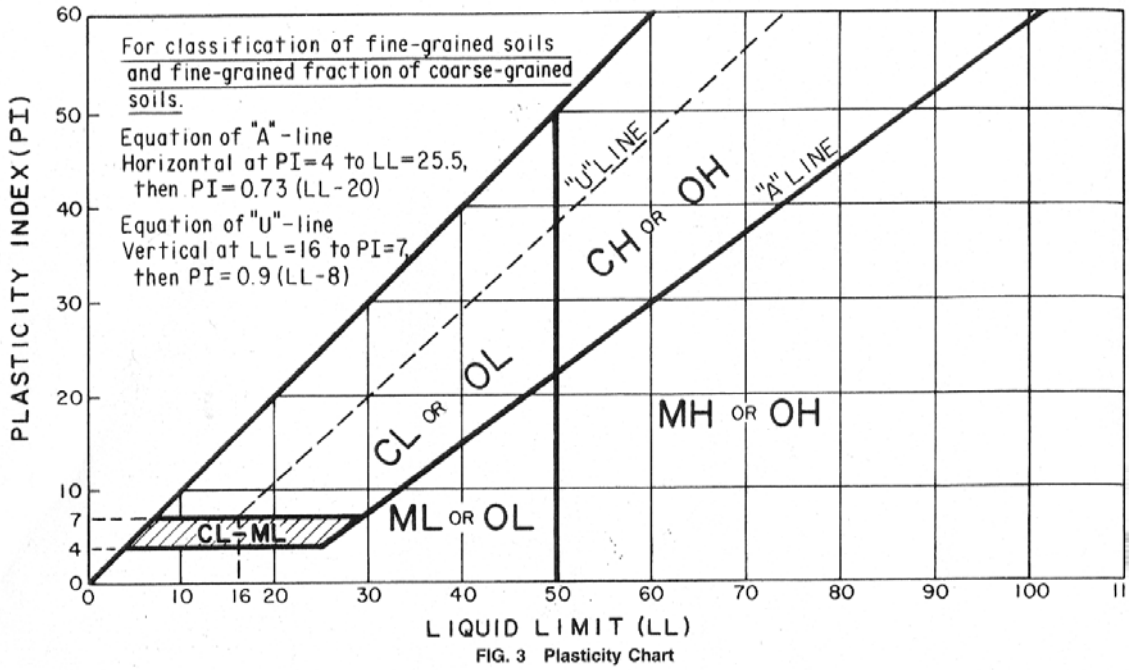


FIG. 3 Plasticity Chart

**TABLE 1 Soil Classification Chart**

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A] | | | | Soil Classification | |
|---|---|---|---|---|---|
| | | | | Group Symbol | Group Name[B] |
| COARSE-GRAINED SOILS | Gravels | Clean Gravels | $Cu \geq 4$ and $1 \leq Cc \leq 3^E$ | GW | Well-graded gravel[F] |
| More than 50 % retained on No. 200 sieve | More than 50 % of coarse fraction retained on No. 4 sieve | Less than 5 % fines[C] | $Cu < 4$ and/or $1 > Cc > 3^E$ | GP | Poorly graded gravel[F] |
| | | Gravels with Fines | Fines classify as ML or MH | GM | Silty gravel[F,G,H] |
| | | More than 12 % fines[C] | Fines classify as CL or CH | GC | Clayey gravel[F,G,H] |
| | Sands | Clean Sands | $Cu \geq 6$ and $1 \leq Cc \leq 3^E$ | SW | Well-graded sand[I] |
| | 50 % or more of coarse fraction passes No. 4 sieve | Less than 5 % fines[D] | $Cu < 6$ and/or $1 > Cc > 3^E$ | SP | Poorly graded sand[I] |
| | | Sands with Fines | Fines classify as ML or MH | SM | Silty sand[G,H,I] |
| | | More than 12 % fines[D] | Fines classify as CL or CH | SC | Clayey sand[G,H,I] |
| FINE-GRAINED SOILS | Silts and Clays | inorganic | PI > 7 and plots on or above "A" line[J] | CL | Lean clay[K,L,M] |
| 50 % or more passes the No. 200 seive | Liquid limit less than 50 | | PI < 4 or plots below "A" line[J] | ML | Silt[K,L,M] |
| | | organic | Liquid limit − oven dried / Liquid limit − not dried < 0.75 | OL | Organic clay[K,L,M,N] |
| | | | | OL | Organic silt[K,L,M,O] |
| | Silts and Clays | inorganic | PI plots on or above "A" line | CH | Fat clay[K,L,M] |
| | Liquid limit 50 or more | | PI plots below "A" line | MH | Elastic silt[K,L,M] |
| | | organic | Liquid limit − oven dried / Liquid limit − not dried < 0.75 | OH | Organic clay[K,L,M,P] |
| | | | | | Organic silt[K,L,M,Q] |
| HIGHLY ORGANIC SOILS | Primarily organic matter, dark in color, and organic odor | | | PT | Peat |

[A] Based on the material passing the 3-in. (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12 % fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12 % fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥15 % sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥15 % gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥30 % plus No. 200, predominantly sand, add "sandy" to group name.

[M] If soil contains ≥30 % plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

Source: 1999 Annual Book of ASTM Standards

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**Figure 2.2.5**

**Category in Unified Soil Classification System**

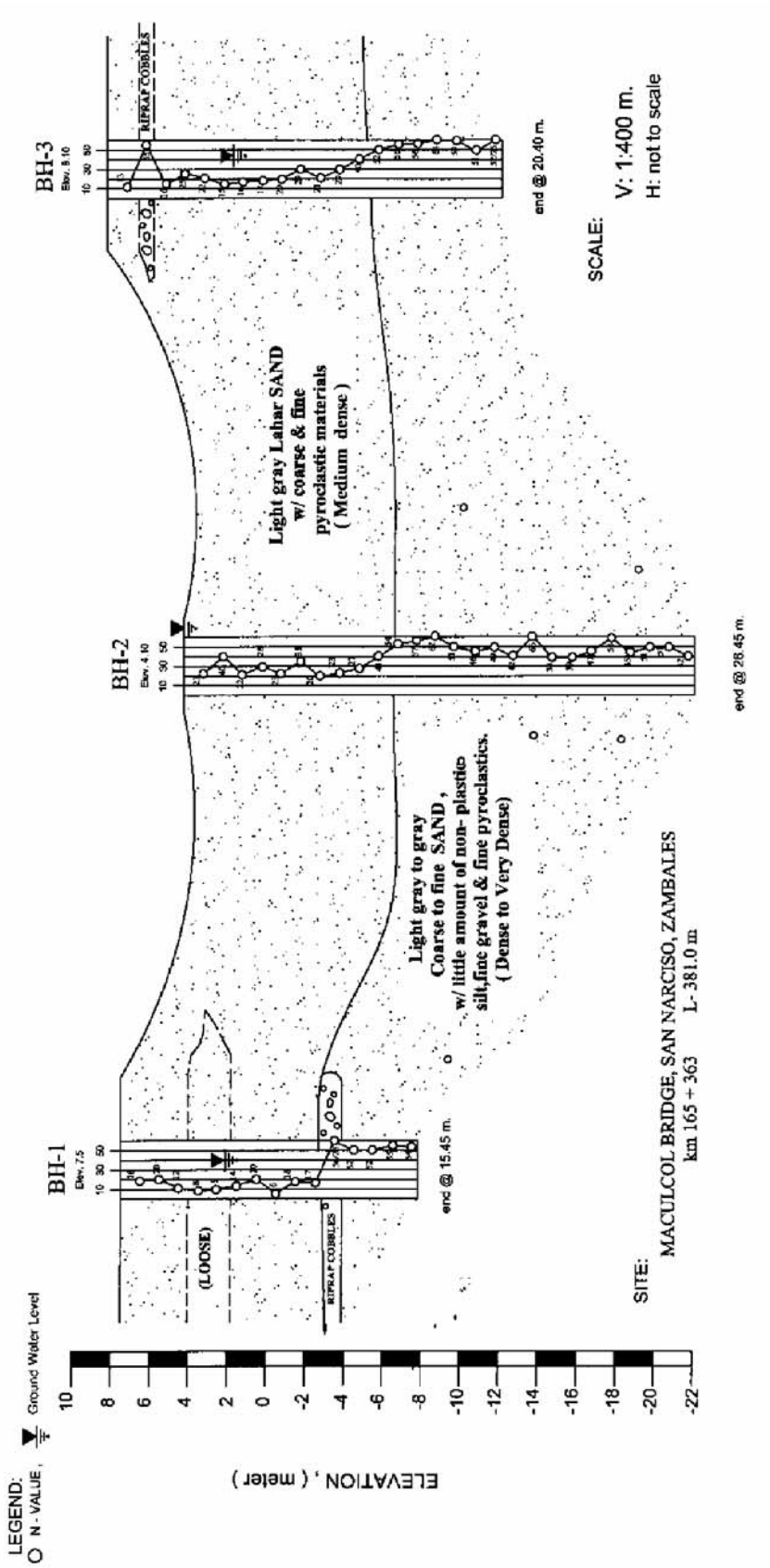


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**Figure 2.2.6**

**Soil Profile at the Maculcol Bridge**

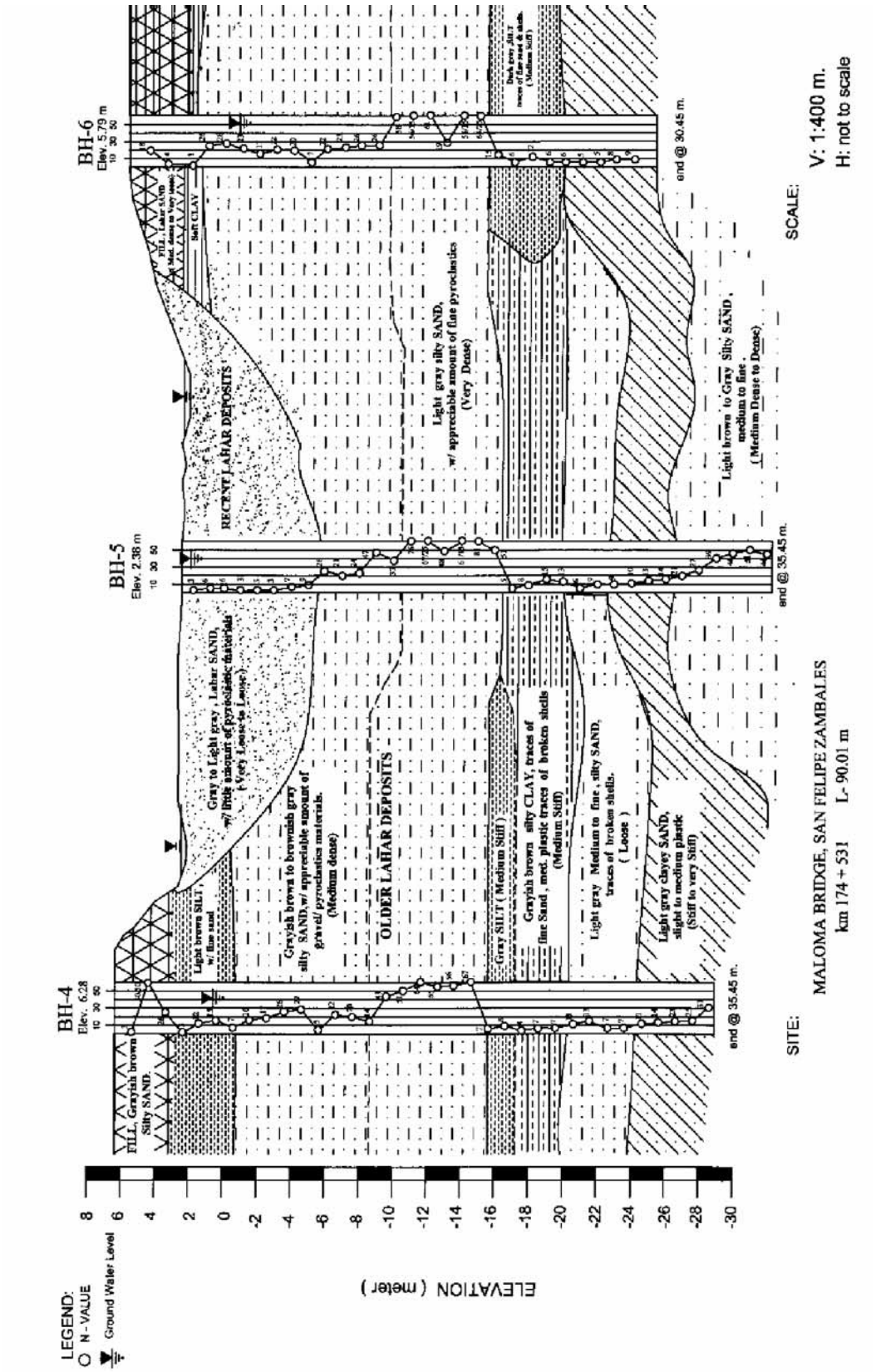


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**Figure 2.2.7**

**Soil Profile at the Maloma Bridge**

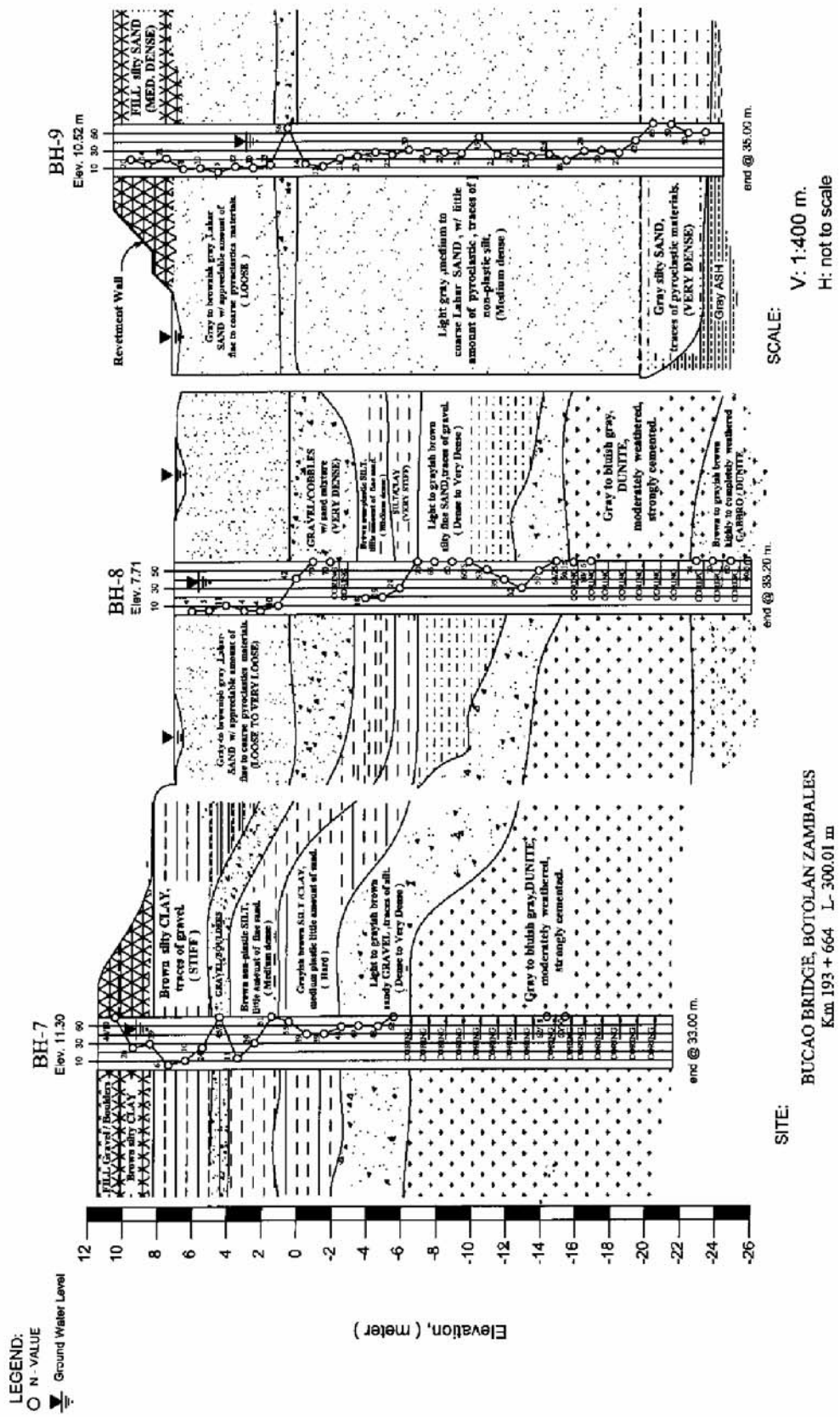


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**Figure 2.2.8**

**Soil Profile at the Bucao Bridge**

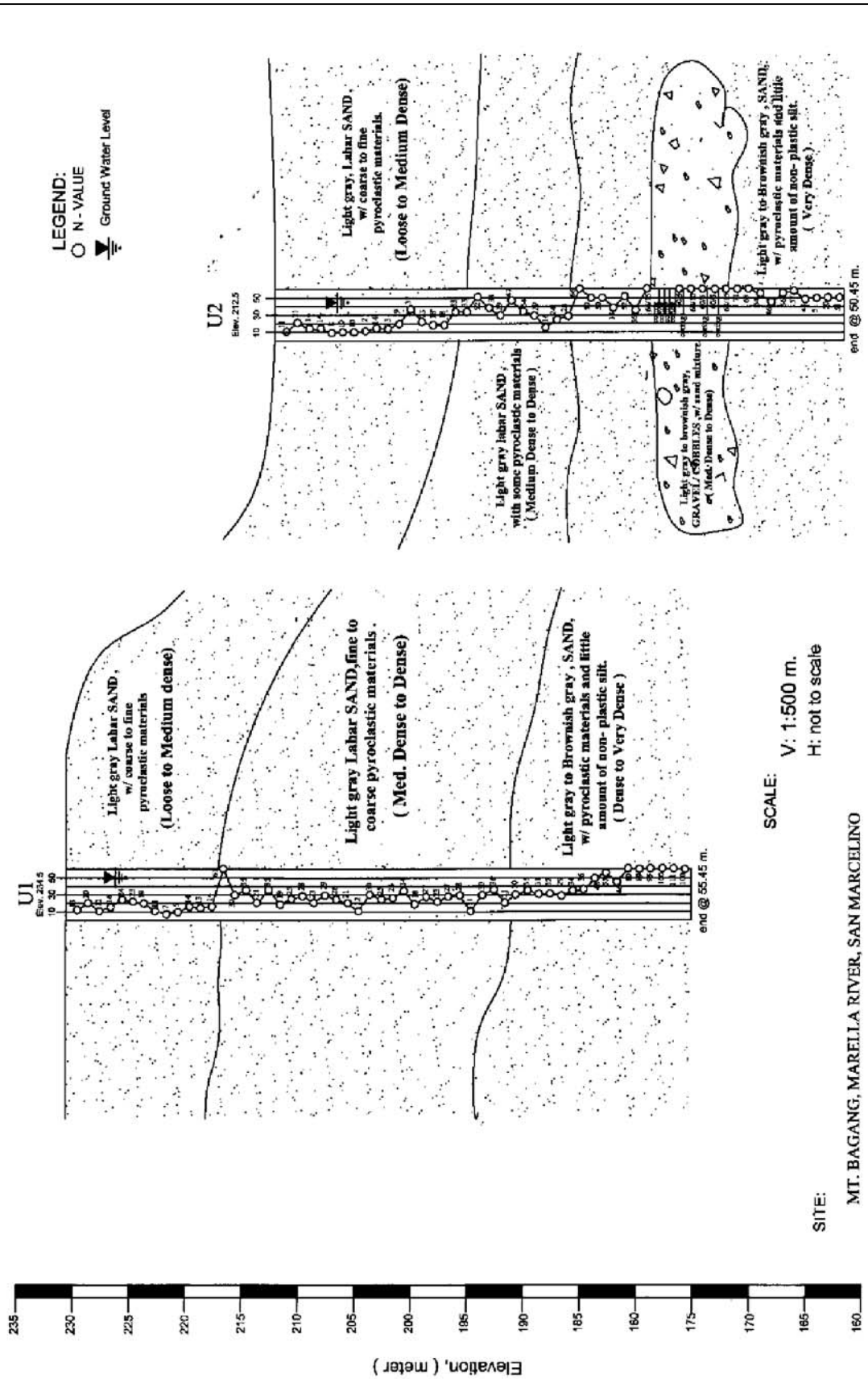


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**Figure 2.2.9**

**Soil Profile in Upstream of the Marella River**

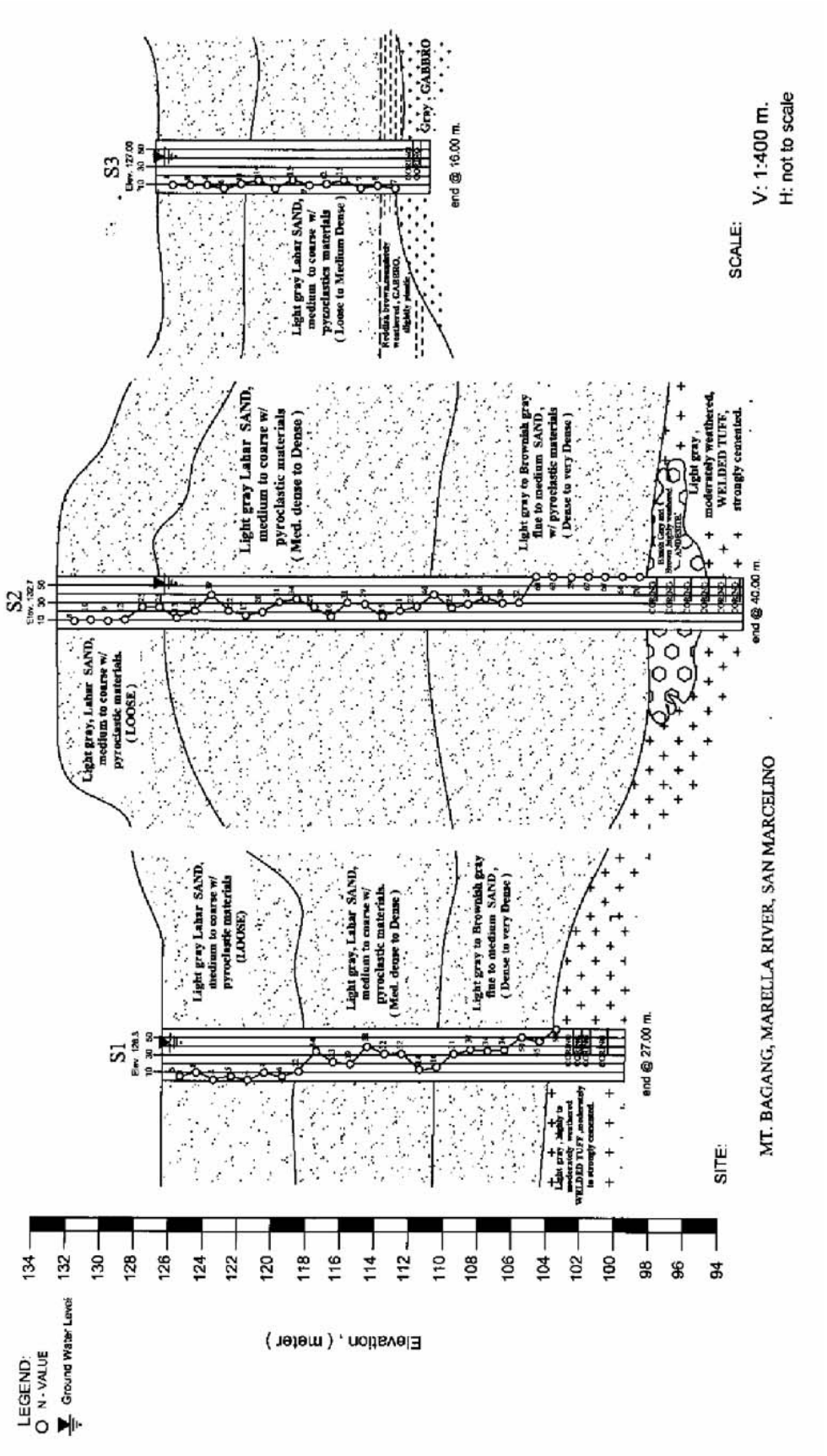


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**Figure 2.2.10**

**Soil Profile at the Mt. Bagang**