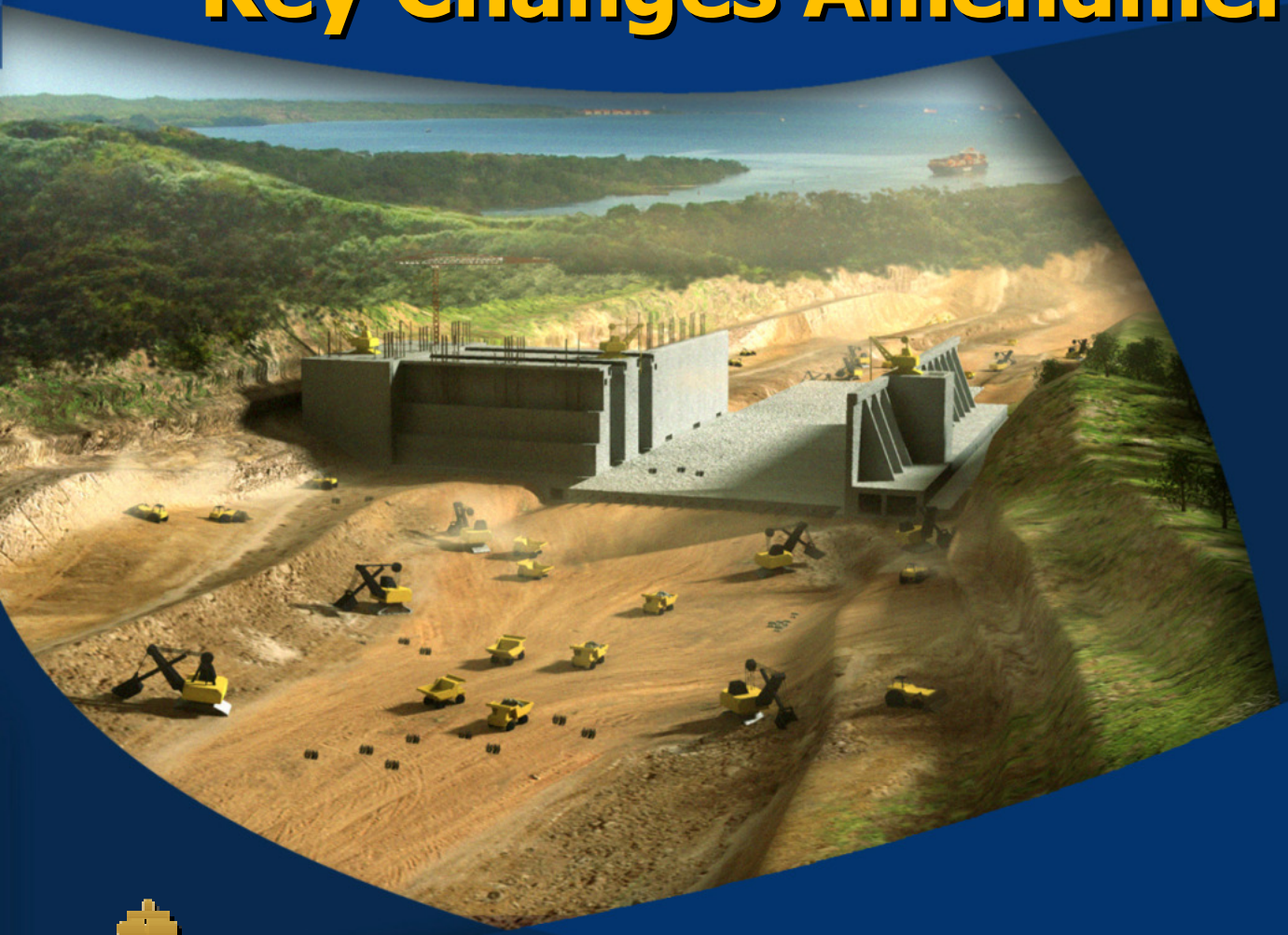
Amendment # 4

- Vol. I, Part 1, Paragraph A-5, Visit Flanders Laboratory
- Vol. I, Part 1, Paragraph B-2, Clarification of RFP
- Vol. I, Part 1, Paragraph C-2, Documents comprising the Tender
- Vol. I, Part 1, Paragraph F-3, Notification of Contract Award
- Vol. I, Part 1, Paragraph F-4, Contract Signing
- Vol. I, Part 1, Paragraph G, Tender documentation to be put in escrow was deleted.
- Vol. III, Part 2, Sub-clause 6.2, Minimum Wage
- Vol. IV, Part 2, Evaluation Criteria for Key Personnel

Instructions to Tenderers Vol. I, Part I

- Paragraph D, Submission of Tenders
- Paragraph E, Tender Opening and Evaluation
- Paragraph F, Contract Award

Key Changes Amendment # 5



Stipend

- Stipend amount is changed from $1.75 Million US to $3 Million US (Appendix to Tender)
- Stipend language is unchanged (Instructions to Tenders, A. 2.)

Alternate Tenders

- Alternate Tenders language is slightly changed (Instructions to Tenders, A. 3.)
- Alternate or qualified tenders will not be considered

Bonding

- Tender Security must be a Bid Bond; but amount is not changed at $100 Million US (Instructions to Tenders, C. 7.)

- Performance Security
  - Must be a Performance Bond
  - Penalty sum is reduced from $750 Million US to $600 Million US
  - Must use AIA Form A312
  - Must remain valid from Commencement Date to issuance of Performance Certificate (Sub-Clause 4.2)

- Payment Security
  - Must be Payment Bond
  - Amount not changed at $250 Million US
  - Must use AIA Form A312 (Sub-Clause 4.2)

- Surety must be licensed in New York and meet requirements of Sub-Clause 4.2.3

Subcontractors

- Particular Conditions Sub-Clause 4.4 is replaced with a new Sub-Clause 4.4
- Contractor shall not subcontract the whole of the works or subcontract one entire locks project
- Contractor shall get Employer consent to subcontract, except:
  - Subcontracts for Materials
  - Subcontractors named in the Contract
  - Subcontracts for less than $1 Million US

Value Engineering

- Particular Conditions Sub-Clause 13.2 is replaced with a new Sub-Clause 13.2
- Cost savings from approved value engineering proposals shall be shared 50/50 between Contractor and Employer

Adjustments for Changes in Cost

- Particular Conditions Sub-Clause 13.8 is replaced with a new Sub-Clause 13.8
- Applies to Rebar, Portland Cement and Diesel fuel
- Quantities and dates are provided – only variable is change in cost
- Cost source not yet determined for Portland Cement

Retention

Retention remains “5% up to 50% of the Accepted Contract Amount and 2.5% thereafter” (Appendix to Tender)

Limitation of Liability

- Limitation of Liability amount changed from 30% of Contract Price to $600 Million US (Appendix to Tender)

- Added new Particular Conditions Sub-Clause 17.6 to refer to Appendix to Tender

Insurance

- New Insurance requirements are included as Particular Conditions Sub-Clause 18
- Owner Controlled Insurance Program

Technical Score/Cost Score

- Technical score changed from 6,000 to 5,500 points
- Cost Score changed from 4,000 to 4,500 points
  - 4,000 points for the lowest Total Price Proposal
  - 500 points for the lowest Total Extended Unit Price Elements
- The successful Tenderer will have the lowest combined Technical and Cost Score

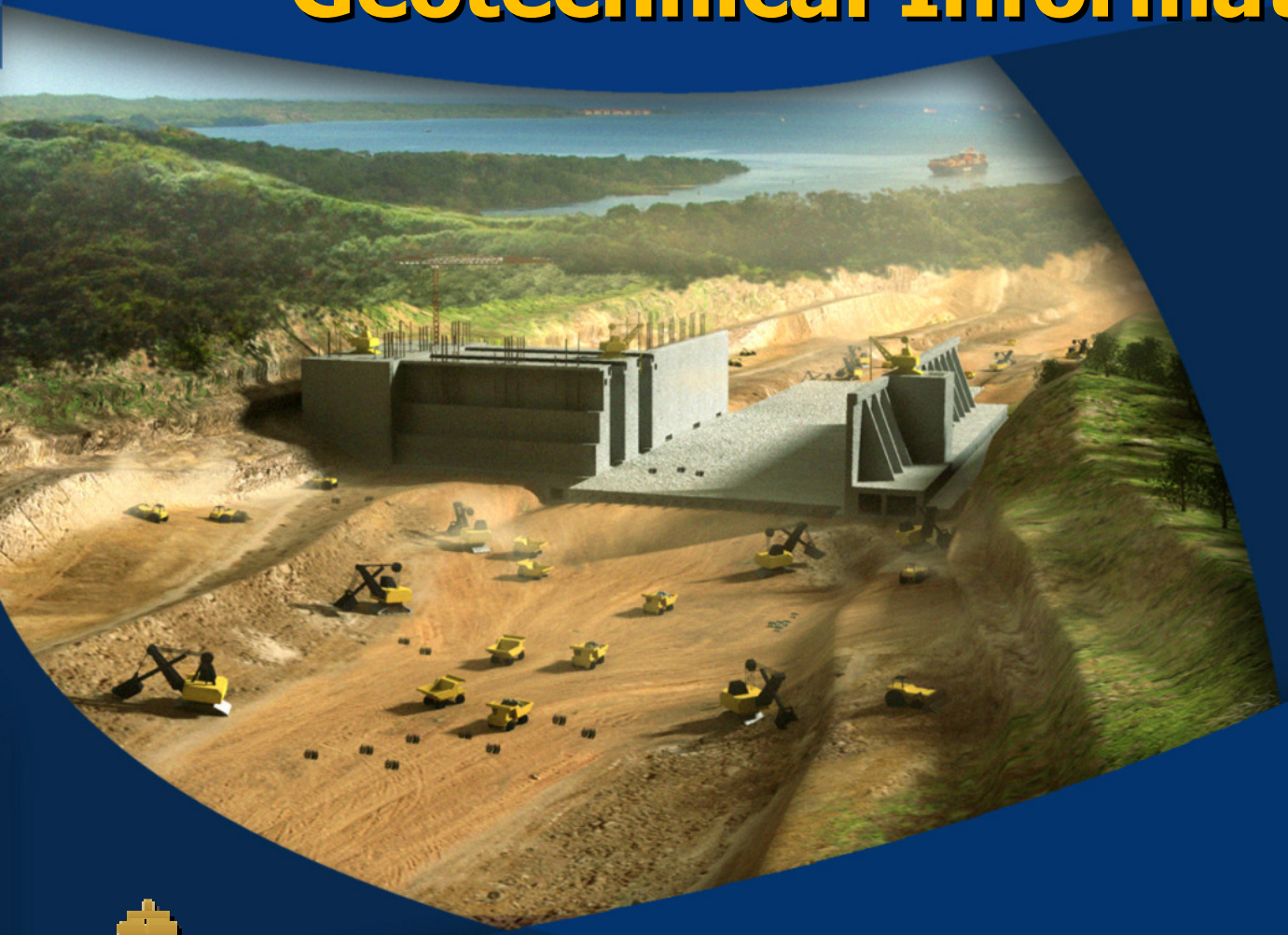
Unit Price Schedule

- Mandatory Unit Price Schedule
- Evaluated in Price Proposal
- For pricing work done through Variations ordered by Employer

Wider Chamber Variance Price

- Requirement for Tenderers to submit a price for 59 meter wide chambers has been eliminated

Geotechnical Information



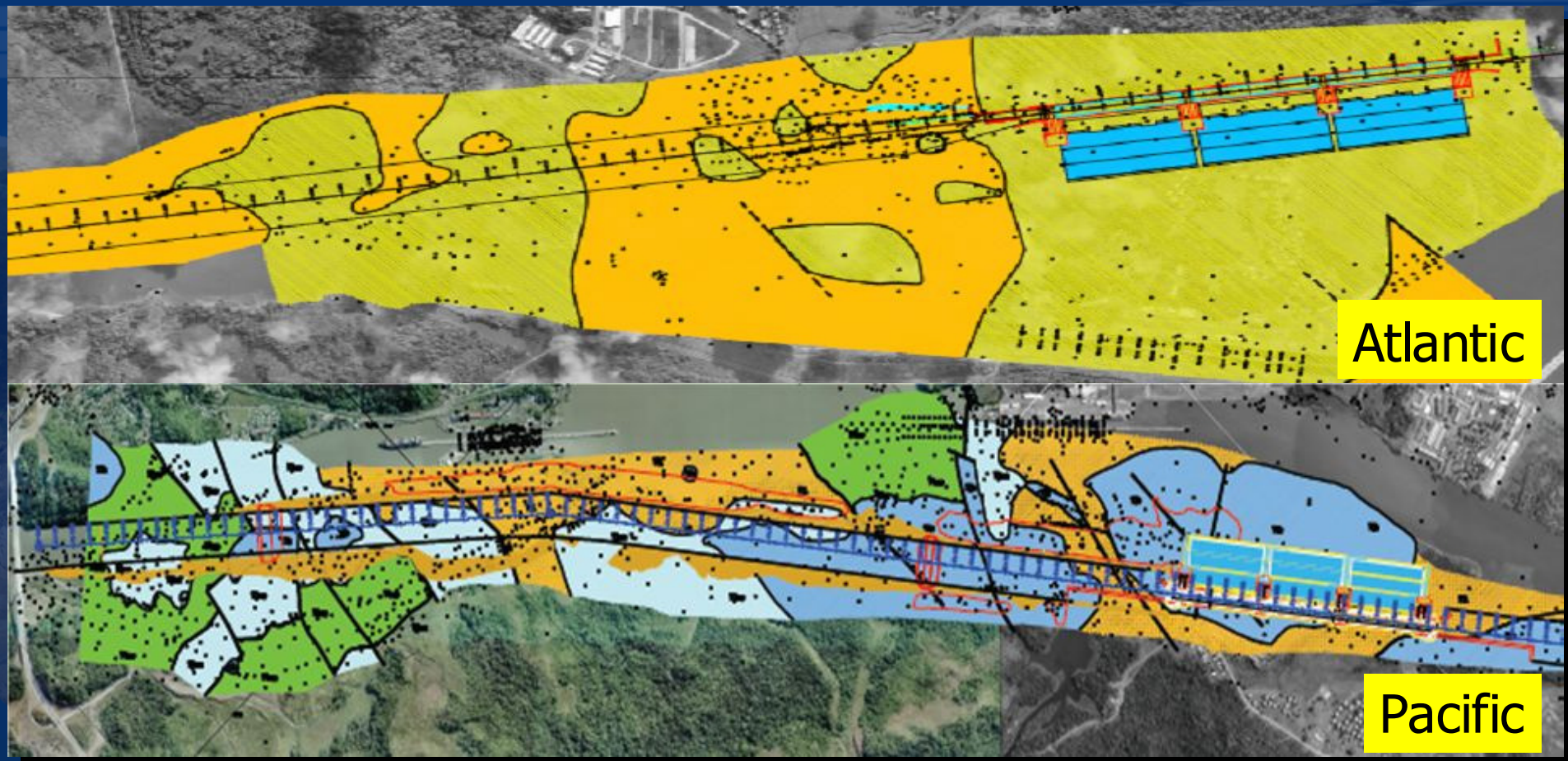
Content

- Objectives
- Geotechnical-Geological Investigations
  - Pacific
    - Site Exploration
    - ACP Geological Profiles
    - Laboratory Testing
    - Field Testing
    - 1941 Construction Photos
  - Atlantic
    - Site Exploration
    - ACP Geological Profiles
    - Laboratory Testing
    - Field Testing
    - 1941 Construction Photos
- Summary of typical Shear Strength Parameters derived from Backanalysis
- Preliminary Design of Borinquen Dams 2E, 1W and 2W.
- Geotechnical and Geological Reports.

Objective

- Provide information necessary for a general characterization of the areas and for the preparation of preliminary designs for bid submittal.

Scope of Geotechnical Investigations

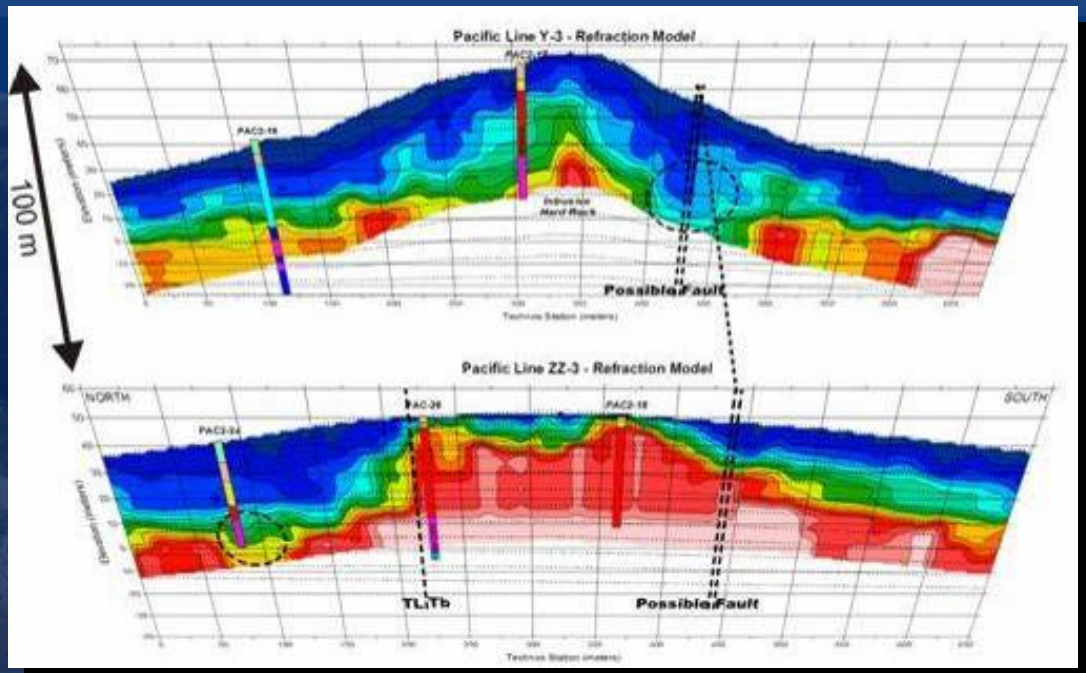


Year	Total	Length (m)
1938-1948	1,569	44,542
2005-2007	473	21,410
TOTAL	2,042	65,952

Geotechnical/Geological Investigations

- Field Tests
  - Lugeon-Permeability, Lefranc
  - Strength and Compressibility:
    - Goodman (Borehole) Jack : hard rocks
    - Presurimeter: soft rocks
    - Dilatometer: soft to medium hard rocks
  - Discontinuities Characteristics
    - Core orientation:
      - a) CHRISTENSEN HÜGEL 1 in hard rocks
      - b) Borehole Image Processing System (BIPS)
    - RQD and core recovery
- Geophysical Profile
- Laboratory Testing

Some Field Tests



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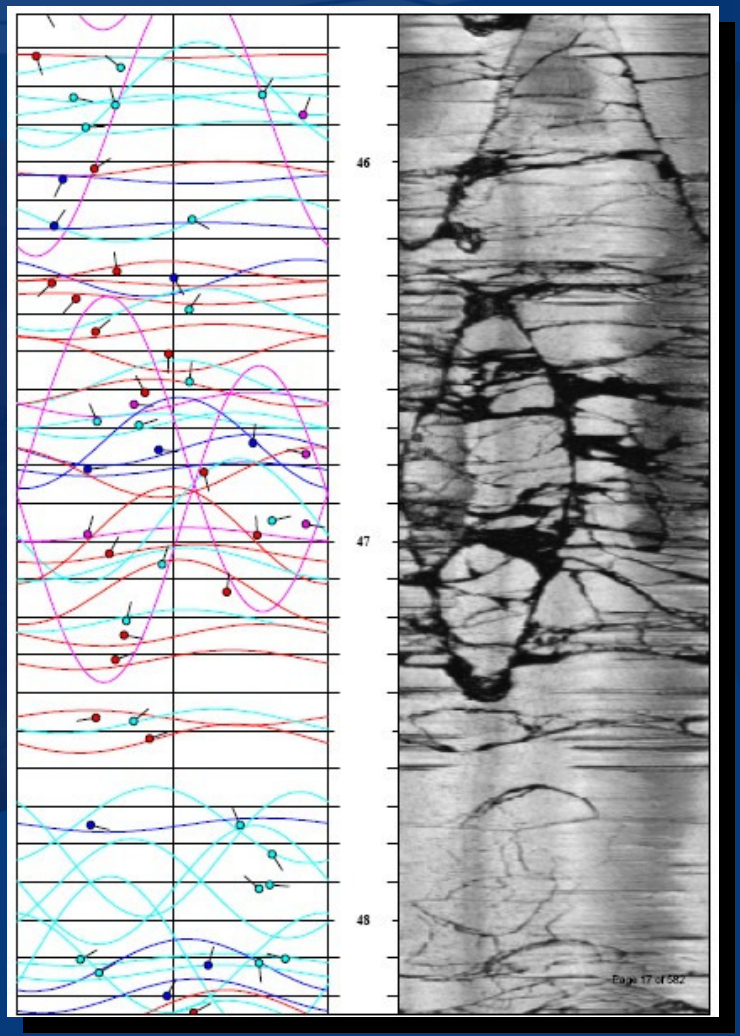
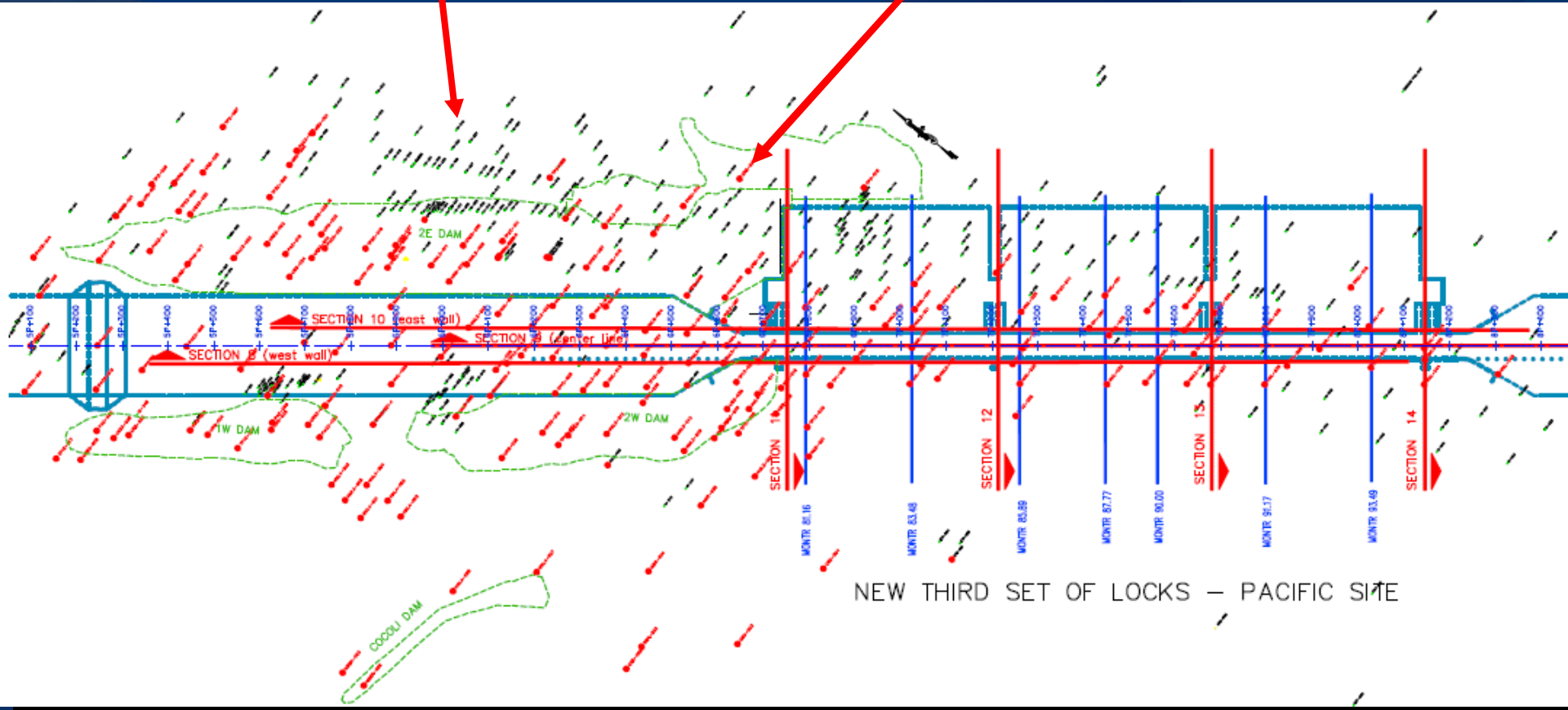


Borehole Image Processing System (BIPS)

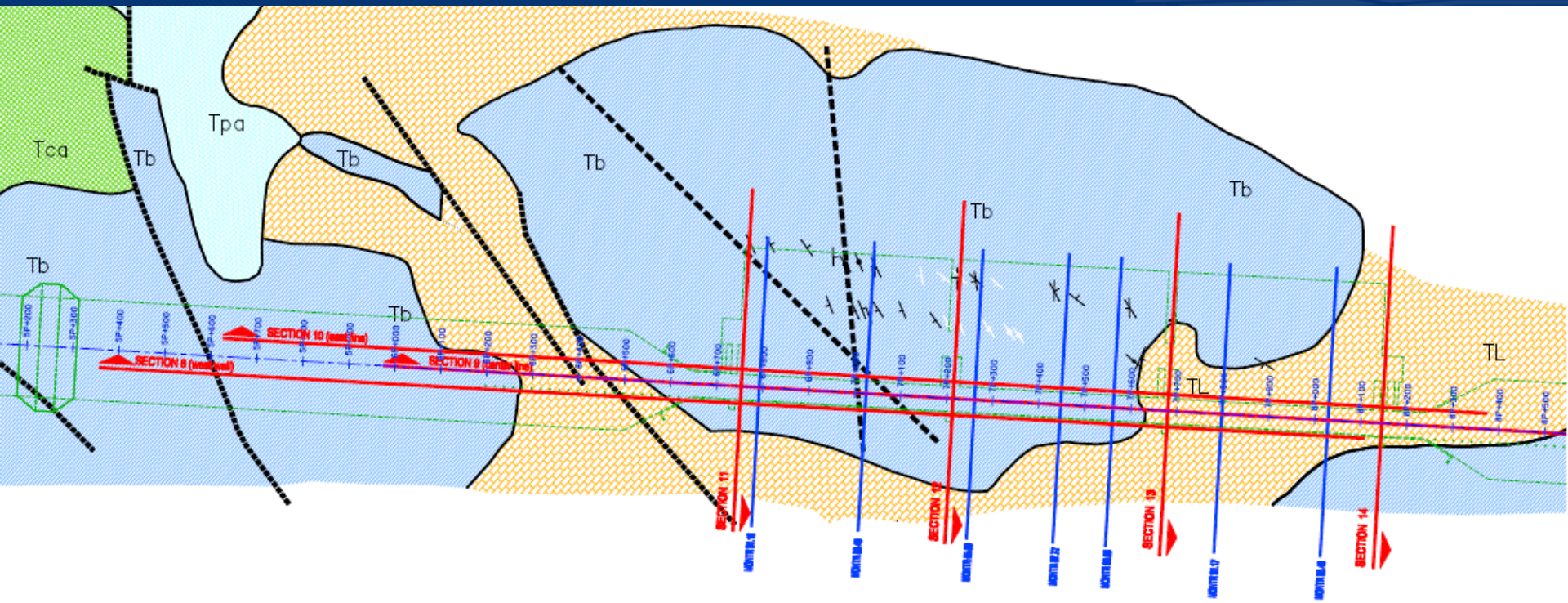
Pacific Site Investigations

Old Boreholes

New Boreholes



Geological Plan View - Pacific



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PEDRO MIGUEL FORMATION, EARLY MIOCENE HARD, FINE TO COARSE-GRAINED AGGLOMERATE

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LA BOCA FORMATION, EARLY MIOCENE SOFT, MUDSTONE, SILTSTONE, SANDSTONE, AND STONE TUFF, AND LIMESTONE

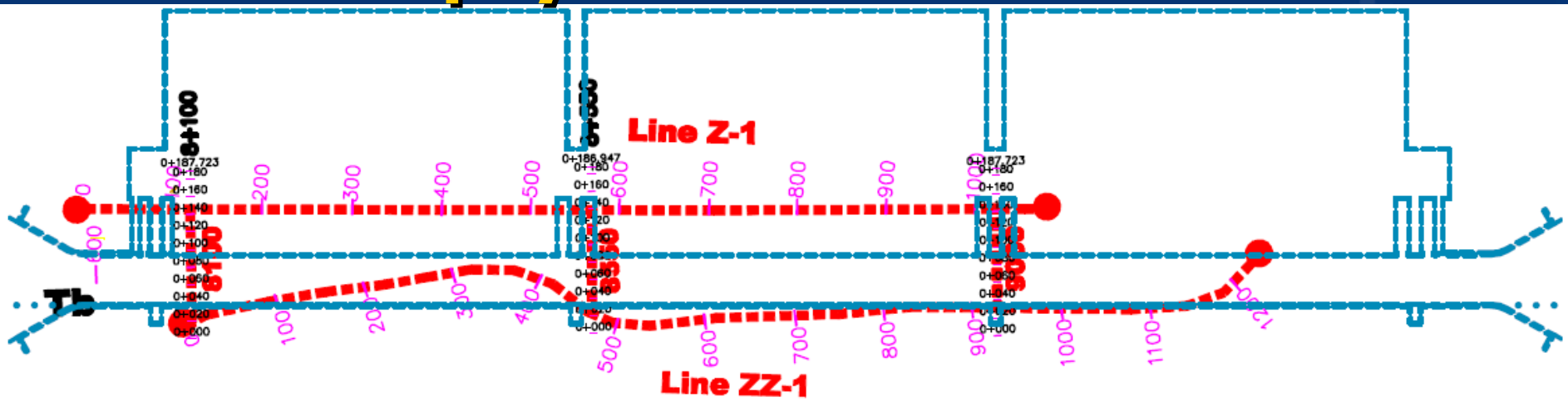
CUCARACHA
CUCARACHA FORMATION, EARLY MIOCENE, SOFT BENTONIC CLAY SHALE, CARBONACEOUS CLAY SHALE AND IN LOWER PART, A THIN ASH FLOW TUFF

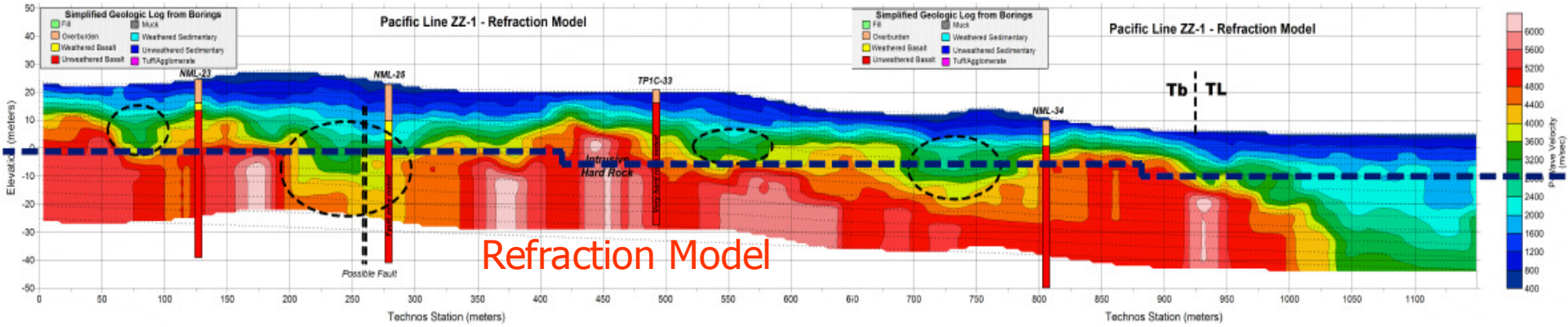
GEOLOGYCAL
CONTACTS

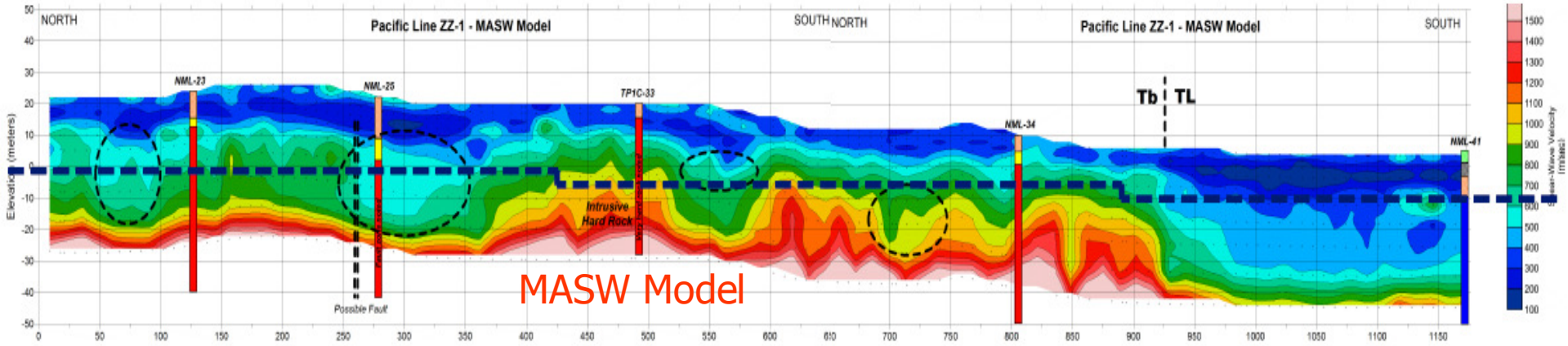
GEOLOGICAL
FAULTS

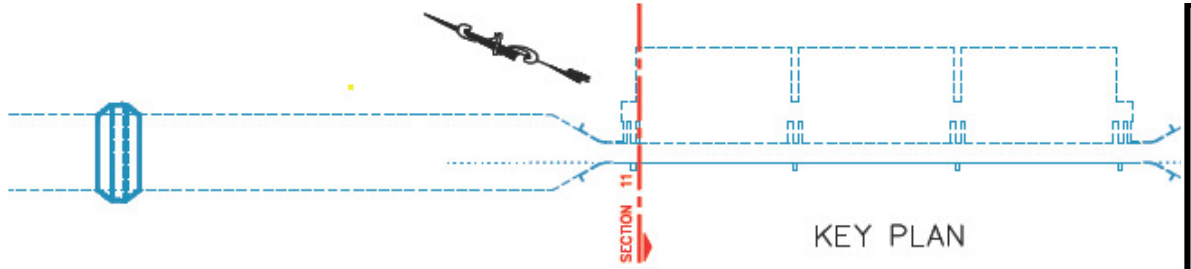
BEDDING

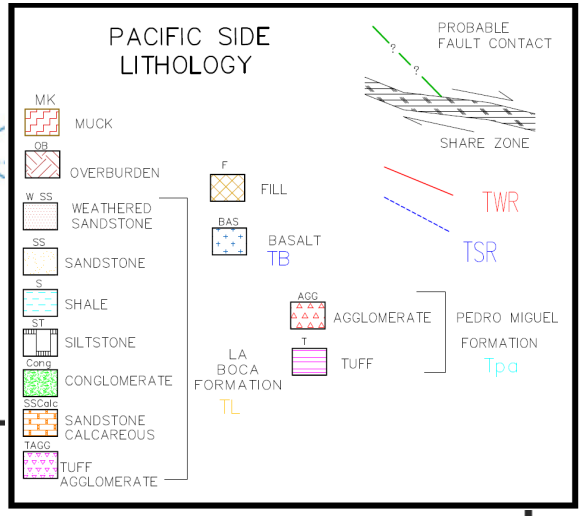
Geophysical Profile -Pacific

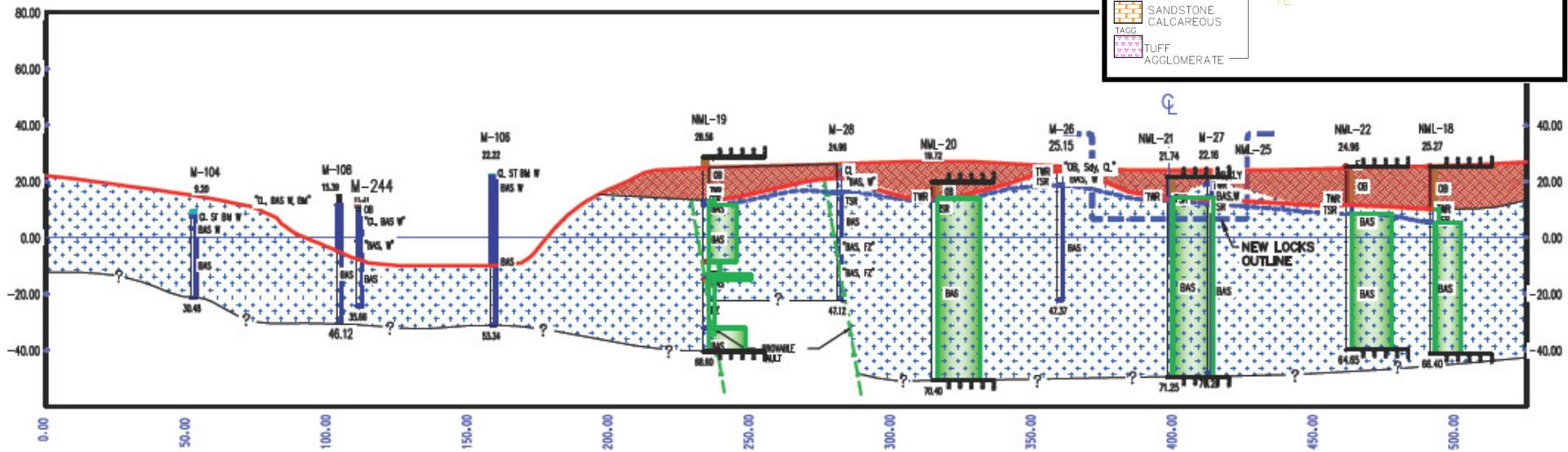












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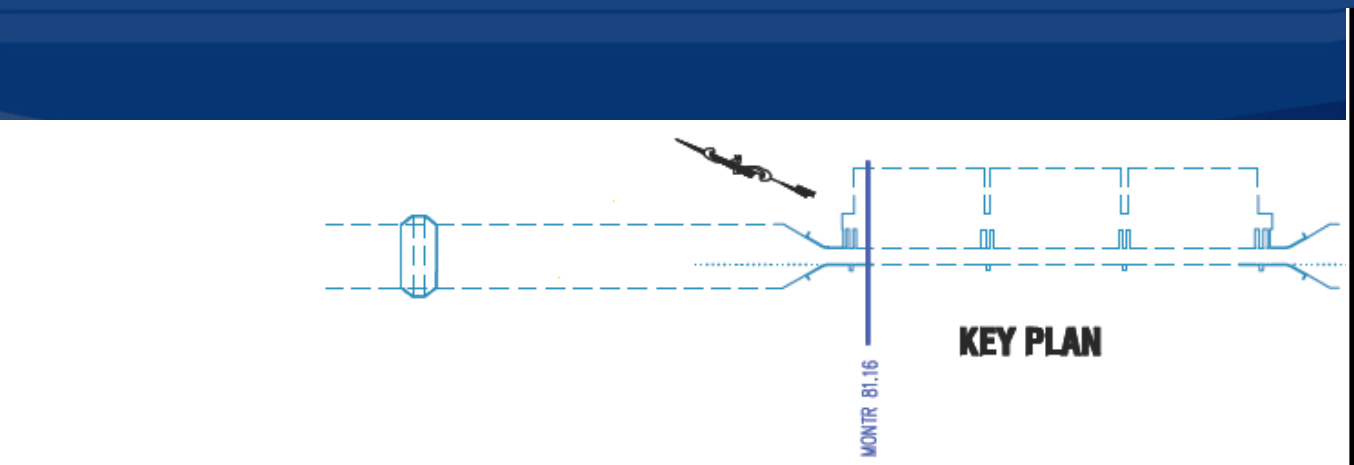
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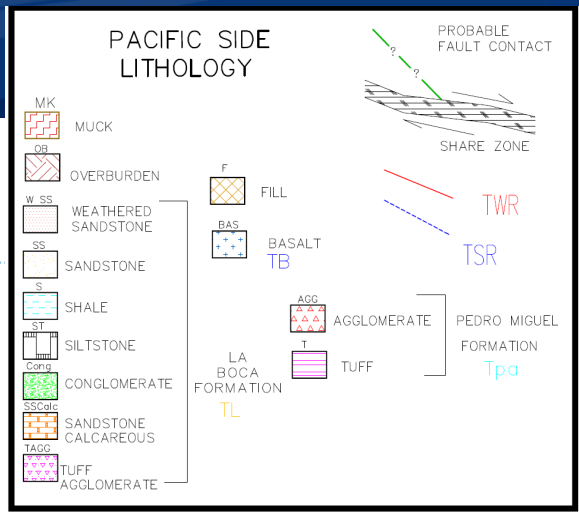
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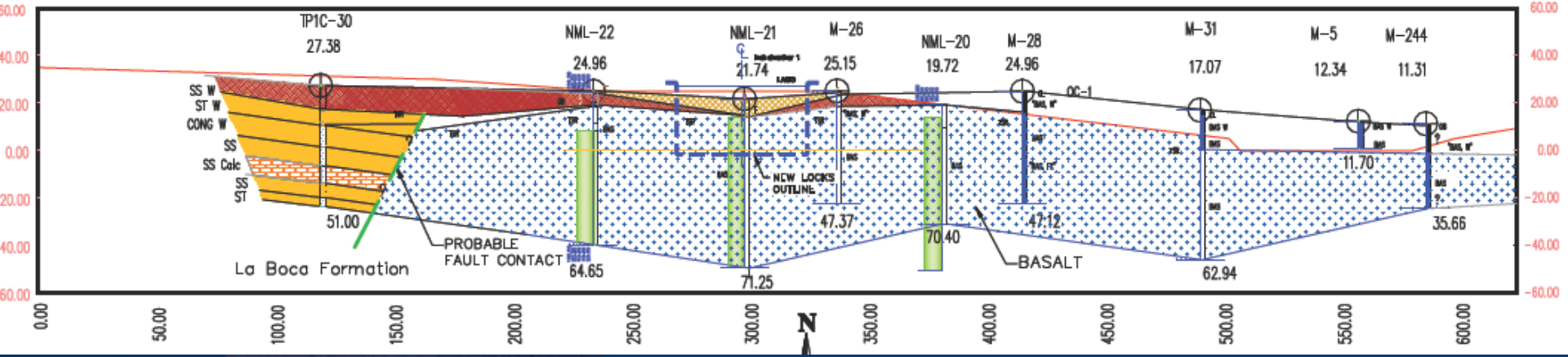
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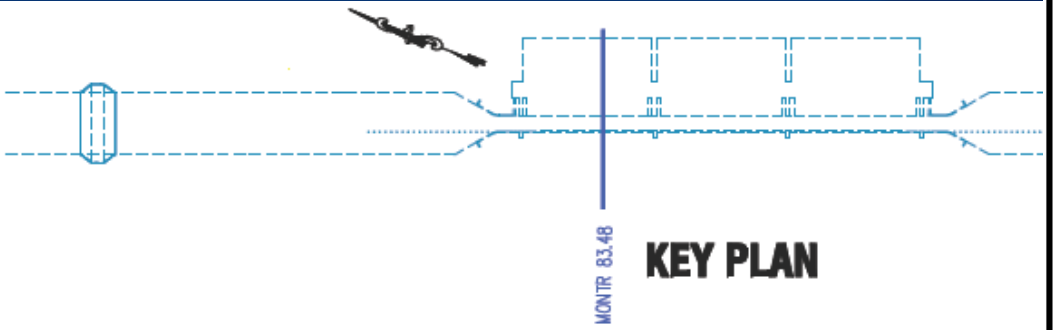
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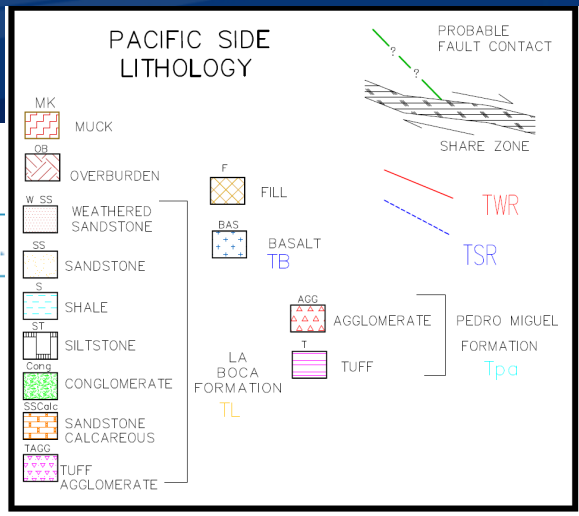
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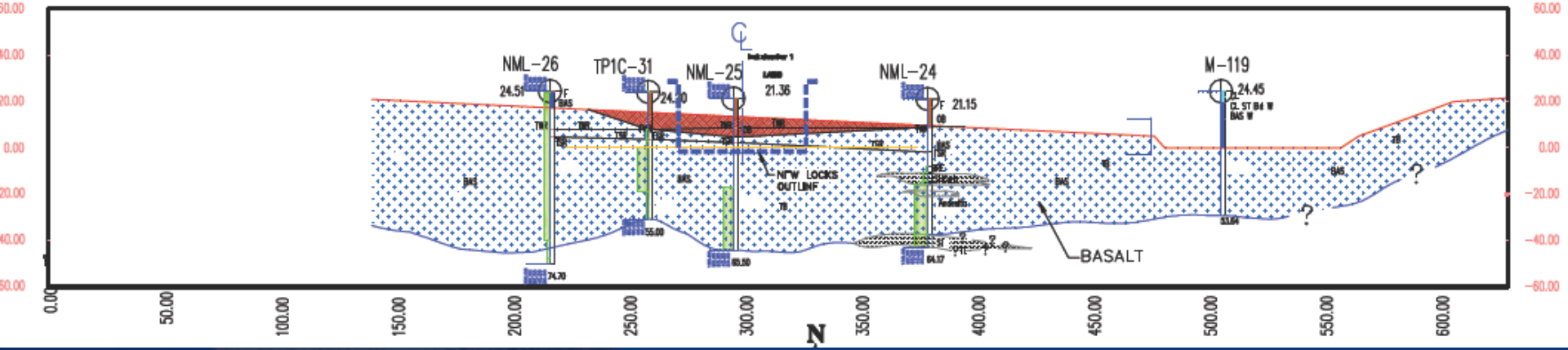
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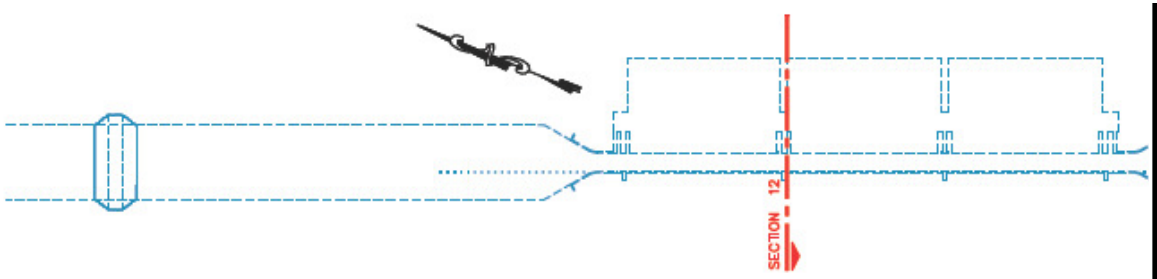

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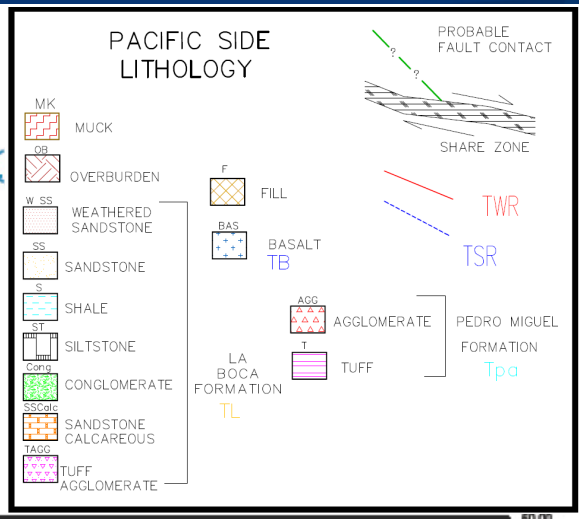

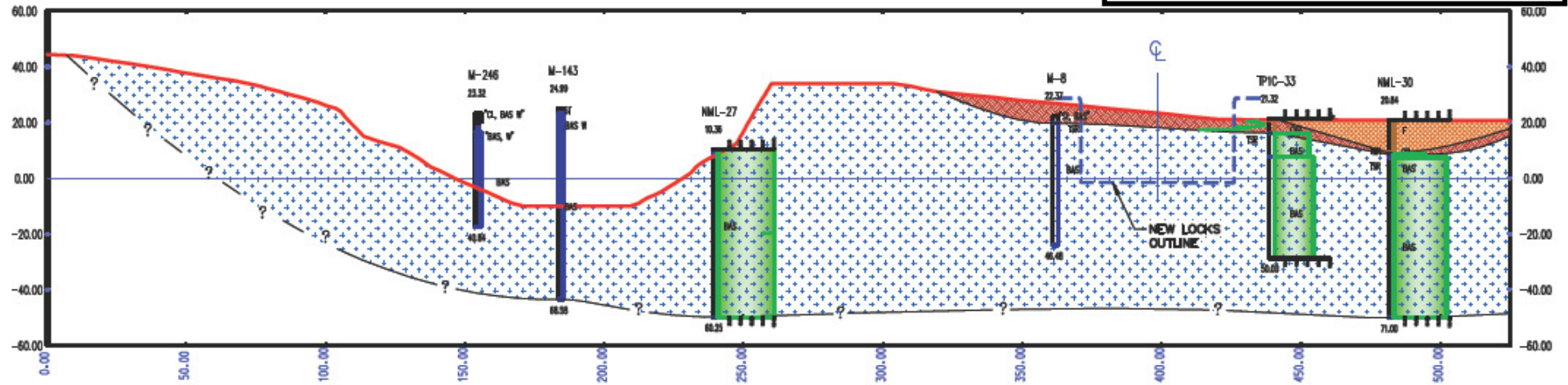

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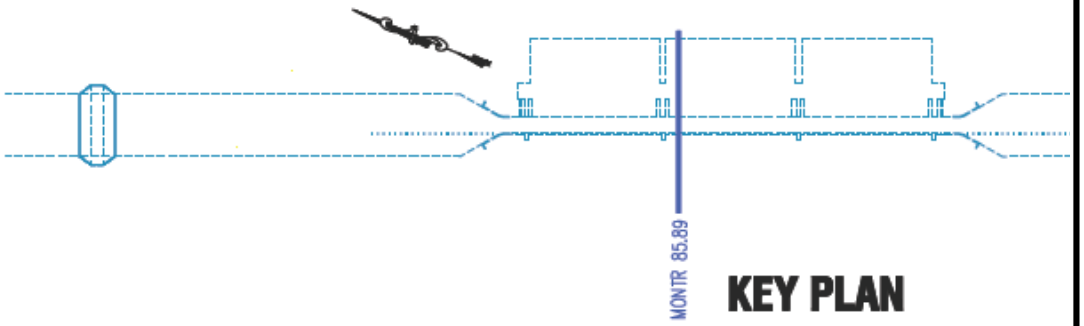
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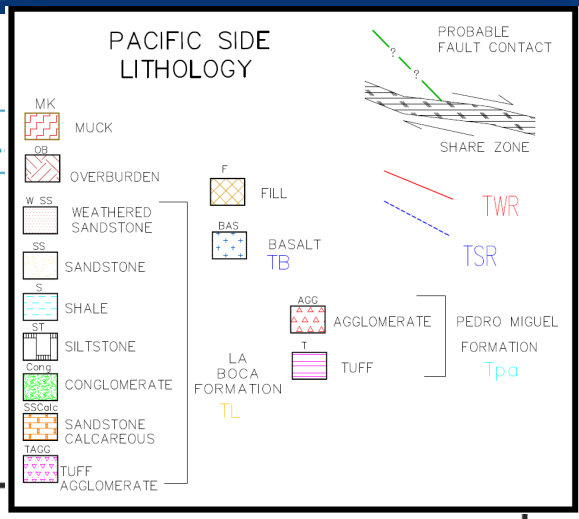
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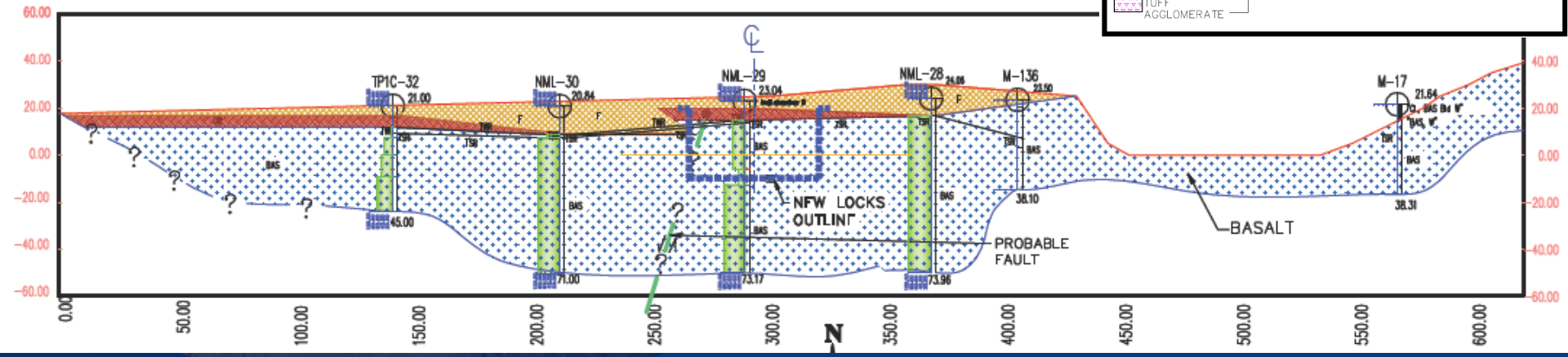
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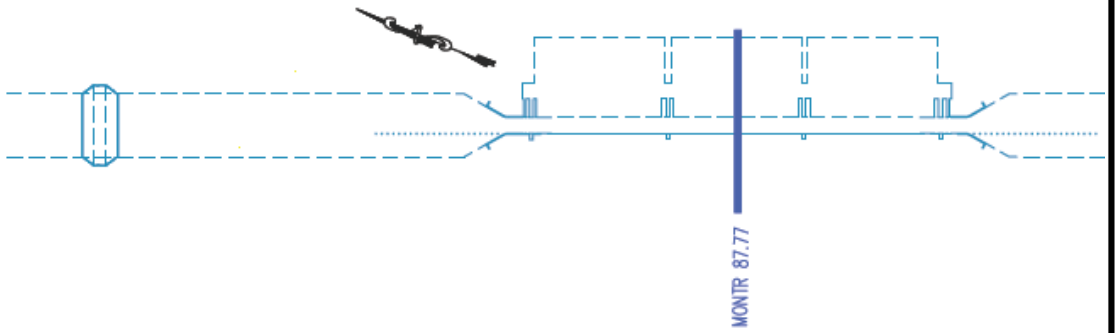
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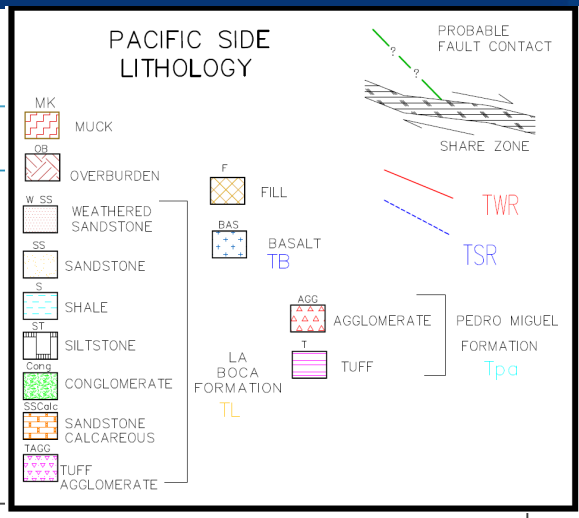
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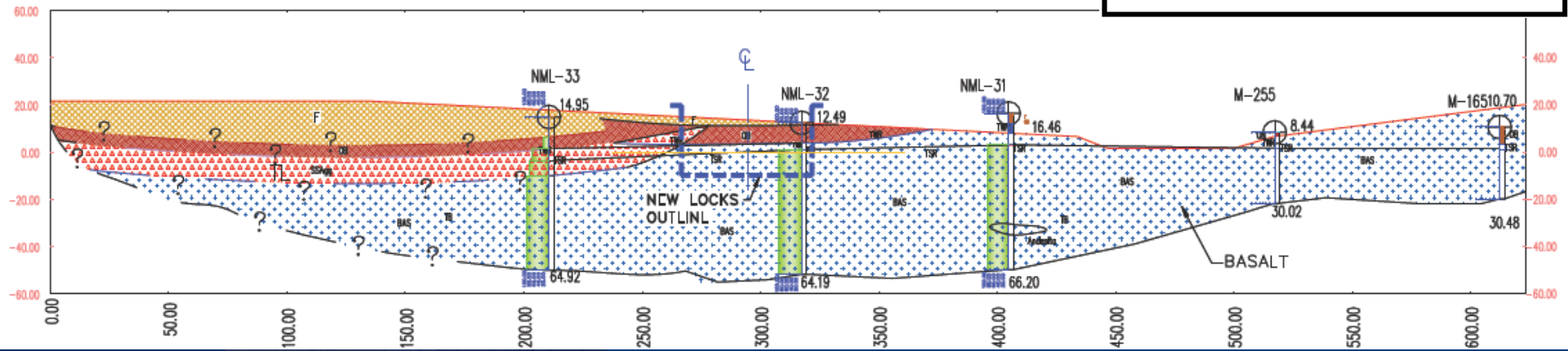
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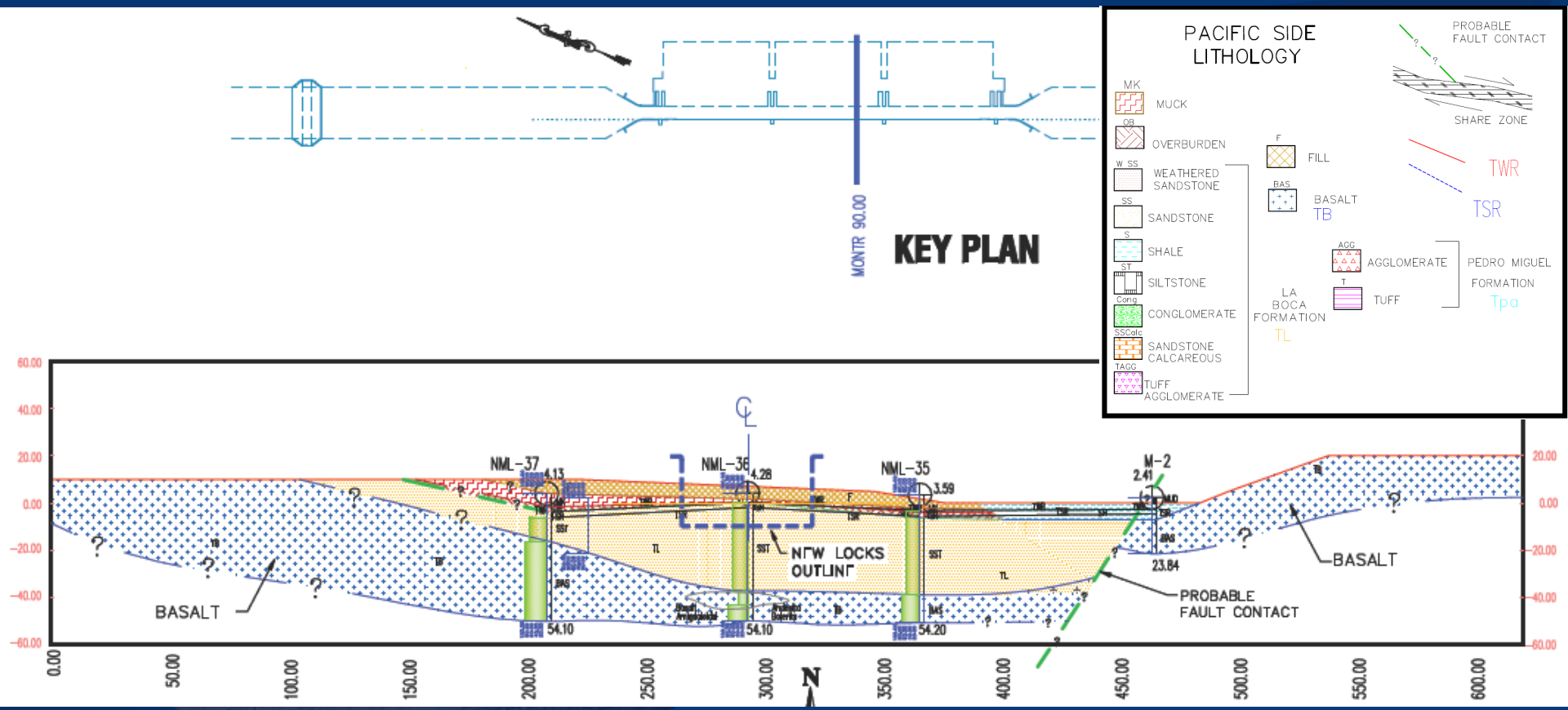
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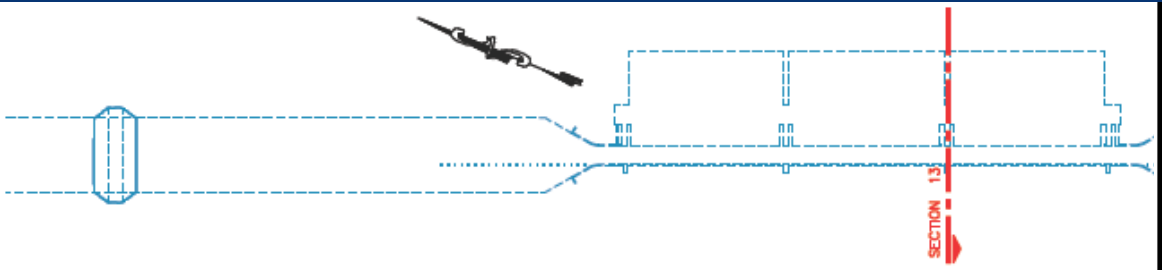
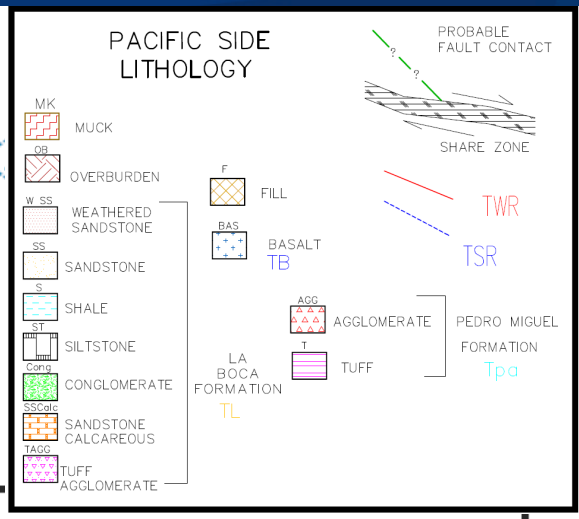
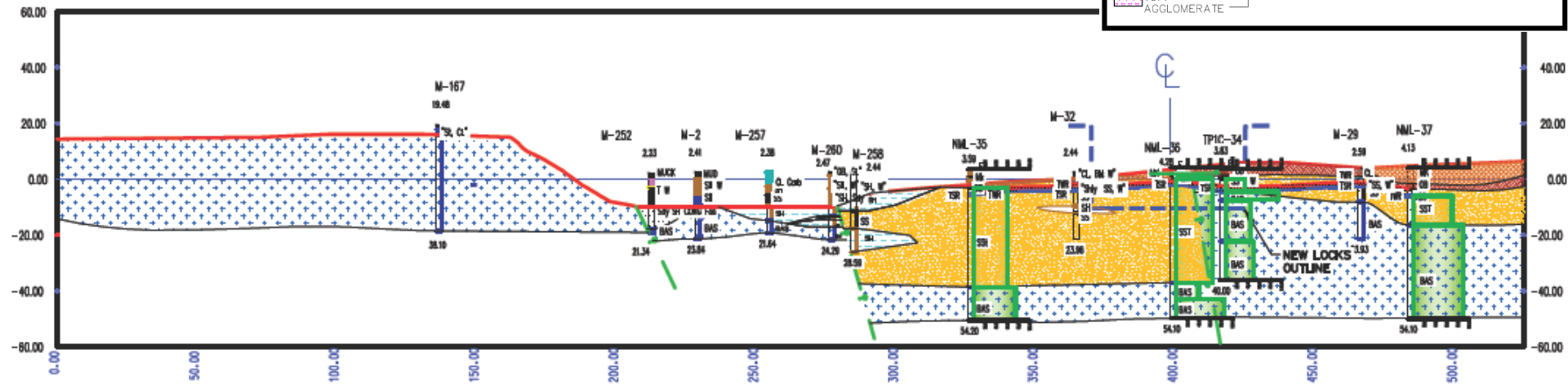


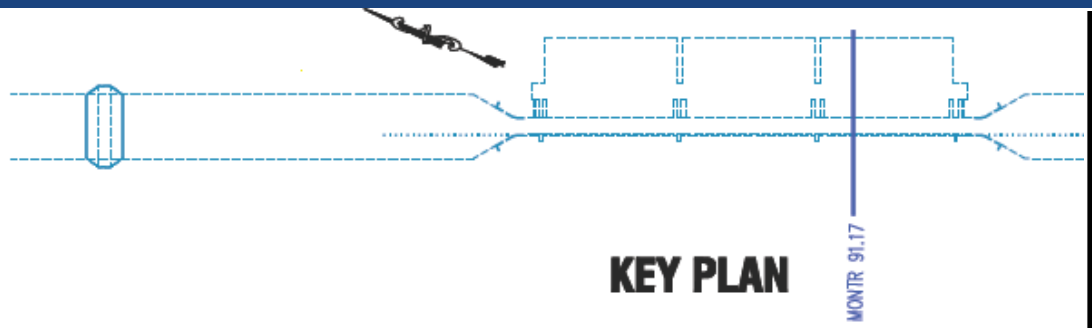
KEY PLAN

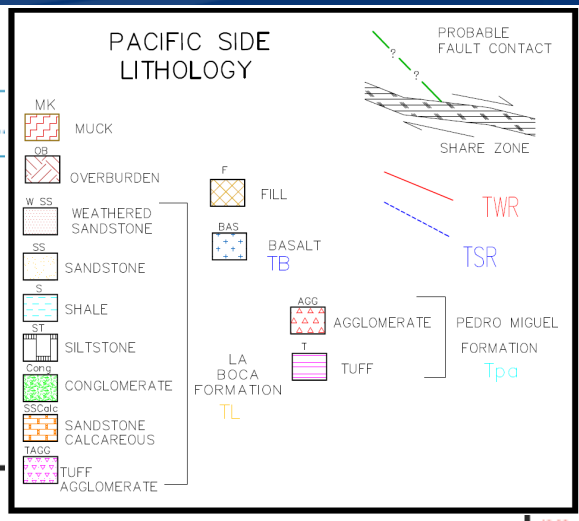


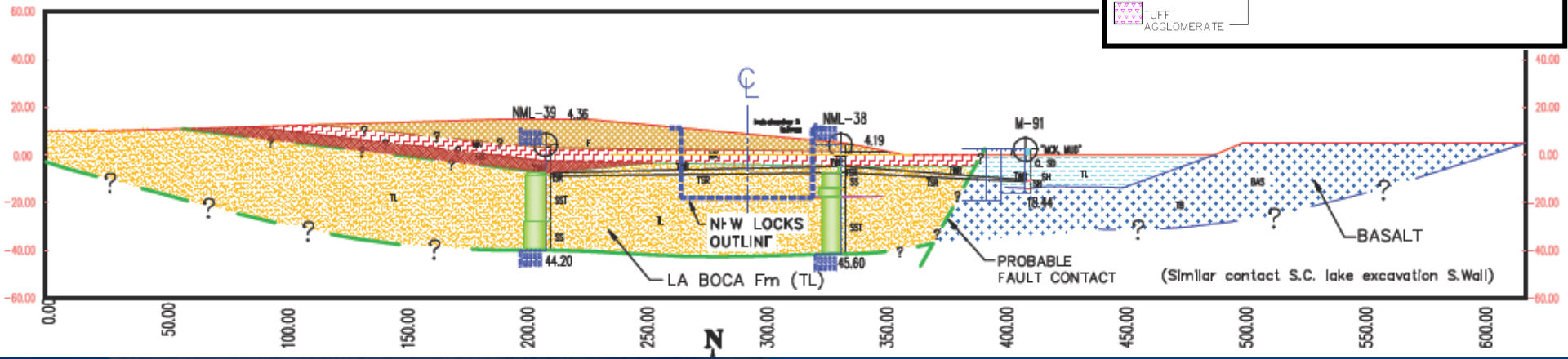


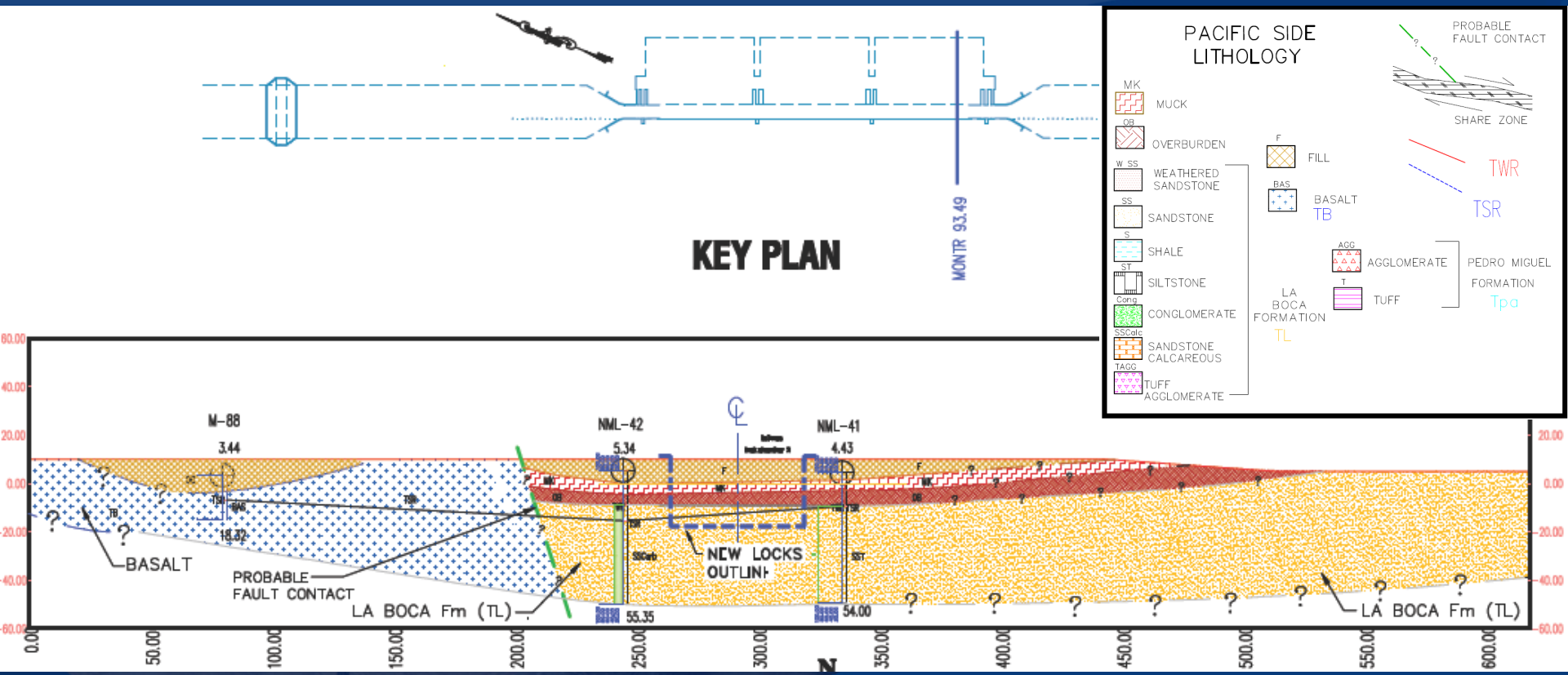
CROSS SECCION 13 STATION 7K+700

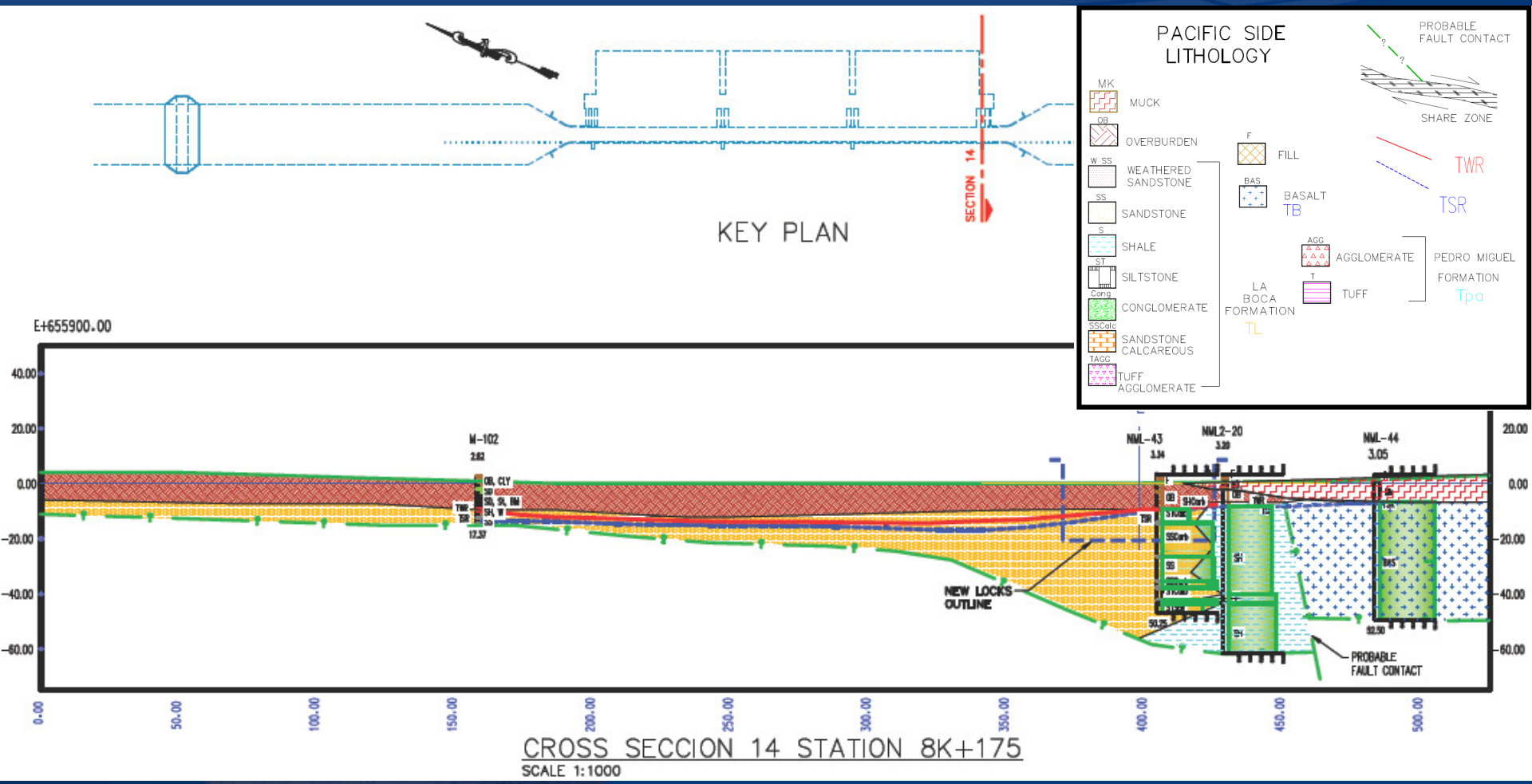
SCALE 1:1000


KEY PLAN
MONTR 91.17

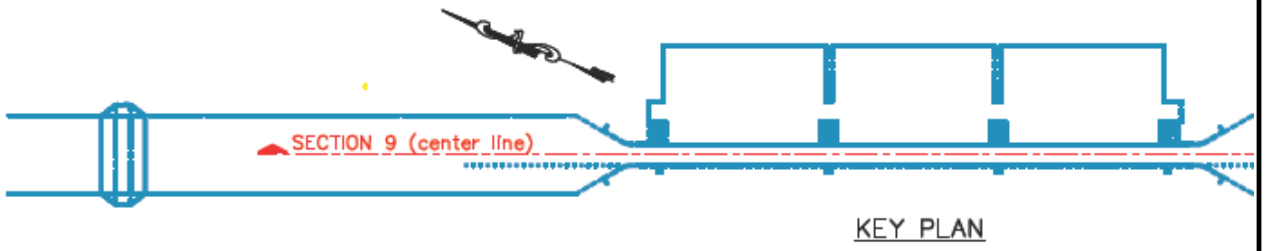

PACIFIC SIDE
LITHOLOGY
PROBABLE
FAULT CONTACT
SHARE ZONE
MK
MUCK
OB
OVERBURDEN
W SS
WEATHERED
SANDSTONE
SS
SANDSTONE
S
SHALE
ST
SILTSTONE
Cong
CONGLOMERATE
SSCalc
SANDSTONE
CALCAREOUS
TAGG
TUFF
AGGLOMERATE
F
FILL
BAS
BASALT
TB
TWR
TSR
AGG
AGGLOMERATE
T
TUFF
PEDRO MIGUEL
FORMATION
Tpa
LA
BOCA
FORMATION
TL

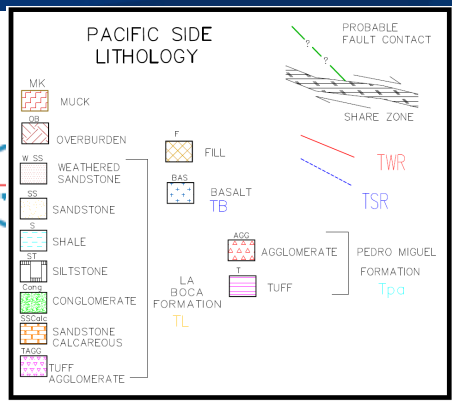

NML-39 4.36
NML-38
4.19
M-91
NEW LOCKS
OUTLINE
44.20
45.60
LA BOCA Fm (TL)
PROBABLE
FAULT CONTACT
(Similar contact S.C. lake excavation S.Wall)
BASALT
N
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
60.00
40.00
20.00
0.00
-20.00
-40.00
-60.00

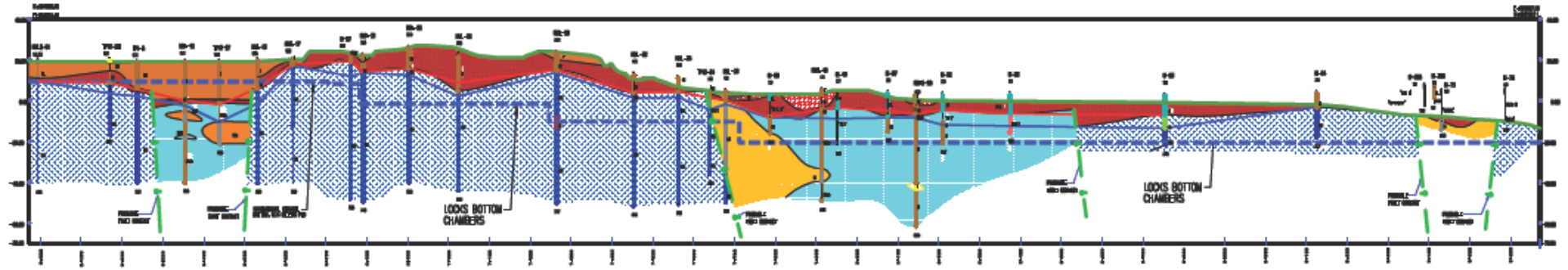

KEY PLAN
MONTR 93.49
PACIFIC SIDE LITHOLOGY
PROBABLE FAULT CONTACT
SHARE ZONE
MK MUCK
OB OVERBURDEN
W SS WEATHERED SANDSTONE
SS SANDSTONE
S SHALE
ST SILTSTONE
Cong CONGLOMERATE
SSCalc SANDSTONE CALCAREOUS
TAGG TUFF AGGLOMERATE
F FILL
BAS BASALT TB
LA BOCA FORMATION TL
AGG AGGLOMERATE
T TUFF
PEDRO MIGUEL FORMATION Tpa
TWR
TSR
M-88
3.44
18.32
NML-42
5.34
NML-41
4.43
BASALT
PROBABLE FAULT CONTACT
LA BOCA Fm (TL)
NEW LOCKS OUTLINE
55.35
54.00
LA BOCA Fm (TL)
N
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
60.00
40.00
20.00
0.00
-20.00
-40.00
-60.00


KEY PLAN
SECTION 14
PACIFIC SIDE LITHOLOGY
MK MUCK
OB OVERBURDEN
W SS WEATHERED SANDSTONE
SS SANDSTONE
S SHALE
ST SILTSTONE
Cong CONGLOMERATE
SSCalc SANDSTONE CALCAREOUS
TAGG TUFF AGGLOMERATE
F FILL
BAS BASALT TB
LA BOCA FORMATION TL
AGG AGGLOMERATE
T TUFF
PEDRO MIGUEL FORMATION Tpa
PROBABLE FAULT CONTACT
SHARE ZONE
TWR
TSR
E+655900.00
M-102
NML-43
NML2-20
NML-44
NEW LOCKS OUTLINE
PROBABLE FAULT CONTACT
CROSS SECCION 14 STATION 8K+175
SCALE 1:1000

Longitudinal Geologic Profile (center)

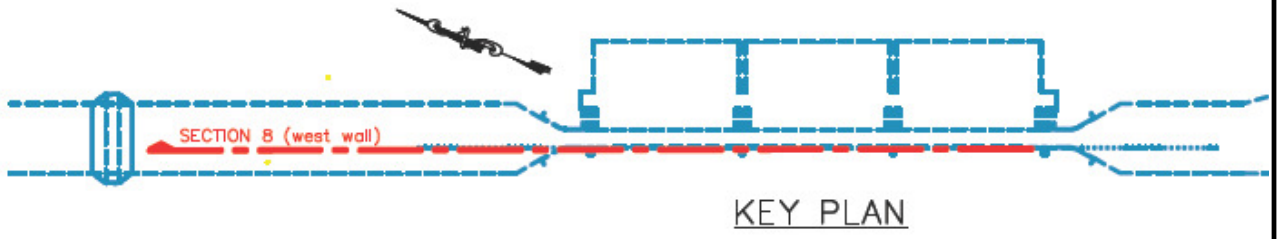




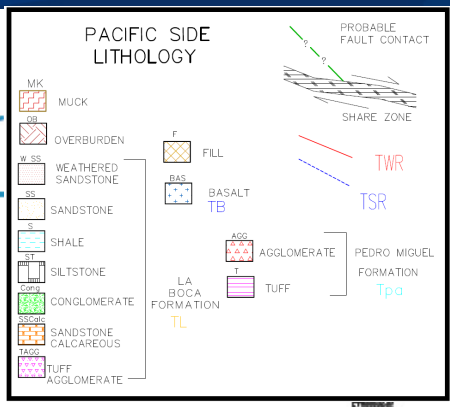


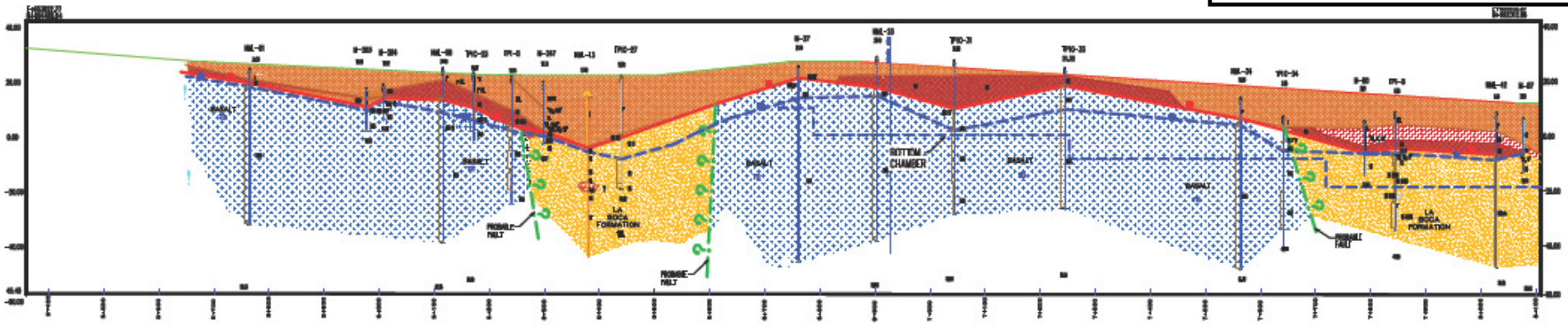
LONGITUDINAL PROFILE 9 CENTER LINE STATION 6K+000 TO STATION 9K+600
SCALE H-1:3000
SCALE V-1:600

Longitudinal Geologic Profile (west)



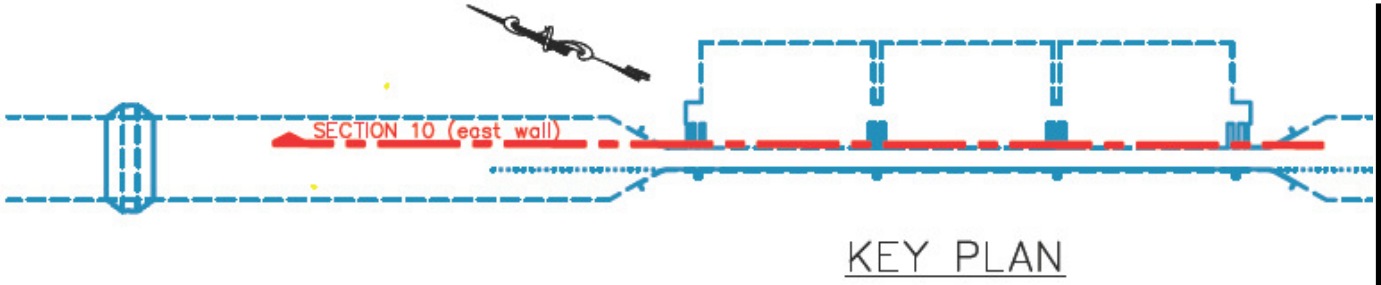
KEY PLAN

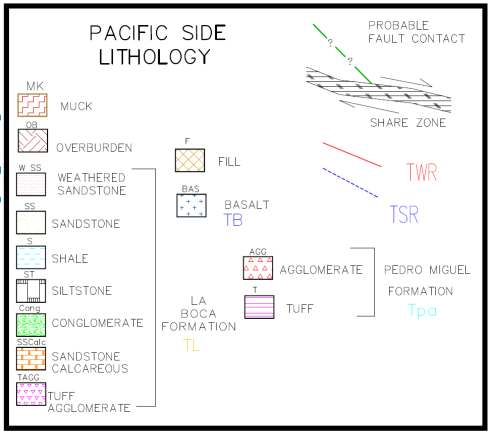


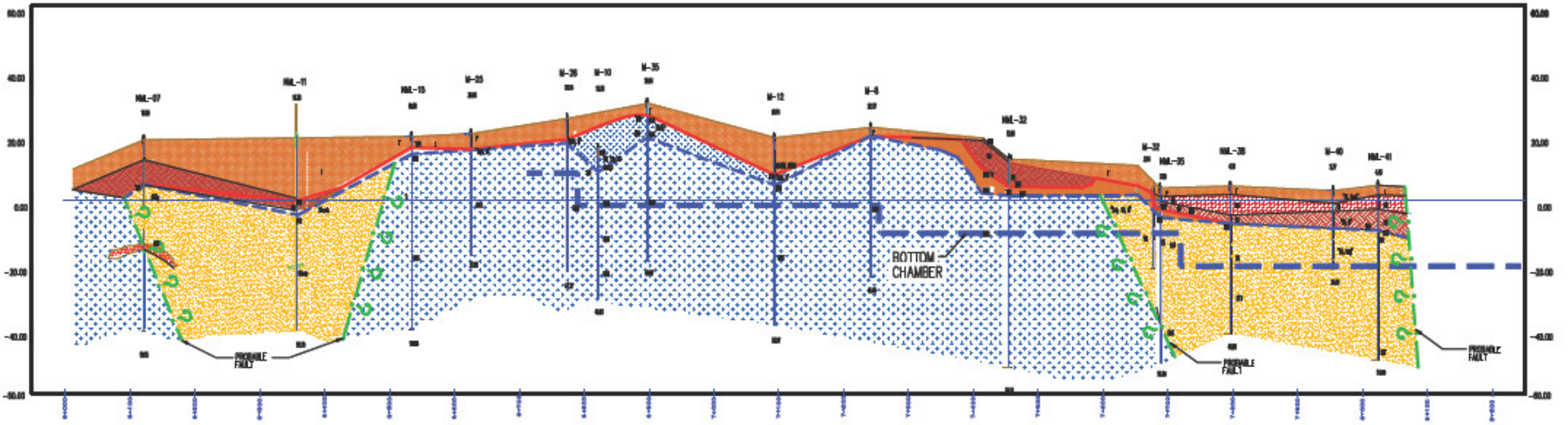


LONGITUDINAL PROFILE 8, STATION 5K+400 TO STATION 8K+100
SCALE H=1:3000
SCALE V=1:600

Longitudinal Geologic Profile (east)







LONGITUDINAL PROFILE 10, STATION 5K+600 TO STATION 8K+400

SCALE H=1:3000

SCALE V=1:600

Laboratory Testing Pacific

TEST	ASTM	#
Specific Gravity	ASTM C 128	2205
Moisture Content	ASTM D 2216	2490
Sieve Analysis	ASTM C 136	1229
Atterberg Limits LL # 40	ASTM D 438	1250
Atterberg Limits LL # 200	ASTM D 438	24
Hydrometer #10	ASTM D 422	53
Hydrometer #200	ASTM D 422	26
Rock Unconfined Compresive Strength	ASTM D 2938	1073
Point Load Test	ASTM D 5731	835
Soil Unconfined Compresive Strength	ASTM D 2166	24
Direct Shear	ASTM D 3080	24
Torsional Ring Shear	ASTM D 6467	7
Large Shear Box		9
Triaxial Soils	ASTM D 4767	8
Triaxial Rocks	ASTM D 2664	135
Slake Durability	ASTM D 4644	13
Compaction Proctor	ASTM 698/1557	17
Percent Dispersion by Double Hydrometer	ASTM D 4221	2
Consolidation	ASTM D 2435	5
Pinhole Test	ASTM D 4647	3
Absortion	ASTM C 127	60
Permeability	ASTM D 5856	5
Petrographic Examination	ASTM C 295	89
X Rays Difraction	ASTM D 5856	13
Field Unit Weight	ASTM D 1556	8
Degradation by Angeles Machine	ASTM C 131	19
Soundness of Sodium Sulfate	ASTM C 88	19
Flat, enlogated Particles	ASTM D 4791	12
Potential Alkali Reactivity	ASTM C 586	3
Compressive Strength (Mortars)	ASTM C 109	7

Table 1 Statistical Summary of Unconfined Compressive Strength, Elastic Modulus, Unit Weight and Specific Gravity (Pacific)

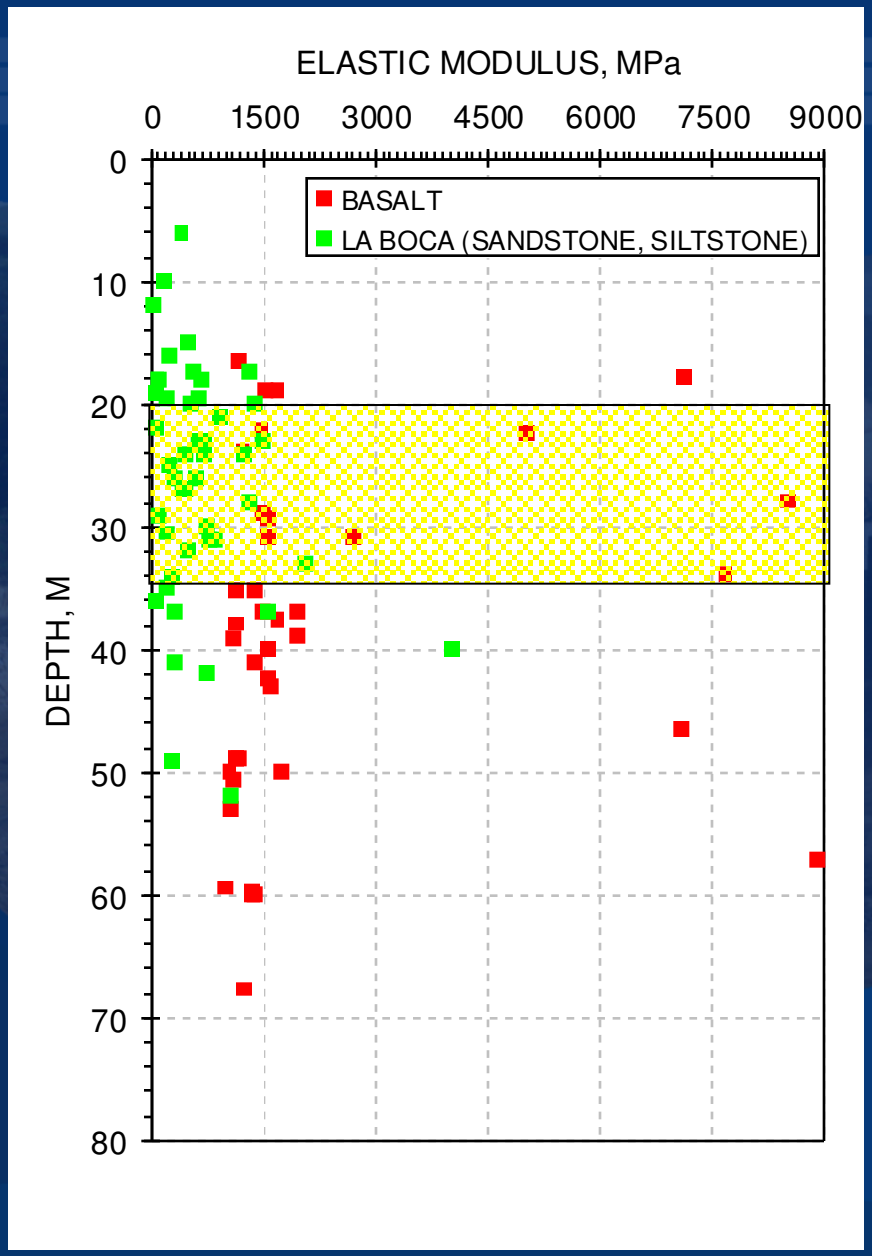
Gs			Unit Weight (Kg/m3)			Elastic Modulus E (Mpa)			UCS σc (Mpa)			Type of rock / Formation
N	Median Average	St. Dev.	N	Median Average	St. Dev.	N	Median Average	St. Dev.	N	Median Average	St. Dev.	
3	2.20 2.19	0.02	3	2,228 2,220	19	3	3,954 3,491	2,005	3	22.57 17.18	10.57	Ash flow
2 4	2.17 2.17 2.28	0.15 0.07	2 4	2,199 2,199 2,279	183 94	2 4	341 341 812	402 307	2 4	0.65 0.65 4.50	0.78 1.71	Clayshale Sandstone
	2.26			2,240			807			4.75		
9	2.20 2.21	0.08	9	2,233 2,224	89	9	994 1,598	1,764	9	5.00 7.98	8.91	Global Cucaracha
17	2.30 2.29	0.10	17	2,314 2,293	125	11	1,050 1,714	1,225	17	6.00 9.22	8.69	Conglomerate
3	2.20	0.10	3	2,185	130	3	1,828	1,229	3	8.00	5.70	Sandstone conglomeratic
	2.24			2,185			1,474			7.10		
73	2.24 2.25	0.06	82	2,224 2,239	125	74	907 2,881	4,563	82	5.75 9.91	11.39	Sandstone
13	2.50	0.11	13	2,448	152	12	4,354	3,571	13	29.00	17.42	Sandstone, calcareous
	2.45			2,430			4,679			30.11		
12	2.22 2.24	0.06	12	2,228 2,232	146	12	847 2,127	3,365	12	4.30 9.62	15.73	Sandstone, silty
15 6	2.20 2.22 2.27 2.27	0.08 0.03	15 6	2,226 2,202 2,253 2,233	95 92	14 6	2,062 2,782 4,137 4,766	2,580 3,446	15 6	10.00 11.99 24.00 25.17	10.54 16.34	Sandstone, tuffaceous Sandstone, agglomeratic
17 6	2.20 2.19 2.12 2.11	0.11 0.06	18 6	2,193 2,139 2,078 2,100	210 89	14 6	797 3,069 608 1,492	5,888 2,159	18 6	2.70 6.20 3.10 3.52	7.29 1.87	Siltstone Tuff
7 9	2.30 2.29 2.28 2.31	0.09 0.11	7 9	2,358 2,303 2,280 2,307	112 123	3 9	2,226 1,817 4,690 4,194	774 1,960	3 9	0.81 0.69 21.00 21.82	0.55 7.81	Agglomerate Tuff, agglomeratic
178	2.25 2.26	0.10	188	2,250 2,244	148	164	1,207 2,932	3,973	188	7.00 11.93	12.79	Global La Boca

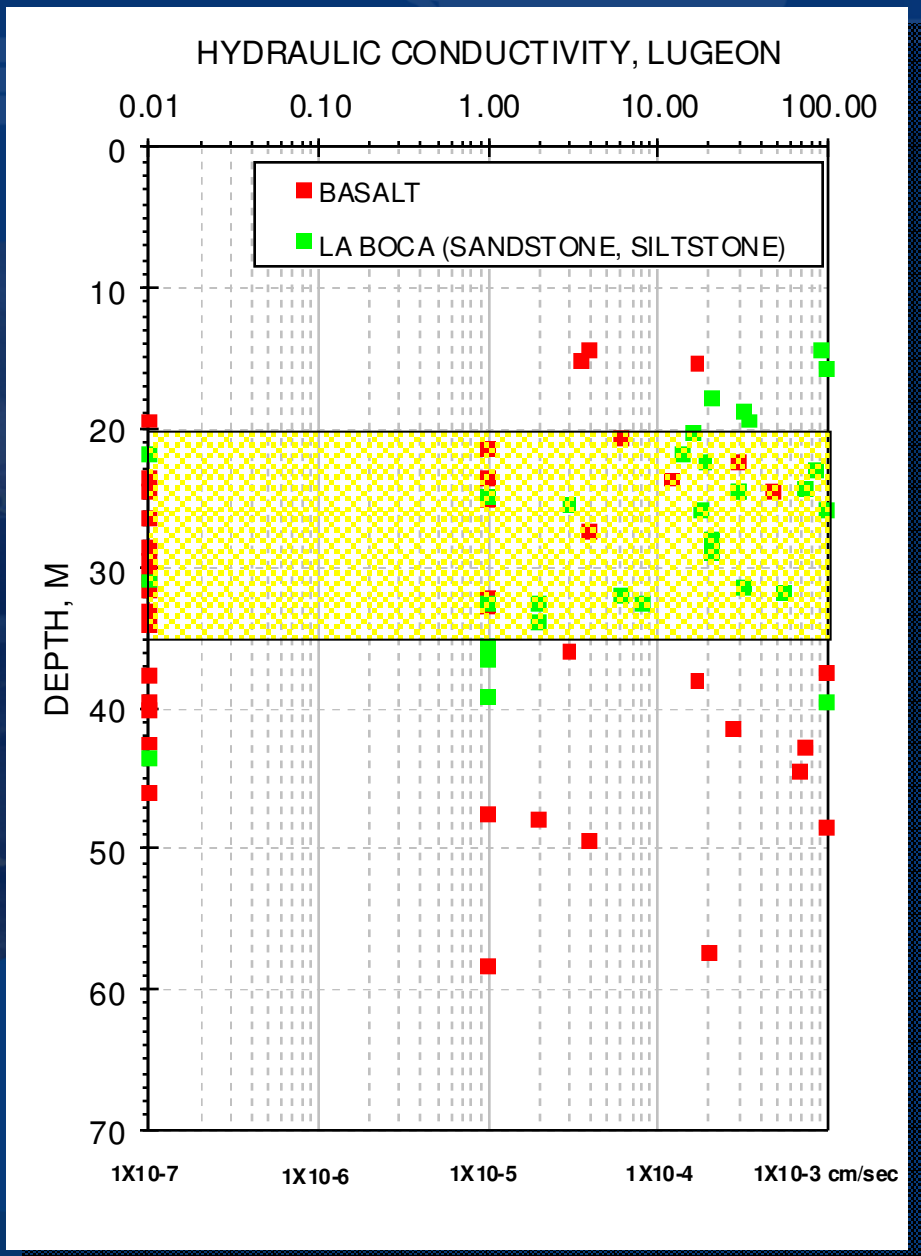
Gs			Unit Weight (Kg/m3)			Elastic Modulus E (Mpa)			UCS σc (Mpa)			Type of rock / Formation
N	Median Average	St. Dev.	N	Median Average	St. Dev.	N	Median Average	St. Dev.	N	Median Average	St. Dev.	
5	2.20 2.28	0.11	5	2,261 2,257	77	--	-- --	--	5	21.00 19.20	6.91	Agglomerate and tuffaceous Agglomerate
2	2.30 2.30	0.00	2	2,253 2,253	33	--	-- --	--	2	17.30 17.30	10.89	Conglomerate
1	2.40 --	--	1	2,333 --	--	--	-- --	--	1	13.00 --	--	Sandy Tuff
8	2.30 2.30	0.09	8	2,269 2,265	66	0	-- --	-- --	8	19.50 17.95	7.00	Global Panama
268	2.40 2.42	0.08	268	2,403 2,414	125	152	7,784 8,229	4,373	268	34.00 33.05	13.00	Agglomerate
16	2.30 2.32	0.02	16	2,335 2,329	113	15	5,663 6,053	3,980	16	24.50 23.84	11.32	Agglomerate, tuffaceous
75	2.34 2.34	0.07	76	2,341 2,332	120	63	5,626 5,741	2,977	76	23.75 24.96	10.62	Tuff, agglomeratic
11	2.31 2.30	0.07	11	2,281 2,308	107	11	5,821 5,654	2,579	11	24.00 26.17	9.29	Tuff
370	2.40 2.39	0.08	371	2,379 2,390	129	241	6,707 7,326	4,115	371	31.70 30.79	12.87	Global Pedro Miguel
276	2.71 2.73	0.06	277	2,724 2,711	110	231	12,641 13,765	7,185	277	57.20 60.57	35.29	Basalt
87	2.76 2.75	0.06	89	2,749 2,740	106	89	13,282 14,459	6,393	89	55.80 56.25	22.03	Basalt/diabase
4	2.73 2.73	0.06	4	2,656 2,670	73	4	15,129 15,061	2,114	4	48.25 55.08	18.28	Basalt/andesite
19	2.48 2.52	0.11	23	2,562 2,562	153	23	6,401 6,758	3,432	23	19.00 21.41	10.64	Basalt (brecciated)
386	2.72 2.72	0.08	393	2,720 2,702	177	347	12,493 13,511	6,980	393	53.70 73.45	321.29	Global Basalt

Rock Triaxial Test

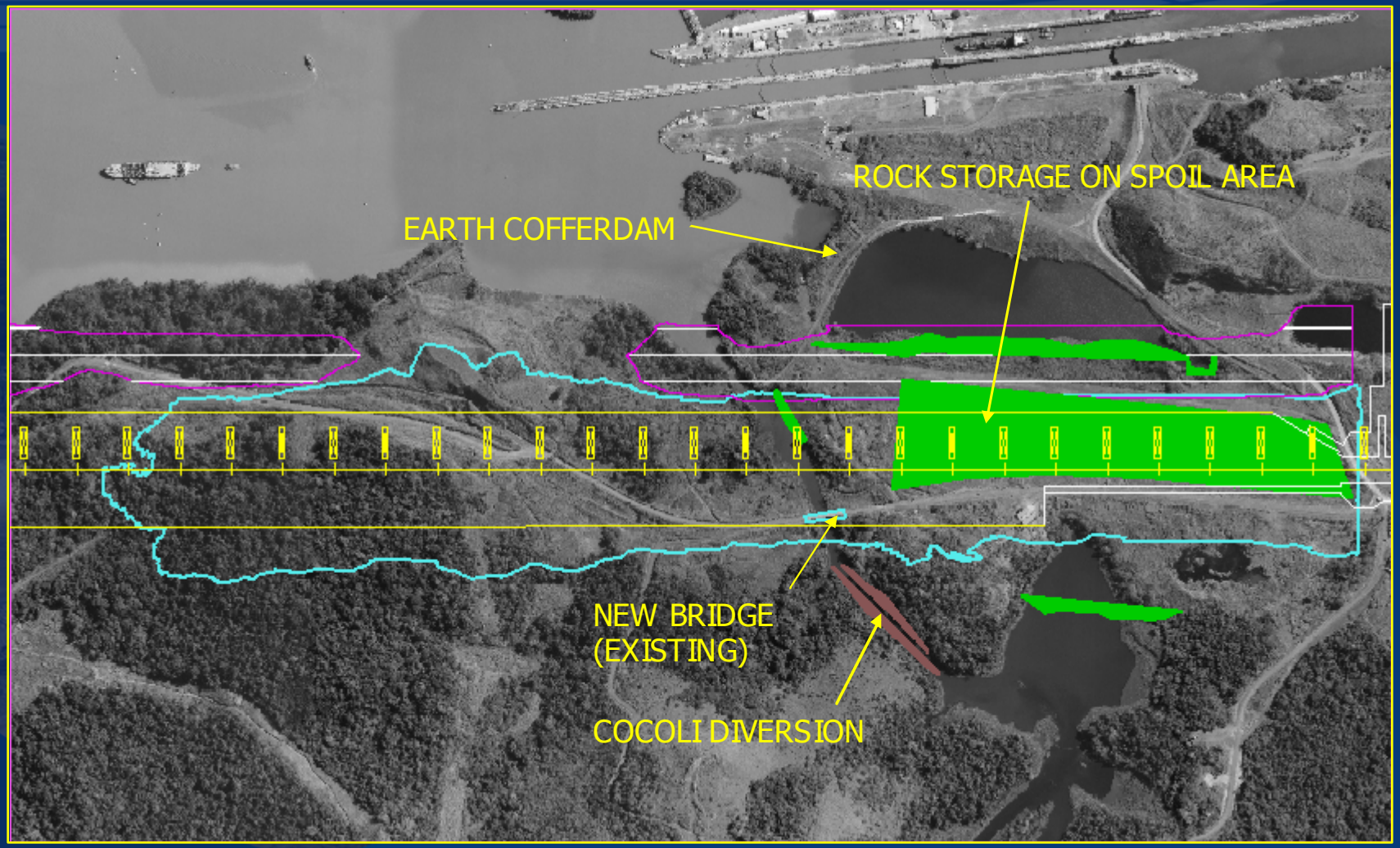
Boring	Depth (m)	sample	Uniaxial Compressive Strength σci(Mpa)	Water Content wo (%)	Density γw (kg/m3)	Triaxial test σ3(Mpa)	Triaxial test σ1(Mpa)	Hoek-Brown Fit mi	Hoek-Brown Fit q_{ui} (Mpa)	Friction angle ϕ'	Cohesion (Mpa)	Material
NML-10	30.05-30.53	1		4.55	2671	1.4	59.2					
NML-10		2		4.47	2623	2.8	69.0	39.0	34.0	**55.0**	**6.0**	Basalt
NML-10		3		4.59	2625	5.5	100.6					
NML-10		4	68.5									
NML-10	36.13-37.10	1		4.68	2519	1.4	33.1					
NML-10		2		5.09	2493	2.8	51.2	50.0	13.0	**57.0**	**2.0**	Basalt
NML-10		3		5.21	2424	5.5	67.6					
NML-10		4	101.5									
NML-10	39.20-39.70	1		8.82	2269	1.4	18.3					
NML-10		2		7.76	2281	2.8	38.8	50.0	4.0	**57.0**	**0.7**	Sandstone
NML-10		3		9.52	2298	5.5	51.1					
NML-10		4	24.8									
NML-14	39.26-39.56	1		3.47	2695	1.4	61.7					
NML-14		2		3.92	2725	2.8	73.8	13.0	52.0	**46.0**	**9.9**	Basalt
NML-14		3		3.51	2687	5.5	86.8					
NML-14		4	95.3									
NML-27	56.65-57.74	1		2.73	2782	1.4	75.5					
NML-27		2		2.91	2777	2.8	90.9	7.2	73.0	**39.0**	**16.0**	Basalt
NML-27		3		2.06	2767	5.5	93.9					
NML-27		4	111.0									
NML-33	21.82-22.80	1		5.88	2201	0.7	37.4					
NML-33		2		6.24	2266	1.4	52.5	24.0	31.0	**52.0**	**6.0**	Tuff-Agglomerate
NML-33		3		5.00	3116	2.8	57.4					
NML-33		4	4.9									
NML-37	15.45-16.05	1		12.52	2281	0.7	20.0					
NML-37		2		12.58	2257	1.4	25.8	50.0	11.0	**57.0**	**2.0**	Sandstone
NML-37		3		10.42	2299	2.8	52.5					
NML-37		4	76.2									
NML2-4	32.05-32.55	2-1		20.02	2078	0.6	25					
NML2-4		2-2		19.41	2088	1.2	40	50.0	9.0	***57.0***	***1.6***	Sandstone
NML2-4		2-3		19.58	2049	1.8	46					
NML2-4		2-3	11									
NML2-17	11.32-11.68	2-1		13.59	2207	0.1	14					
NML2-17		2-2		9.45	2215	0.3	34	49.0	12.0	***57.0***	***2.0***	Sandstone Agglomeratic
NML2-17		2-3		10.92	2272	0.5	44					
NML2-17		2-3	29									
PAC2-19	23.20-23.70	2-1		13.37	2269	0.25	27					
PAC2-19		2-2		13.97	2258	0.5	37	49	16	**57**	**2.8**	Tuff, Agglomeratic
PAC2-19		2-3		13.05	2283	1	50					
PAC2-19		2-4	10.2									
PAC-3-16	9.04-9.76	1-1		3.44	2636	0.69	29					
		1-2		3.89	2610	1.38	53	**50**	**29**	**57**	**5**	Agglomerate
		1-3		5.02	2514	2.76	60					
			29									
PAC-3-16	11.68-12.78	2-1		1.74	2502	0.69	43					
		2-2		1.46	2769	1.38	103					Agglomerate
		2-3		1.59	2759	2.76	124	**50**	**28**	**57**	**5**	
		2-4		2.12	2747	5.52	142					
			28									
PAC-3-16	16.40-17.24	3-1		5.11	2542	0.69	48					
		3-2		4.02	2605	1.38	51					Agglomerate
		3-3		2.66	2598	2.76	53	**10**	**33**	**43**	**6**	
		3-4		3.13	2704	5.52	73					
			33									
URS2-4	16.73-17.68	1-1		12.00	2176	0.69	34					Tuff, agglomeratic
		1-2		11.38	2196	1.38	43					
		1-3		12.10	2156	2.76	45	12	29	**45**	**6**	Pedro Miguel Fm
		1-4		11.92	2177	5.52	61					
			29									
URS2-4	21.46-22.41	2-1		11.35	2206	0.39	32					Tuff, agglomeratic
		2-2		12.13	2136	1.38	37					
		2-3		11.64	2135	2.76	34	11	23	**44**	**5**	Pedro Miguel Fm
		2-4		11.52	2122	2.76	40					
		2-5		11.04	2209	5.52	59					
			23									

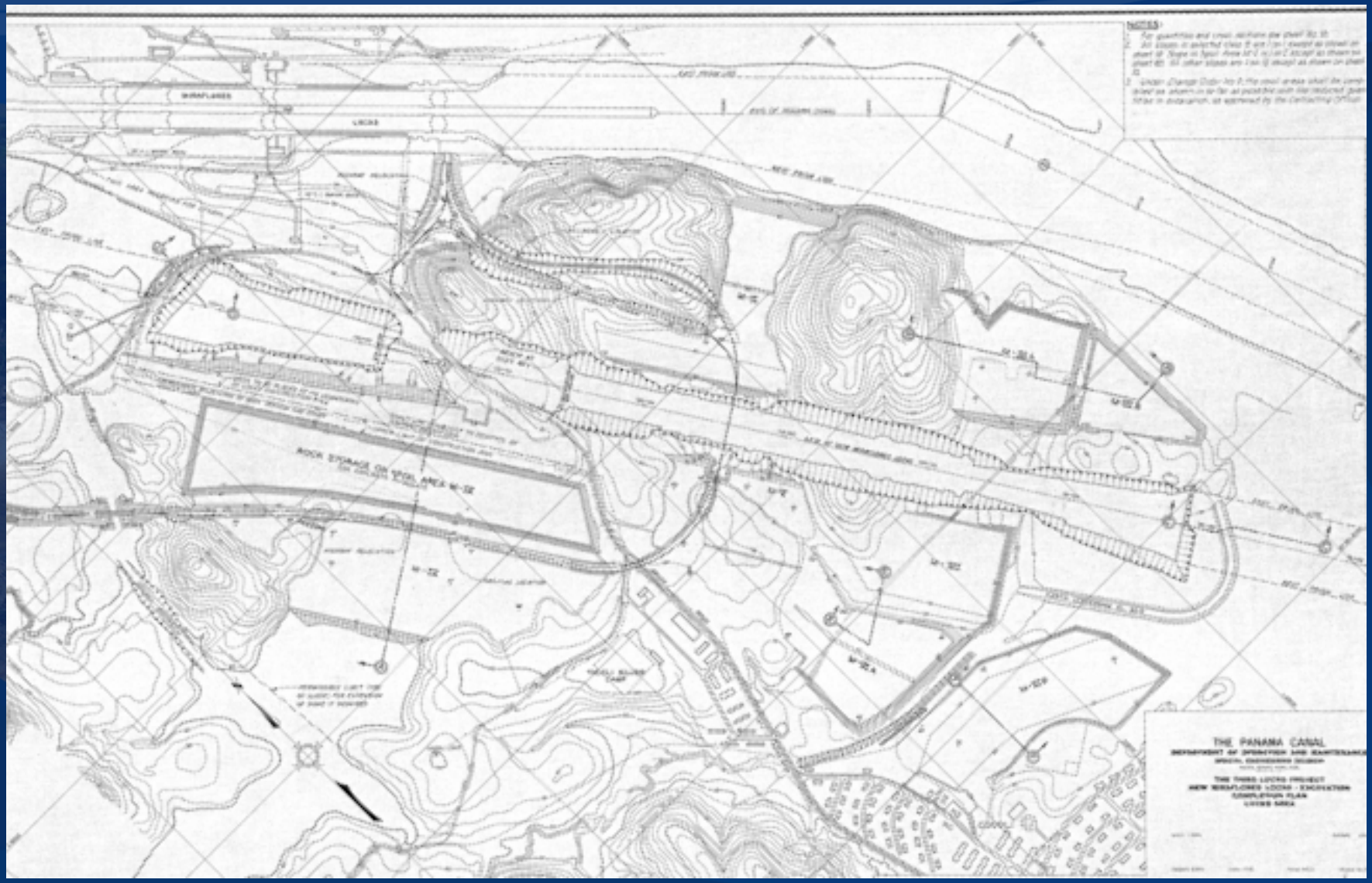
Field Tests Results (Dilatometer, Lugeon) - Pacific





The Third Locks Project (1941)




NOTES:
WINGLADES
LOCKS
ROCK STORAGE ON SPOIL AREA W-12
THE PANAMA CANAL
THE THIRD LOCKS PROJECT
NEW WINGLADES LOCKS - EXCAVATION
COMPLETION PLAN
LOCKS AREA

Pacific Locks (1941 excavation), Looking south

Pacific Locks (1941 excavation), Looking north

SPECIAL ENGINEERING DIVISION | THE PANAMA CANAL | DIABLO HEIGHTS, C. Z.

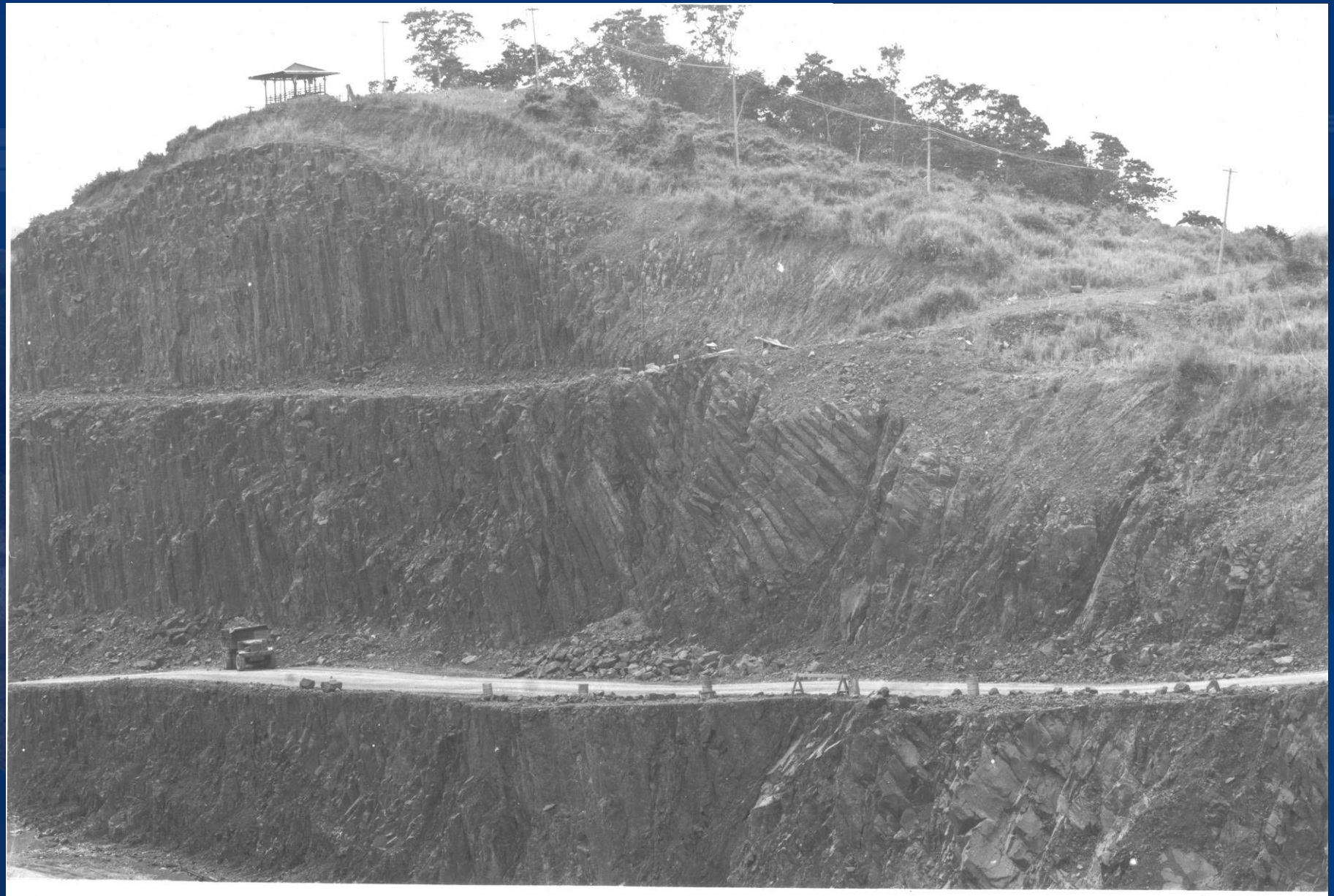
THE THIRD LOCKS PROJECT
6-9-43 NEW MIRAFLORES LOCKS. COMPLETED EXCAVATION. VIEW WEST FROM STA. 97+50, PANAMA CONSTRUCTORS, INC.
M-1-202 OFFSET 180' EAST. LEFT MARKER AT 96+00, RIGHT AT 99+00. (W5).

CONTRACT NO. PC1p-602

SPECIAL ENGINEERING DIVISION | THE PANAMA CANAL | DIABLO HEIGHTS, C. Z.

THE THIRD LOCKS PROJECT
3/31/42 NEW MIRAFLORES LOCKS EXCAVATION. VIEW LOOKING SOUTH FROM STATION 123
M-1-63 SHOWING EXCAVATION WORK IN PROGRESS AT STATION 108.

CONTRACT NO. PC1p-602
PANAMA CONSTRUCTORS, INC.



SPECIAL ENGINEERING DIVISION · THE PANAMA CANAL · DIABLO HEIGHTS, C.Z.

THE THIRD LOCKS PROJECT

12/23/42
M-4-66

NEW MIRAFLORES LOCKS. FOUNDATIONS. VIEW LOOKING SOUTHERLY FROM STA. 119/00 SHOWING INCLINED (45 DEGREE) COLUMNAR BASALT AT STA. 110/00 WEST WALL FACE.

CONTRACT NO. PC1p-602
PANAMA CONSTRUCTORS, INC.

SPECIAL ENGINEERING DIVISION | THE PANAMA CANAL | DIABLO HEIGHTS, C. Z.

THE THIRD LOCKS PROJECT
6-10-43
M-1-209

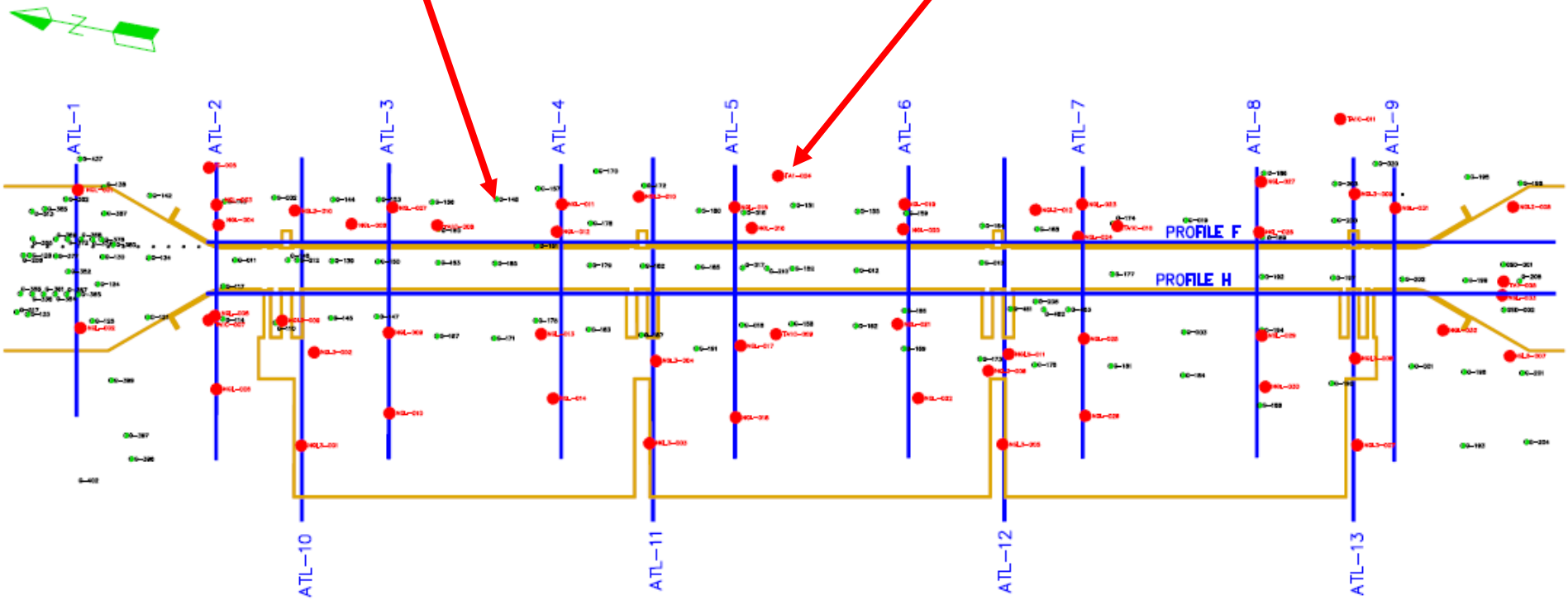
NEW MIRAFLORES LOCKS. COMPLETED EXCAVATION. VIEW WEST FROM STA. 118+05, OFFSET 219' EAST. LEFT MARKER AT 117+00, RIGHT AT 120+00. (W12).

CONTRACT NO. PC1p-602
PANAMA CONSTRUCTORS, INC.

Atlantic Site Investigations

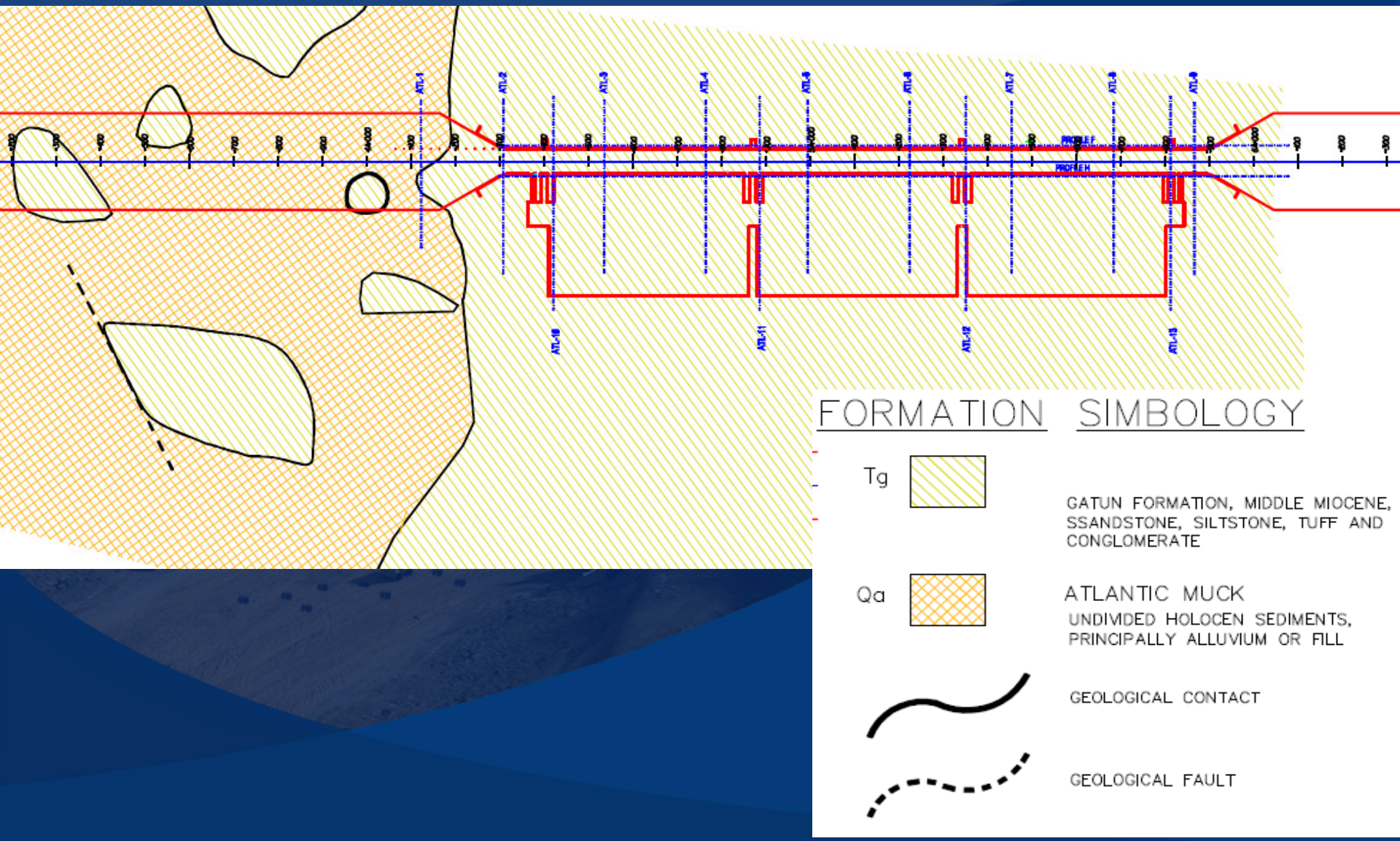
Old Boreholes

New Boreholes

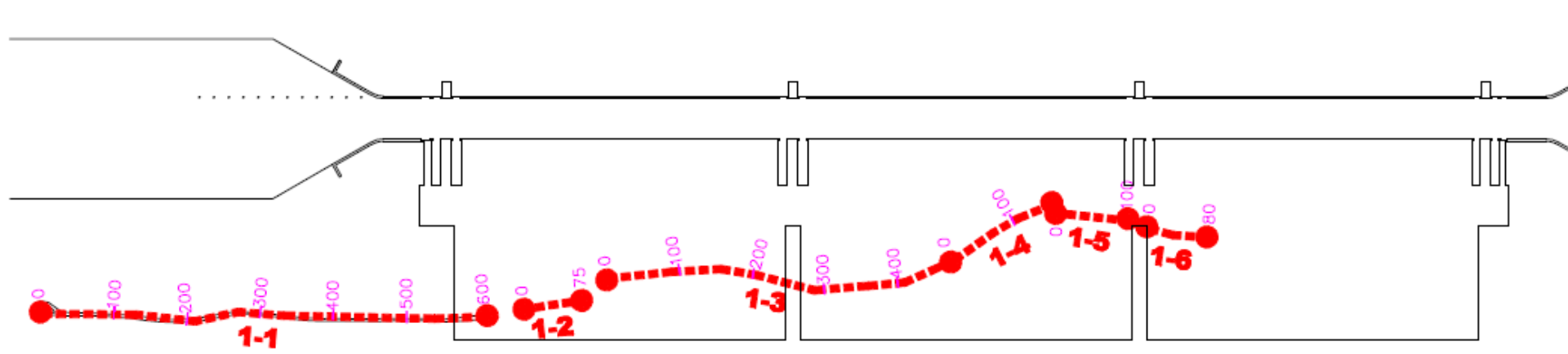


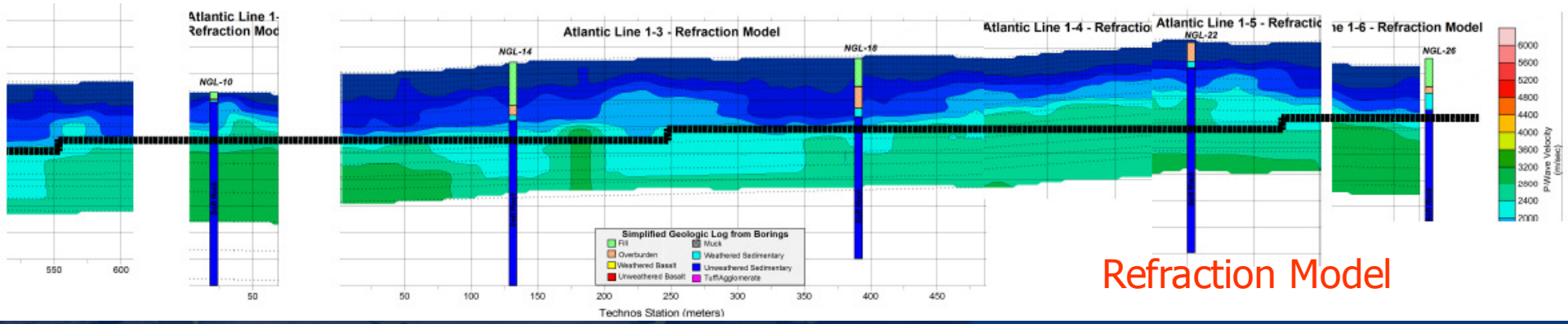
NEW THIRD SET OF LOCKS – ATLANTIC SITE

Geology Plan View - Atlantic

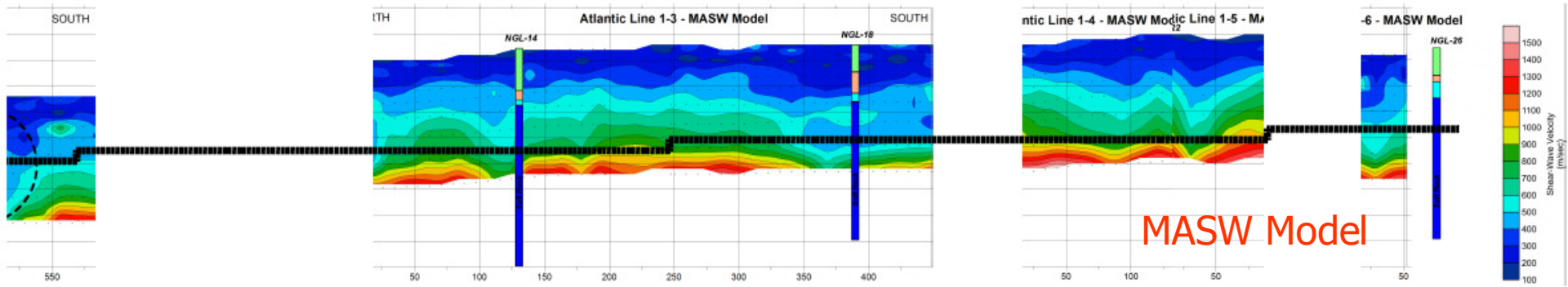


Geophysical Profile -Atlantic

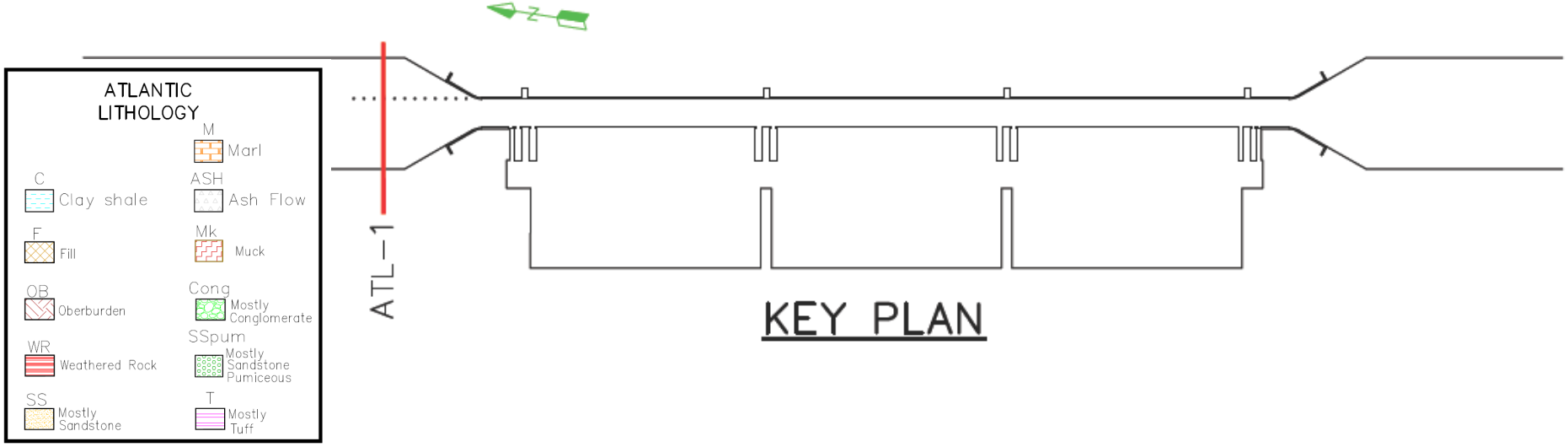




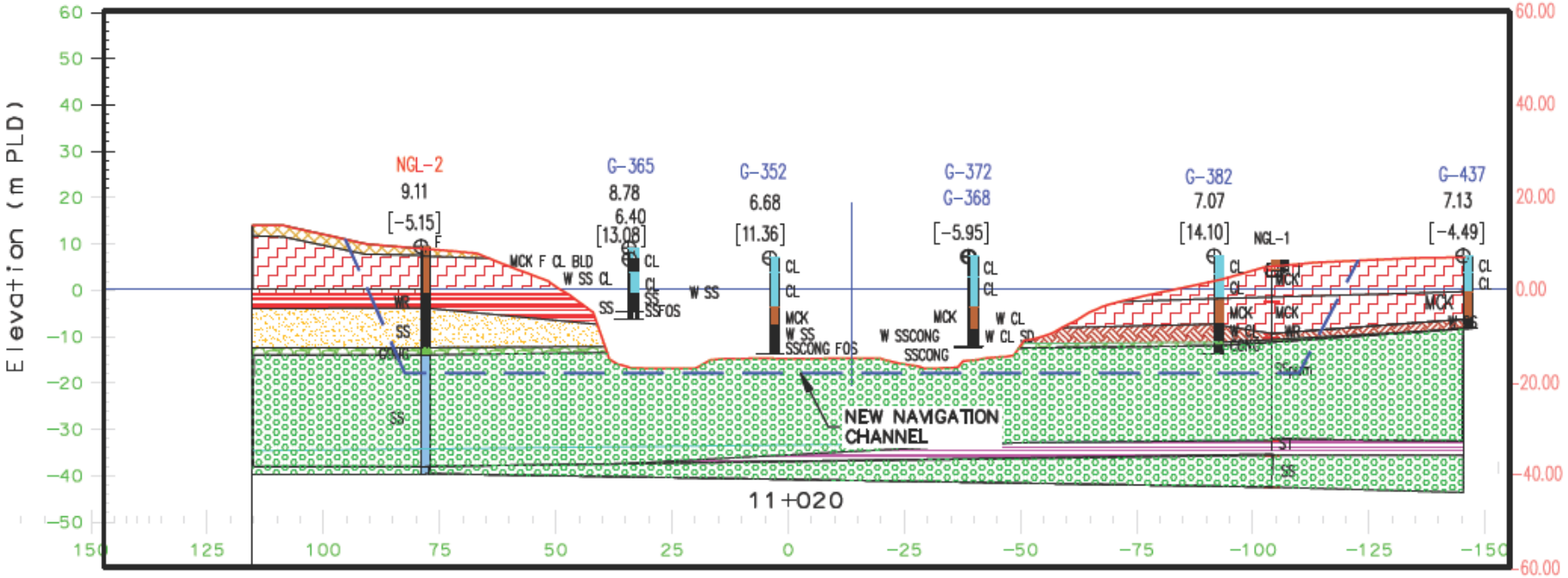
Refraction Model



MASW Model



KEY PLAN



CROSS SECTION 1

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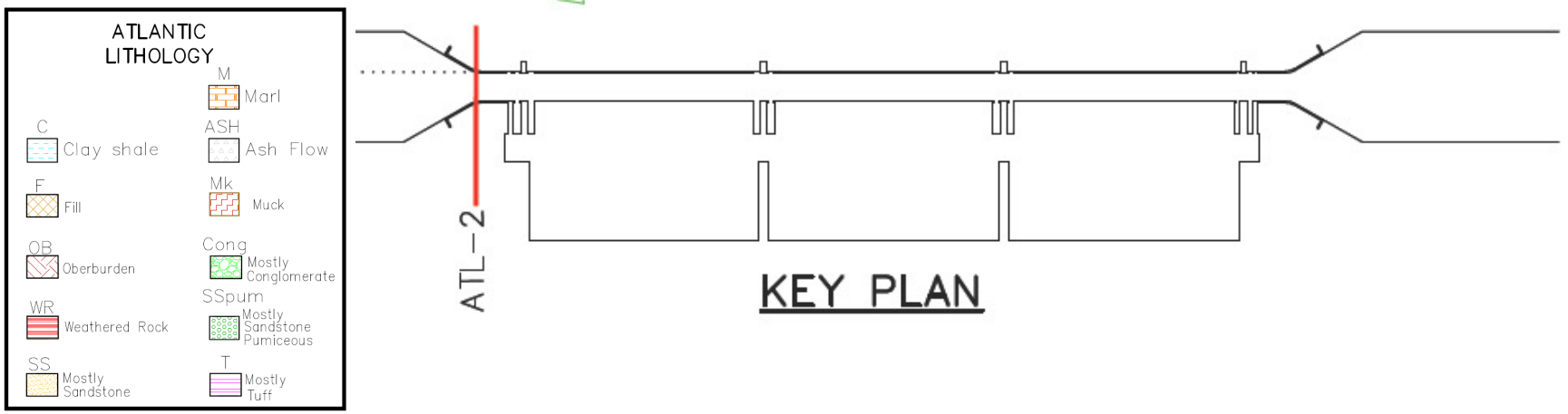
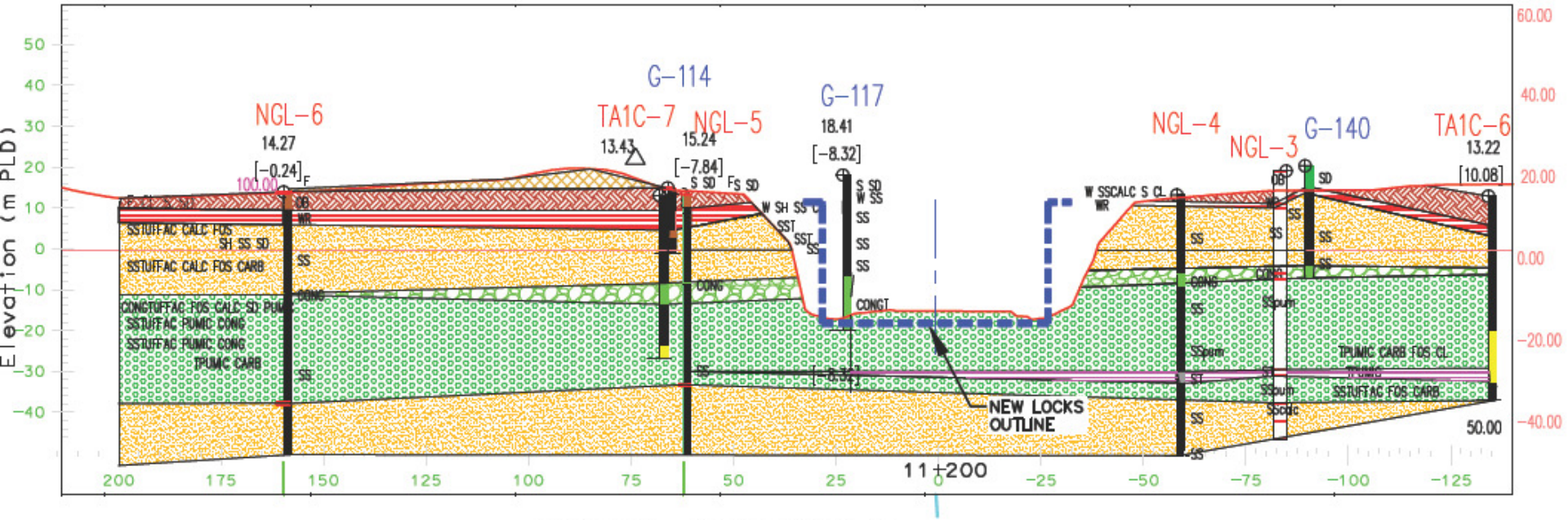


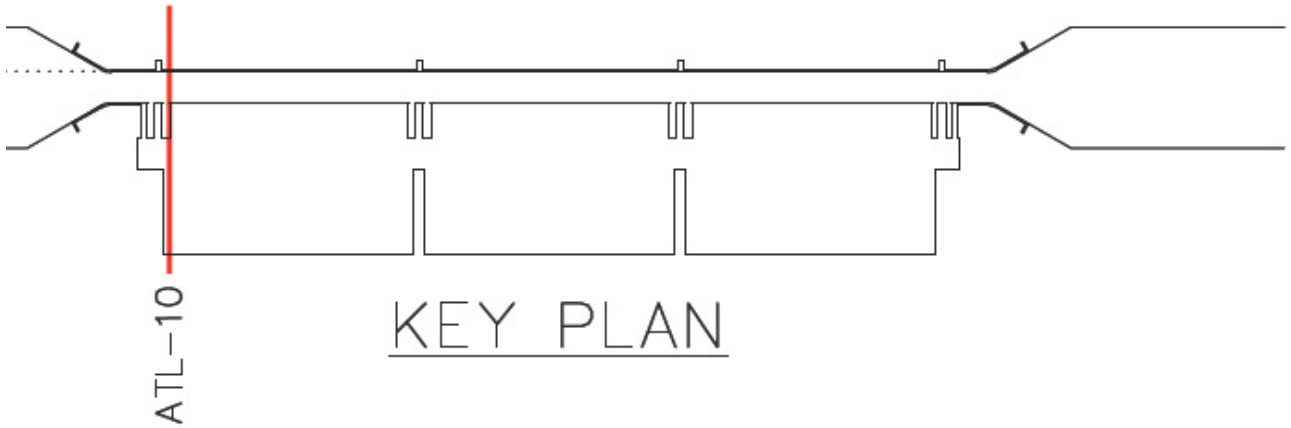


CROSS SECTION 2

SCALE 1:1000

ATLANTIC
LITHOLOGY

- M — Marl
- C — Clay shale
- ASH — Ash Flow
- F — Fill
- Mk — Muck
- OB — Oberburden
- Cong — Mostly Conglomerate
- WR — Weathered Rock
- SSpum — Mostly Sandstone Pumiceous
- SS — Mostly Sandstone
- T — Mostly Tuff



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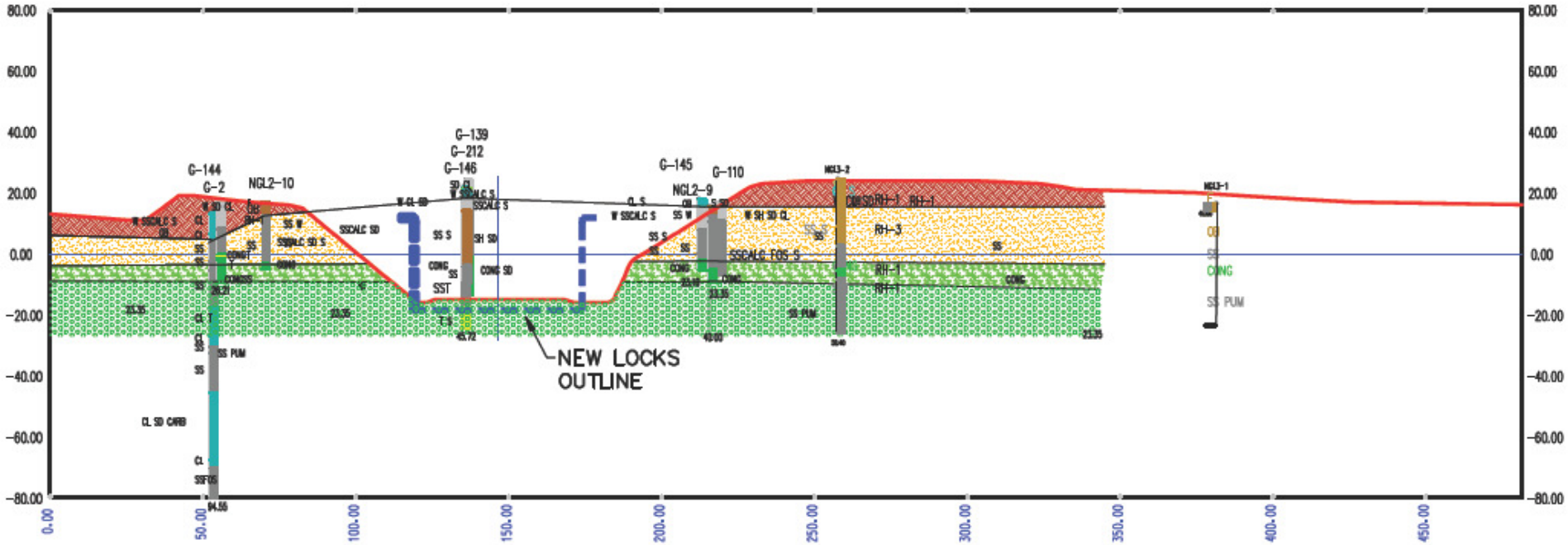
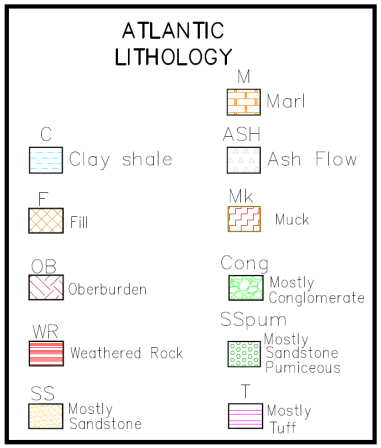
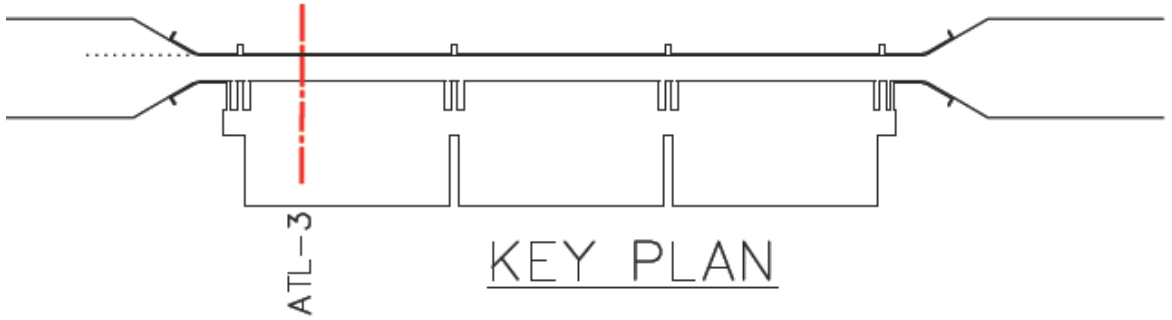
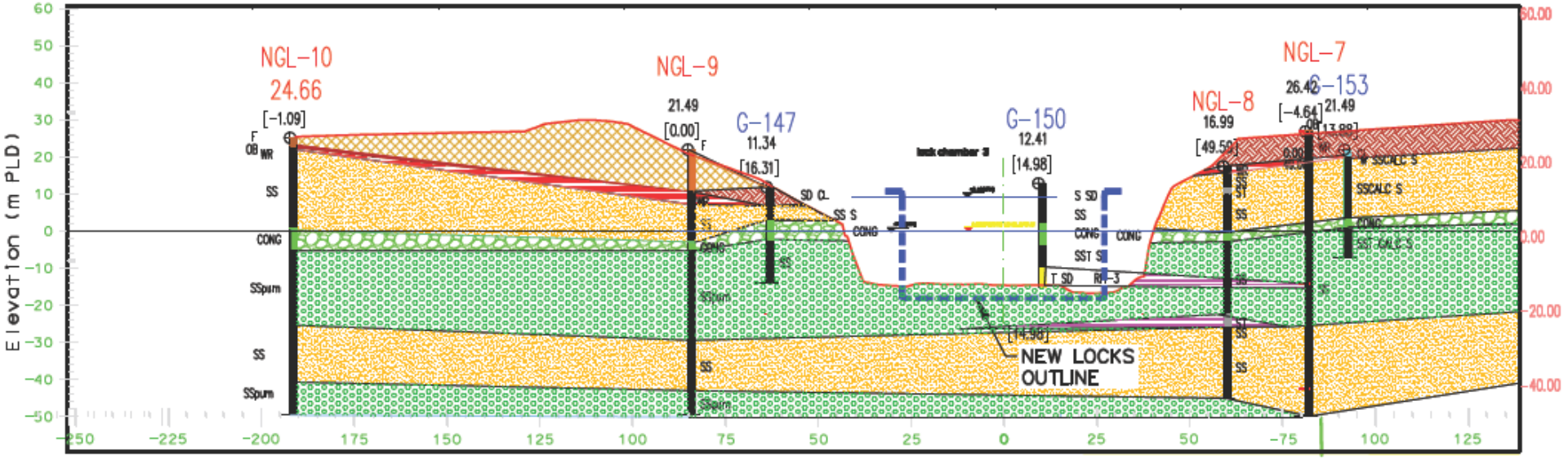


CROSS SECTION 10

SCALE 1:1000







CROSS SECTION 3

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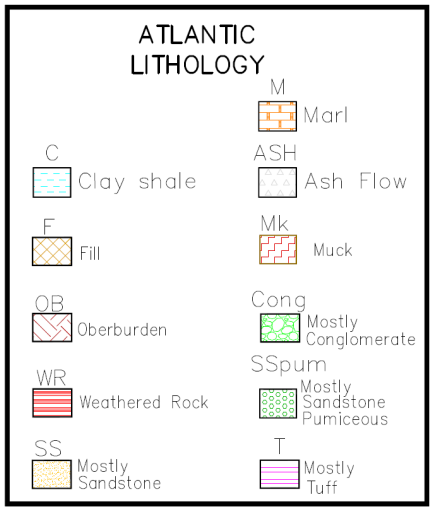
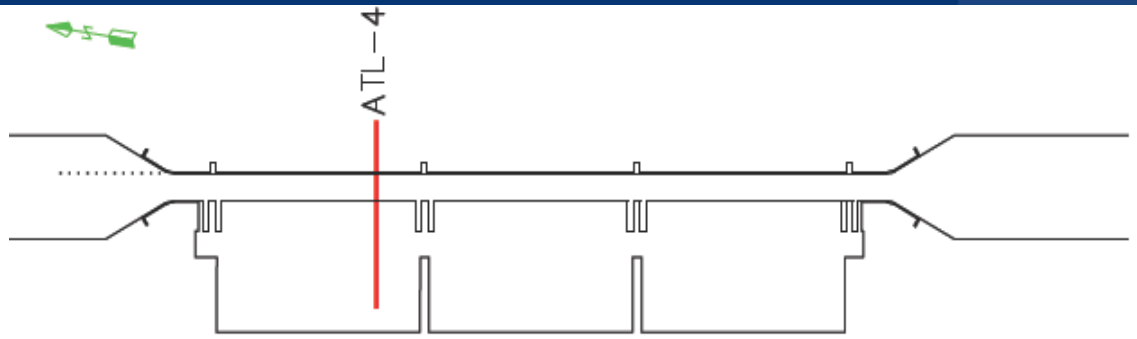
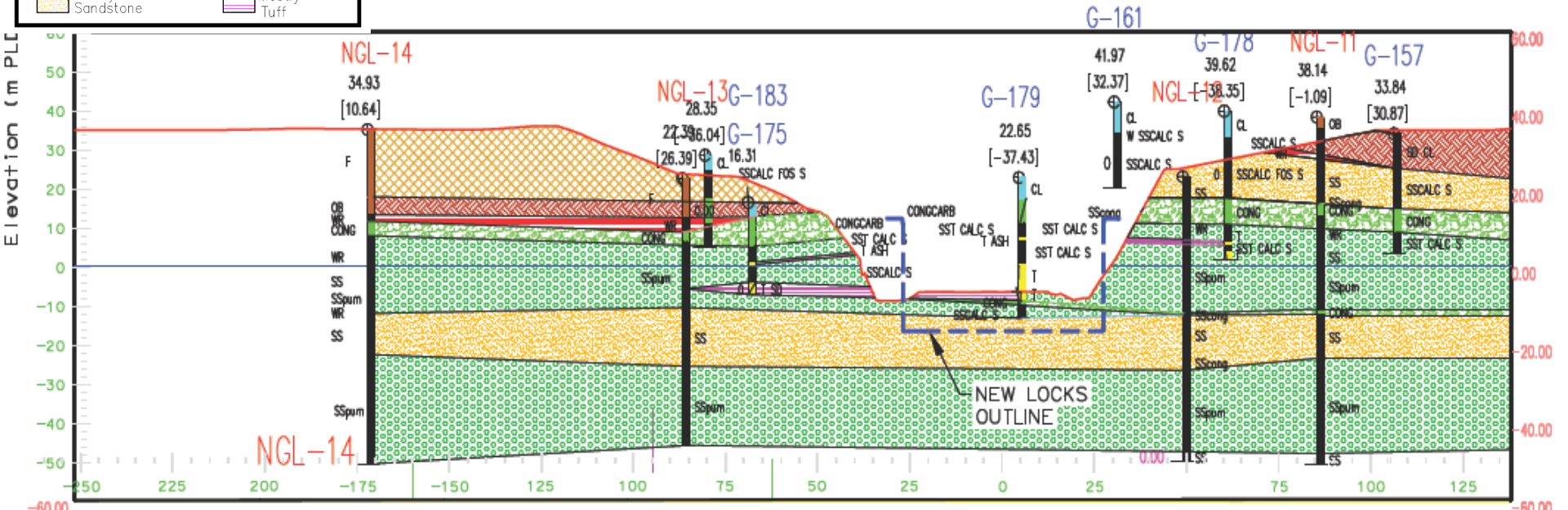




KEY PLAN

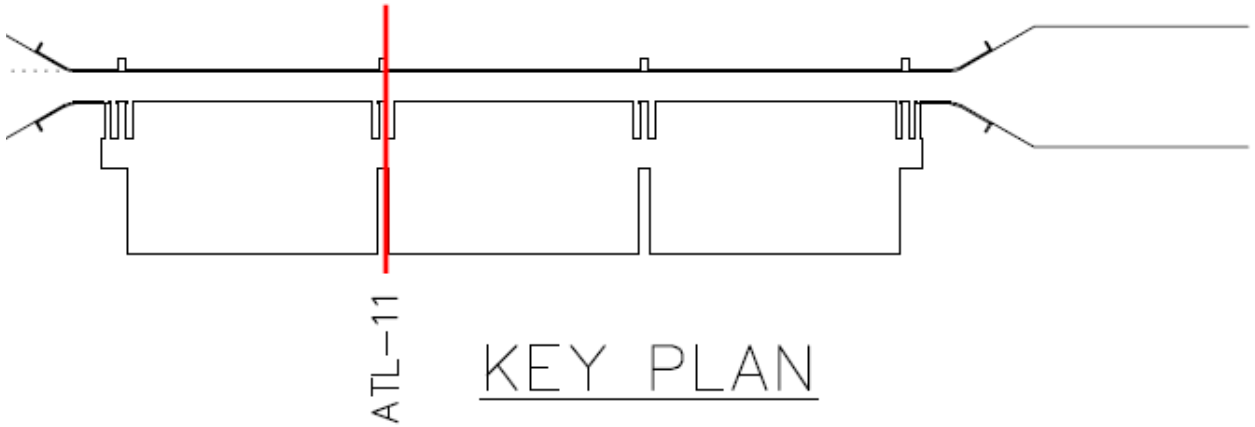


CROSS SECTION 4

SCALE 1:1000

ATLANTIC
LITHOLOGY

- M — Marl
- C — Clay shale
- ASH — Ash Flow
- F — Fill
- Mk — Muck
- OB — Oberburden
- Cong — Mostly Conglomerate
- WR — Weathered Rock
- SSpum — Mostly Sandstone Pumiceous
- SS — Mostly Sandstone
- T — Mostly Tuff



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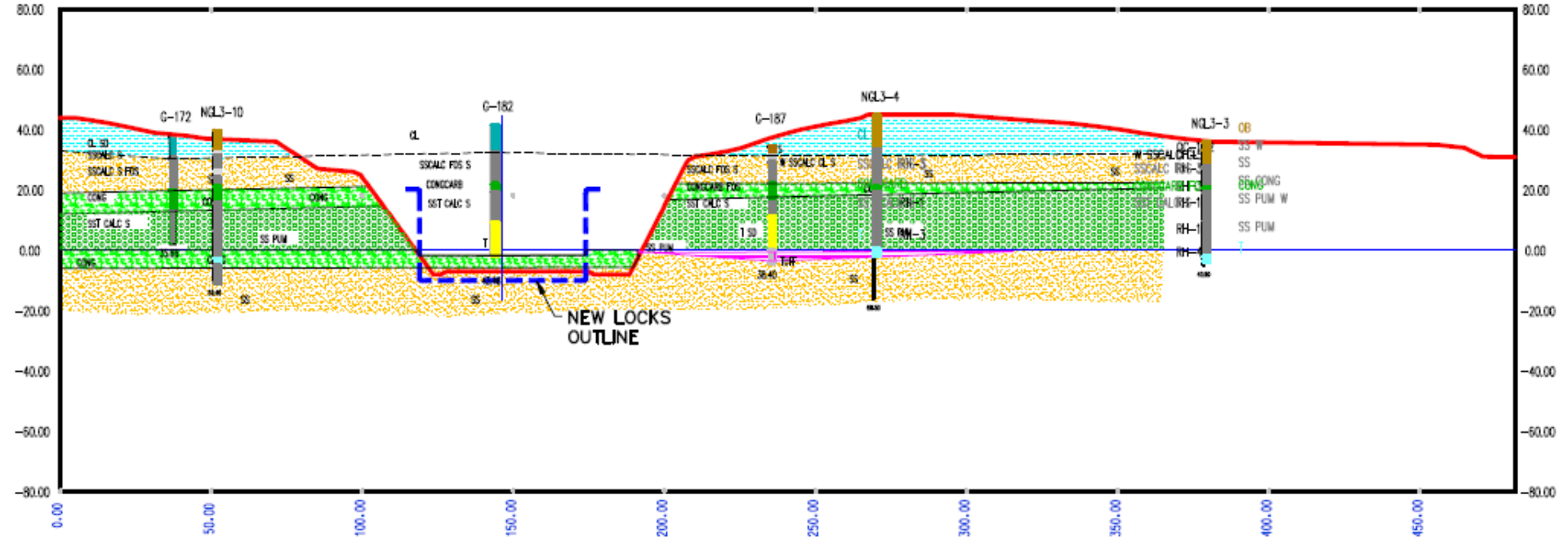
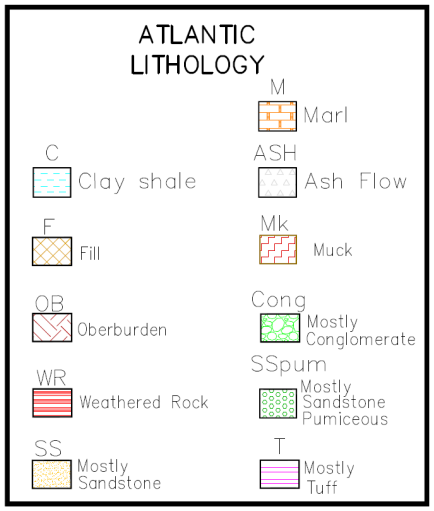
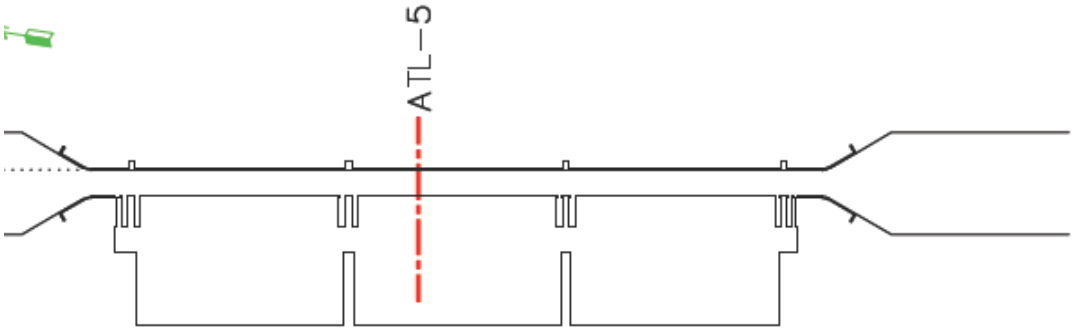


CROSS SECTION 11

SCALE 1:1000





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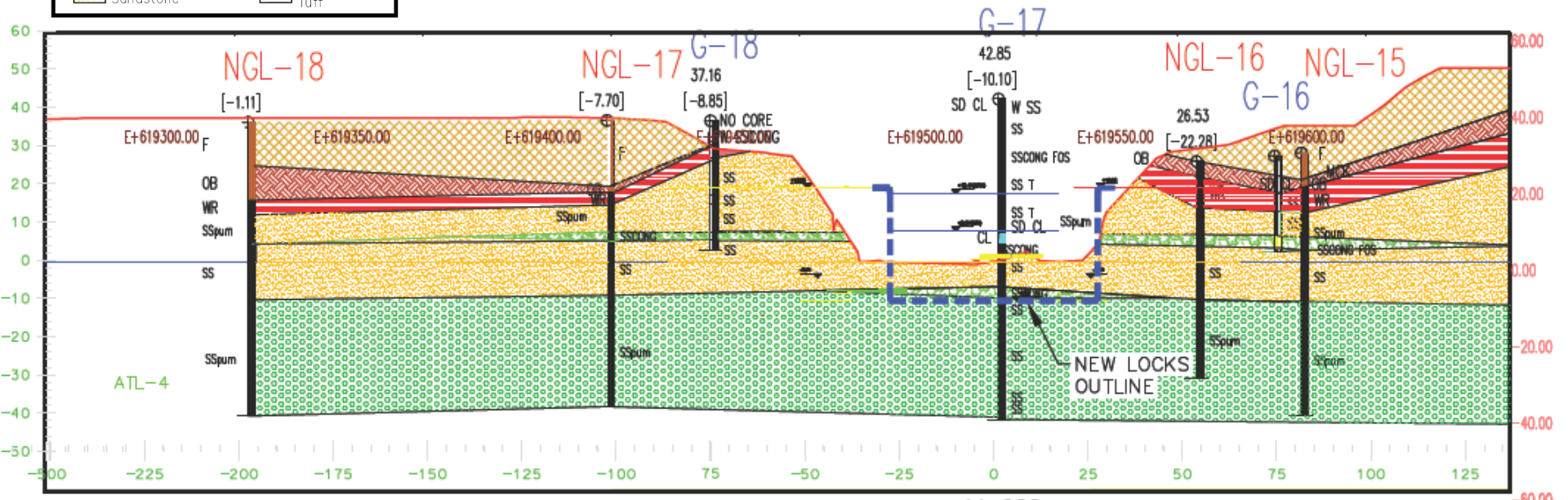
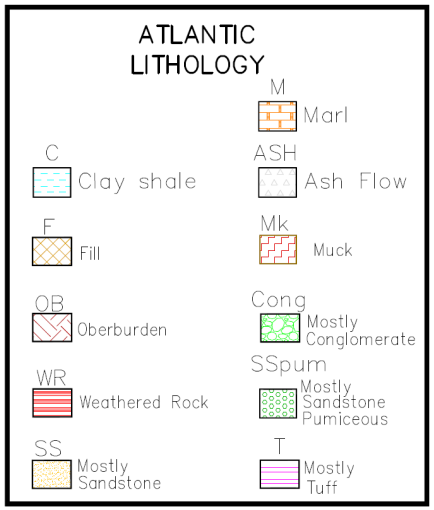
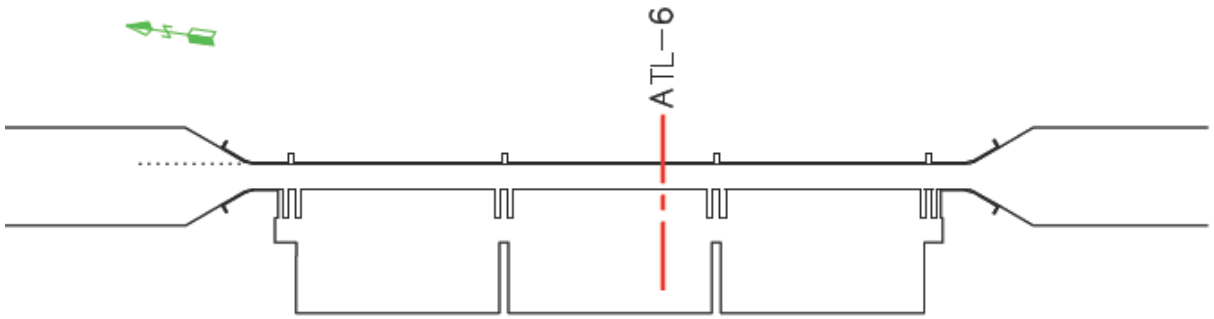


CROSS SECTION 5
SCALE 1:1000





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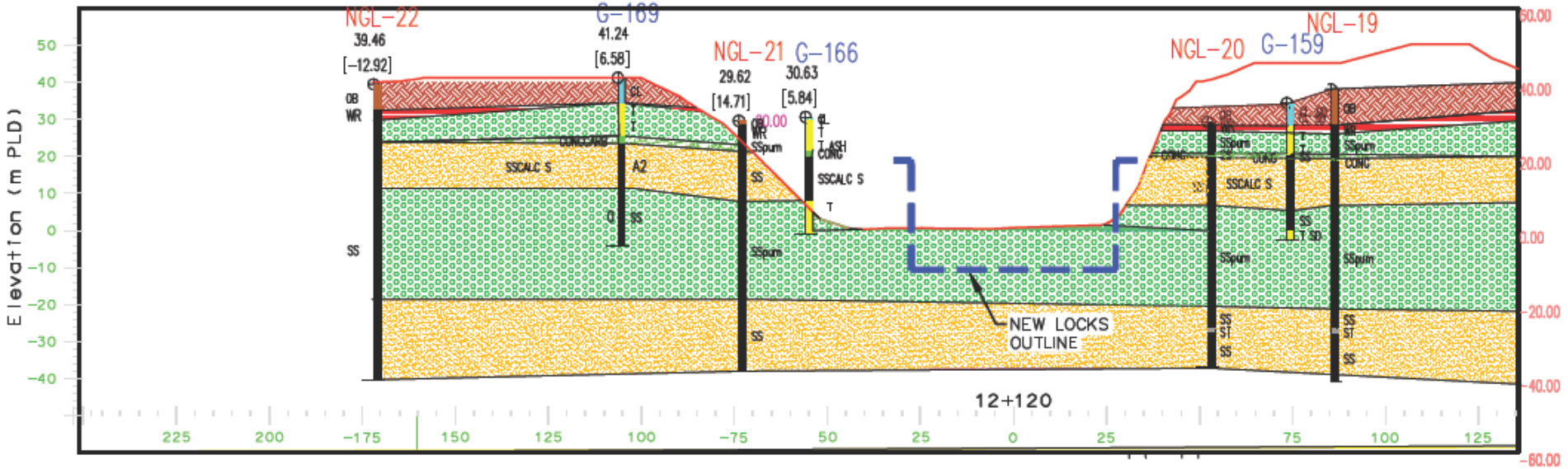
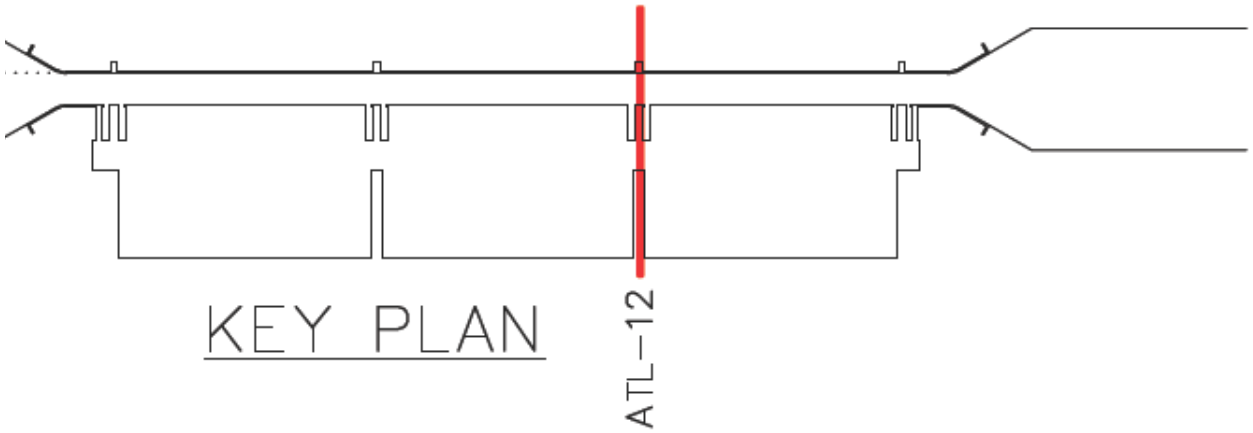


CROSS SECTION 6
SCALE 1:1000

ATLANTIC
LITHOLOGY

- M — Marl
- C — Clay shale
- ASH — Ash Flow
- F — Fill
- Mk — Muck
- OB — Oberburden
- Cong — Mostly Conglomerate
- WR — Weathered Rock
- SSpum — Mostly Sandstone Pumiceous
- SS — Mostly Sandstone
- T — Mostly Tuff



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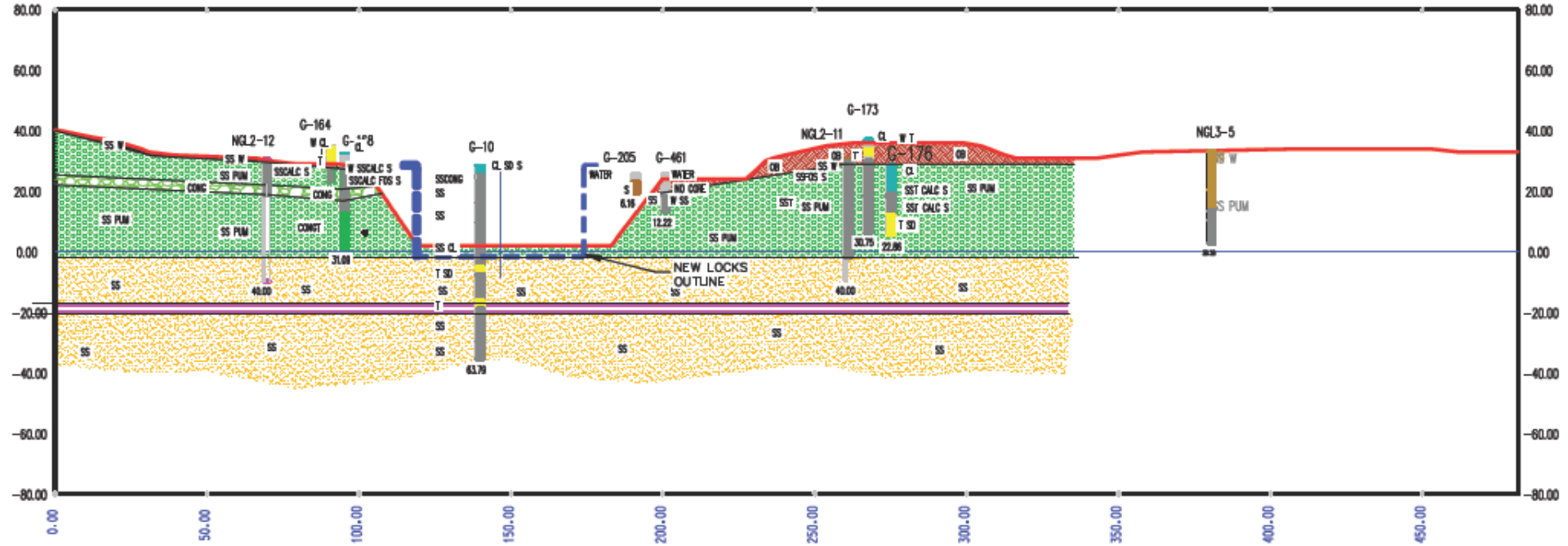
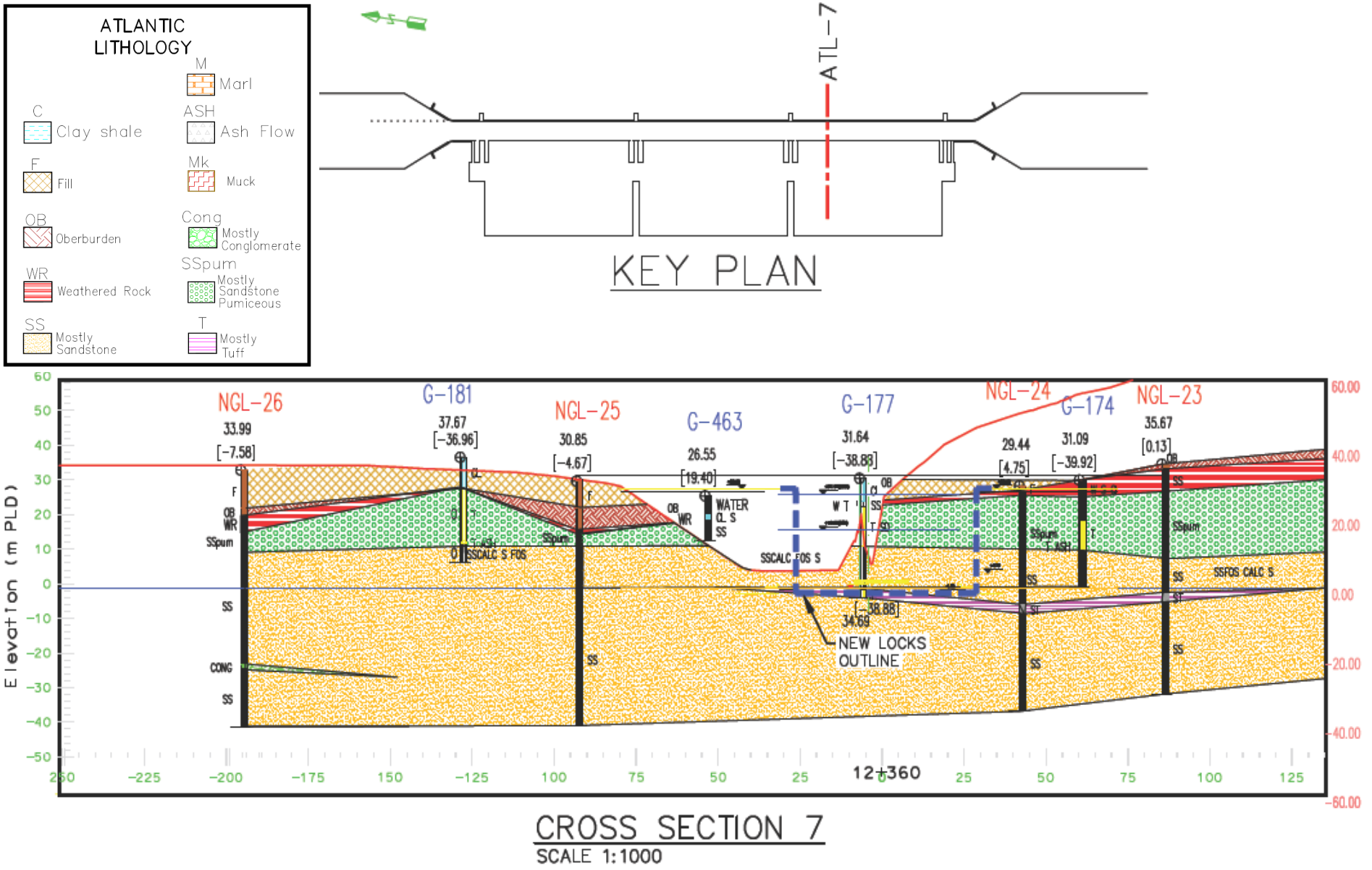


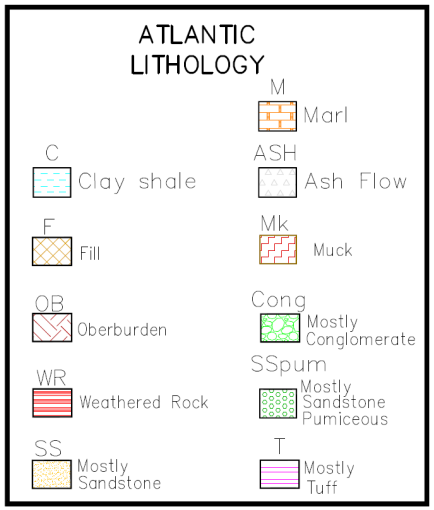
CROSS SECCION 12

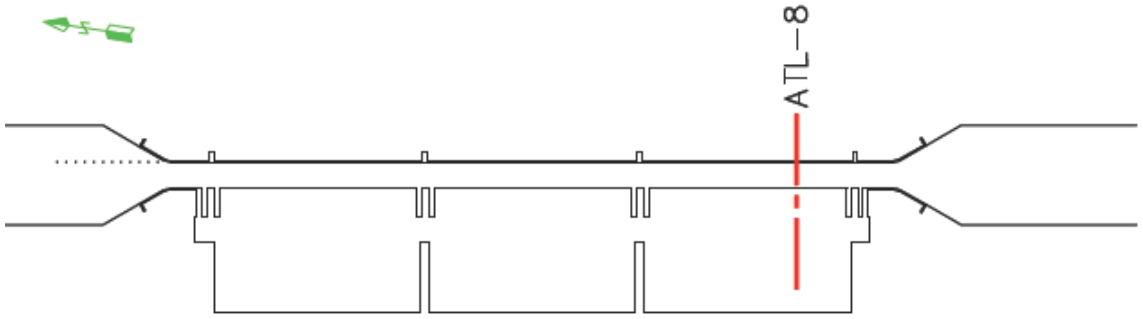
SCALE 1:1000



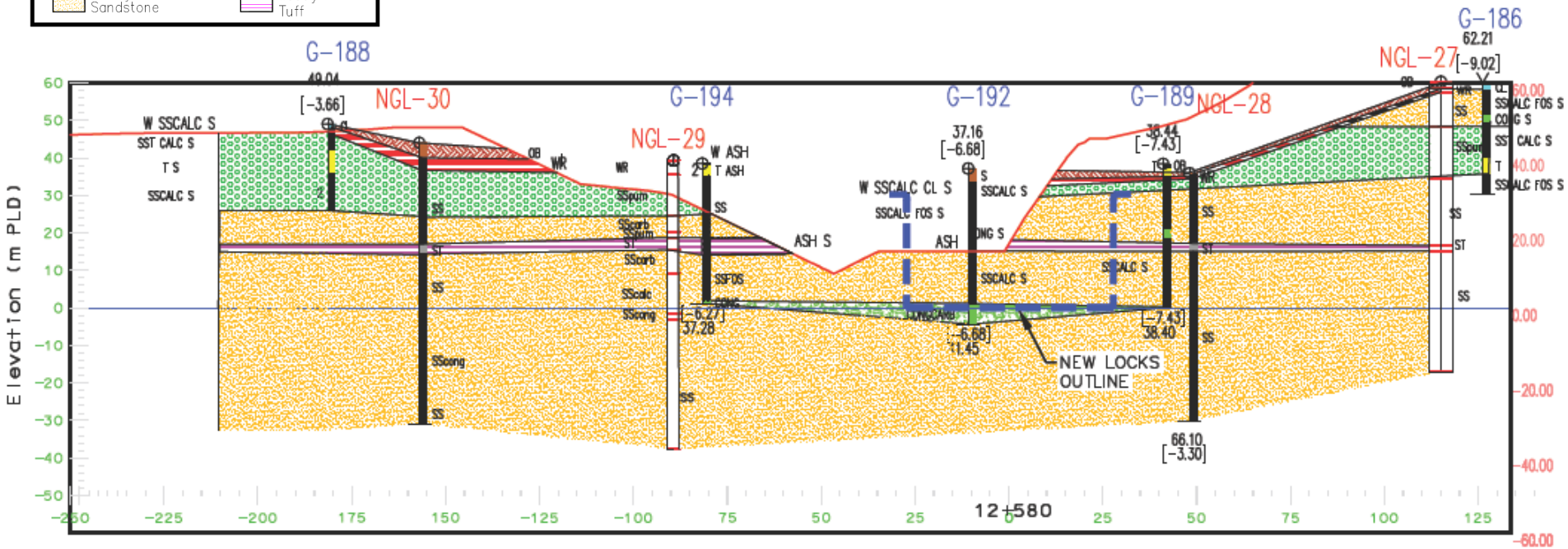
CROSS SECTION 7

SCALE 1:1000



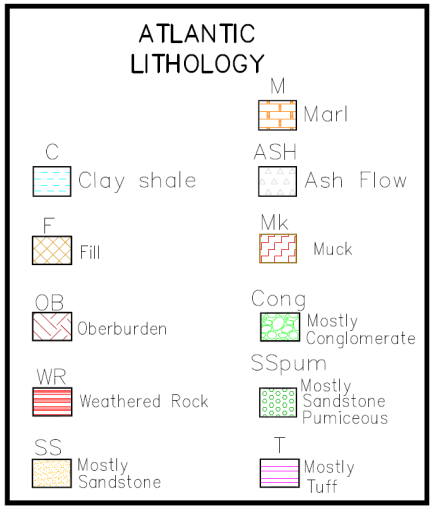


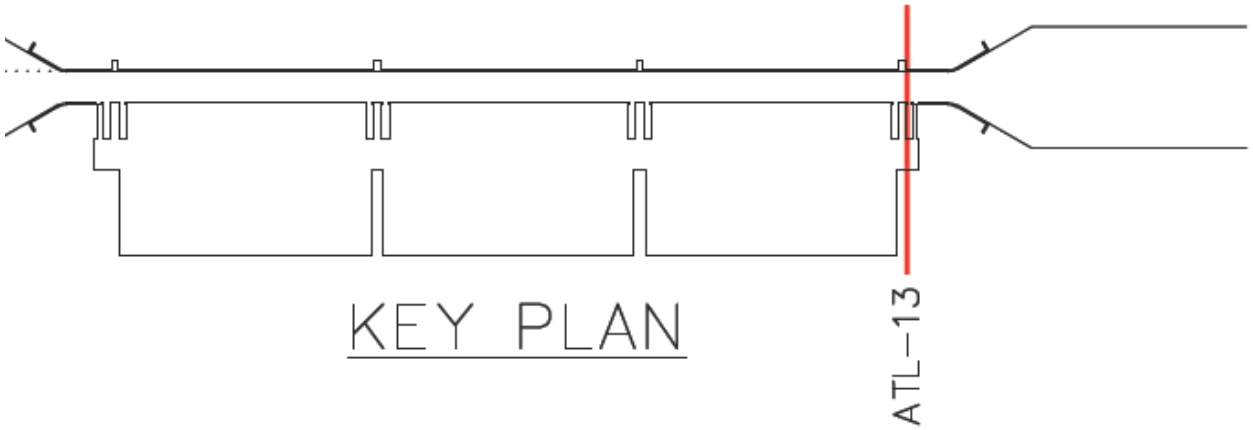
KEY PLAN

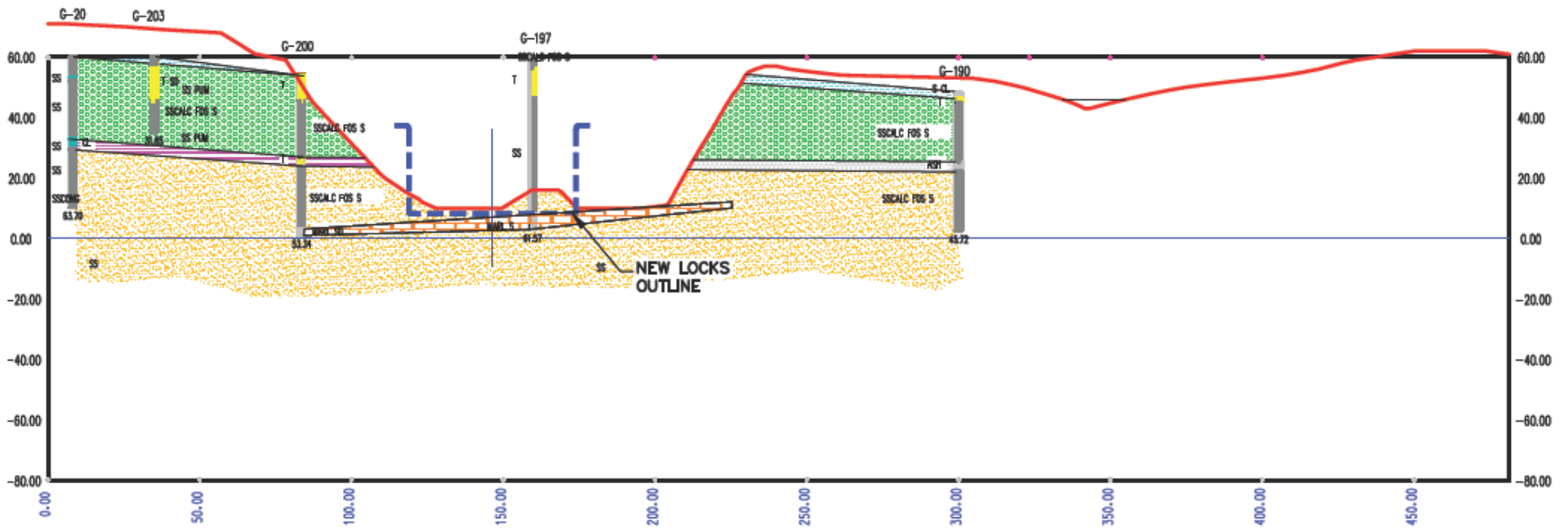


CROSS SECTION 8

SCALE 1:1000

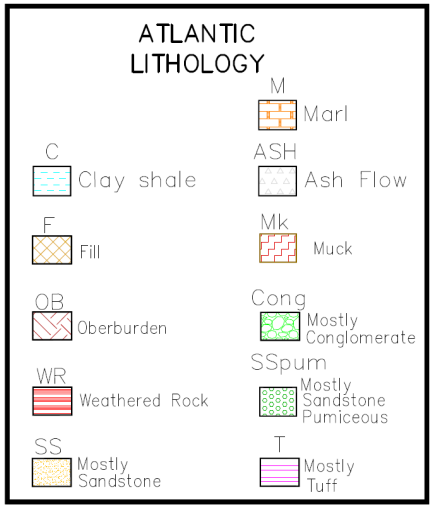


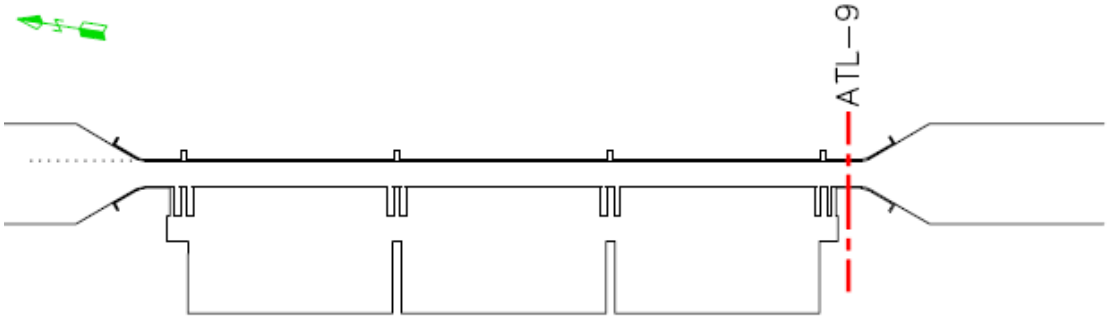




CROSS SECTION 13

SCALE 1:1000





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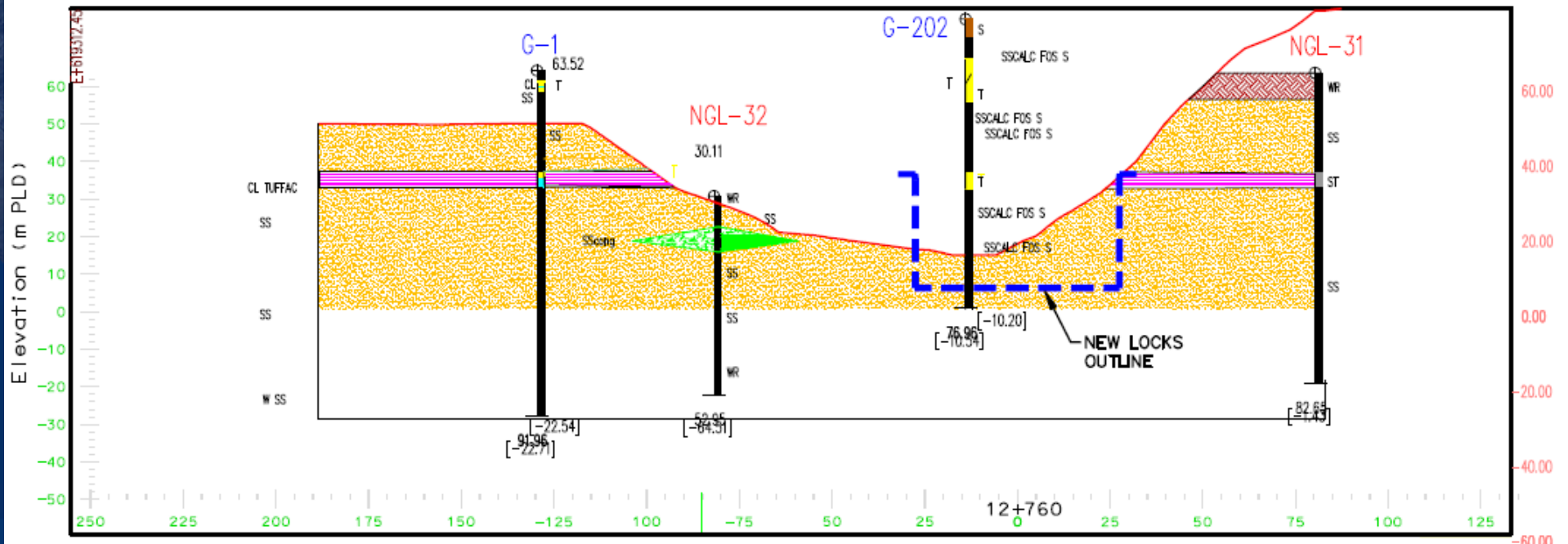


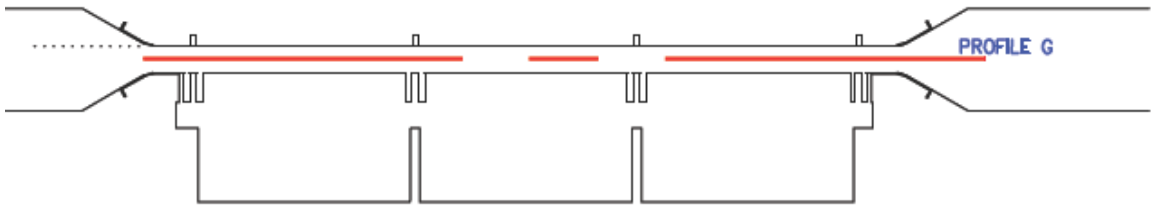
CROSS SECTION 9

SCALE 1:1000

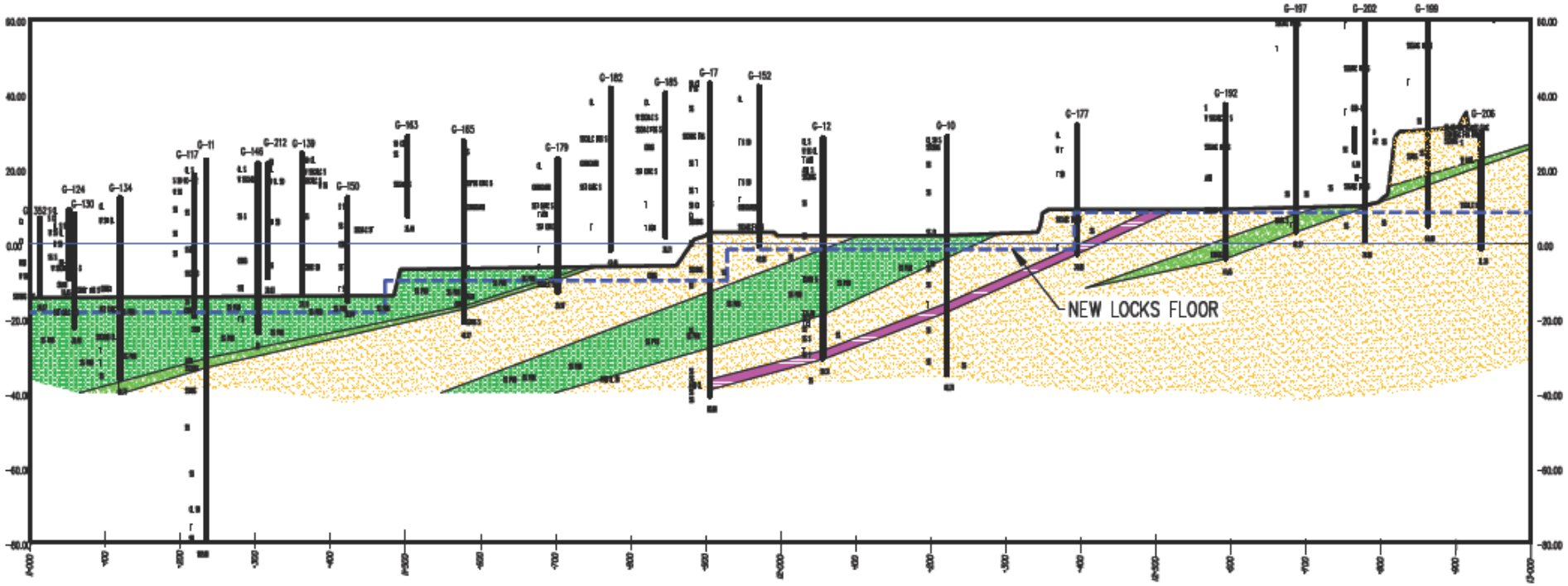
Longitudinal Geologic Profile (center)

ATLANTIC LITHOLOGY

- M — Marl
- C — Clay shale
- ASH — Ash Flow
- F — Fill
- Mk — Muck
- OB — Oberburden
- Cong — Mostly Conglomerate
- WR — Weathered Rock
- SSpum — Mostly Sandstone Pumiceous
- SS — Mostly Sandstone
- T — Mostly Tuff



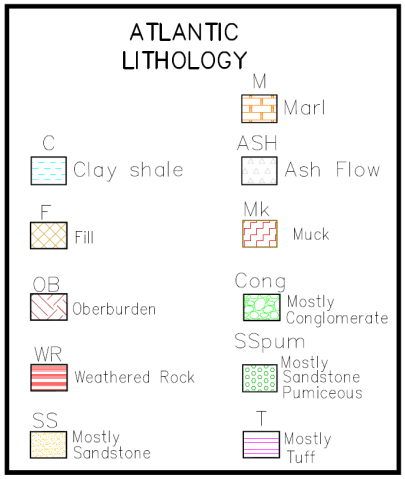
KEY PLAN

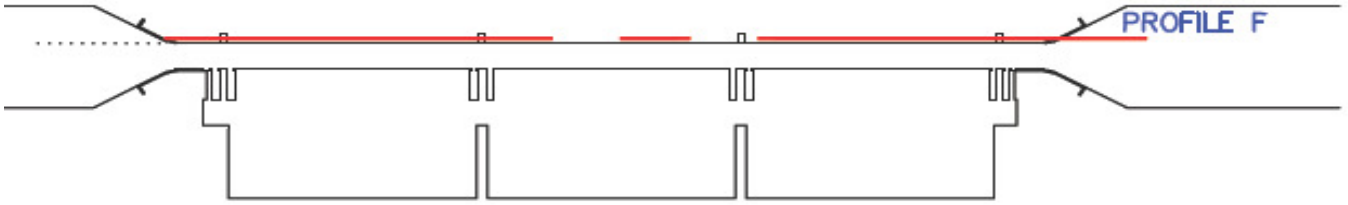


LONGITUDINAL PROFILE 2, STATION 11K+200 TO STATION 13K+200

SCALE H=1:3000
SCALE V=1:600

Longitudinal Geologic Profile (east)





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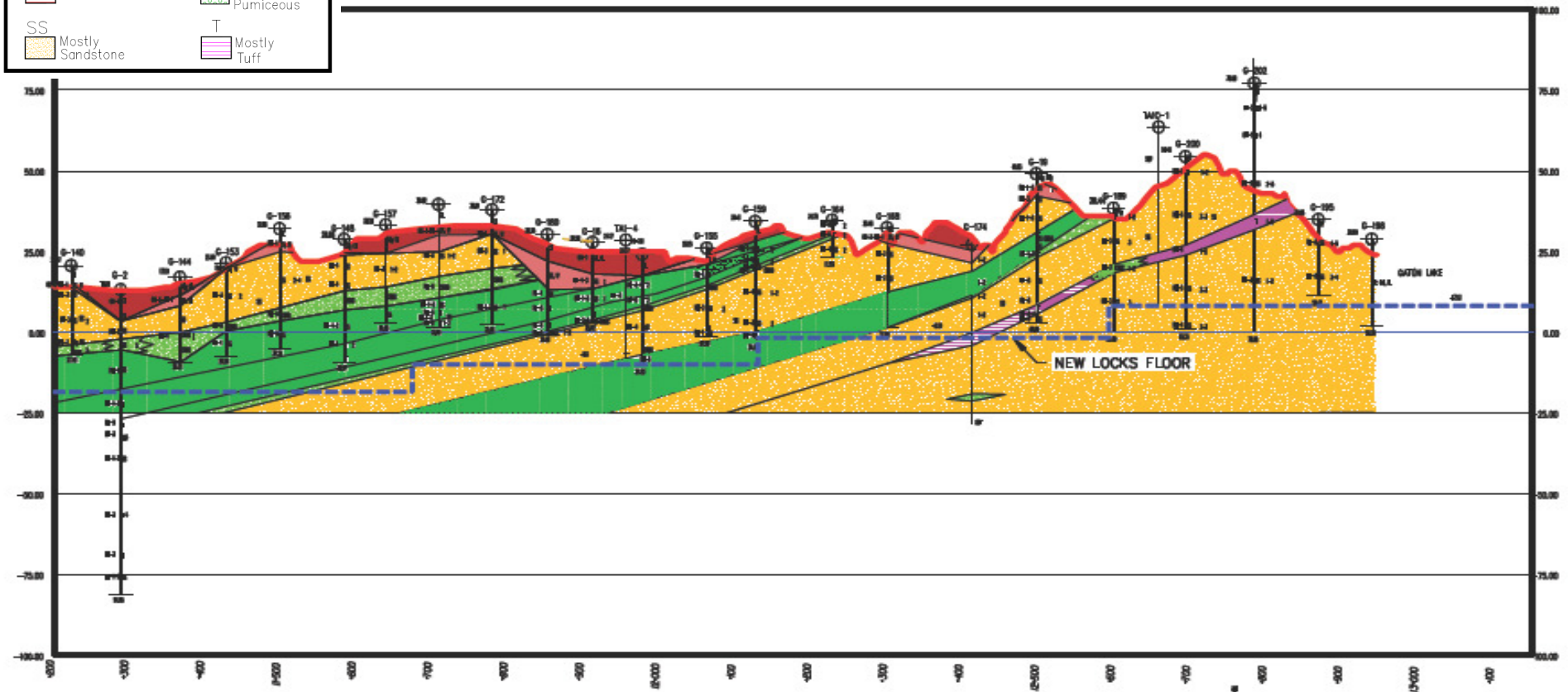


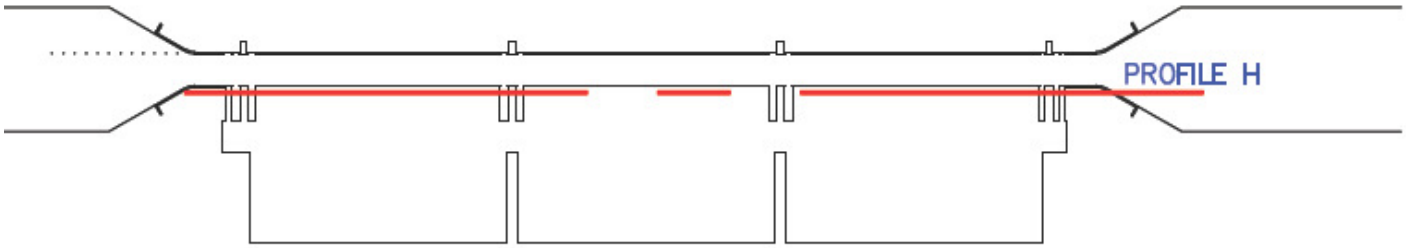
LONGITUDINAL PROFILE F

SCALE H=1:3000
SCALE V=1:600

Longitudinal Geologic Profile (west)

ATLANTIC LITHOLOGY

- M — Marl
- C — Clay shale
- ASH — Ash Flow
- F — Fill
- Mk — Muck
- OB — Oberburden
- Cong — Mostly Conglomerate
- WR — Weathered Rock
- SSpum — Mostly Sandstone Pumiceous
- SS — Mostly Sandstone
- T — Mostly Tuff



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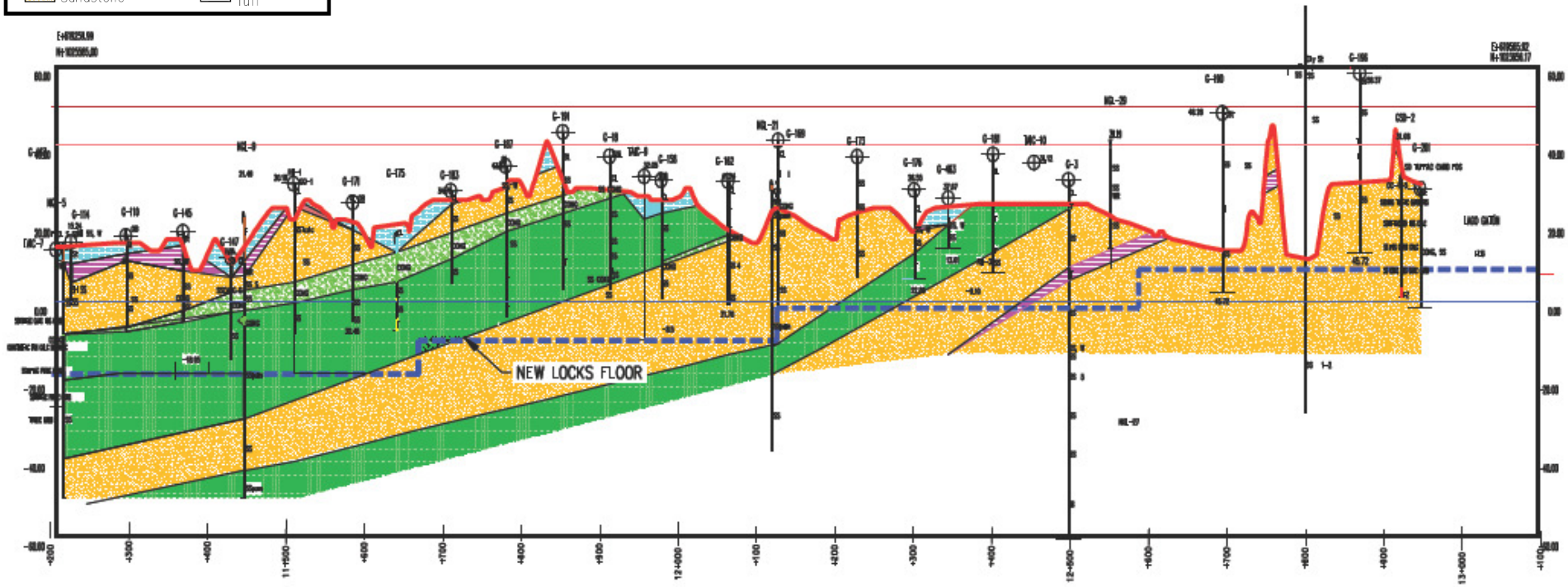


LONGITUDINAL PROFILE H

SCALE H=1:3000
SCALE V=1:600

Laboratory Testing Atlantic

TEST	ASTM	#
Specific Gravity	ASTM C 128	886
Moisture Content	ASTM D 2216	869
Sieve Analysis	ASTM C 136	370
Atterberg Limits LL # 40	ASTM D 438	377
Atterberg Limits LL # 200	ASTM D 438	4
Hydrometer #10	ASTM D 422	6
Hydrometer #200	ASTM D 422	4
Rock Unconfined Compresive Strength	ASTM D 2938	450
Point Load Test	ASTM D 5731	383
Soil Unconfined Compresive Strength	ASTM D 2166	33
Direct Shear	ASTM D 3080	3
Torsional Ring Shear	ASTM D 6467	1
Large Shear Box		1
Triaxial Soils	ASTM D 4767	1
Triaxial Rocks	ASTM D 2664	10
Slake Durability	ASTM D 4644	3
Compaction Proctor	ASTM 698/1557	1
Absortion	ASTM C 127	1
Petrographic Examination	ASTM C 295	2
X Rays Difraction	ASTM D 5856	1

Statistical Summary – UCS - Atlantic

Table 1 Statistical Summary of Unconfined Compressive Strength (ASTM D 2938), Elastic Modulus, Unit Weight and Specific Gravity (Atlantic)

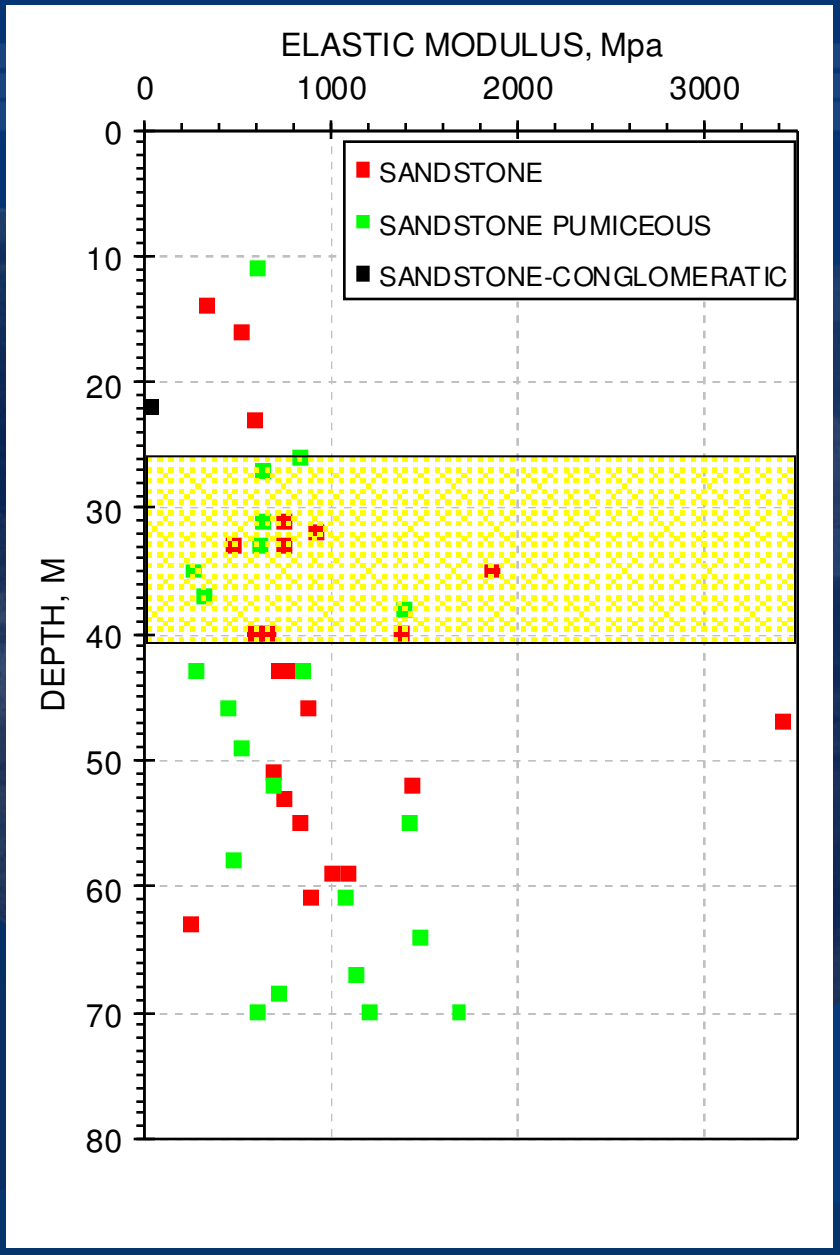
Gs			Unit Weight (Kg/m3)			Elastic Modulus (Mpa)			UCS σc (Mpa)			Type of rock
N	Median Average	St. Dev.	N	Median Average	St. Dev.	N	Median Average	St. Dev.	N	Median Average	St. Dev.	
283	2.32 2.31	0.24	262	1,890 1,885	163	262	1,008 1,162	701	262	5.1 5.9	3.6	Sandstone
5	2.32 2.36	0.06	5	2,145 2,063	144	5	1,095 1,206	357	5	5.1 4.8	1.3	Sandstone, fossiliferous
9	2.40 2.35	0.24	9	1,884 1,923	165	9	1,008 1,303	905	9	3.4 3.6	1.4	Sandstone, conglomeratic
24	2.30 2.33	0.20	24	2,071 2,059	170	24	1,117 1,412	1,005	24	5.1 6.4	4.1	Conglomerate
78	2.34 2.26	0.19	76	1,658 1,664	130	76	1,328 1,459	842	76	5.3 6.5	4.3	Sandstone, pumiceous
34	2.10 2.14	0.12	31	1,872 1,896	111	31	1,008 1,200	610	31	5.2 5.6	1.7	Sandstone, tuffaceous
21	2.17 2.19	0.27	19	1,810 1,803	124	19	1,506 1,971	1,217	19	10.3 9.8	5.8	Siltstone
3	2.00 1.97	0.06	3	1,641 1,637	78	3	2,483 2,229	988	3	12.7 11.3	5.7	Tuff
457	**2.32** **2.29**	**0.23**	**429**	**1,863** **1,854**	**183**	**429**	**1,096** **1,278**	**794**	**429**	**5.2** **6.1**	**3.9**	**Global**

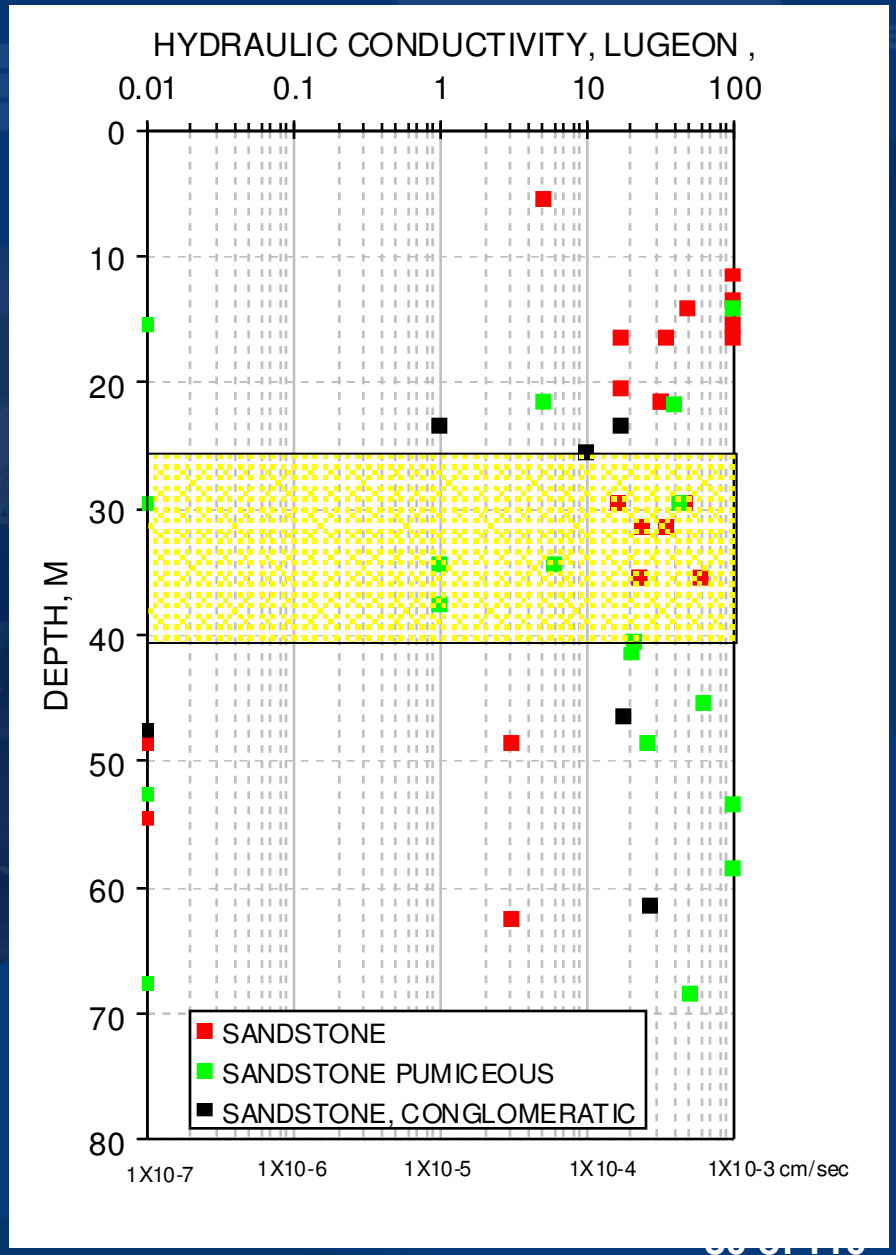
Rock Triaxial Test

Table 1 Summary of Rock Triaxial Tests (ASTM D2664) in Gatun Formation (Atlantic)

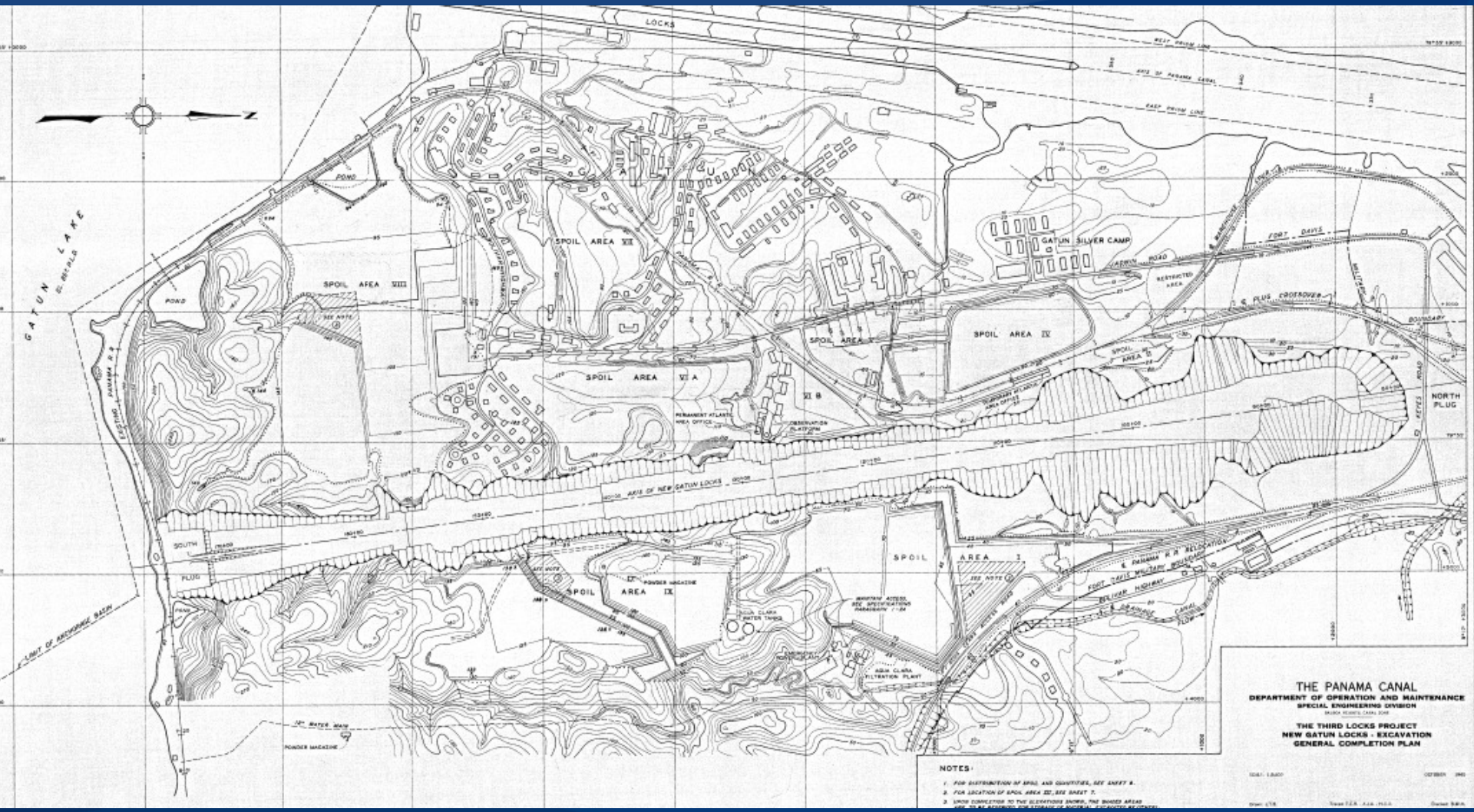
Boring	Depth (m)	sample	UCS σci (MPa)	Water Content Wo (%)	Density (kg/m3)	σ3 (MPa)	σ1 (MPa)	Hoek-Brown Fit mi	Hoek-Brown Fit q_{ui} (MPa)	ϕ	C (MPa)	Type of Rock
NGL-6	41.33-42.33	1		25.7	1536	0.7	14.6					
NGL-6		2		33.1	1755	1.4	15.7	33.0	5.0	54.0	0.9	sandstone pumiceous
NGL-6		3		33.1	1755	2.8	27.3					
NGL-6		4	7.7									
NGL-7	41.68-42.38	1		25.3	1193	0.7	4.3					
NGL-7		3		21.4	1185	2.8	9.9	25.0	1.0	52.0	0.1	sandstone
NGL-7		4	4.6									
NGL-10	44.60-45.15	1		12.1	1210	0.7	14.8					
NGL-10		2		41.1	1381	1.4	21.0	50.0	5.0	57.0	0.9	sandstone pumiceous
NGL-10		3	6.7									
NGL-7	40.61-41.19	1		18.4	1131	0.7	9.4					
NGL-7		2		19.3	1209	1.4	12.4	11.0	5.0	44.0	1.0	sandstone pumiceous
NGL-7		5	4.7									
NGL2-1	23.90-24.95	3-1		33.24	1923	0.5	47					
NGL2-1		3-2		33.55	1925	1.0	69					
NGL2-1		3-3		31.13	1950	1.5	63	50.0	39.0	57.0	6.0	Sandstone Tuffaceous
NGL2-11		3-4		54.48	1654	2.0	77					
NGL2-11	36.77-37.26	3-5	5									
NGL2-3	25.24-25.65	5-1		29.87	1918	0.4	22					
NGL2-3		5-2		31.98	1884	0.8	78					
NGL2-3		5-3		31.19	1914	1.2	43	50.0	34.0	57.0	6.0	Sandstone
NGL2-11		5-4		45.83	1626	1.6	80					
NGL2-11	36.77-37.26	5-5	5									
NGL2-4	23.32-23.64	3-1		37.18	1834	0.5	3					
NGL2-4		3-2		26.97	1990	0.9	26	50.0	15.0	57.0	3.0	
NGL2-4		3-3		26.49	2173	1.4	71					Sandstone
NGL2-4		3-4	5									
NGL	summary		5		1746			28.0	23.0	53	4	sandstone
NGL	summary		6		1425			49.0	3.0	57	0.5	sandstone pumiceous

Field Tests Results (Dilatometer, Lugeon) - Atlantic





The Third Locks Project (1941)



New Gatun Locks, Completed Excavation

Beds 1, 2, 3, and 4 on Left Wall Between Stations 167+00 and 171+00
Bed 1: Sandstone; Bed 2: Volcanic Ash;
Bed 3: Sandstone; Bed 4: Volcanic tuff and Ash

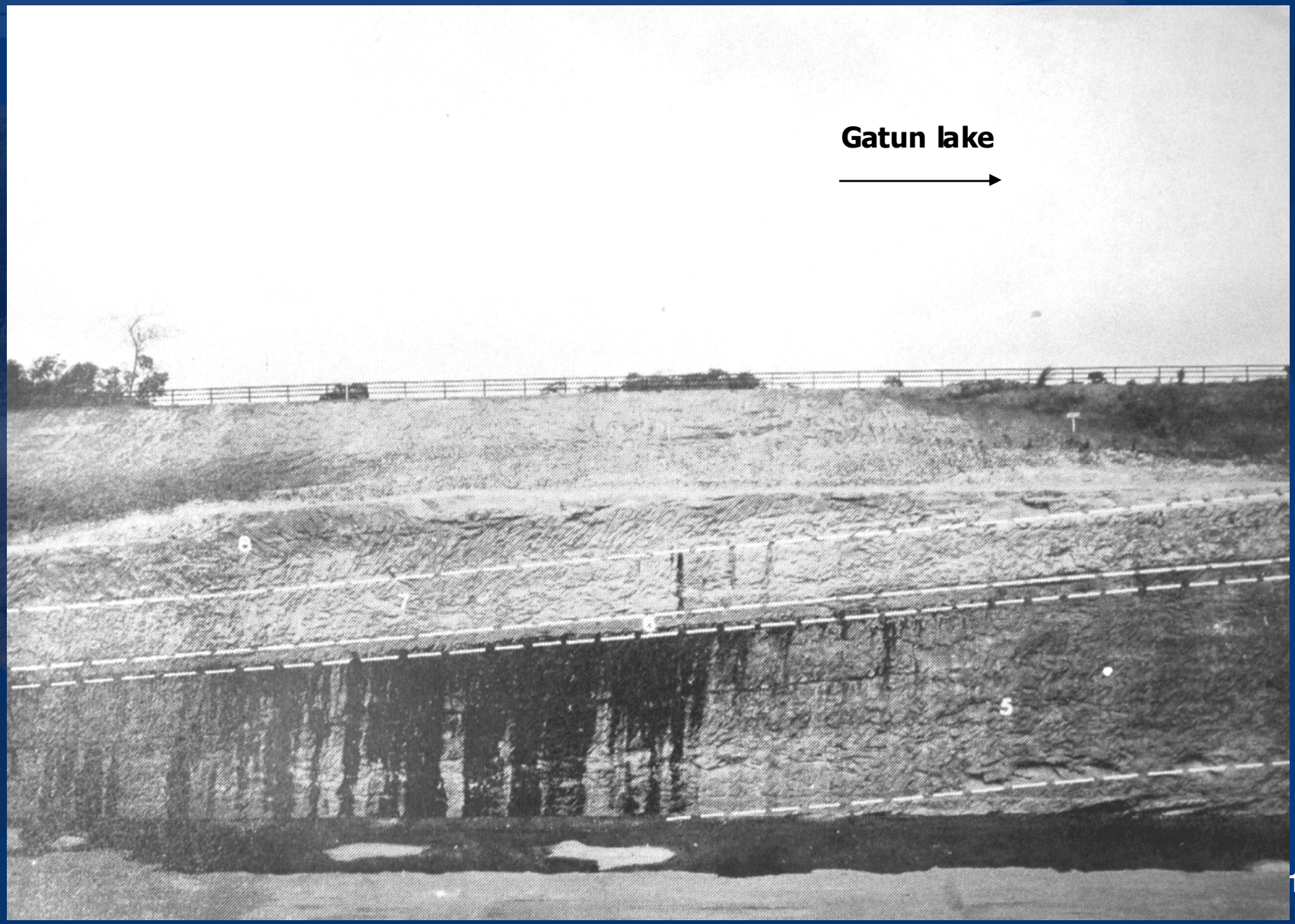
New Gatun Locks, Completed Excavation

Beds 3, 4, 5, 6 and 7 on Left Wall Between Stations 151+45 and 155+00

Bed 3: Sandstone; Bed 4: volcanic Tuff and Ash; Bed 5: Sandstone; Bed 6: Sandstone

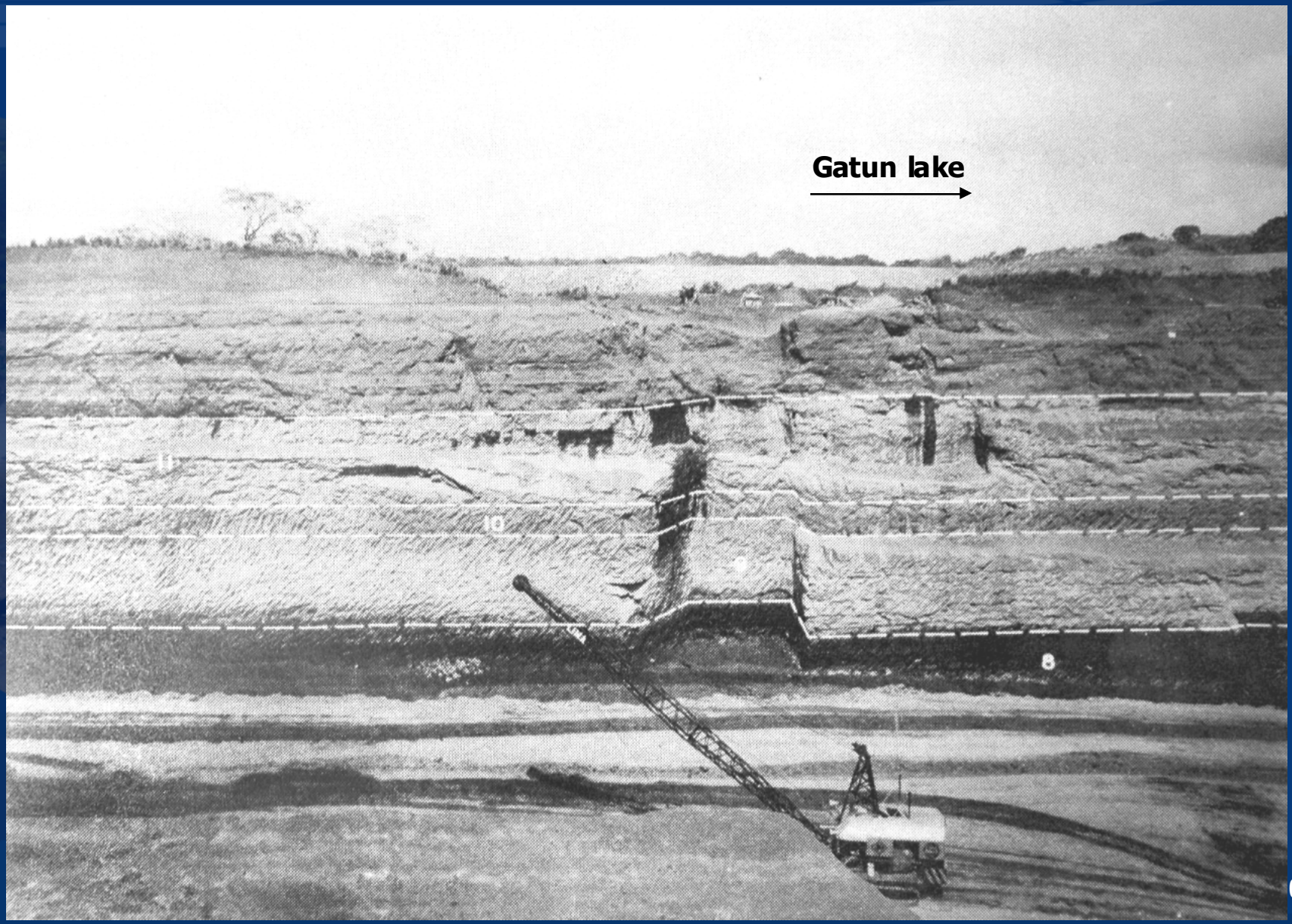
New Gatun Locks, Completed Excavation

Beds 4, 5, 6, 7 and 8 on Left Wall Between Stations 143+00 and 147+00
Bed 4: volcanic Tuff and Ash; Bed 5: Sandstone; Bed 6: Sandstone;
Bed 7: Volcanic Ash; Bed 8: Volcanic Tuff and Ash



New Gatun Locks, Completed Excavation

Beds 8, 9, 10, 11 and 12 on Left Wall Between Stations 119+00 and 123+00
Bed 8: Volcanic Tuff and Ash; Bed 9: Sandstone; Bed 10: Conglomerate;
Bed 11: Sandstone; Bed 12: Sandstone



Gatun Slopes

New Gatun Locks, South Plug and Ramp

New Gatun Locks, North Plug

Summary of typical Shear Strength Parameters derived from Backanalysis

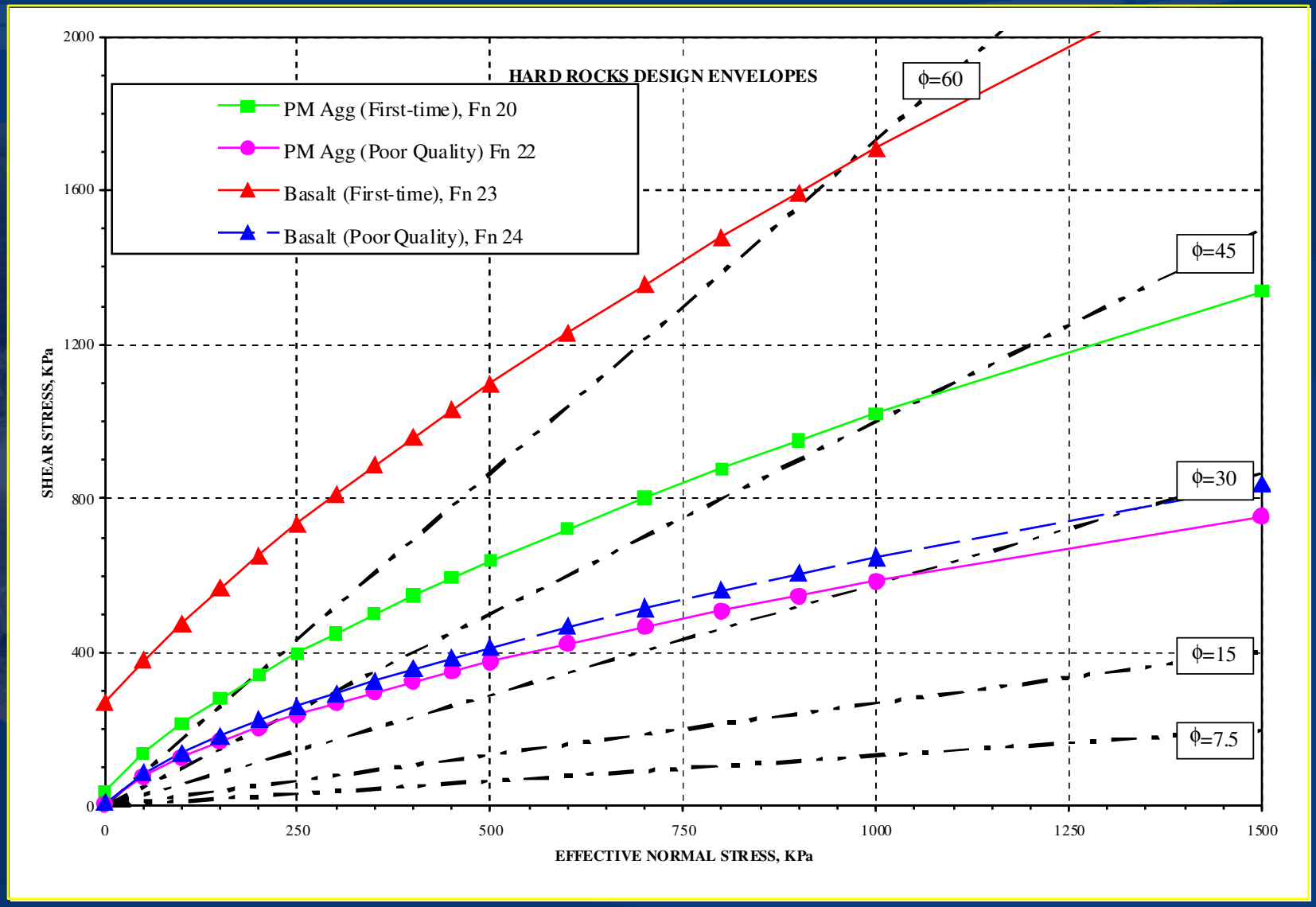
Fn. #	FORMATION	MECHANISMS	FUNCTION	EQUATION	BLASTED MATERIAL	UNIT WEIGHT
1	La Boca	First Time	Fully Softened	$\phi = 17.5 + 20.3 / (1+\sigma n / 200)$	No	21.2 - 22.0
2	La Boca	Reactivated	Residual	$\phi = 7.5 + 14.0 / (1+\sigma n / 150)$	Si	
7	Cucaracha	First Time	Fully Softened	$\phi = 13.5 + 17.1 / (1+\sigma n / 373)$	No	21.2 - 22.0
8	Cucaracha	Reactivated (lab)	Residual	$\phi = 7.4 + 8.7 / (1+\sigma n / 100)$	Si	
25	Cucaracha	Reactivated (backanalysis)	Residual	$\phi = 8.5 + 13.0 / (1+\sigma n / 100)$	Si	
26	Cucaracha	First time	Fully Softened (upper)	$\phi = 13.5 + 24.0 / (1+\sigma n / 373)$	No	
9	Culebra	First Time	Fully Softened	$\phi = 13.1 + 20.9 / (1+\sigma n / 120)$	No	21.2 - 22.0
10	Culebra	Reactivated	Residual	$\phi = 9.1 + 5 \log (2400 / \sigma n)$	Si	
11	Gatuncillo	First Time	Fully Softened	$\phi = 12.0 + 20.7 / (1+\sigma n / 362)$	No	21.2 - 22.0
12	Gatuncillo	Reactivated	Residual	$\phi = 7.3 + 6 \log (4600 / \sigma n)$	Si	
3	Las Cascadas (Tuff)	First Time	Fully Softened	$\phi = 14.2 + 10.7 / (1+\sigma n / 475)$	No	22.0 - 22.8
5	Las Cascadas (Tuff)	Reactivated (lab)	Residual	$\phi = 5.0 + 8.5 / (1+\sigma n / 200)$	Si (for Tuff only)	
27	Las Cascadas (Weak Plane - La Pita)	Weak Plane (backanalysis)	Barton (σc=1110 psi)	$\phi = 8 + 10 \log (1110 / \sigma n)$	Si (for Aggl. & Andesite)	
4	Las Cascadas (Aggl. & Andesite)	First Time	Hoek & Brown	$m = 0.3, s = 0.0001, \sigma c = 1200$ psi	No	
6	Las Cascadas (Aggl. & Andesite)	Poor Quality Rock	Hoek & Brown	$m = 0.069, s = 0.000003, \sigma c = 1200$ psi	Si (for Aggl. & Andesite)	
16	Bas Obispo	Plane failure along a disc.(option 2)	Barton (σc=3000 psi)	$\phi = 16 + 5 \log (3000 / \sigma n)$	No	22.8 - 23.5
17	Bas Obispo	Plane failure along a disc.(option 3)	Barton (σc=5515 psi)	$\phi = 16 + 5 \log (5515 / \sigma n)$	No	
13	Bas Obispo	First Time (option 1)	Hoek & Brown	$m = 0.34, s = 0.0001, \sigma c = 3000$ psi	No	
14	Bas Obispo	First Time (option 2)	Hoek & Brown	$m = 0.34, s = 0.0001, \sigma c = 5515$ psi	No	
18	Bas Obispo	Poor Quality Rock (option 1)	Hoek & Brown	$m = 0.069, s = 0.000003, \sigma c = 3000$ psi	Si	
19	Bas Obispo	Poor Quality Rock (option 2)	Hoek & Brown	$m = 0.069, s = 0.000003, \sigma c = 5515$ psi	Si	
20	Pedro Miguel Agglomerate	First Time	Hoek & Brown	$m = 0.34, s = 0.0001, \sigma c = 5515$ psi	No	
21	Pedro Miguel Agglomerate	Reactivated & Plane Failure	Barton (σc=5515 psi)	$\phi = 16 + 5 \log (5515 / \sigma n)$	No	
22	Pedro Miguel Agglomerate	Poor Quality Rock	Hoek & Brown	$m = 0.069, s = 0.000003, \sigma c = 5515$ psi	Si	
23	Basalt	First Time	Hoek & Brown	$m = 1.21, s = 0.0021, \sigma c = 7255$ psi	No	23.5
24	Basalt	Poor Quality Rock	Hoek & Brown	$m = 0.069, s = 0.000003, \sigma c = 7255$ psi	Si	

Soft Rocks

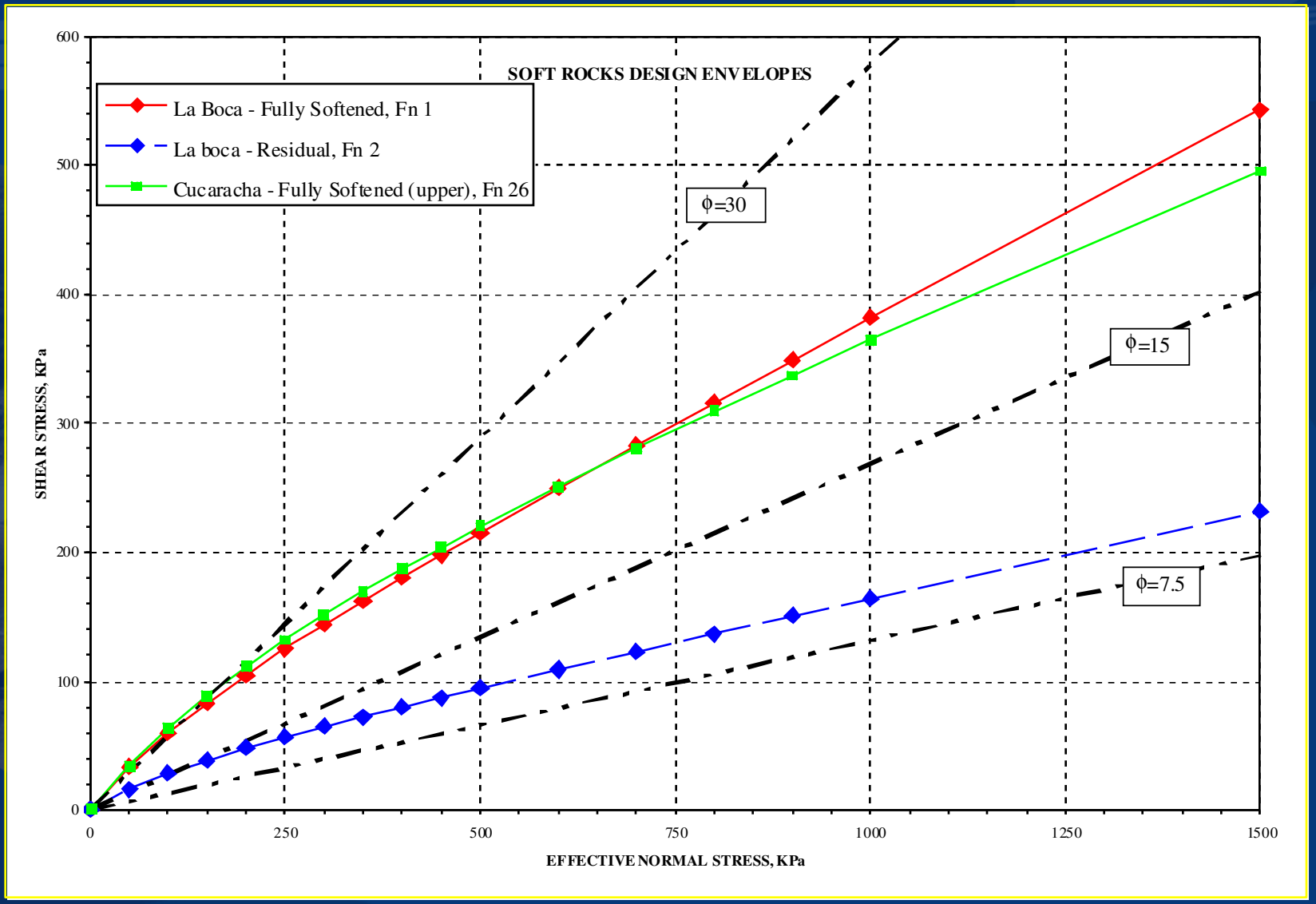
Soft to Hard Rocks

Hard Rocks

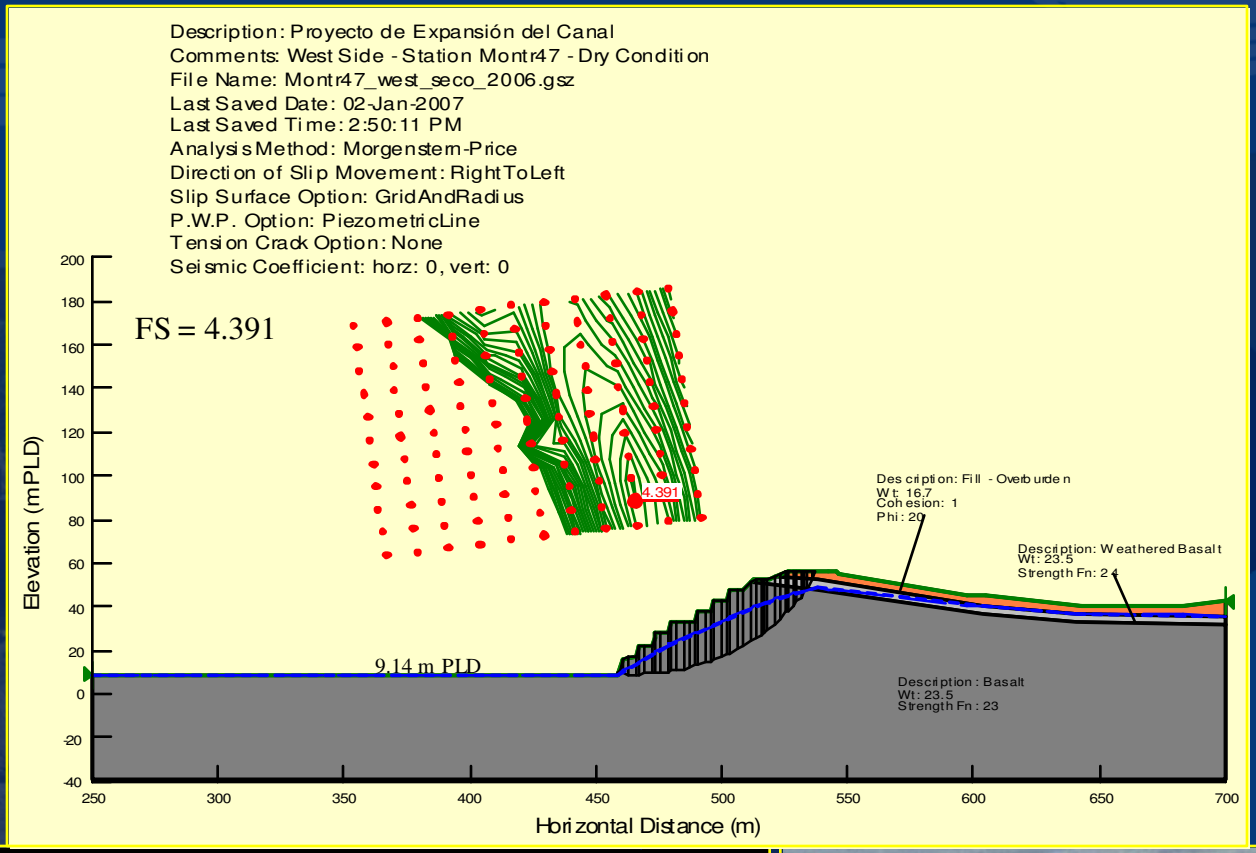
Shear Strength Envelopes (PM Agglomerates, Basalts)

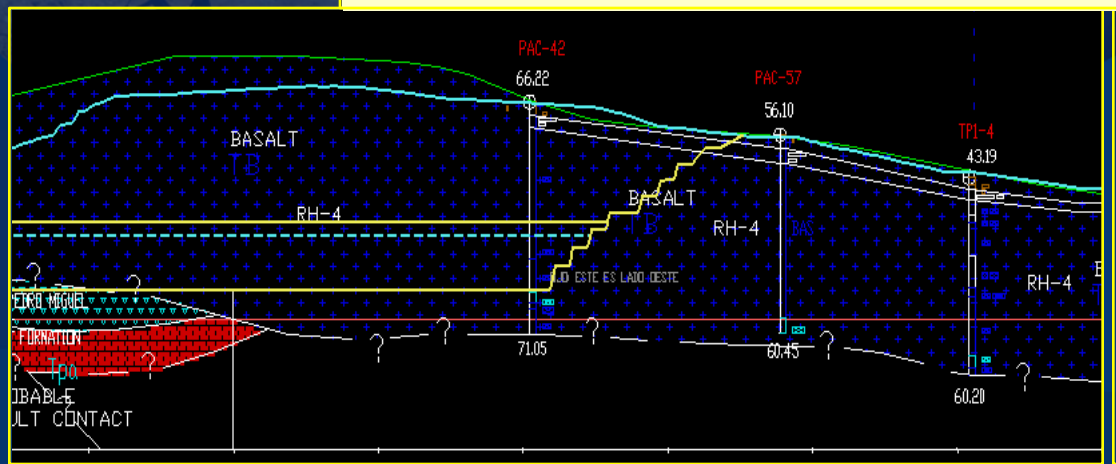


Shear Strength Envelopes (La Boca Formation)

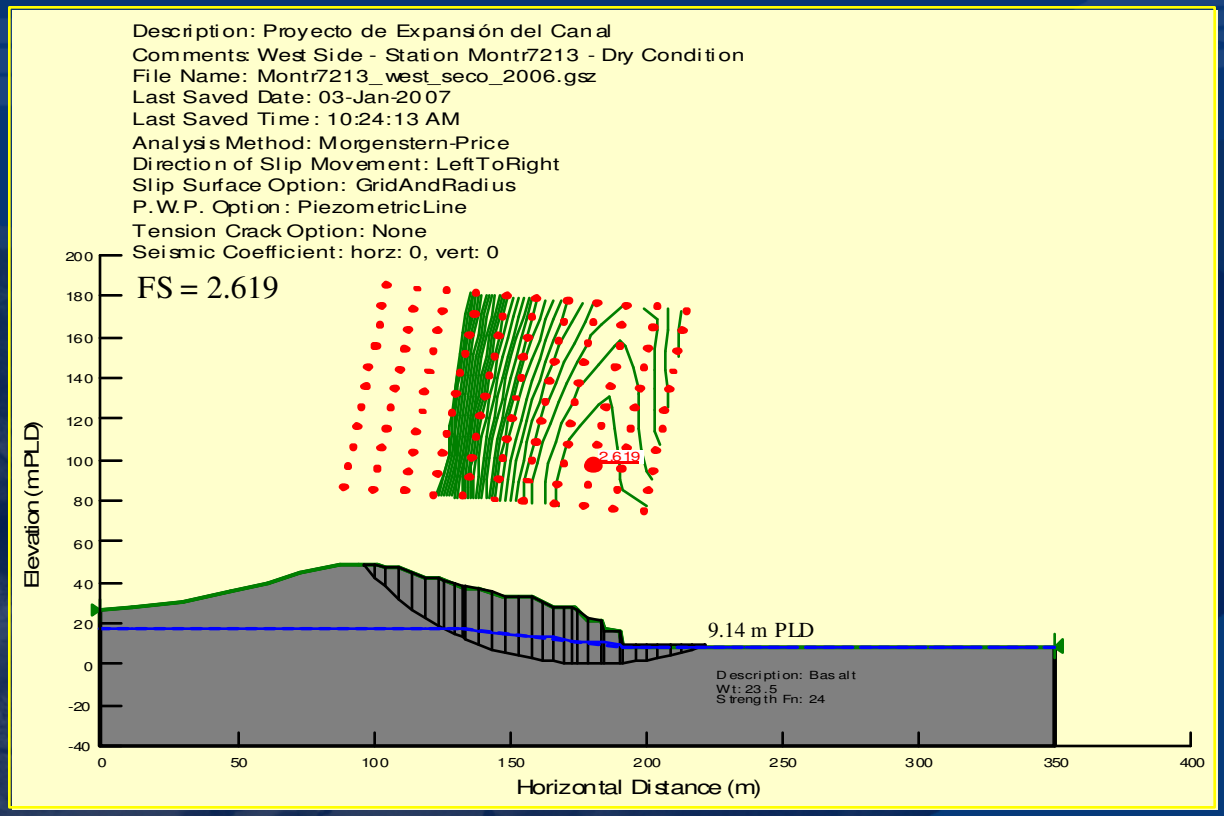


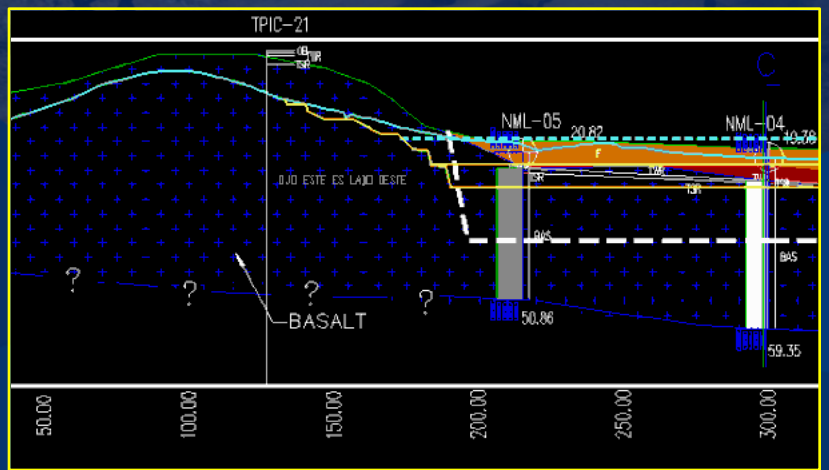
Typical Stability Analysis in Basalt Slopes (good quality)





Typical Stability Analysis in Basalt Slopes (poor quality)

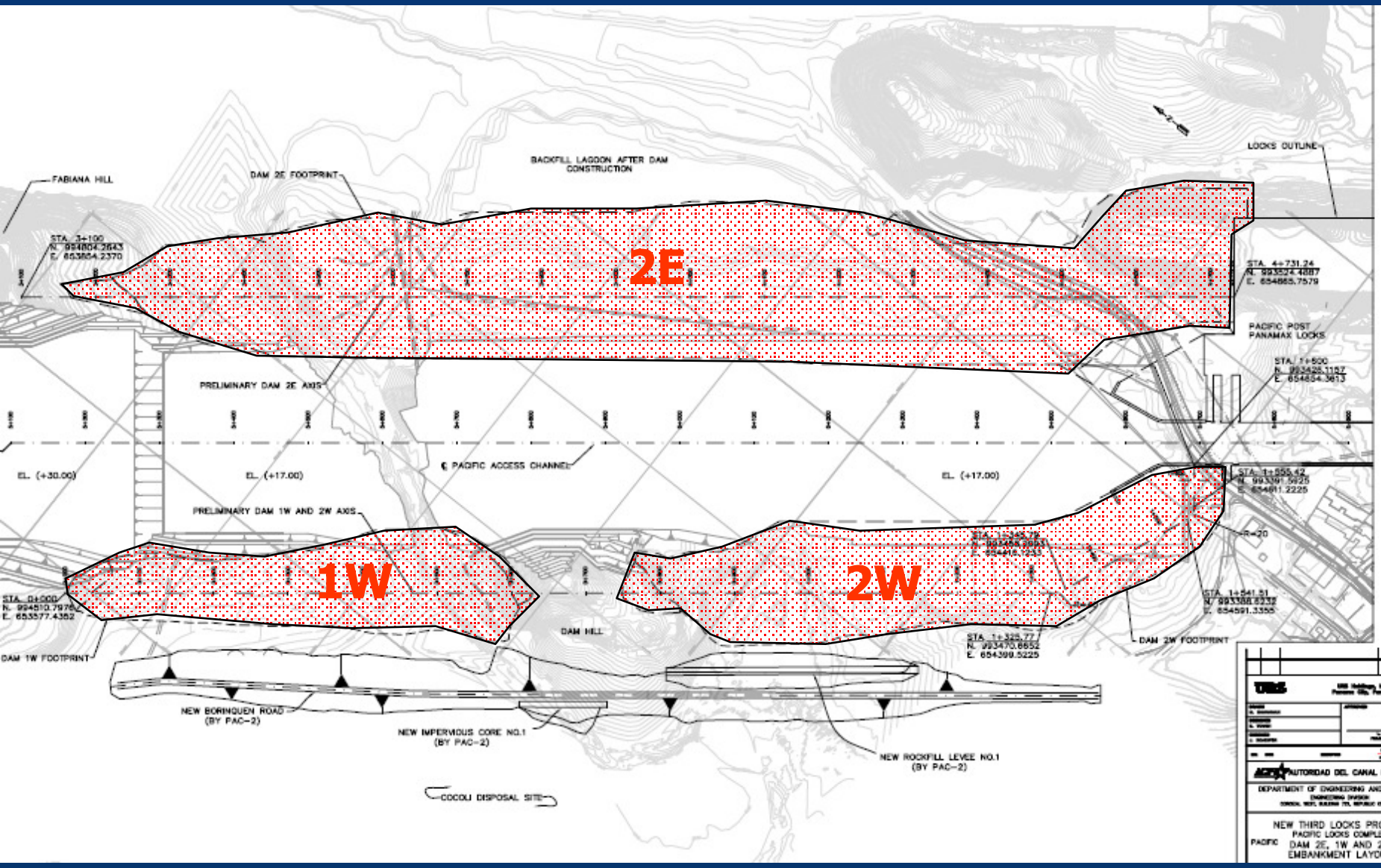




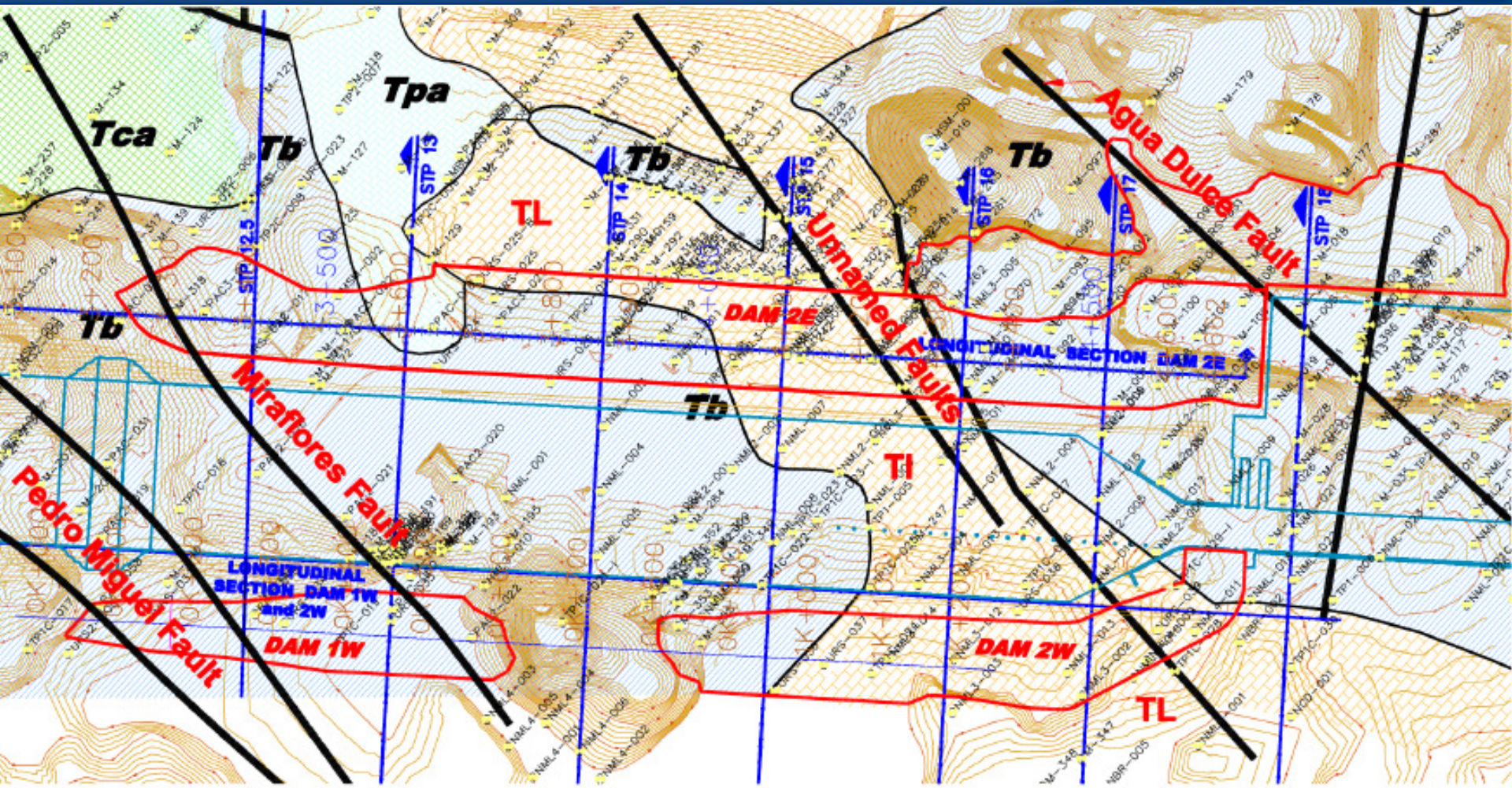
Observations on Shear Strength Envelopes

- These envelopes are derived from Backanalysis of past failures. Represent the average long-term shear strength of the slope mass.
- Their directly application to slope mass affected by discontinuities or plane of weakness is not advisable without prior studying their sensitivity in the stability of the slope. Judgment will be required for the adjustment and use in stability analysis.
- This information is given as reference and not as recommended shear strength for design.

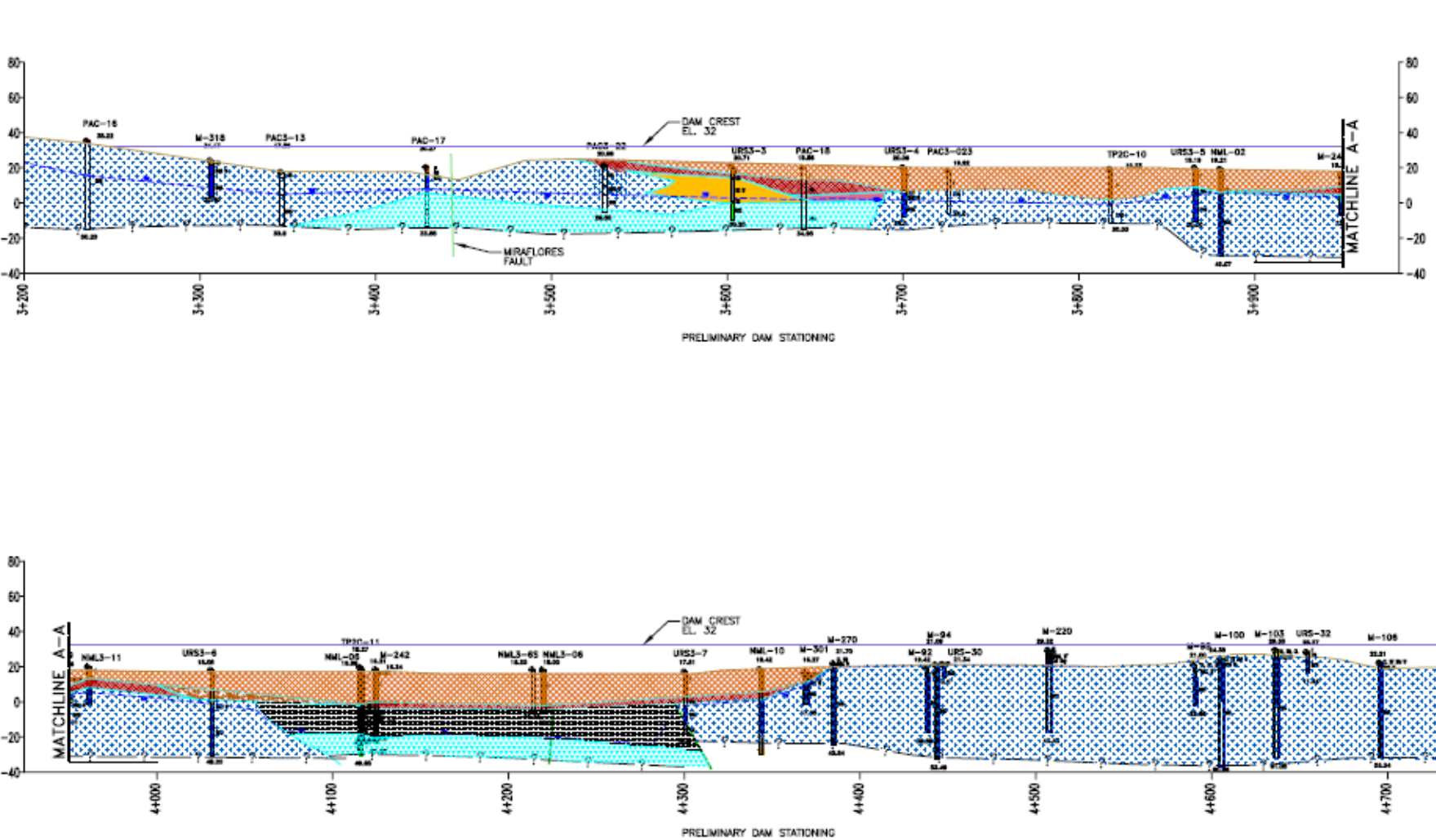
Preliminary Design of Borinquen Dams: 2E, 1W & 2W



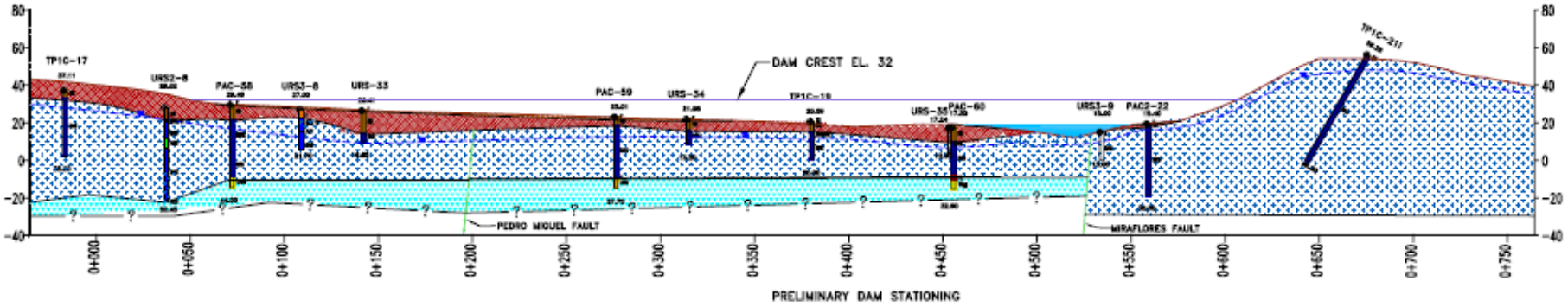
Geologic Plan – Dams Areas



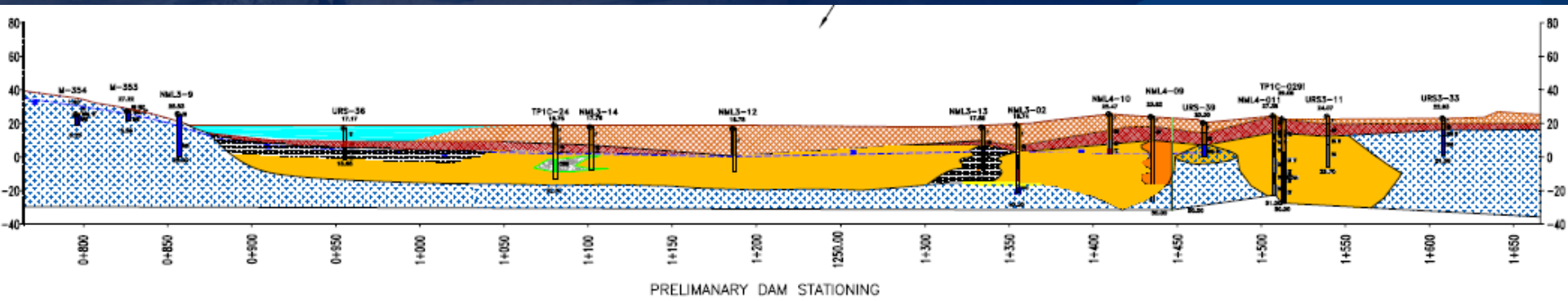
Dam 2E Longitudinal Geologic Profile



Dam 1W and 2W Longitudinal Geologic Profile

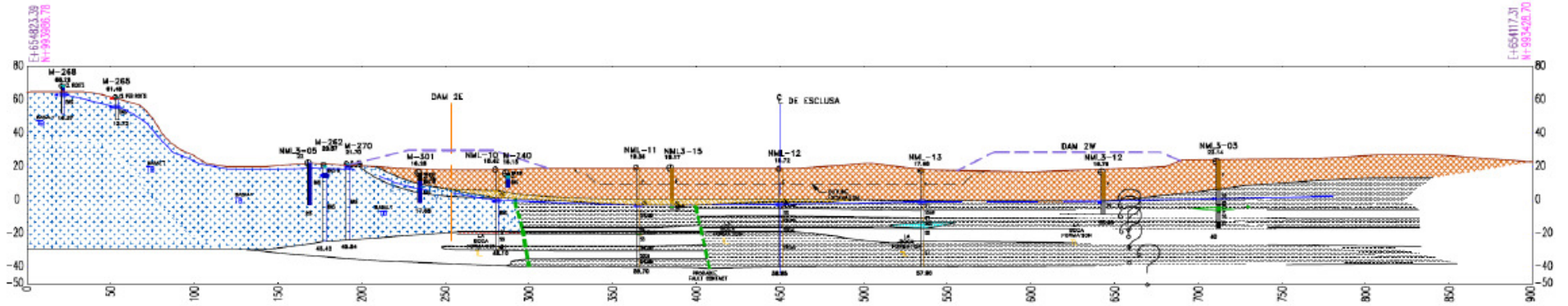


1W

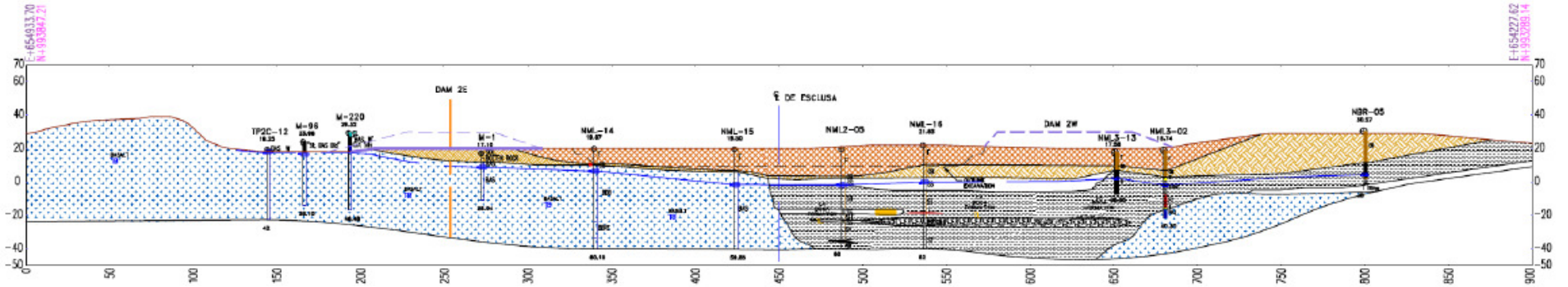


2W

Geological Cross Sections



SECTION STP-16



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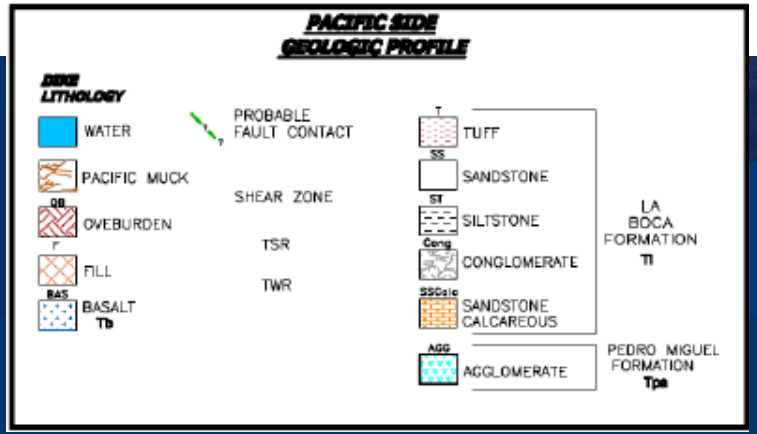
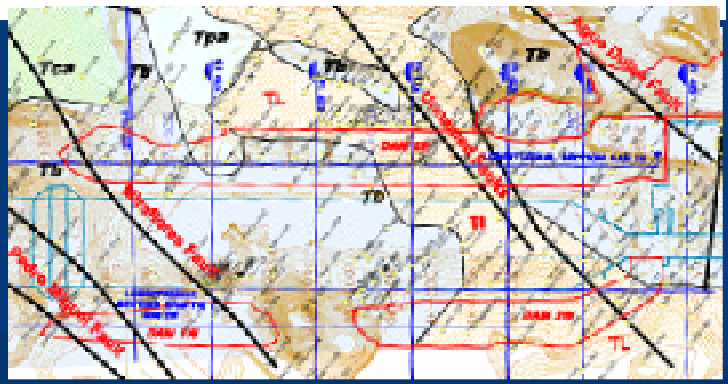
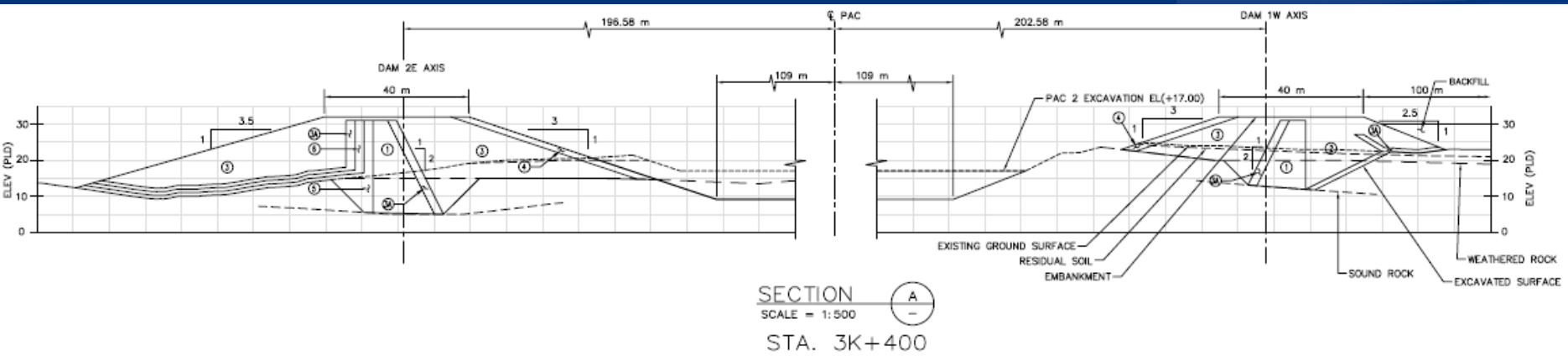


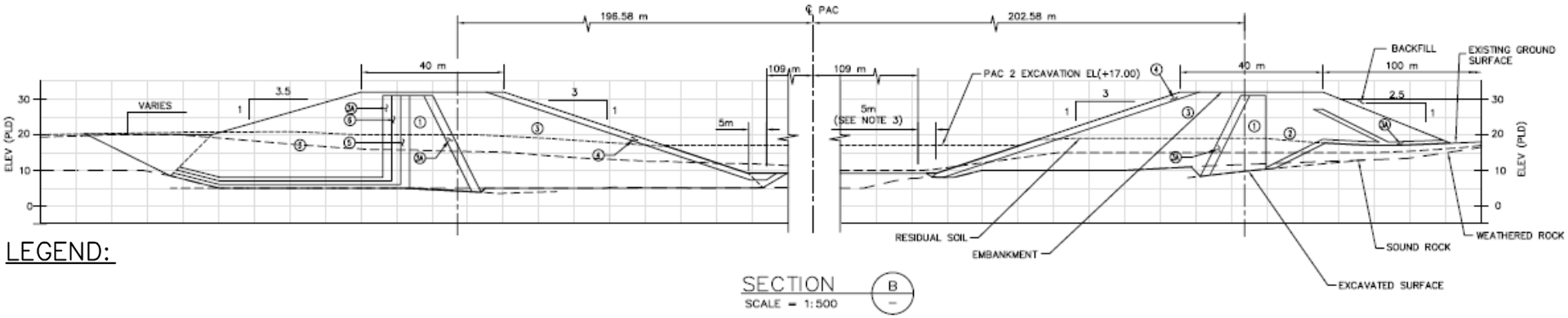


Typical Dam Sections



SECTION A
SCALE = 1:500

STA. 3K+400



SECTION B
SCALE = 1:500

STA. 3K+610

LEGEND:

①	CORE
②	EARTHFILL
③	ROCKFILL SHELL
③A	TRANSITION
④	RIPRAP
⑤	CHIMNEY/BLANKET FILTER
⑥	CHIMNEY DRAIN/BLANKET FILTER

Interpretative Data from URS (Dam Foundation)

Table 5-1
Shear Strength Values From Hoek and Brown Criterion and Unit Weights for Foundation Rock

Rock Type	Representative Borings	Description	GSI	m_i	UCS (MPa)	Friction Angle (degrees)	Cohesion (kPa)	Unit Weight (kg/m^3)
Weathered Basalt	NML4-3, URS-22, 23, 24, 27, 34, 35, 39	Intensely to moderately fractured Highly to moderately weathered	20 to 40	25	50	52	300	2,630
Sound Basalt	NML4-3, 4, URS-22, 23, 24, 27, 28, 34, 35	Moderately to slightly fractured Slightly weathered to fresh	40 to 80	25	50	57	900	2,630
Weathered Agglomerate	URS-25	Intensely to highly fractured Highly to moderately weathered	30	19	30	48	300	2,350
Sound Agglomerate	URS-25	Moderately fractured to massive slightly weathered to fresh	40 to 70	19	30	54	500	2,350
Weathered Sandstone	NML4-10, URS-25, 26	Intensely to highly fractured highly to moderately weathered	20 to 30	17	5	32	200	2,200
Sound Sandstone	NML4-9, 10, 11	Highly fractured to massive moderately weathered to fresh	30 to 70	17				
Weathered Siltstone	NML4-11	Intensely to highly fractured Completely to highly weathered	15 to 25	7				
Sound Siltstone	NML4-11	Moderately to intensely fractured moderately to slightly weathered	30 to 60	7				
Weathered Tuff	NML4-9	Highly to intensely fractured Completely to highly weathered	15 to 20	13	5	25	100	2,200
Sound Tuff	NML4-9, 10	Moderately to intensely fractured Moderately to highly weathered	15 to 35	13	5	27	100	2,200

[1] Friction angle and cohesion are based on a confining stress of 0.8 MPa.

Interpretative Data from URS (Dam Foundation)

Table 5-2
Summary of Shear Wave Velocities Estimated From Downhole Seismic Velocity Tests and MASW Surveys Near Dam 2E

Geologic Formation	Location	V_{s30} (m/s)
Basalt	MASW-1	710 (700)[1]
	MASW-3	650 (1970)[1]
	MASW-4	930 (2070)[1]
La Boca	CHT-5	590
	MASW-15	620

[1] Values in parenthesis are converted from V_p.

Table 8-1
Engineering Properties for Foundation Materials

Material	Unit Weight kg/m³		Total Stress Parameters		Effective Stress Parameters		Permeability	
	Moist	Saturated	C kPa	ϕ deg	c' kPa	ϕ' deg	k_x (cm/sec	k_r/k_y
Fill	1,700	1,920	45	-	0	24	$6x10^{-3}$	1
Residual Soil (La Boca)	1,730	1,730	45	-	35	22	$8x10^{-4}$	1
Residual Soil (Basalt)	1,720	1,900	35	-	40	24	$8x10^{-4}$	1
Basalt	2,630	2,630	-	-	300	52	$8x10^{-5}$	1
Pedro Miguel Agglomerate	2,350	2,350	-	-	300	48	$8x10^{-5}$	1
La Boca (Sandstone and Siltstone)	2,200	2,200	-	-	200	32	$4x10^{-4}$	1
Tuff	2,200	2,200	-	-	100	25	$4x10^{-4}$	1

Reports That Contains Geotechnical Interpretative Data

- Isthmian Canal Company, Department of Operation and Maintenance, Special Design Office, "Drawings for Excavation, Gatun and Miraflores", Third Locks Project, Panama, 1939
- Isthmian Canal Company, Final Report on Modified Third Locks Project, Part II, Design, Chapter 5, Foundations and Slopes, December 1943.
- Isthmian Canal Company, "Report of the Governor of the Panama Canal" Isthmian Canal Studies, 1947.
- Consorcio Post-Panamax (CPP), "New Miraflores Locks - Joint Geological Survey in South Cocoli Lake." Prepared as part of Panama Canal Authority's Contract CMC 159475: Engineering Services for Additional Studies and Technical Assistance for New Locks, 2006.
- Consorcio Post-Panamax (CPP), "New Gatun Locks - Joint Geological Survey in Gatun" Prepared as part of Panama Canal Authority's Contract CMC 159475: Engineering Services for Additional Studies and Technical Assistance for New Locks, 2006.
- Consorcio Post-Panamax (CPP), "Excavations and structures conceptual design – Lock wall alternative studies for bottom F/E system (Atlantic and Pacific sides)." Prepared as part of Panama Canal Authority's Contract CMC 159475: Engineering Services for Additional Studies and Technical Assistance for New Locks, 2006.

Reports That Contains Geotechnical Interpretative Data

- Consorcio Post-Panamax (CPP), "Geology And Geotechnics Report / Data Collection - Atlantic Side." Prepared as part of Panama Canal Authority's Contract CMC 159475: Engineering Services for Additional Studies and Technical Assistance for New Locks, 2006.
- Consorcio Post-Panamax (CPP), "Geology And Geotechnics Report / Data Collection - Pacific Side." Prepared as part of Panama Canal Authority's Contract CMC 159475: Engineering Services for Additional Studies and Technical Assistance for New Locks, 2006.
- URS Corporation, GEOLOGIC ASSESSMENT - DESIGN OF NEW BORINQUEN DAMS, Task Order No. 4 Sub-Task A.1.3. February 2008
- URS Corporation, FOUNDATION MATERIALS FOR DAMS 2E, 1W, AND 2W, GEOTECHNICAL INTERPRETIVE REPORT (GIR), Task Order No. 4 Sub-Task A.1.4. February 2008

LOCKS RFP – Seismic Design Criteria

TERCER JUEGO DE ESCLUSAS

ACP

Seismic Design Criteria

- Overview of Section 01 81 16.13
- Specific Highlights
- Questions

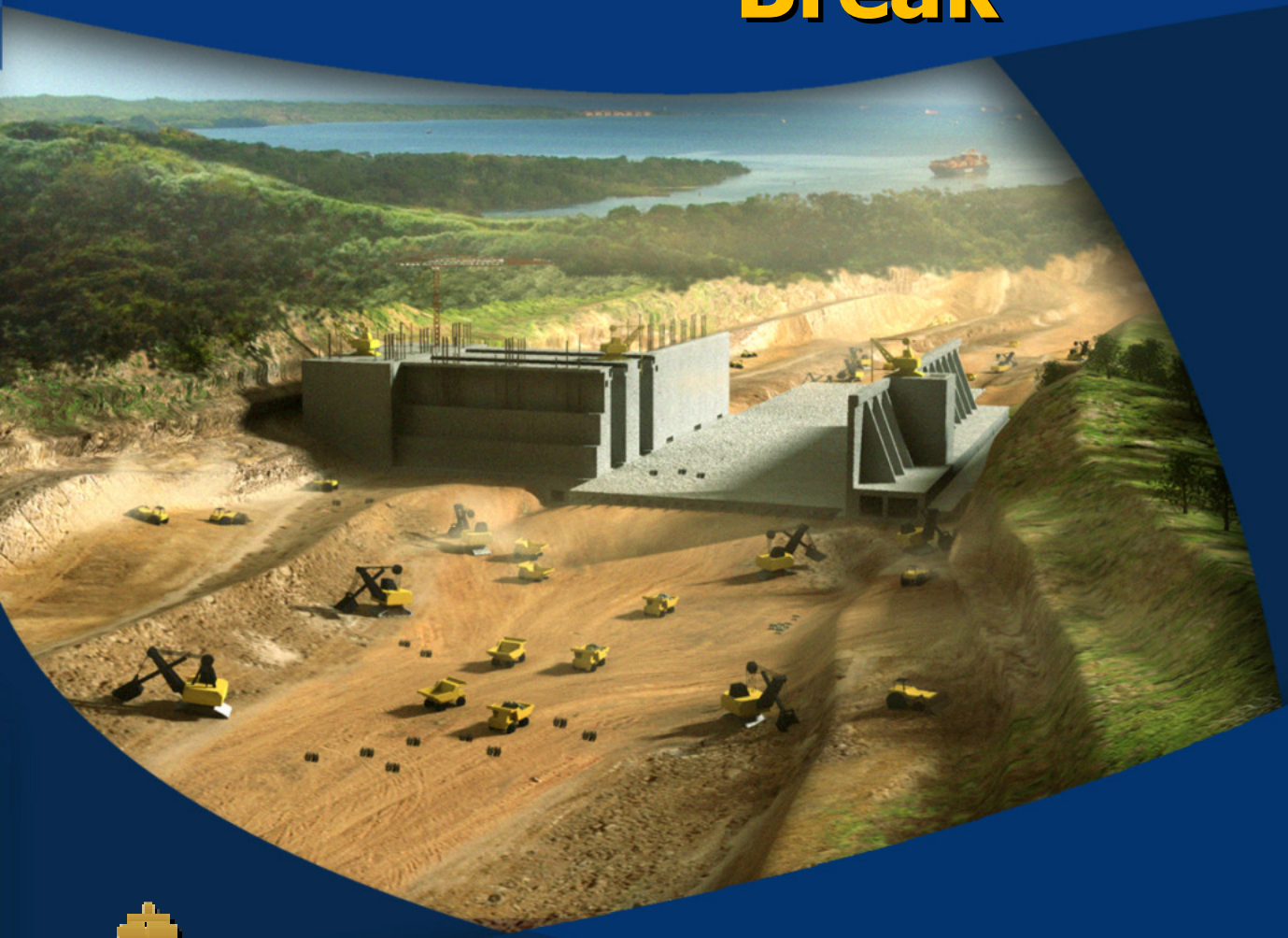
Overview of Section 01 81 16.13

- Existing Section 01 18 16.13 to be replaced in its entirety
- Performance
  - Critical Components of the System are expected to sustain no permanent damage
  - Non-Critical Components can sustain minor damage
- Design
  - Single Performance Level [except emergency closure]
  - Tender Requirements
  - Intermediate and Final Design Stages
    - Linear Elastic Behavior
    - Finite Element Model
    - Identify the Seismic Load Paths and Redundancy
- Ground Motions
  - Atlantic PGA – 0.42
  - Pacific PGA – 0.52
  - Borinquen Dams PGA – 0.90

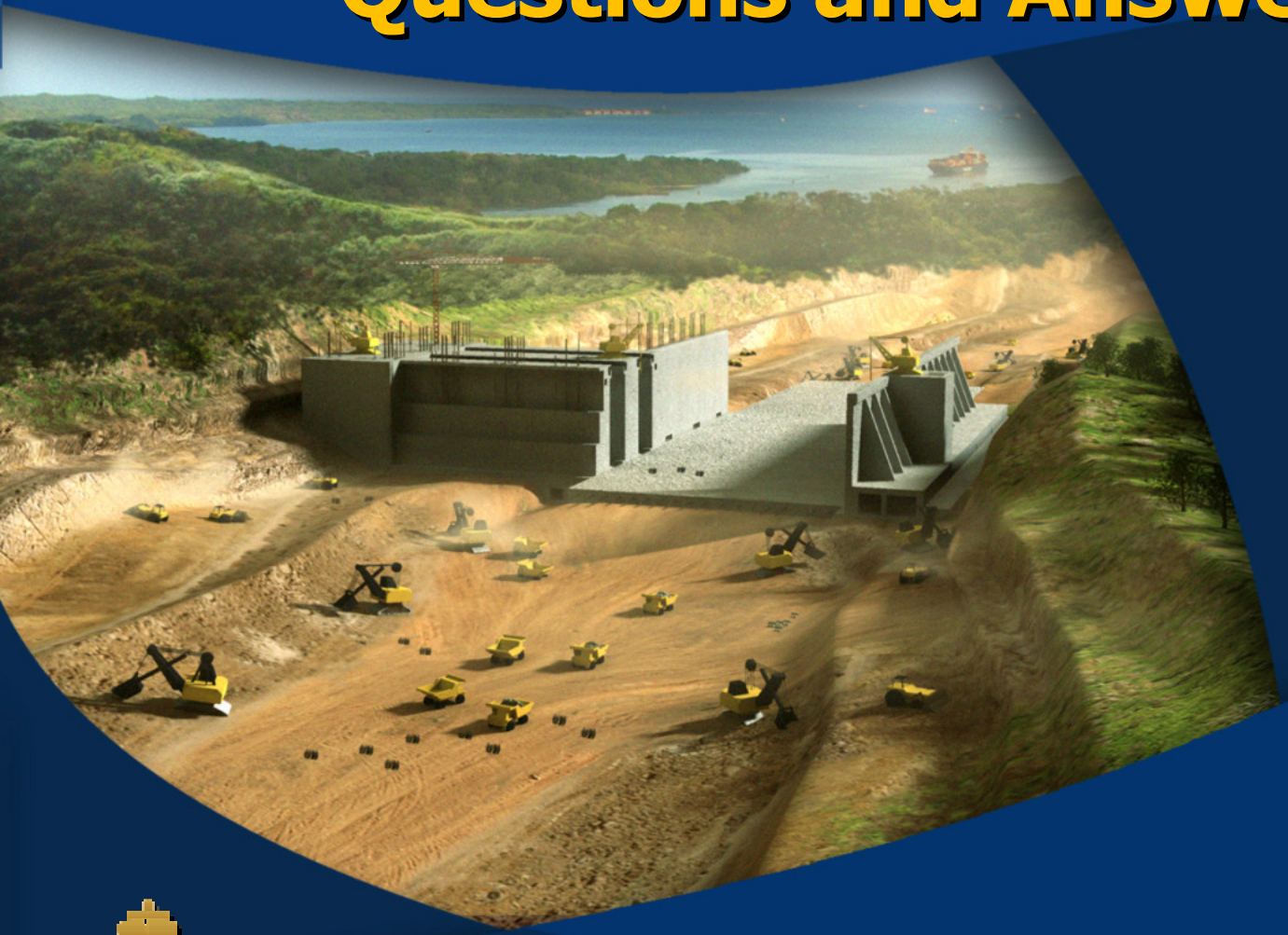
Seismic Design Criteria – Specific Highlights

- Definition and References Enhanced Clarity
- Independent Design Check specifics
- Technical Evaluation for Proposed Design has been deleted in its entirety from this Section

Break



Questions and Answers



Locks Pre-Tender Meeting

26MAR08

TERCER JUEGO DE ESCLUSAS

ACP