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Golder Associates

REPORT ON

GEOTECHNICAL ASSESSMENT
FRESHET 2007
URGENT MITIGATIVE FLOOD WORKS
IR#2 AND COLONY FARMS DIKE
PITT RIVER ROAD, PORT COQUITLAM, BC

Submitted to:

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1.0 INTRODUCTION

As requested, Golder Associates Ltd (Golder) has provided geotechnical input for upgrading the Coquitlam River – IR#2 and Colony Farms Dikes located off Pitt River Road and Shaughnessy Street, Port Coquitlam, BC. The proposed dike upgrades involve:

- Increasing the height of the IR#2 dike crest by up to 1.2 m to reach El 5.95 to 6.30 m (geodetic datum) over a 1.3 km length of dike; and ,

- Increasing the height of the Colony Farms dike by up to 1 m to reach El 5.8 m (geodetic datum) over a 0.9 km length of dike and substantial extension of the downstream (landside) toe over virgin ground over about 0.6 km.

The requirement for dike raising was identified after potential flood levels predicted for the Fraser River during the 2007 freshet were estimated to exceed current dike crest levels.

The City of Port Coquitlam (the City) was granted approval from the Ministry of Environment (MoE) to proceed with the proposed dike upgrade, under provisions within the Dike Maintenance Act (ref: 07-02-01B letter dated May 24 2007). The approval was granted with the following terms and conditions:

- The design and construction standards should conform, where possible, to the "Dike Design and Construction Guide – Best Management Practices for British Columbia, July 2003";

- The timing of construction should be carefully scheduled to take into account and/or accommodate the elevated water levels that occur during the annual freshet;

- The quality control and assurance (QA/QC) monitoring shall be under the supervision of a Professional Engineer;

- Any damage to the dike caused by the construction should be restored to equal or better than its original condition;

- A completion report shall be submitted including project description, photos, drawings, geotechnical conditions, material specifications, and any other relevant information;

- As-built drawings shall be submitted including detailed information on the specifications for the materials used;

- The geotechnical consultant shall complete seepage and slope stability analysis of several typical dike sections and provide factors of safety; and

- The project consultants shall provide recommendations for future work to upgrade the dike (including any subsurface and geotechnical investigations) to fully meet provincial guidelines with respect to dike stability, side slopes and crest widths.

The City appointed Associated Engineering (BC) Ltd (AE) as the project consultant and Jack Cewe Ltd (Cewe) as the construction contractor. AE requested Golder assist with the geotechnical aspects of the project. The scope of work for the geotechnical input was outlined in our proposal submitted to AE on April 18, 2007 (reference: e-mail from Randy Williams) and included:

- Review available documentation related to the existing dike conditions (including previous geotechnical investigations where available);

- Review and verify selected sections for geotechnical conditions and stability; and

- Provide recommendations for implementation of the proposed upgrade.

The scope of this assessment was limited solely to the geotechnical aspects of the project and did not include any investigation, analytical testing or assessment of potential soil and groundwater contamination or for any bio-environmental considerations.

This report should be read in conjunction with the ***"Information and Limitations of This Report"*** which is appended following the text of the report. The reader's attention is specifically drawn to this information as it is essential that it be followed for the proper use and interpretation of this report.

2.0 SITE DESCRIPTION

2.1 Location

The Coquitlam River Dike is located within the Kwikwetlem Indian Band Reserve #2 (IR#2) in Port Coquitlam, BC as shown on Figure 1. IR#2 is bound by the Coquitlam River to the west, Pitt River Road to the north, Shaughnessy Street to the east, and the Colony Farm Park to the south. The Coquitlam River Dike includes a north-south leg, called the IR#2 Dike and a west-east leg called the Colony Farms Dike.

The IR#2 section of the Coquitlam River Dike divides IR#2 roughly parallel to the Coquitlam River; the section west of the dike constitutes 60 acres of pristine natural habitat, the section east of the dike constitutes a combination of protected habitat, habitat buffer zones and commercial/residential use by the Kwikwetlem community.

The Colony Farms section of the dike divides the IR#2 reserve and the Colony Farms Park between Shaughnessy Street and the tie-in to the IR#2 dike. The area north of the dike is generally zoned for general use by the Kwikwetlem community, except for the western quarter, which is a habitat buffer zone. The area south of the dike is a wildlife habitat zone.

2.2 Alignment and Nomenclature

The existing IR#2 dike runs south-east from Pitt River Road for 400 m, and then turns around a 90 degree bend to run south west for another 800 m to a hairpin bend, where it adjoins the Colony Farms dike. The Colony Farms dike extends east for 900 m to almost meet Shaughnessy Street.

In terms of construction nomenclature, the IR#2 dike extends from STA: 0+900 at its southern boundary to STA: 2+243 at its northern boundary; the Colony farms dike extends from STA: 0+000 at its eastern boundary to STA: 0+900 at its western boundary.

Figures 2A to 2C show a plan and profile of the Site with construction nomenclature.

2.3 Topography and Land Development

The northern end of the IR#2 dike the native ground has been covered with some fill, mostly associated with the following infrastructure: at STA: 2+243 the dike ties into Pitt River Road and also crosses a GVRD pipeline; at STA: 2+ 220 there is a pump station; and at STA 2+150 the dike crosses the old Pitt River Road embankment. South of the old road embankment, the native terrain is generally flat, low-lying and swampy ranging in elevation from 2.7 m to 3.5 m geodetic datum.

On the upstream side (riverside) of the IR#2 dike, the topography is relatively consistent along its entire length: a branch of the Coquitlam River runs reasonably close to the dike, snaking to within about 10 m and up to 100 m away.

On the downstream side of the IR#2 dike, a shallow drainage ditch runs parallel to the downstream toe from STA: 2+000 to STA: 1+900 where the ditch opens to a wide shallow pond extending to STA: 1+800. Beyond the pond, the dike bends around 90 degrees. From there, the density of the vegetation increases and includes some trees.

On the upstream side of the Colony Farms dike, a 4 m to 9 m wide bench gently slopes down from the toe of the dike to meet a steep side slope that forms the side of a drainage ditch. The elevation at the top of the steep slope is about 1.5 m to 2.5 m and the elevation at the bottom of the drainage ditch is at 0 m to -0.5 m geodetic datum. The slope ranges from 1 vertical to between 1 and 2 horizontal.

On the downstream side of the Colony Farms dike, the ground is relatively flat, low-lying and swampy except within the eastern-most 200 m where significant fill has been placed within the IR#2 reserve.

2.4 Existing Dike Condition

A pre-construction meeting and dike inspection was held at the dike on April 23 2007 with representatives from the City, AE, CEWE and Golder in attendance. The purpose of the meeting and inspection was to assess the current condition of the dike, discuss construction considerations and to develop a conceptual approach to the upgrade works.

Generally the condition of the dike was good; the side slopes were vegetated with grasses and some small shrubs, the crest was in good condition. Some areas that required attention included:

- Some small sloughing had occurred on the downstream toe of the IR#2 Dike;
- A beaver was residing in the IR#2 dike at about STA: 2+050. The beaver had burrowed a few holes into the downstream toe of the dike. It was agreed that the holes would need to bee exposed and backfilled to reinstate the original condition of the dike and that effort to remove the beaver would need to be taken;
- Numerous mounds of soil and small burrows were observed on the downstream slope of the IR#2 dike from STA: 1+700 to 1+350;
- A concrete floodbox was located at 1+920. The current condition of the floodbox was not known and it was agreed that investigations would be carried out to confirm the integrity of the pipe, and if required, the pipe would be lined with a sleeve;

- The downstream slope of the Colony Farms Dike was over-steepened to about 1 horizontal to 1 vertical between STA: 0+250 to STA: 0+700; and

- The upstream toe of the Colony Farms dike was relatively close to a deep drainage channel.

3.0 AVAILABLE INFORMATION

3.1 Geological Map

The surficial geology map prepared by the Geological Survey of Canada (Map 1484A, dated 1980) indicates the site is underlain by Quaternary age mountain stream deltaic and channel fill comprising coarse gravel and sand up to 15 m thick. The site lies immediately north of an area underlain by Quaternary age Fraser River overbank, deltaic and tidal flat deposits comprising silt and silty clay loam up to 40 m thick.

3.2 Construction History

The majority of the IR#2 dike, from STA: 2+243 to STA: 1+350, was constructed in 1994. At STA: 1+350 the 1994 dike was tied into an existing dike to form a T-intersection, whereby the northern branch of the dike became redundant, and the southern branch formed part of the dike now defined as IR#2. Hence, from STA: 1+350 to STA: 0+900, the existing dike was raised in 1994.

The Colony Farms dike was constructed in the early 1900's and the crest elevation was raised by about 1.2 m in 1994.

3.3 1994 Investigation

Golder carried out a preliminary geotechnical investigation at the site for the IR#2 Dike construction and Colony Farms Dike raising in 1994 (report ref: 942-1030 dated March 21, 1994). The investigation was conducted to assess the shallow soil and groundwater conditions along the dike alignment, and based on the information; provide preliminary geotechnical recommendations on design and construction.

The geotechnical investigations included 19 hand augers to depths of between 2.6 m to 5.3 m and moisture content testing on disturbed samples. The locations of the previous test holes, and the test hole logs, are included in Appendix I and the stratigraphy is shown on the profile of the alignment on Figures 2A to 2C.

The preliminary geotechnical assessment indicated that the Site is underlain by very soft to soft organic soils to depths of about 3 m to 4 m overlying soft to firm silts. Along the Colony Farms section, the surficial soils include 1 m to 2.5 m of soft peat.

Based on the subsurface conditions the 1994 report recommended the following measures for the IR#2 dike construction:

- The final crest elevation of the dike should be over-built to allow for post-construction settlement of 0.5 m to 1.5 m for respective fill depths of 1 m to 3 m;
- The post-construction stability of the dike under static conditions had a factor of safety close to unity. Therefore, it was recommended that geogrid reinforcement or flatter slopes be considered;
- The rate of fill placement should be monitored during construction to allow sufficient time for dissipation of excess pore pressure and strength gain of native soils. The recommended rate was 0.6 m lifts of fill placed every two to three weeks;
- Subgrade preparation should include removal of trees, dead wood and brush. Beneath the upstream core, both vegetation and topsoil should be completely removed. Elsewhere, vegetation should be cut to a maximum height of 150 mm;
- Geogrid should be placed over the subgrade soils to improve trafficability and reduce the risk of punching failure; and
- Instrumentation should be installed including settlement gauges, slope inclinometers and piezometers.

3.4 1994 Construction Records

Settlement plates were installed and monitored during construction of the IR#2 Dike in 1994; settlement plates were not installed in the Colony Farms section. The records were recovered and the extent of construction settlement was determined. Also, the dike crest was surveyed in March 2007; the surveyed crest elevation was compared the as-constructed crest elevation and the difference was assumed to be a result of post-construction settlement. Generally, the observed settlement was grouped into three zones:

- From STA: 2+243 to STA: 1+900
  Construction settlement was less than 0.1 m
  Post-construction settlement was 0.1 m to 0.15 m;
- From STA: 1+900 to STA: 1+350
  Construction settlement ranged from 0.5 m to 1.1 m
  Post-construction settlement was 0.35 m to 0.5 m; and,

- From STA: 1+350 to STA 0+900
  Construction settlement was less than 0.1 m
  Post-construction settlement was 0.1 m to 0.2 m.

The records also indicated the rate of fill placement. Generally, fill was placed in lifts of 0.6 m every 2 to 3 weeks, with some exceptions where the lift thickness was increased to 1 m.

The plots of settlement and fill placement versus time are shown in Appendix II and the extents of construction and post-construction settlement are shown on the profile of the alignment on Figures 2A to 2C.

Within the Colony Farms section, there was no available information on the construction settlement that occurred in 1994. Based on the surveyed crest elevation was compared the as-constructed crest elevation, the post-construction settlement was less than 0.1 m.

3.5 1994 As-Constructed Drawings

There are no as-built drawings available for the pre-1994 dike. As-constructed drawings for the 1994 dike raising (ref: Drawings 342987 to 342992 dated March 1995) indicate the dike section geometry included a crest width of 3.7 m and upstream and downstream side slopes of 3 horizontal to 1 vertical.

From STA: 0+000 to 0+750 the raise involved placing up to 1.2 m of fill (of undefined composition) on the crest, with no downstream or upstream expansion. The remainder of the dike was constructed of zoned earth fill as follows:

- Type 1: Bulk fill, composition/specification was not described;

- Type II: Upstream sloping core consisting of 1 m thick silty or clayey material. From STA: 2+243 to STA: 1+350, where the dike was being constructed over virgin ground, the core extended from ground surface to Elevation 5.4 m. From STA: 1+350 to STA: 0+750, where the existing dike was being raised, the core extended from the crest of the original dike to Elevation 5.1 m;

- Type III: Downstream filter blanket consisting of 0.5 m thick sand and gravel. From STA: 2+243 to STA: 1+350, where the dike was being constructed over virgin ground, the filer blanket extended from the centre-line of the dike to 1 m outside the toe. From STA: 1+350 to STA: 0+750, where the existing dike was being raised, the filter blanket extended from the downstream toe of the original dike to 1 m outside the new downstream toe; and

- Running surface consisting of 0.15 m gravel sloping at 2%.

The as-constructed drawings do not detail the use of a geogrid at the base of the dike; however anecdotal information from a representative of AE indicates that a geogrid was placed over the virgin ground.

4.0 2007 GEOTECHNICAL INVESTIGATION AND MONITORING

4.1 Scope

The geotechnical conditions along the IR#2 section of the Coquitlam River dike have been reasonably well defined by previous investigation works and construction monitoring records. In addition, the proposed extent of fill placement on the IR#2 dike was within the existing dike footprint, without any requirement to extend the dike footprint over virgin ground. Therefore, it was not considered necessary to carry out investigation work in this area.

The geotechnical information available for the Colony Farms section indicated that the soil conditions were somewhat different to those along the IR#2 section; the main difference being that a layer of peat was present along the majority of the Colony farms dike. Also, because the 1994 dike raise was limited to placing a cap on the existing dike, there was little information available to predict the ground behaviour in response to a significant loading over virgin ground in a relatively short time frame. Therefore, it was considered prudent to carry out further investigation and install instrumentation to assess the ground response during the dike raising project.

4.2 Cone Penetration Test Results

The geotechnical investigation work included four Cone Penetration Tests (CPT's), CPT-07-01 to CPT-07-04 at the locations shown on Figure 2A. The CPT's were pushed to depths of between about 6 m to 8 m below native ground level. The results were interpreted and are summarized in **Appendix III.**

4.3 Instrumentation Monitoring

Nine settlement plate gauges and four pneumatic piezometers were installed along the Colony Farms dike at the locations shown on Figure 2A. The settlement plate gauges were surveyed daily during construction and the rate of settlement was assessed to assist in determination of whether additional fill could be placed. Graphs of cumulative settlement versus time at each settlement plate are shown in Appendix IV.

The pneumatic piezometers were read as required during construction to measure the pore water pressure. The extent of excess pore water pressure was assessed to determine whether additional fill could be placed. Graphs of excess pore water pressure versus time at the four piezometer locations are shown in Appendix IV.

5.0 SUBSURFACE CONDITIONS AND FILL MATERIALS

5.1 Soil Stratigraphy

The geotechnical information indicates that the Site is underlain by:

- Peat was encountered in the upper 1 m of the soil profile along the Colony Farms dike. The interpretation of CPT Results indicates the peat may have undrained shear strength in the order of 20 kPa;

- Very soft to soft organic silts were encountered below the peat or from the surface, to depths of about 3 m to 4 m. These soils had moisture contents ranging from 75% to 265%, the higher moisture content generally indicative of greater organic content. It appears this layer may not be present at the northern end of the alignment. Also, the layer may be up to 6 m thick at the western end of the Colony Farms Dike. The interpretation of CPT results along Colony Farms indicates this layer may have undrained shear strength in the order of 20 kPa; and

- The organic silts were underlain by soft to firm silts, which extended to the maximum depth of the auger holes. These soils had moisture contents ranging from 50% to 90%. It appears this layer includes increasing amounts of sand toward the northern end of the alignment. The interpretation of CPT results at Colony Farms indicates this layer may have undrained shear strength in the order of 40 kPa.

The stratigraphy is shown on the profile of the alignment on Figures 2A to 2C.

5.2 Groundwater

The groundwater level was at the existing surface, and some areas were flooded. The water levels are expected to vary with season and precipitation.

5.3 Fill Materials

The fill materials proposed to be used to raise the dike came from two sources, Jervis Inlet Pitrun and Pipeline Road Pitrun. Laboratory testing was carried out on selected samples; results are summarized below and report sheets included in Appendix V.

TABLE 1: Summary of Laboratory Test Results on Various Fill Materials

Material Source		Particle Size Distribution			Compaction Characteristics		Permeability (m/sec)
		% Grav	% Sand	% Fines	SPMDD (kg/m^3)	OMC (%)	
Jervis Inlet		11	82	7	1883	5.6	9.3 x 10-6
		37	58	5	1936	9.0	
Pipeline Road Pit Run	unscreened	15	56	29	-	-	3.75 x 10-8
		13	64	23	-	-	
					2107	7.3	
					2049	7.7	
	screened	29	57	14	2047	9.1	
Road mulch					2240	7.3	

6.0 GEOTECHNICAL ASSESSMENT

6.1 Design Criteria and Considerations

It was anticipated that potential flood levels for the Fraser River during the 2007 freshet may reach the 1 in 200 year High Water Level (HWL). The project was considered urgent with a required completion date of June 15, which was recently extended to 22 June 2007.

The design crest elevation was based on accommodating the 1 in 200 year HWL with appropriate allowances for freeboard and short-term settlement as follows:

- High Water Level: varies from 5.2 m at the southern end of the dike section to 5.3 m at the northern end;
- Freeboard: 0.6 m;
- Short-term Settlement: the dike crest should be overbuilt to accommodate settlement occurring from the onset of construction to the end of July; and
- Long-term Settlement: additional settlement is expected to occur over the design life of the dike. It is expected that accommodating long-term settlement is outside the scope of the current urgent construction program.

The dike raise was generally required to be confined to the downstream side due to the presence of pristine habitat on the upstream side. Within the area of the pond, STA: 1+700 to STA: 1+950, this requirement was relaxed and permission to place fill on the upstream slope was granted.

6.2 Design Section

The design cross-sections were provided by AE (ref: 20251109 and 20251110 Revision 2).

The IR#2 section geometry comprised a 4.8 m to 5 m wide crest at El 6.0 m to 6.4 m geodetic datum with side slopes of 2 horizontal to 1 vertical. Generally, the dike upgrade was confined to the downstream side, with the exception of the section of dike between STA: 1+700 to STA: 1+950, where the dike raise straddles the existing dike.

The Colony farms section geometry comprised a 4.4 m to 4.6 m wide crest at El 5.8 m geodetic datum with side slopes of 2 horizontal to 1 vertical. The raise was carried out on the downstream side and involved extending the footprint out onto the virgin ground by up to 5.3 m.

6.3 Geotechnical Model

The geotechnical parameters required for the assessment included unit weight, shear strength and hydraulic conductivity. These parameters were selected for each soil layer based on available historical information (including grain size analyses and fines content) and typical values for the soil types described on the borehole logs and interpreted from the CPT test results. The geotechnical parameters for each soil layer are summarized in Table 2.

TABLE 2: Geotechnical Parameters

Soil Description		Unit Weight (kN/m3)	Undrained Cohesion (kPa)	Friction Angle (degrees)	Hydraulic Conductivity (m/s)
Dike Fill	2007 Embankment Fill	19		32	9×10^{-6}
	IR#2 1994 Bulk Fill	19		32	1×10^{-6}
	IR#2 1994 Drainage Blanket	19		34	5×10^{-5}
	IR#2 1994 Upstream Core	19	20		1×10^{-7}
	Colony Farms Original Dike	19	20		1×10^{-7}
Native Soils	Peat – outside dike footprint	17	20		1×10^{-5}
	Peat – beneath dike footprint	17	30		1×10^{-9}
	Organic Silt	17	20		1×10^{-8}
	Silt	19	25		1×10^{-8}

6.4 Settlement

Short-term settlement expected over the construction and 3 month freshet period was estimated based on historical construction records from 1994. To accommodate this short-term settlement, the following overbuild was recommended:

- STA: 2+243 to STA: 1+900 - minimum overbuild of 0.15 m;
- STA: 1+900 to STA: 1+850 - minimum 0.5 m overbuild;
- STA: 1+850 to STA: 1+700 - overbuild may be reduced to 0.4 m;
- STA: 1+700 to STA: 1+350 - minimum 0.5 m overbuild;
- STA: 1+350 to STA: 0+900 - minimum overbuild of 0.15 m; and
- STA: 0+00 to STA: 0+900 – minimum overbuild between 0.15 m and 0.4 m; difficult to predict without historical records and should be monitored over the construction period.

Long-term settlement of the dike over the next 15 years may be in the order of 0.1 m to 0.5 m. It is expected that accommodating long-term settlement is likely to involve topping–up the dike as part of on-going dike maintenance. It is recommended the first topping-up be carried out during April 2008, allowing 9 months of long-term settlement to have occurred, if there is a high flood risk. Alternatively, the dike should be surveyed in July 2008 and as needed 'topped off' in August or early September 2008.

6.5 Seepage

Seepage analyses were carried out using the computer program Geostudio 2004 Seep/W version 6.21. The analyses assumed the water level on the upstream side of the dike would be at the 1 in 200 year flood level for a sufficient period to develop steady state seepage conditions through and beneath the dike. Three sections were selected for analyses; at STA 0+300, STA 1+400 and STA 1+800. The stratigraphy at these locations was based on that shown on Figures 2A to 2C and the geotechnical parameters as detailed in TABLE 2.

The results of the analyses indicate that exit gradients at the toe of the dike are acceptable and in the order of 0.1 to 0.4. The results are presented on Figure 3.

6.6 Stability

Stability analyses were conducted using the computer program Geostudio 2004-Slope/W, version 6.21 with the Morgenstern-Price solution method. Static limit-equilibrium stability analyses were carried out for short-term conditions for both upstream and downstream failure directions. No earthquake loads were applied.

The water level was modeled at the 1 in 200 year flood level, with the exception of the rapid drawdown case for upstream failure which modeled the water level at the ground surface. In all cases, the stability models assumed the phreatic surface as that output from the Seep/W model under steady state seepage conditions.

The results of the stability analyses are presented on Figures 4A and 4B and are summarized in Table 3.

TABLE 3: Summary of Slope Stability Results

Failure Direction	Load Case	Factor of Safety		
		STA 0+300	STA 1+400	STA 1+800
Downstream	1 in 200 year flood	1.8(1)	1.5	1.7
Upstream	1 in 200 year flood	1.9	3.0	2.5
	Rapid drawdown after 1 in 200 year flood	1.4	1.8(1)	1.6(1)

Note: (1) Some failure surfaces with lower factors of safety may occur but are limited to sloughing that will require repair. These failure circles are been included on the Figures.

The factors of safety are considered acceptable for the dikes at this location considering the conservative design criteria.

7.0 2007 CONSTRUCTION RECOMMENDATIONS AND MONITORING

7.1 Subgrade Preparation

Along the IR#2 section of the dike, it was recommended that subgrade preparation include removal of vegetation from the side slopes to expose the original dike fill and scarifying the existing crest. In areas where burrows from beavers or other creatures were found, it was recommended the holes be exposed and filled in with appropriate dike fill materials.

Based on the daily reports provided by AE, the IR#2 subgrade preparation was carried out as follows:

- Removal of vegetation: April 16 to 18, 2007;
- Repairs to the dike from the beaver holes: April 17, 2007; and,
- Stripping on the crest and sides of dike: April 24 to 26, 2007.

Along the Colony Farms section of the dike, it was recommended that subgrade preparation include scarifying the existing crest, removal of vegetation from the side slopes to expose the original dike fill and removal of large vegetation from the areas where the new dike footprint would extend over native ground. It was recommended that a filter fabric and geogrid be placed to improve trafficability and subgrade strength. It was recommended that the fabric, geogrid and first lift of fill be placed to form a pillow as follows: place fabric and geogrid to overlap the existing dike side slope and extend over the virgin ground, place the first lift of fill, wrap the geogrid back over the first lift of fill and pin into the side slope of the existing dike. Based on the daily reports provided by AE, the Colony Farms subgrade preparation was carried out as follows:

- Removal of vegetation and installation of silt fences along the south side of the existing dike: April 16 to 18, 2007;
- Hogweed removal on north side of the existing dike: May 02, 2007;
- Removal of vegetation over the native ground: May 03, 2007; and
- Placement of filter cloth and geogrid: May 07 to 11, 2007.

7.2 Pipeline at STA: 1+920

It was recommended that the pipeline be tested for leakage; the concern was that gaps in the pipe joints provide a potential path for migration of dike fill. If the testing indicated gaps were present, it was recommended a method of sealing the joints be undertaken, which would probably involve placing a HDPE pipe within the existing pipe and sealing the gap between the two pipes with grout.

Daily reports from AE indicate an area around either end of the pipeline was sandbagged on May 2 and surveyed with a video camera on May 3. The results of the video survey indicated the first joint west of the east end of the pipeline had a one inch gap. Additional survey was carried out on May 16 and indicated the four joints within the pipeline all had gaps of half to one inch. The daily reports do not indicate what actions, if any, were taken to repair to joints.

7.3 Fill Materials

Imported fills should come from established borrow pits. The materials should be free from organic, man made materials and environmental contaminants. The proposed borrow materials described in Section 5.3 are considered suitable for use as follows:

- Bulk Fill – either Pipeline Road or Jervis Sand;
- Drainage Blanket (if required) – Jervis Sand; and
- Upstream sloping core – any new dike fill above the present dike crest level and within 2 m of the river side slope of the dike should have at least 20% silt and clay sizes (percent passing the 0.075 mm sieve). Based on the laboratory test results outlined in Section 5.3, the Pipeline Road pit run material would satisfy this criteria whilst the Jervis material would not.

Based on the daily reports provided by AE, bulk fill was placed along the IR#2 section between April 26 and May 24, 2007. A combination of Pipeline material and Jervis Sand was used for bulk fill. The records indicate that the only occurrence of Pipeline Road material being placed on the crest was the final lift of bulk fill on May 24 between STA: 1+555 to 2+070.

If the material placed within the upstream core zone does not have the recommended 20% silt content, measures may be required to modify the dike section to correct deficiency after the emergency, particularly if future dike raises are required.

Based on the daily reports provided by AE, bulk fill was placed along the Colony Farms section between May 08 and June 14, 2007. The initial lifts of fill placed on the downstream side of the dike over the native ground, were 3 inch minus pit run from Jervis Inlet. Subsequent lifts comprised Pipeline material and Jervis Sand. The records indicate that Jervis material was placed over the crest, but was later removed and replaced with Pipeline pit run.

7.4 Fill Compaction

It was recommended that the fill should be placed in uniform horizontal lifts not exceeding 300 mm in loose thickness. The fill should be compacted to a minimum of 95% of Standard Proctor Maximum Dry Density (SPMDD). Compaction testing was carried out by Golder on an as-requested basis, results are summarized in TABLE 4.

TABLE 4: Compaction Test Results

Test Location by Station	Compaction Achieved: Measured Field Density as a Percent of Spmdd (%)			
	May 4	May 24	May 30	June 15
0+050			101	
0+100		81		97
0+200		93	101	96
0+215			100	
0+250		81		
0+300		92	102 & 98	98
0+400		90	100, 90 & 93	97
0+500		79	101, 93 & 90	97
0+575 0+600			99, 89 & 98	98
0+700			100	97
0+800		80	101	
0+950/0+900	100 & 94	95		
1+000	101	95		
1+100	102	96		
1+200	99	96		
1+300	101	95		98
1+400	100	95		
1+500	102	95		
1+550/1+600	101	93		
1+700	100	96		
1+780	100	95		
1+850				98
1+900	102	95		
2+000	100	95		
2+100	101	96		
2+150	100	-		98
2+200	92	98		

Generally, the cases where the field density failed to achieve 95% SPMDD were located on the Colony Farms section of dike side within the initial lifts over the virgin ground. These lifts were not expected to meet the compaction standard, and the low results are not considered problematic.

7.5 Hydroseeding

It was recommended that the finished side slopes were hydroseeded. Placement of topsoil was not recommended as it would be unlikely to remain in place. The daily reports from AE indicate hydroseeding was carried out on the IR#2 right side slopes on June 6 and IR#2 left side slopes on June 7.

8.0 RECOMMENDATIONS

Future work should include the following before further crest elevation increases:

- Identification of the soil conditions within 2 m of the upstream face, to confirm that a continuous impervious core has been achieved above the high water level. If permeable materials exist above – below the high water level, consideration may be given to constructing a 2 m wide low permeability zone on the upstream face. The low permeability zone would key into the original dike and extend at least to the elevation of the high water level.

- Survey of the crest prior to the 2008 freshet, to confirm the predicted long-term settlement is reasonable and to identify the requirements for topping-up.

- Carry out regular inspections each spring to identify any burrow holes from beavers or other creatures in the sections from 1+900 to 1+200.

- Confirm the condition of the floodbox at 1+920 and if needed upgrade pipe or place sleeve in pipe.

9.0 CLOSURE

The factual data, interpretations and recommendations contained in this report are based on the soil conditions encountered at the test locations, and local experience. This report has been prepared for the exclusive use of Associated Engineering Ltd. and its representatives (specifically including the City of Port Coquitlam) for specific application to the development described within this report. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it are the responsibility of such third parties. Golder accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report. This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied is made.

Please call the undersigned if you have any questions, or desire additional information.

Yours very truly,

GOLDER ASSOCIATES LTD.

J.I. Perrett
Geotechnical Group

John Hull, P.Eng.
Principal

PROFESSIONAL ENGINEER OF BRITISH COLUMBIA JOHN A. HULL

JIP/JAH/cap/nnv/ggg
07-1411-0098/2000
Attachments
O:\FINAL\2007\1411\07-1411-0098\2000\RPT-0726_07 AE(BC)-MITIGATIVE FLOOD WORKS.DOC

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

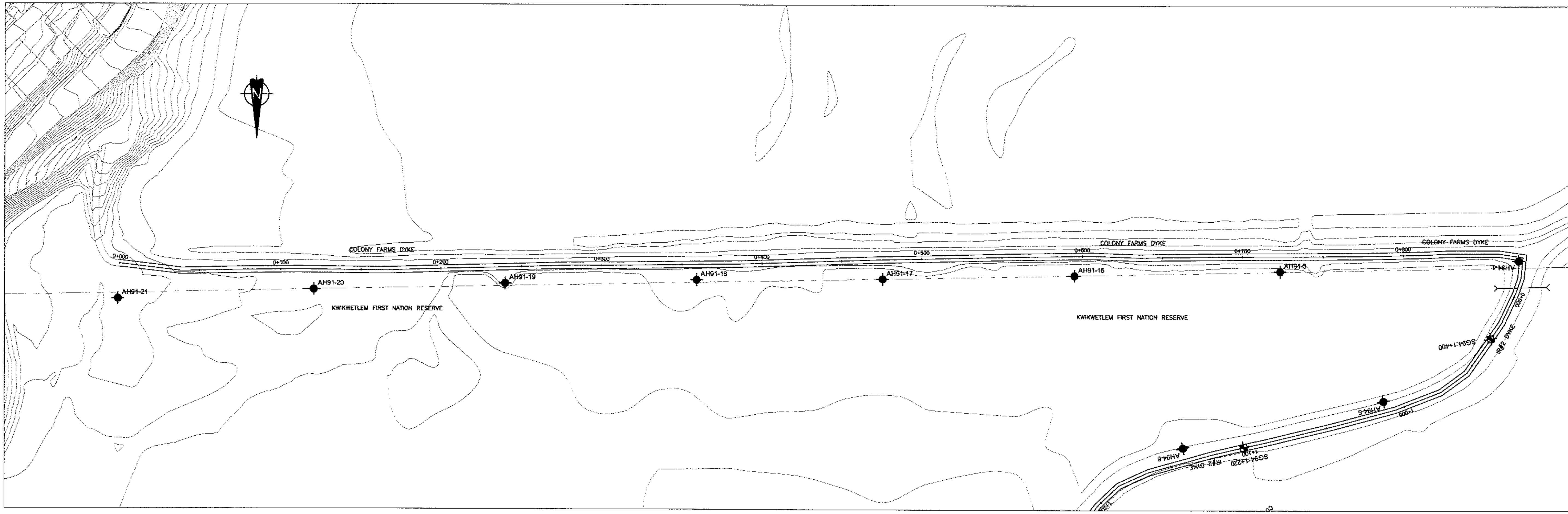
REVISION DATE: July 3, 2007 BY: MGM and GGG FILE: FINAL\2007\1411\07-1411-0098\2000\FIGURE 1 – LOCATION MAP.PPT

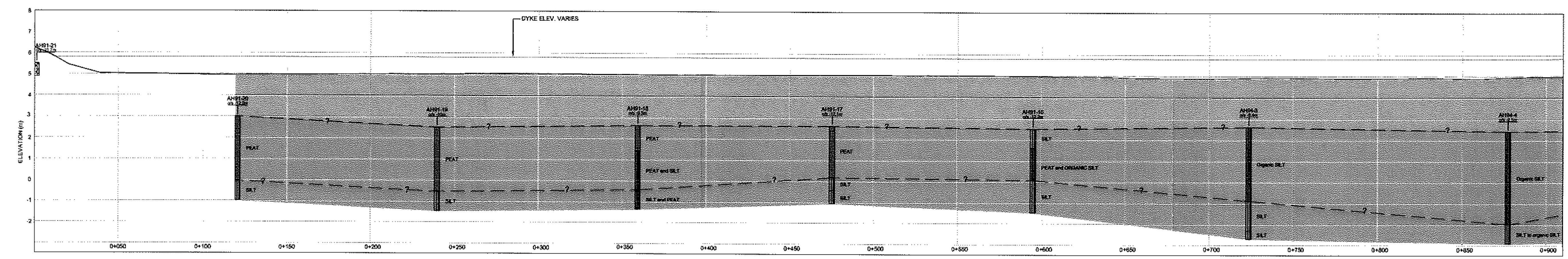
PROJECT
ASSOCIATED ENGINEERING
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER ROAD, PORT COQUITLAM, B.C.

TITLE
Location Map

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	GGG	03JUL07	SCALE NTS	REV.
CADD	MCM	03JUL07	**FIGURE 1**	
CHECK	JIP	03JUL07		
REVIEW				





LEGEND

- 1994 Hand Auger
- 1994 Settlement Plate
- Design Crest Elevation
- As-Constructed 1994 Elevation
- Existing Dyke Elevation (March 2007)
- —?— Interpreted Soil Stratigraphy

POST - GLACIAL DEPOSITS:

- FILL / Surficial Mineral Soils
- PEAT / Organic Soils
- SILT / Clayey SILT to Silty CLAY / Organic SILT
- SAND / Silty SAND / Sandy SILT

SG94:1+400 — Settlement Plate

0.105 — 1994 - 2007 Long Term Settlement

0.11 — 1994 Construction Settlement

REFERENCES

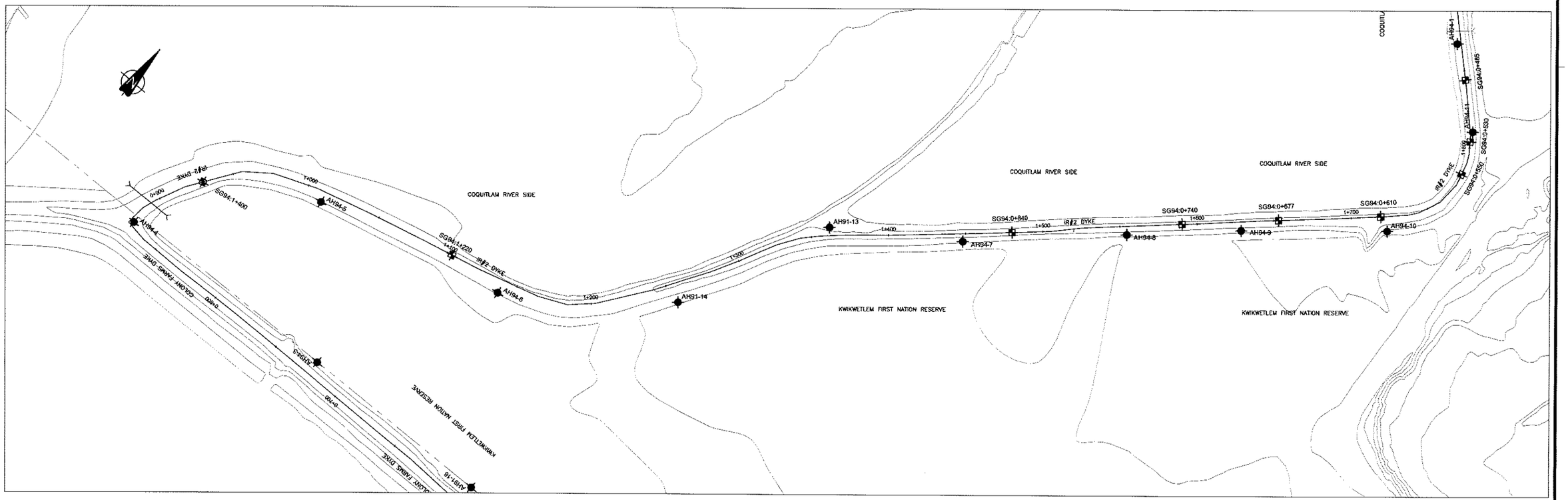
1) Base plan provided by Associated Engineering on May 10, 2007.

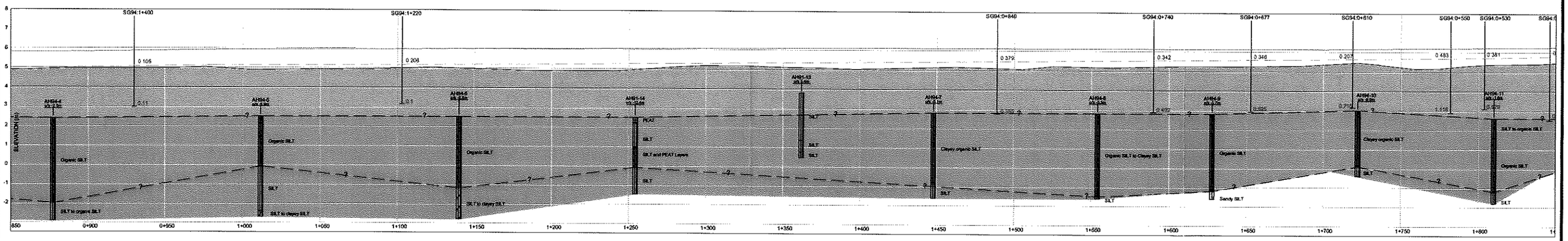
Horizontal Scale in Meters

Vertical Scale in Meters

PROJECT	
	ASSOCIATED ENGINEERING URGENT MITIGATIVE FLOOD WORKS PITT RIVER ROAD, PORT COQUITLAM, B.C.
TITLE	COQUITLAM RIVER DIKE STATION 0+000 TO STATION 0+900

Golder Associates			
PROJECT No. 07-1411-0098			FILE No.
DESIGN	JP	14MAY07	SCALE AS SHOWN REV. -
CADD	SRR	14MAY07	FIGURE 2A
CHECK			
REVIEW			





LEGEND

- 1994 Hand Auger
- 1994 Settlement Plate
- Design Crest Elevation
- As-Constructed 1994 Elevation
- Existing Dyke Elevation (March 2007)
- Interpreted Soil Stratigraphy

POST - GLACIAL DEPOSITS:

- FILL / Surficial Mineral Soils
- PEAT / Organic Soils
- SILT / Clayey SILT to Silty CLAY / Organic SILT
- SAND / Silty SAND / Sandy SILT

SG94:1+400 — Settlement Plate

0.105 — 1994 - 2007 Long Term Settlement

0.11 — 1994 Construction Settlement

REFERENCES

1) Base plan provided by Associated Engineering on May 10, 2007.

Horizontal Scale in Meters: 0 10 20 30 40 50

Vertical Scale in Meters: 0 1 2 3 4 5

PROJECT

ASSOCIATED ENGINEERING
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER ROAD, PORT COQUITLAM, B.C.

TITLE

COQUITLAM RIVER DIKE
STATION 0+850 TO STATION 1+850

Golder Associates

PROJECT No. 07-1411-0098			FILE No.		–
DESIGN	JP	14MAY07	SCALE	AS SHOWN	REV. –
CADD	SRR	14MAY07			
CHECK					
REVIEW					

FIGURE 2B

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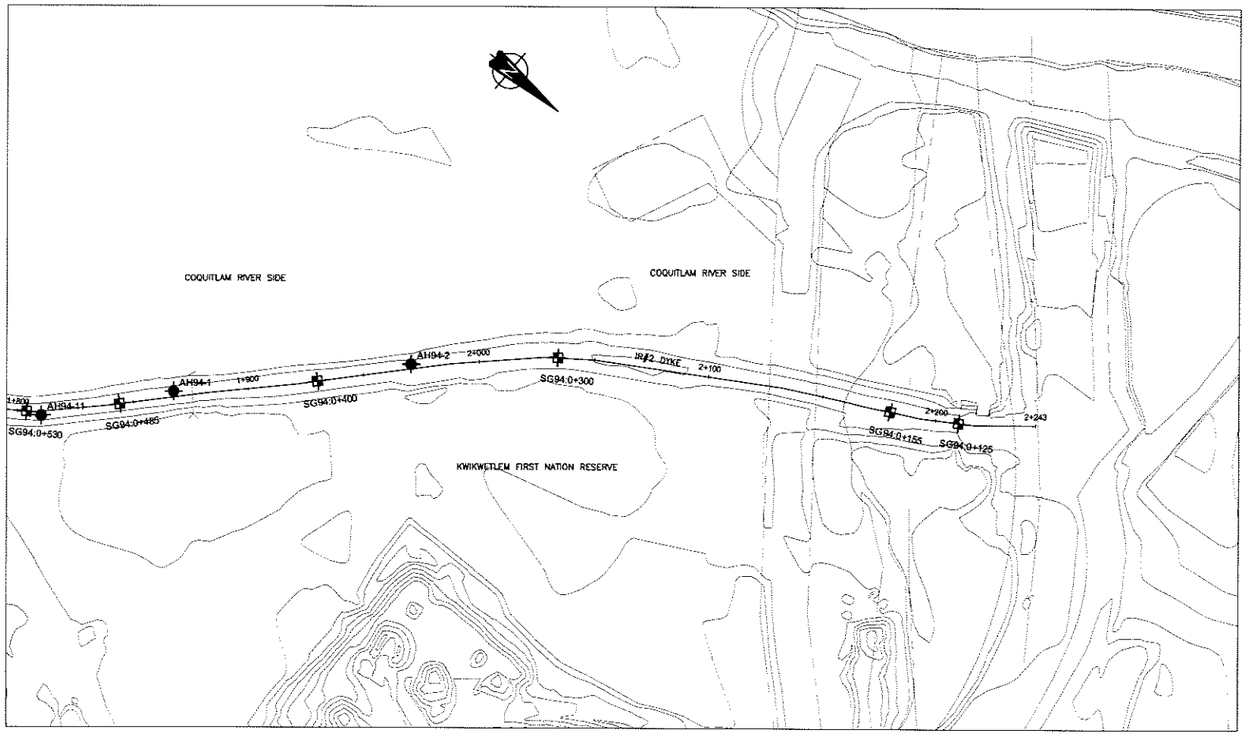

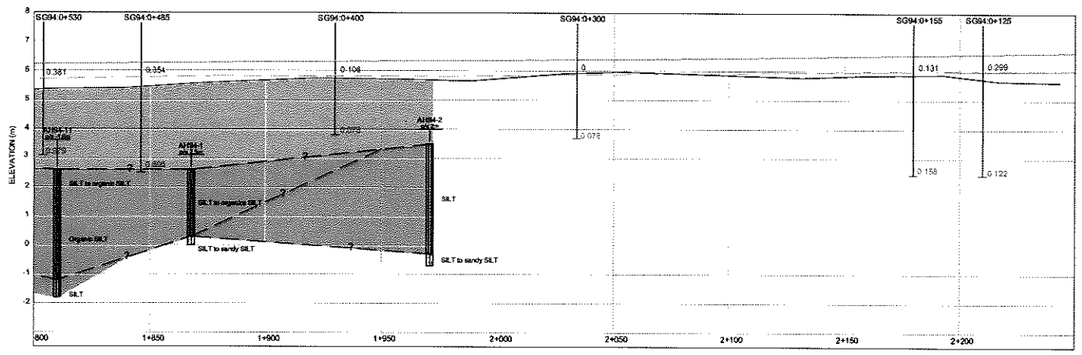

LEGEND

- 1994 Hand Auger
- 1994 Settlement Plate
- Design Crest Elevation
- As-Constructed 1994 Elevation
- Existing Dyke Elevation (March 2007)
- ——?—— Interpreted Soil Stratigraphy

POST - GLACIAL DEPOSITS:

- FILL / Surficial Mineral Soils
- PEAT / Organic Soils
- SILT / Clayey SILT to Silty CLAY / Organic SILT
- SAND / Silty SAND / Sandy SILT

SG94:1+400 — Settlement Plate

0.105 — 1994 - 2007 Long Term Settlement

0.11 — 1994 Construction Settlement

REFERENCES

1) Base plan provided by Associated Engineering on May 10, 2007.

0 10 20 30 40 50
Horizontal Scale in Metres

0 1 2 3 4 5
Vertical Scale in Metres

PROJECT
ASSOCIATED ENGINEERING
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER ROAD, PORT COQUITLAM, B.C.

TITLE
COQUITLAM RIVER DIKE
STATION 1+800 TO STATION 2+243

Golder Associates

PROJECT No. 07-1411-0098			FILE No.		-
DESIGN	JP	14MAY07	SCALE	AS SHOWN	REV. -
CADD	SRR	14MAY07			
CHECK					
REVIEW					

FIGURE 2C

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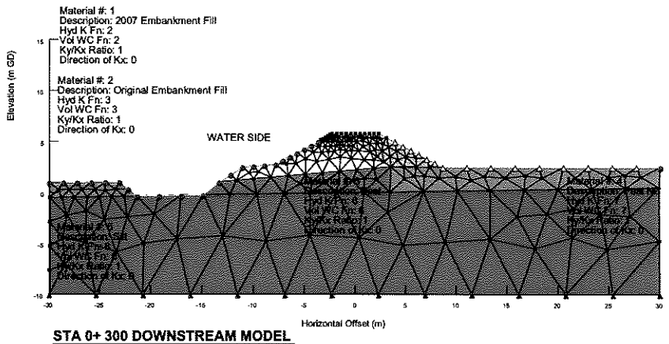

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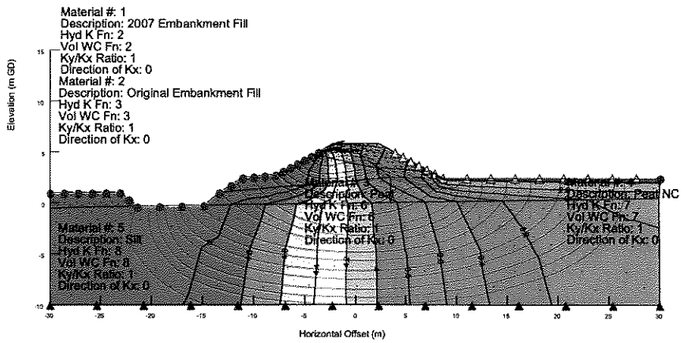

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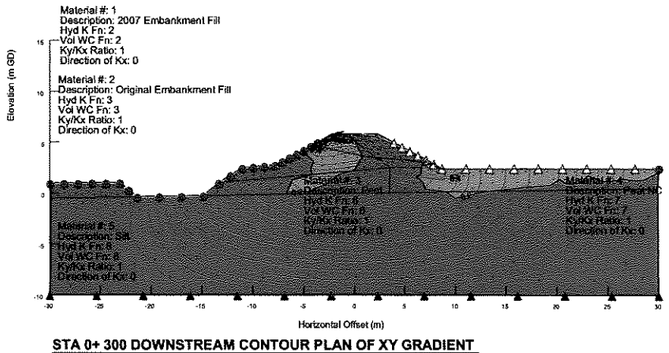

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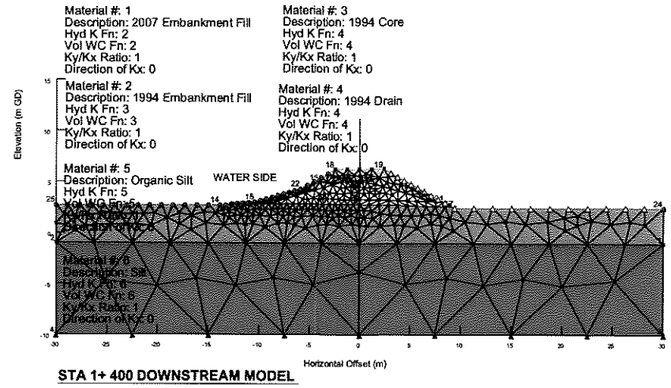

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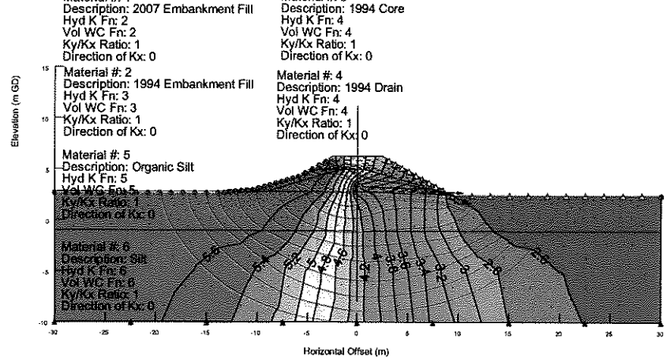

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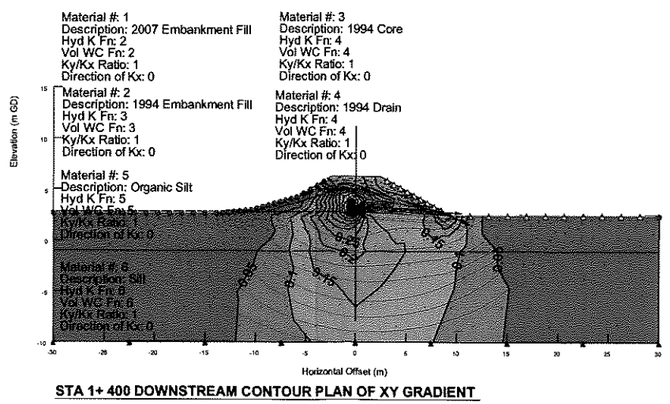

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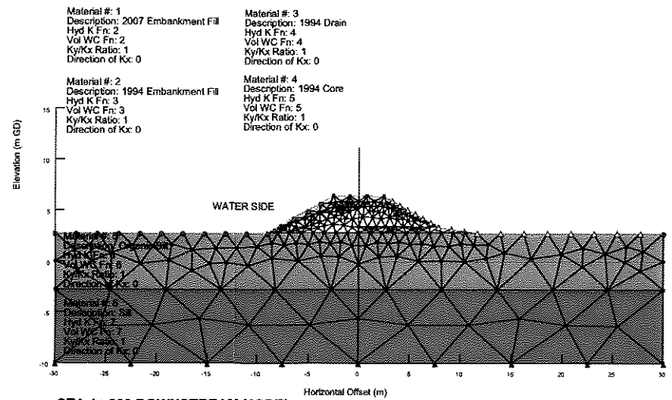

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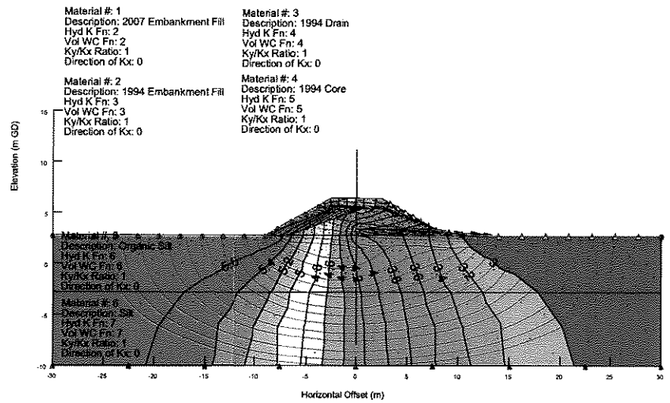

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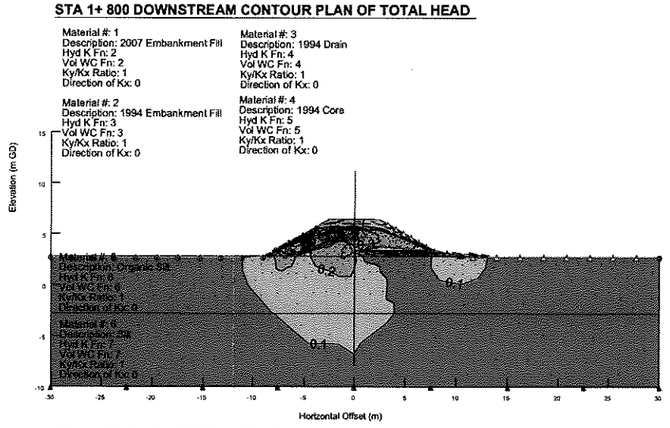

STA 1+ 800 DOWNSTREAM CONTOUR PLAN OF XY GRADIENT

LEGEND

- Flow Path
- Contour Boundary
- 0.15 / 5.6 Contour Labels
- ● △ ▲ Boundary Conditions

PROJECT
ASSOCIATED ENGINEERING
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER ROAD, PORT COQUITLAM, B.C.

TITLE
COQUITLAM RIVER DIKE
RESULTS OF SEEPAGE ANALYSIS

Golder Associates

PROJECT No. 07-1411-0098			FILE No.		--
DESIGN	JP	14MAY07	SCALE	AS SHOWN	REV. --
CADD	SRR	14MAY07			
CHECK					
REVIEW					

FIGURE 3

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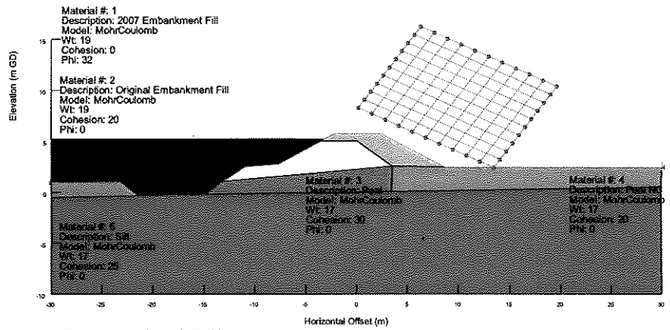

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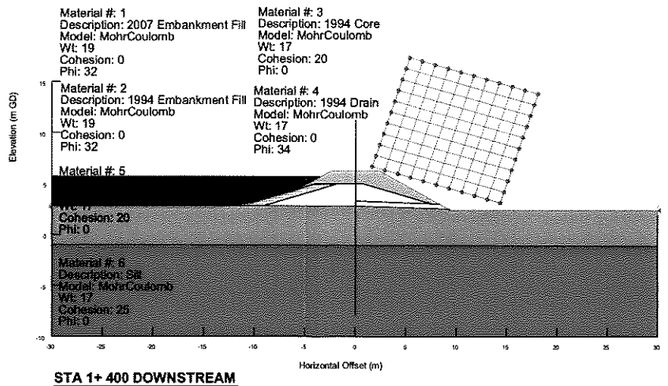

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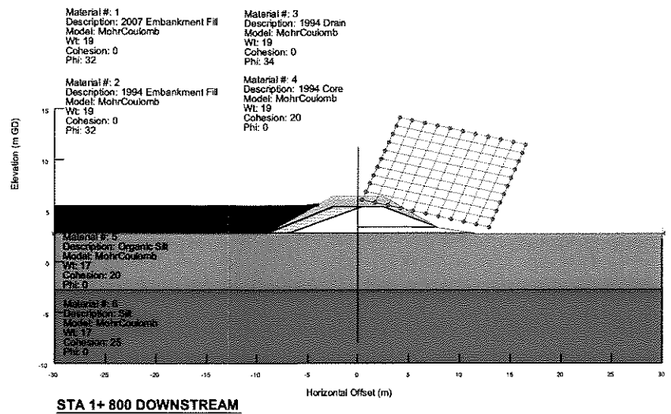

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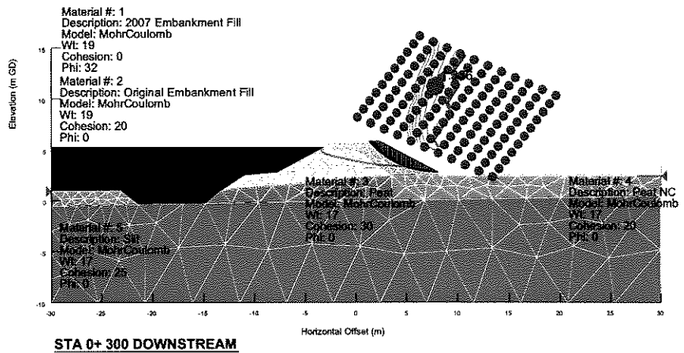

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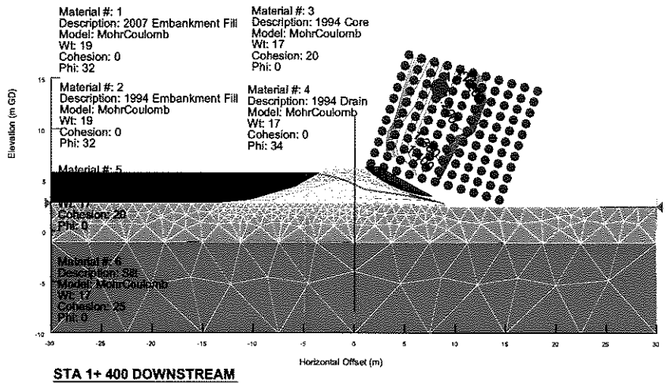

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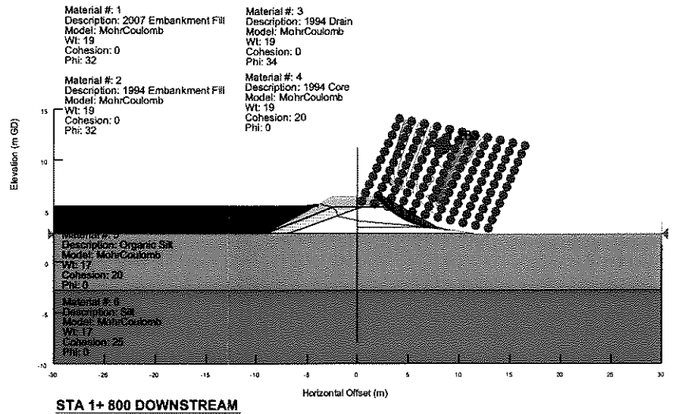


STA 1+ 800 DOWNSTREAM

PROJECT

ASSOCIATED ENGINEERING
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER ROAD, PORT COQUITLAM, B.C.

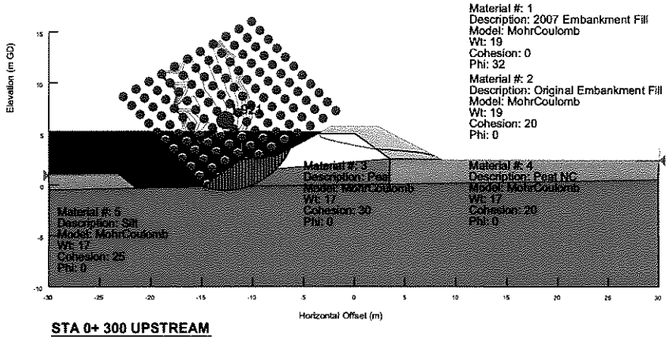
TITLE

COQUITLAM RIVER DIKE
RESULTS OF STABILITY ANALYSIS

Golder Associates

PROJECT No. 07-1411-0098			FILE No.		-
DESIGN	JP	14MAY07	SCALE AS SHOWN	REV.	-
CADD	SRR	14MAY07			
CHECK			**FIGURE 4A**		
REVIEW					

REVISION DATE: 07/07/23 04:10PM By: kschaefer CADD FILE: K:\Burn~Graphics\Projects\2007\1411\07-1411-0098\Drafting\2300\071411009B-2300-A_03-4A-48.dwg



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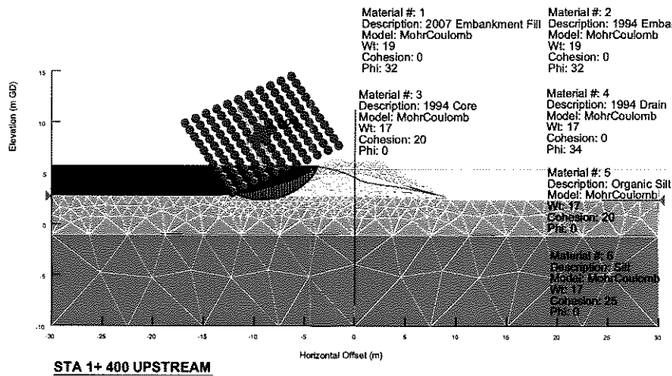

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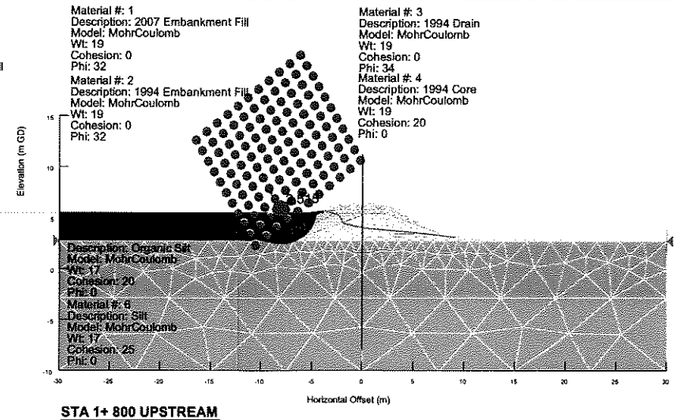

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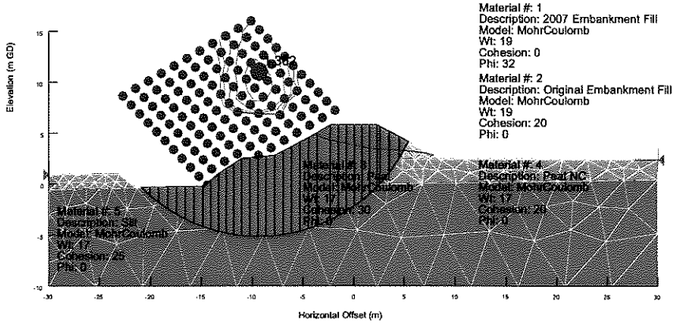

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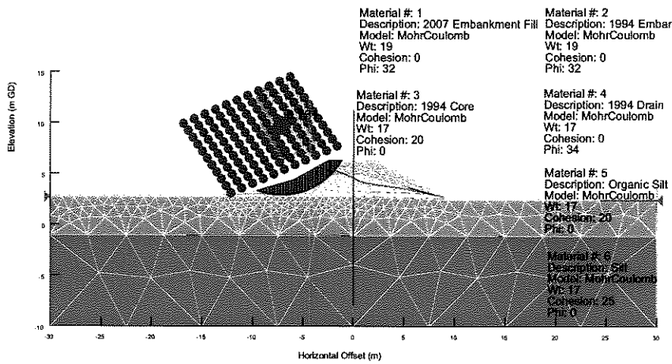

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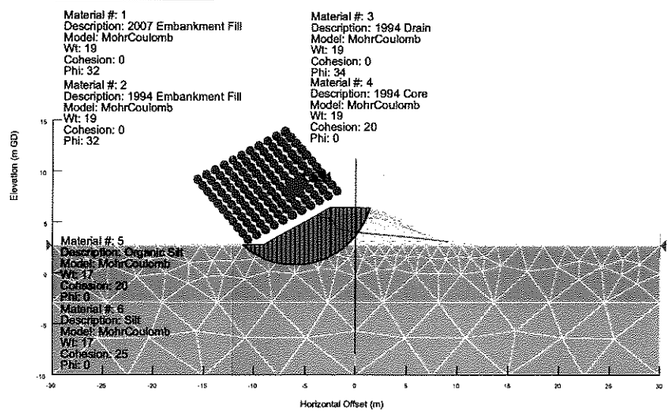

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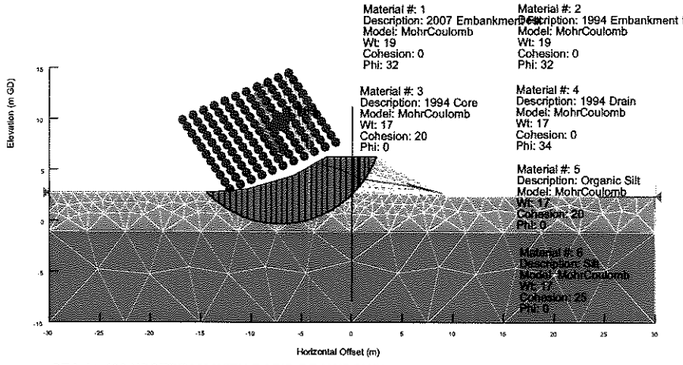


STA 1+ 400 UPSTREAM WITH RAPID DRAWDOWN

PROJECT
ASSOCIATED ENGINEERING
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER ROAD, PORT COQUITLAM, B.C.

TITLE
COQUITLAM RIVER DIKE
RESULTS OF STABILITY ANALYSIS

Golder Associates

PROJECT No. 07-1411-0098			FILE No.		-
DESIGN	JP	14MAY07	SCALE AS SHOWN	REV.	-
CADD	SRR	14MAY07			
CHECK					
REVIEW					

FIGURE 4B

APPENDIX I

1994 CONSTRUCTION – RECORD OF BOREHOLE LOGS

RECORD OF AUGERHOLES

Augerhole No.	Depth (m)	Description	Sample/ Depth
94-1	0.0-2.3	Very soft to soft, brown SILT to organic SILT, trace to some clay, trace sand.	1 0.61-0.76
			2 1.52-1.68
	2.3-2.6	Firm, brown, SILT to sandy SILT, trace organics.	3 2.44-2.59
	2.6	End of Augerhole.	
94-2	0.0-3.8	Soft, brown SILT, trace to some fine sand and organics, trace clay.	1 0.61-0.76 *w*=49.7%
			2 1.52-1.68 *w*=47.8%
			3 2.44-2.59 *w*=65.4%
			4 3.35-3.51 *w*=64.8%
	3.8-4.2	Soft to firm, grey brown, SILT to sandy SILT, trace clay.	5 3.81-4.11 *w*=58.7%
	4.2	End of Augerhole	

RECORD OF AUGERHOLES

Augerhole No.	Depth (m)	Description	Sample/ Depth
94-4	0.0-4.4	Very soft to soft, brown to grey brown, organic SILT, trace fine sand and clay.	1 0.61-0.76 w=101.7%
			2 1.68-1.83 w=177.7%
			3 2.44-2.59 w=151.4%
			4 3.35-3.51 w=186.6%
			5 4.27-4.42 w=193.5%
	4.4-5.3	Soft to firm, grey brown SILT to organic SILT, trace fine sand and clay.	6 5.18-5.33 w=83.2%
	5.3	End of Augerhole.	
94-5	0.0-2.6	Soft, brown, organic SILT, trace to some fine sand, and clay.	1 0.61-0.76
			2 1.52-1.68
			3 2.44-2.59

RECORD OF AUGERHOLES

Augerhole No.	Depth (m)	Description	Sample/ Depth
94-7	0.0-3.7	Soft, brown, clayey organic SILT, trace fine sand.	1 0.61-0.91 *w*=102.1%
			2 1.52-1.83 *w*=126.7%
			3 2.44-2.59 *w*=99.0%
			4 3.35-3.51 *w*=118.0%
	3.7-4.4	Firm, brown SILT, trace to some fine sand, clay, and organics.	5 4.27-4.42 *w*=90.9%
	4.4	End of Augerhole.	
94-8	0.0-4.3	Soft, brown, organic SILT to clayey SILT, trace fine sand.	1 0.61-0.91 *w*=124.6%
			2 1.52-1.83 *w*=144.6%
			3 2.44-2.59 *w*=131.6%
			4 3.35-3.51 *w*=136.8%

RECORD OF AUGERHOLES

Augerhole No.	Depth (m)	Description	Sample/ Depth
	2.9-3.4	Firm, grey brown SILT, some fine to medium grained sand, trace clay.	4 3.20-3.35
	3.4	End of Augerhole.	
94-11	0.0-1.0	Very soft to soft, brown SILT to organic SILT, trace fine sand and clay.	1 0.61-0.91 *w*=264.6%
	1.0-3.8	Soft, grey brown organic SILT, trace to some clay and trace fine sand.	2 1.52-1.83 *w*=270.7%
			3 2.44-2.59 *w*=324.1%
			4 3.35-3.51 *w*=122.6%
	3.8-4.4	Firm, grey brown SILT, trace to some clay and organics, trace fine sand.	5 4.27-4.42 *w*=159.5%
	4.4	End of Augerhole.	

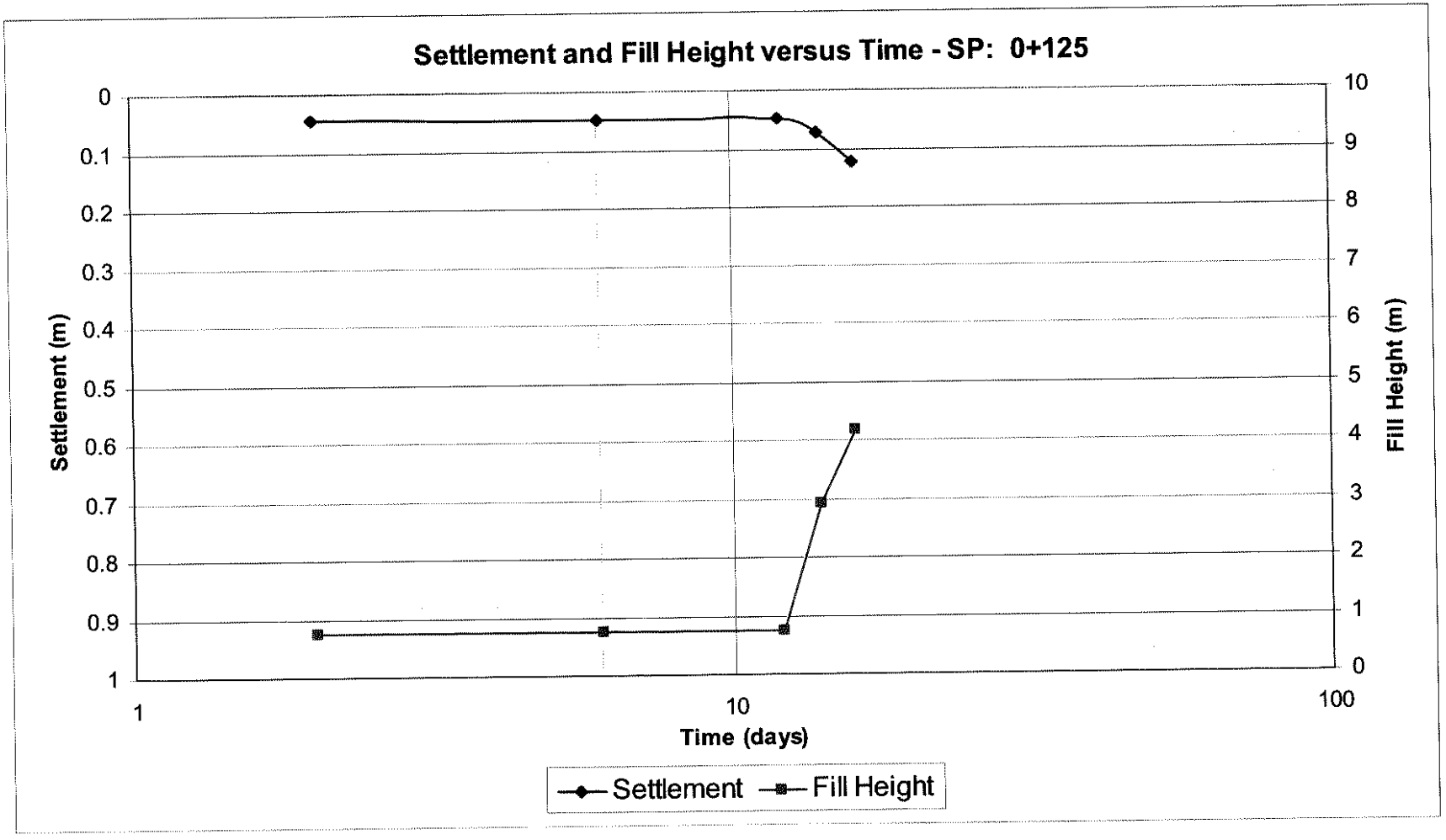
RECORD OF TEST PITS

Auger Hole No.	Depth (m)	Description	Sample/ Depth
	3.66	End of Auger Hole.	
91-18	0.0 - 1.22	Soft, brown PEAT.	
	1.22 - 3.05	Soft, brown PEAT and grey SILT mixture.	Sa. 1 Sa. 2
	3.05 - 3.96	Firm, grey SILT and PEAT mixture.	Sa. 3
	3.96	End of Auger Hole.	
91-19	0.0 - 3.05	Soft, brown PEAT.	Sa. 1
	3.05 - 3.96	Soft, grey SILT, some clay and organics.	Sa. 2
	3.96	End of Auger Hole.	
91-20	0.0 - 3.05	Soft, brown PEAT.	Sa. 1
	3.05 - 3.96	Soft, grey and brown SILT, some organics, trace clay.	Sa. 2
	3.96	End of Auger Hole.	
91-21	0.0 - 0.61	Loose to compact, brown SILT, SAND and GRAVEL.	Sa. 1
	0.61	End of Auger Hole.	

APPENDIX II

1994 CONSTRUCTION – RECORD OF SETTLEMENT PLATE DATA

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt



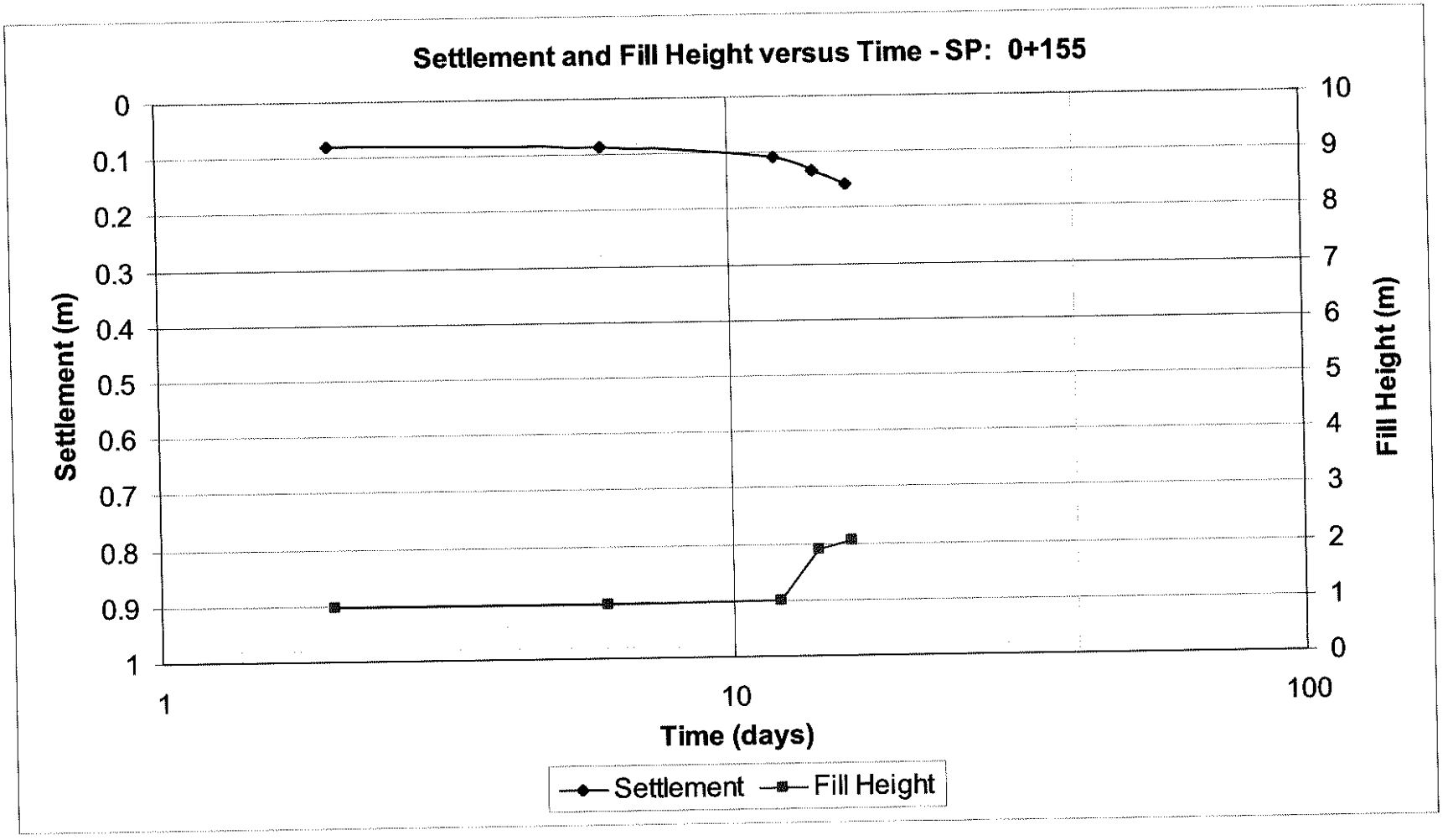
PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07		
CHECK	JIP	28JUN07		
REVIEW				

FIGURE II-1

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

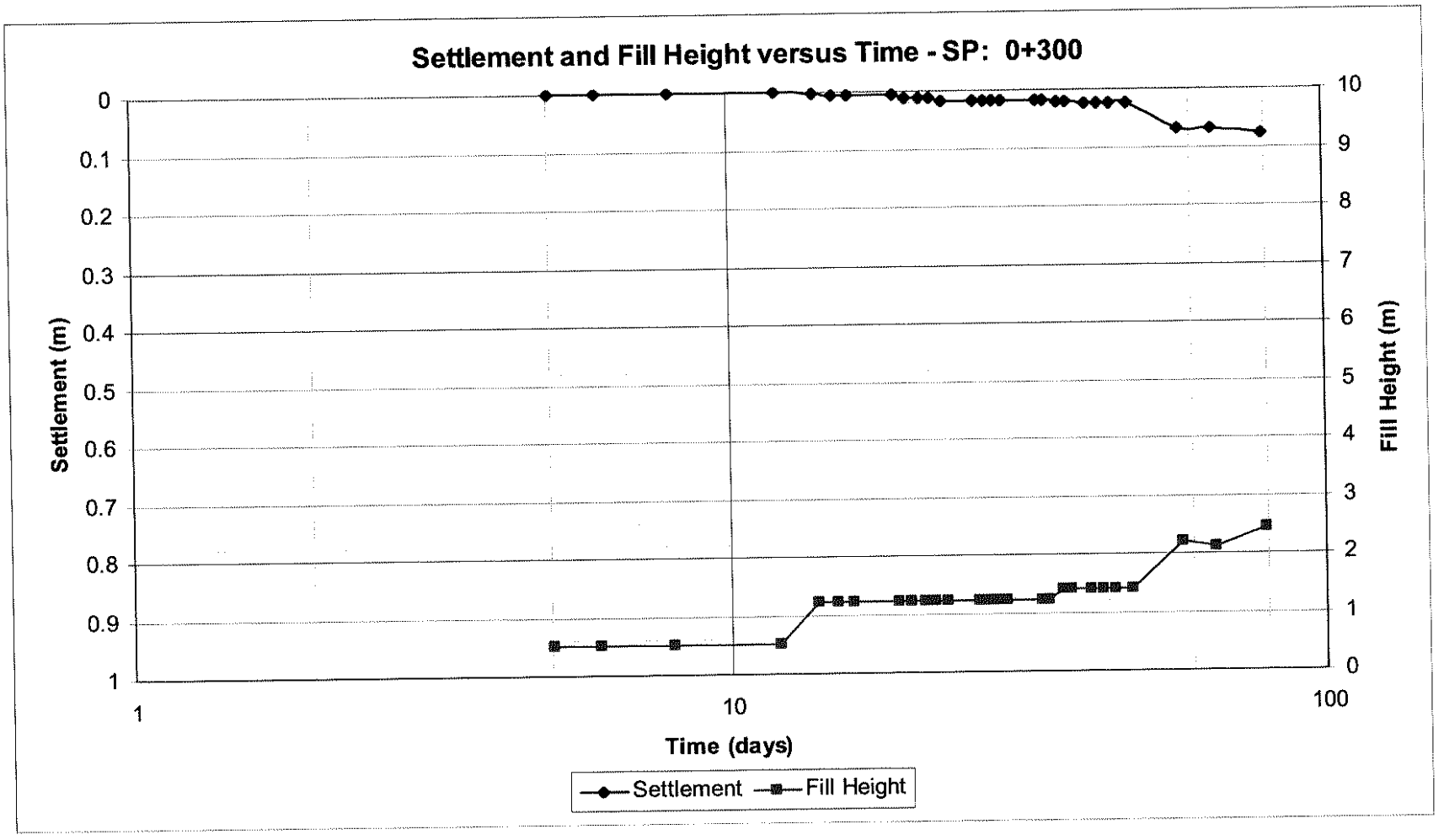


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	FIGURE II-2	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

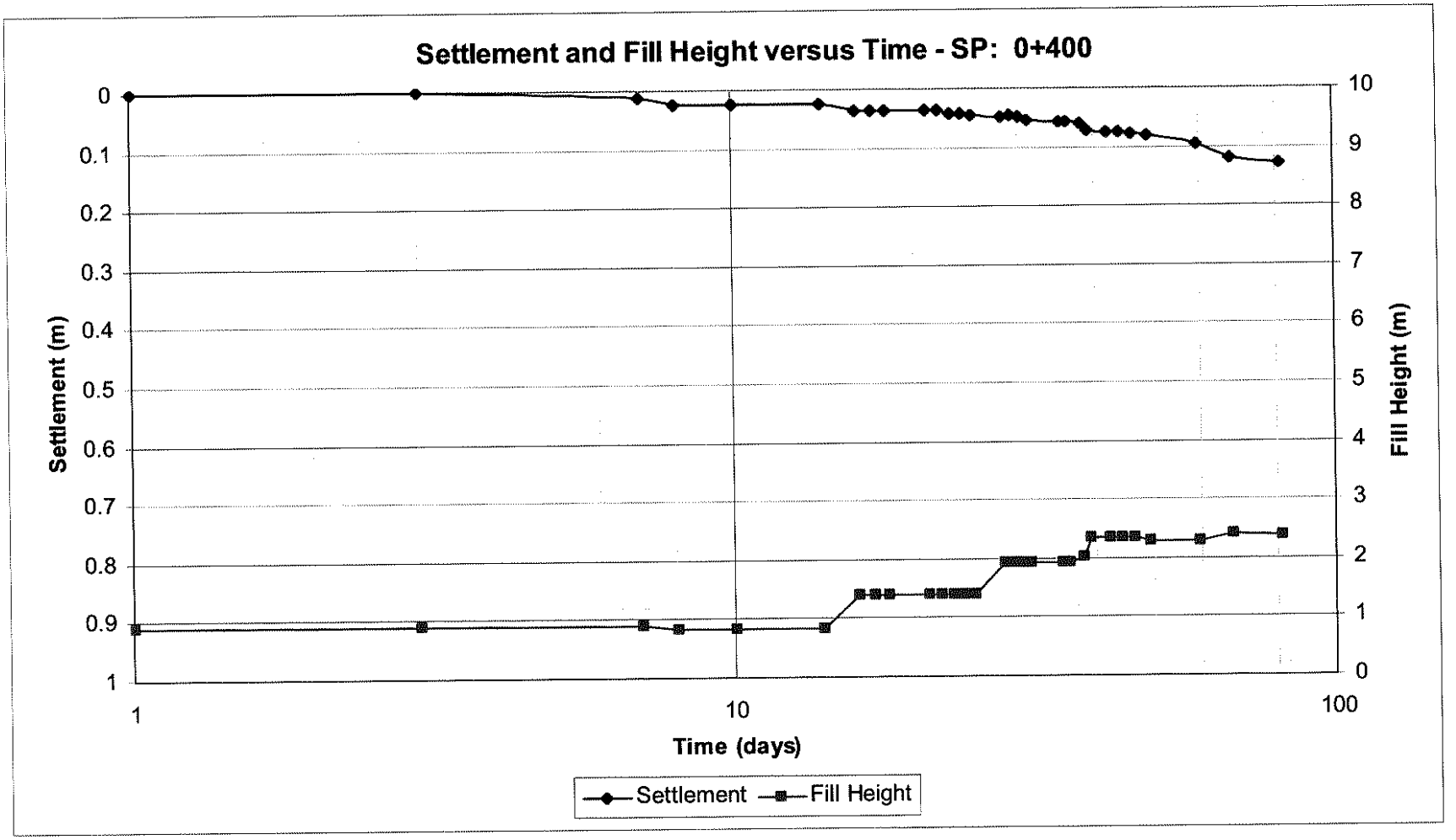


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

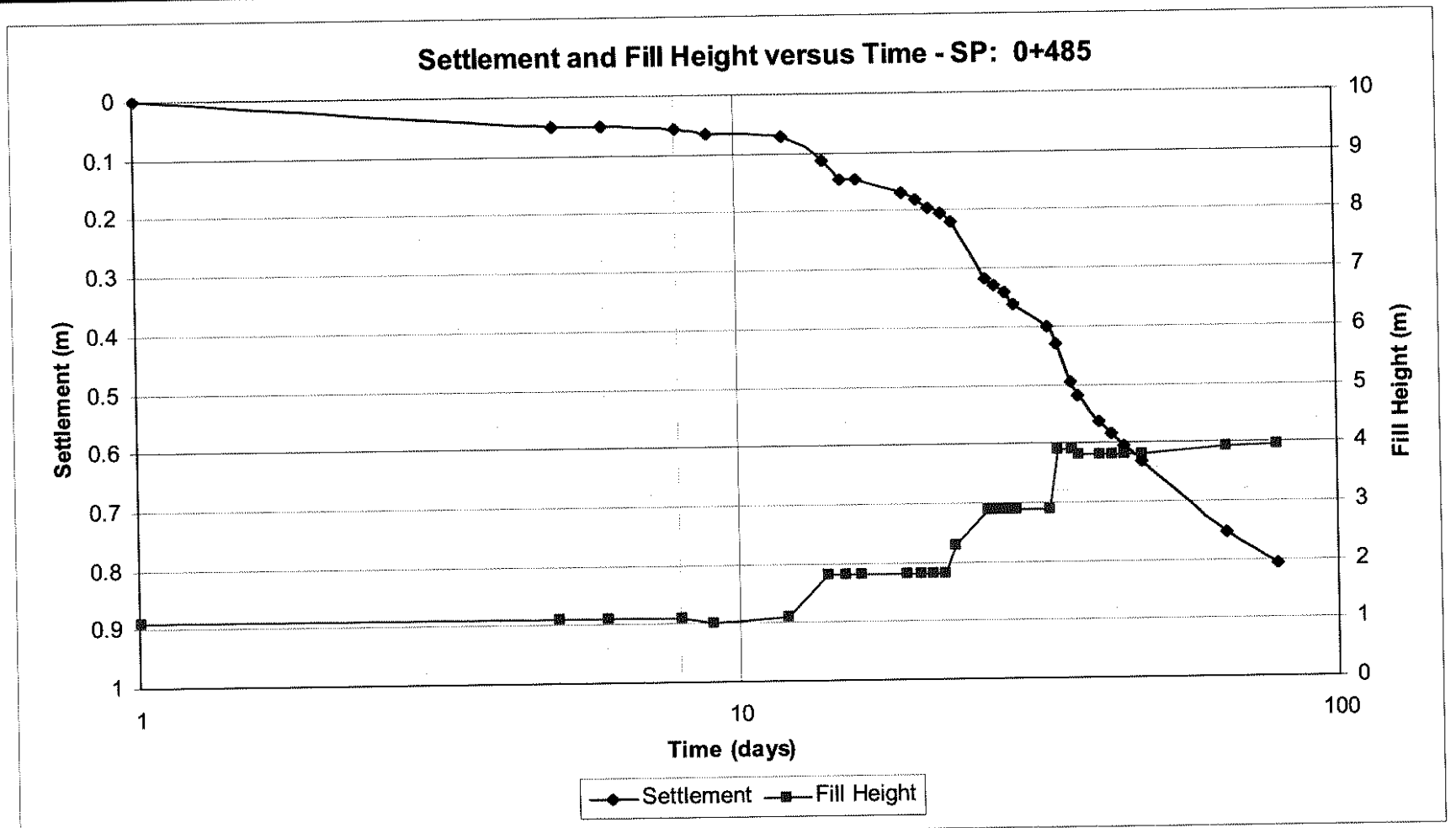
PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	FIGURE II-3	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt



PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER				
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data				
Golder Associates	PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
	DESIGN	JIP	28JUN07	SCALE NTS	REV.
	CADD	GGG	28JUN07	FIGURE II-4	
	CHECK	JIP	28JUN07		
	REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt



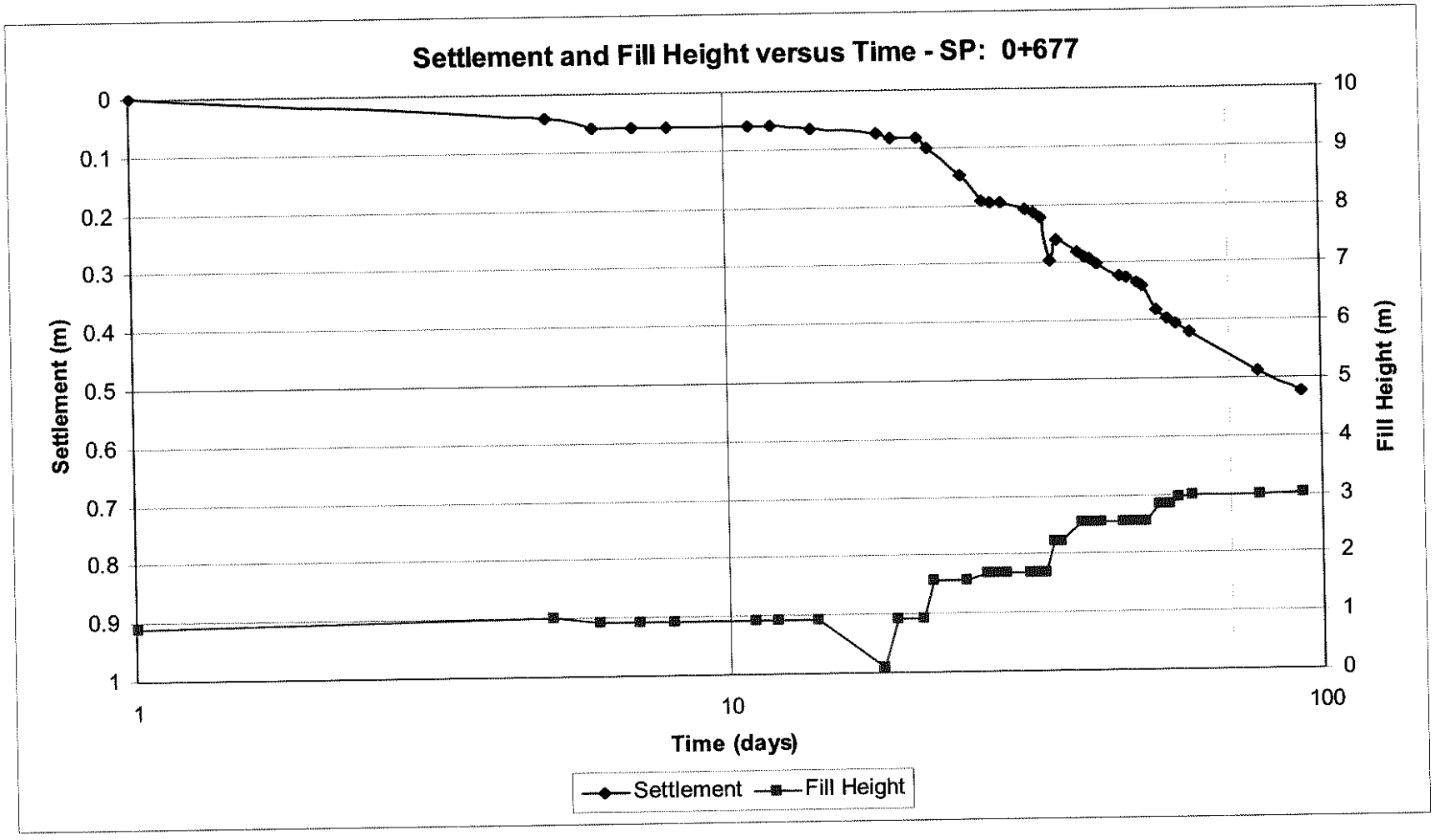
PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07		
CHECK	JIP	28JUN07		
REVIEW				

FIGURE II-5

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

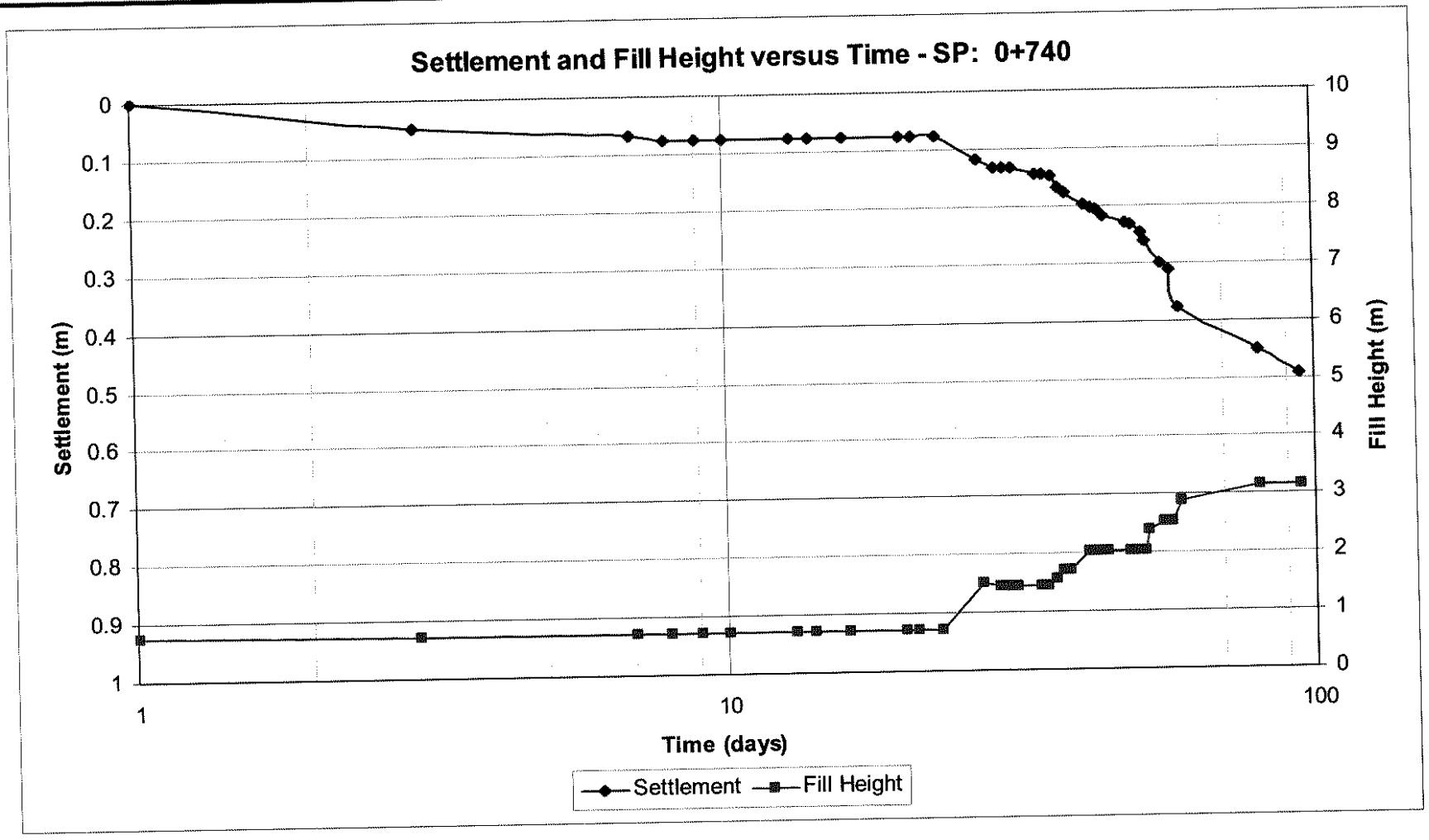


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	FIGURE II-6	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

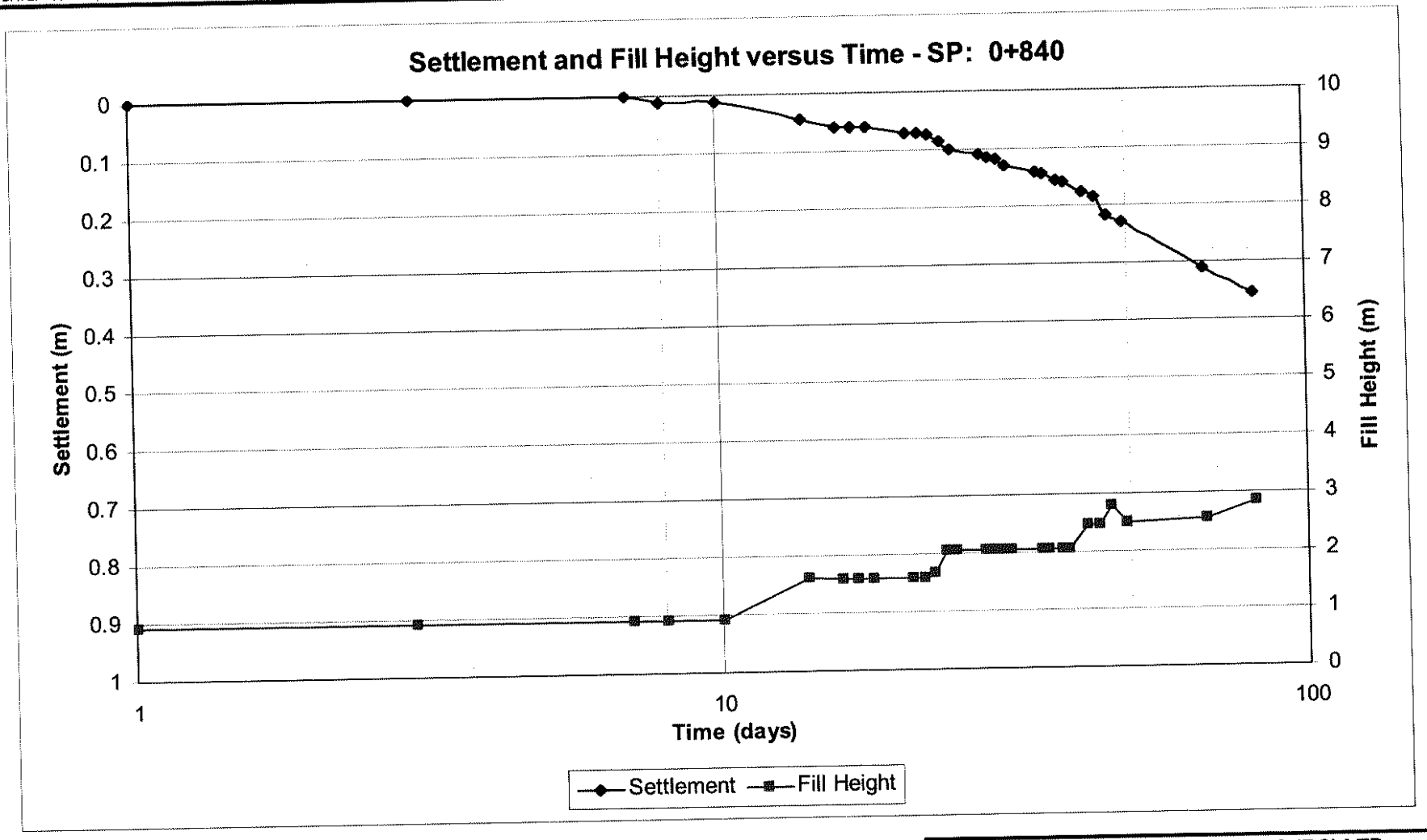


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000
DESIGN	JIP	28JUN07	SCALE NTS REV.
CADD	GGG	28JUN07	FIGURE II-7
CHECK	JIP	28JUN07	
REVIEW			

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

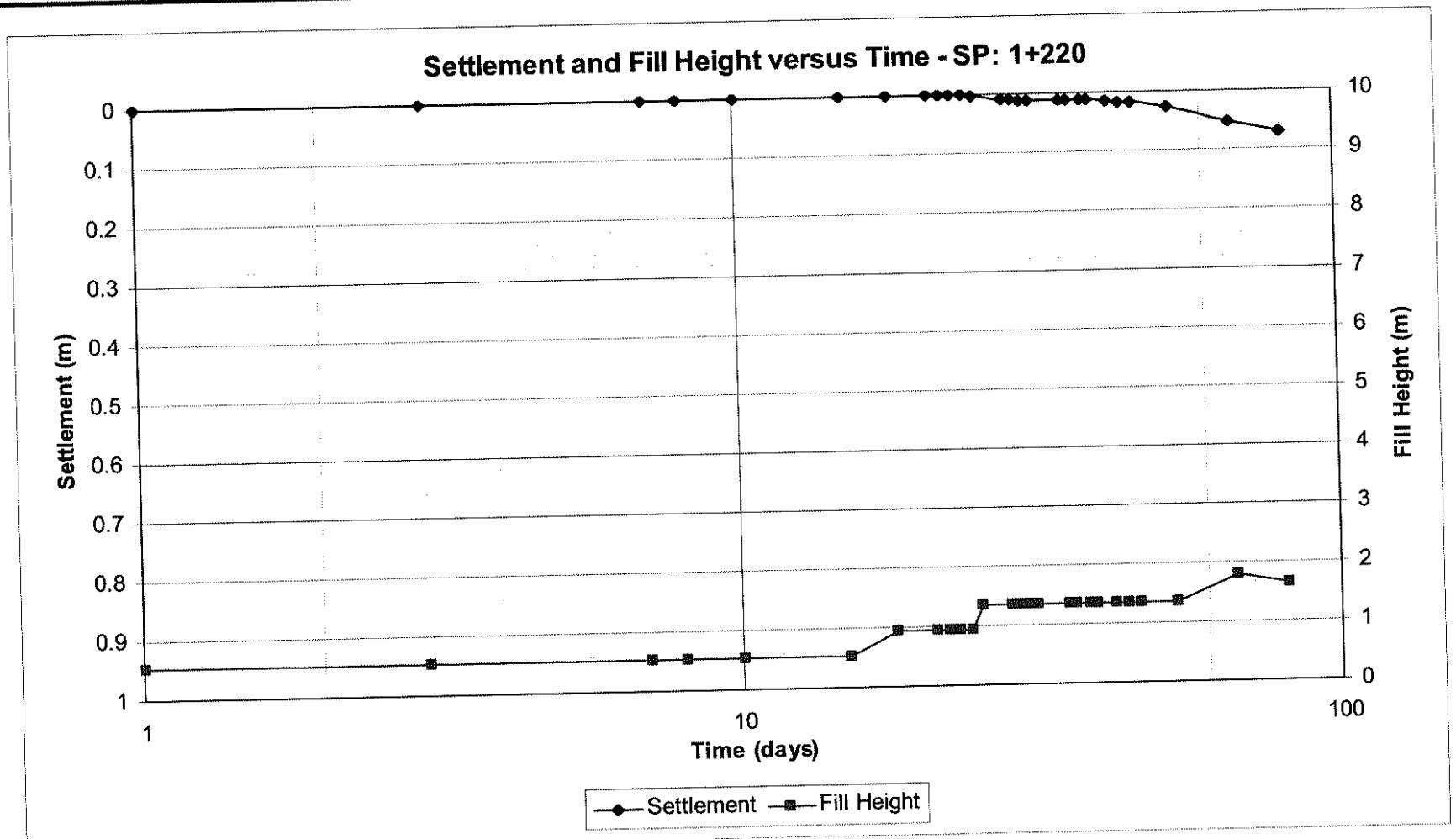


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000
DESIGN	JIP	28JUN07	SCALE NTS REV.
CADD	GGG	28JUN07	FIGURE II-8
CHECK	JIP	28JUN07	
REVIEW			

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

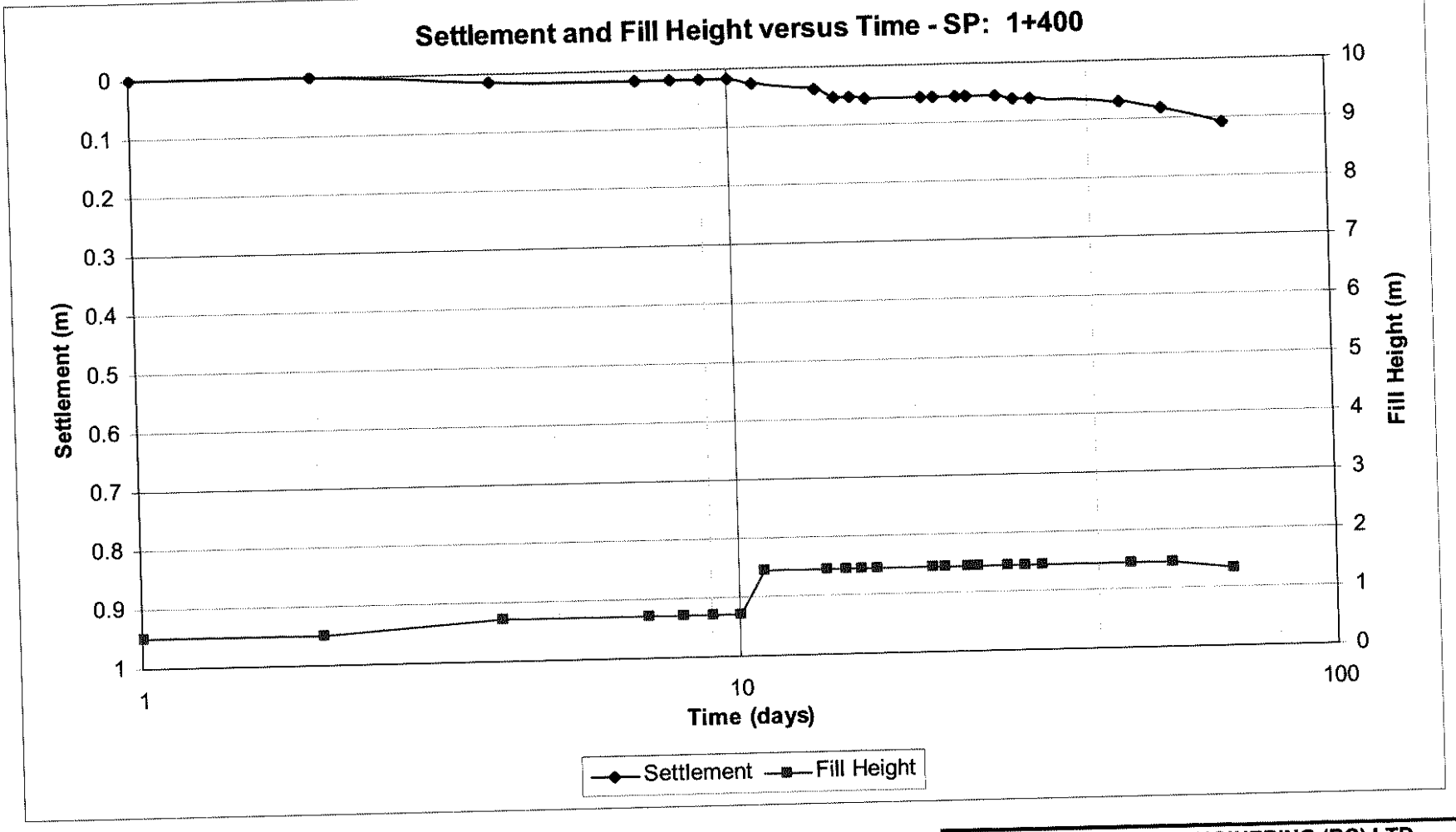


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	FIGURE II-9	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

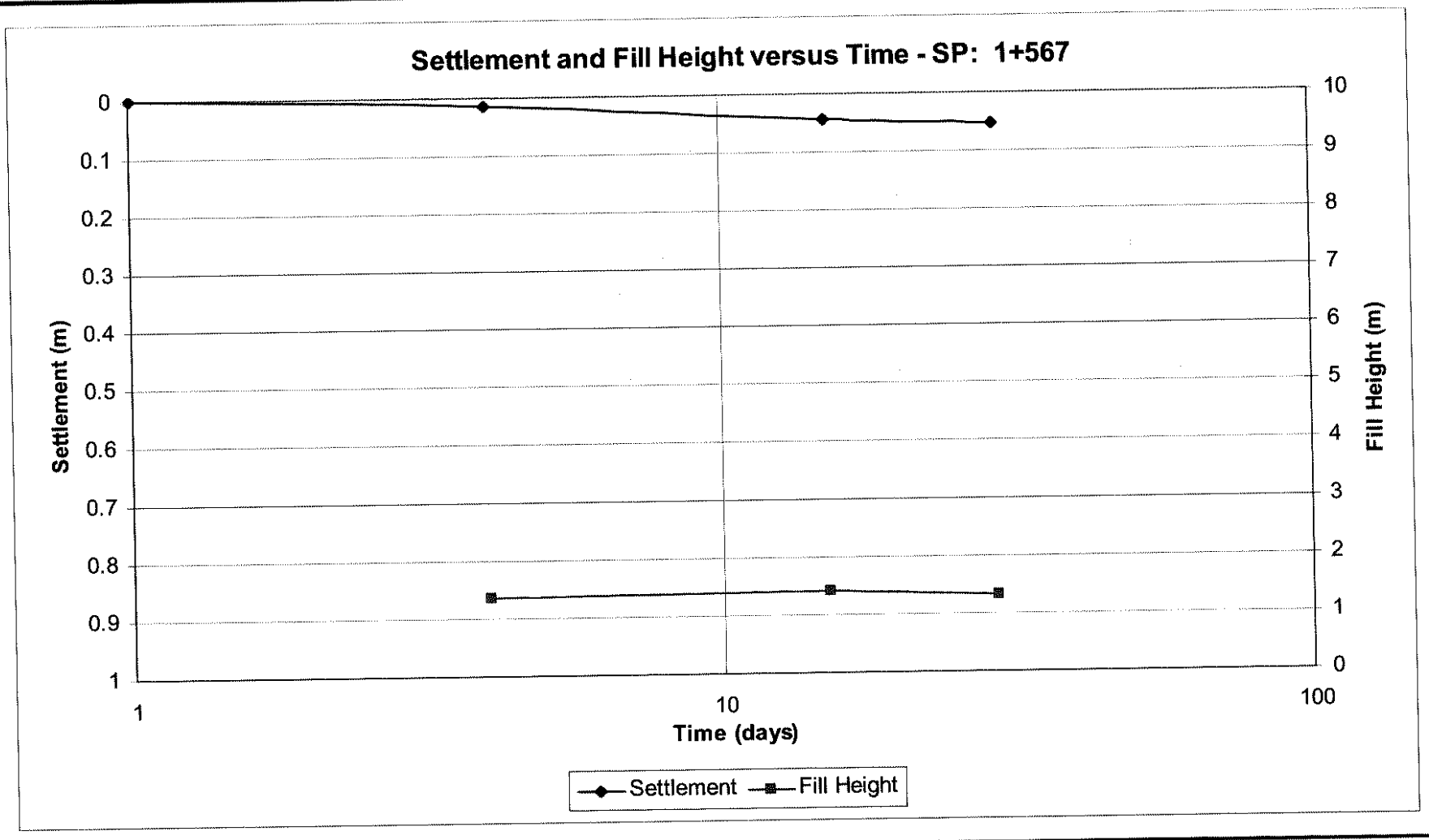


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	FIGURE II-10	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

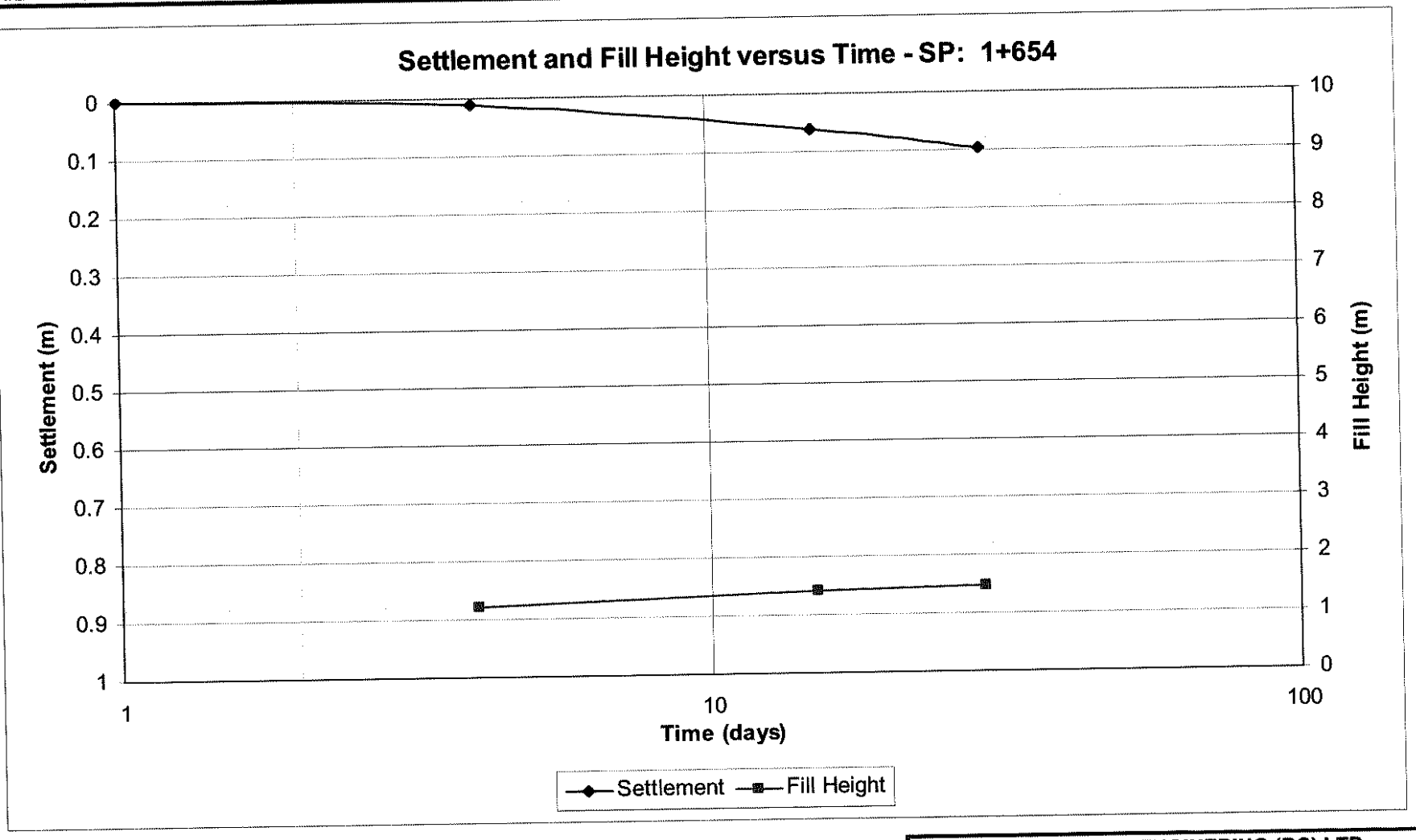


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	FIGURE II-11	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt

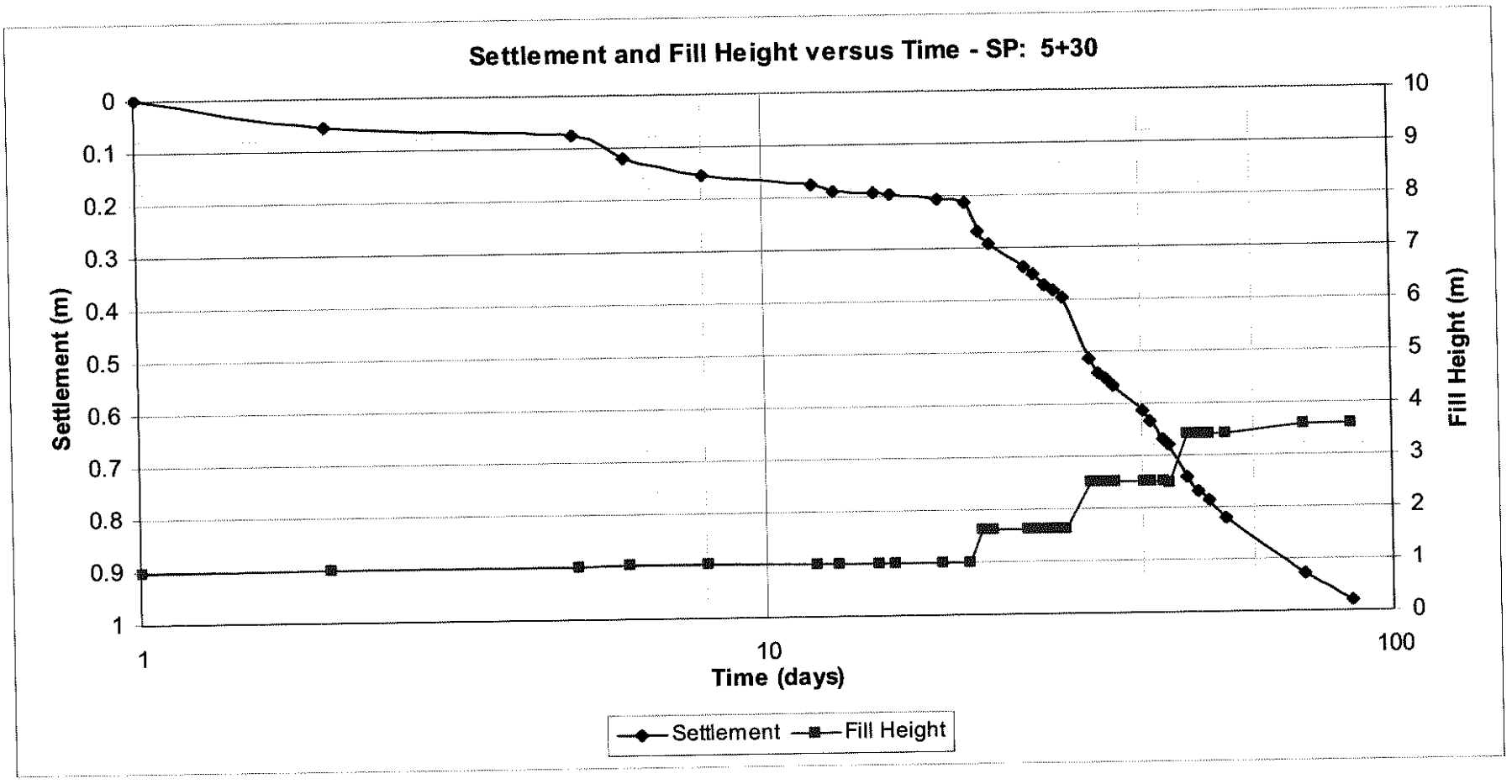


PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data

Golder Associates

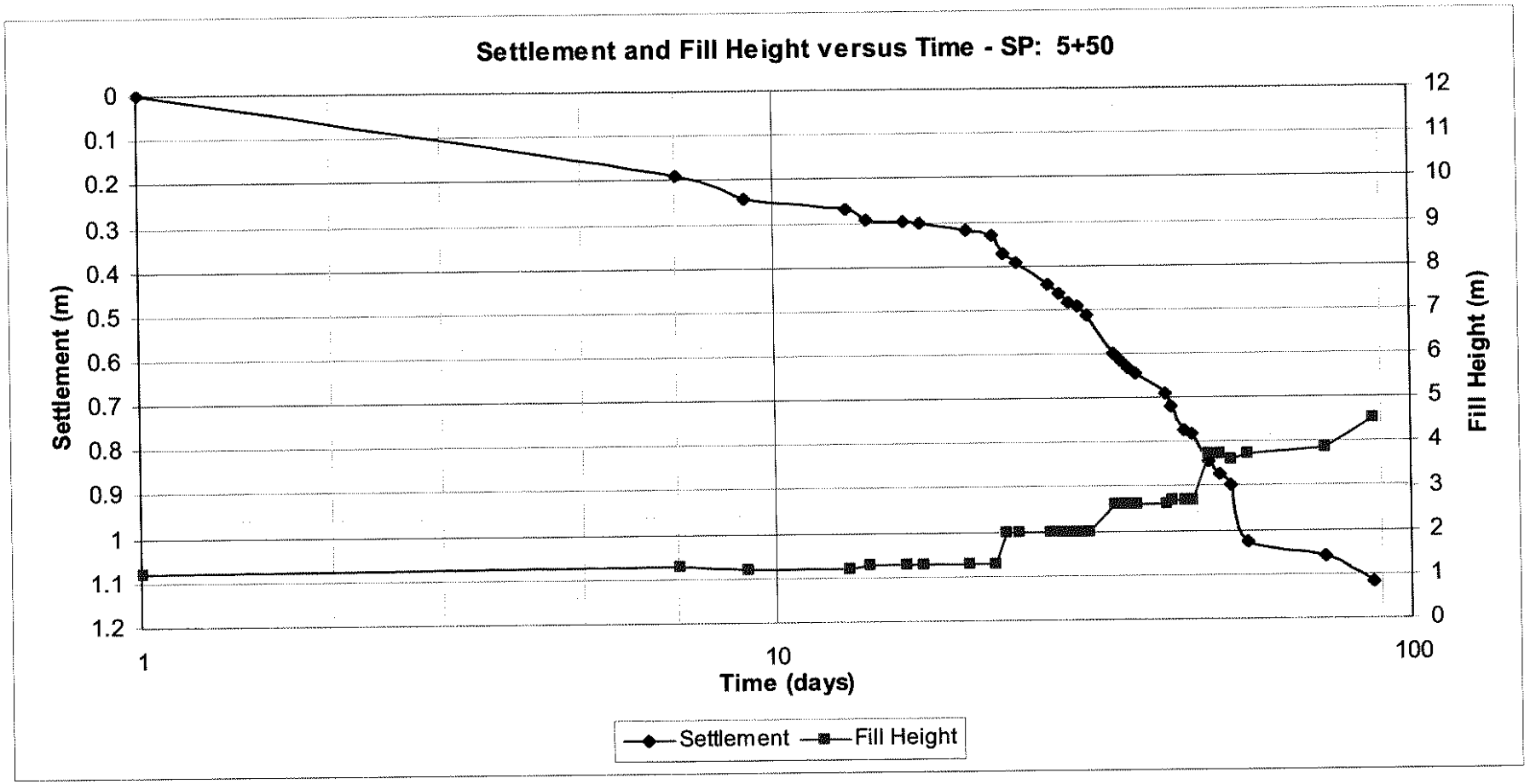
PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	FIGURE II-12	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt



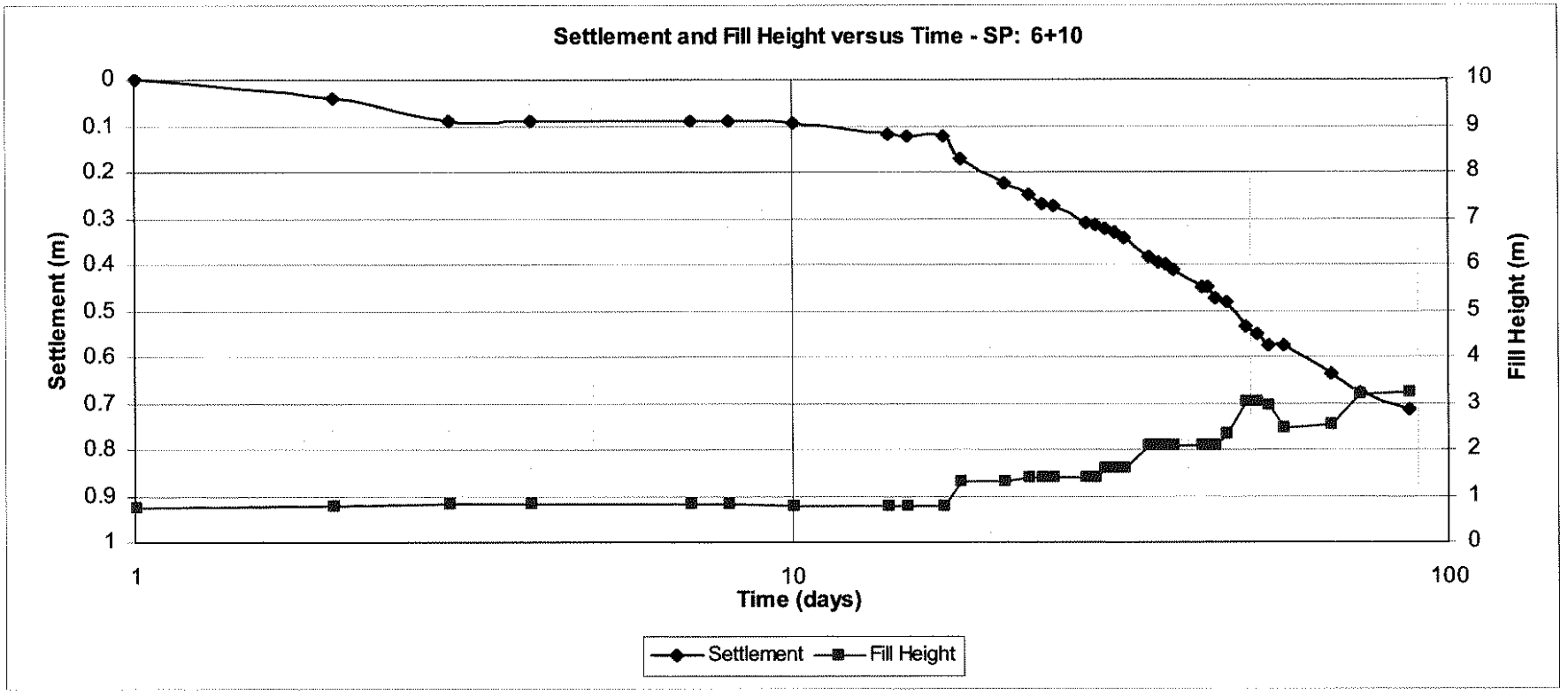
PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER				
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data				
Golder Associates	PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
	DESIGN	JIP	28JUN07	SCALE NTS	REV.
	CADD	GGG	28JUN07	FIGURE II-13	
	CHECK	JIP	28JUN07		
	REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt



PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER				
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data				
Golder Associates	PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
	DESIGN	JIP	28JUN07	SCALE NTS	REV.
	CADD	GGG	28JUN07	FIGURE II-14	
	CHECK	JIP	28JUN07		
	REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix II\Figures II-1 to II-15.ppt



PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER				
TITLE	Coquitlam River – IR#2 1994 Construction Records Settlement Plate Data				
Golder Associates	PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
	DESIGN	JIP	28JUN07	SCALE NTS	REV.
	CADD	GGG	28JUN07		
	CHECK	JIP	28JUN07	FIGURE II-15	
	REVIEW				

APPENDIX III

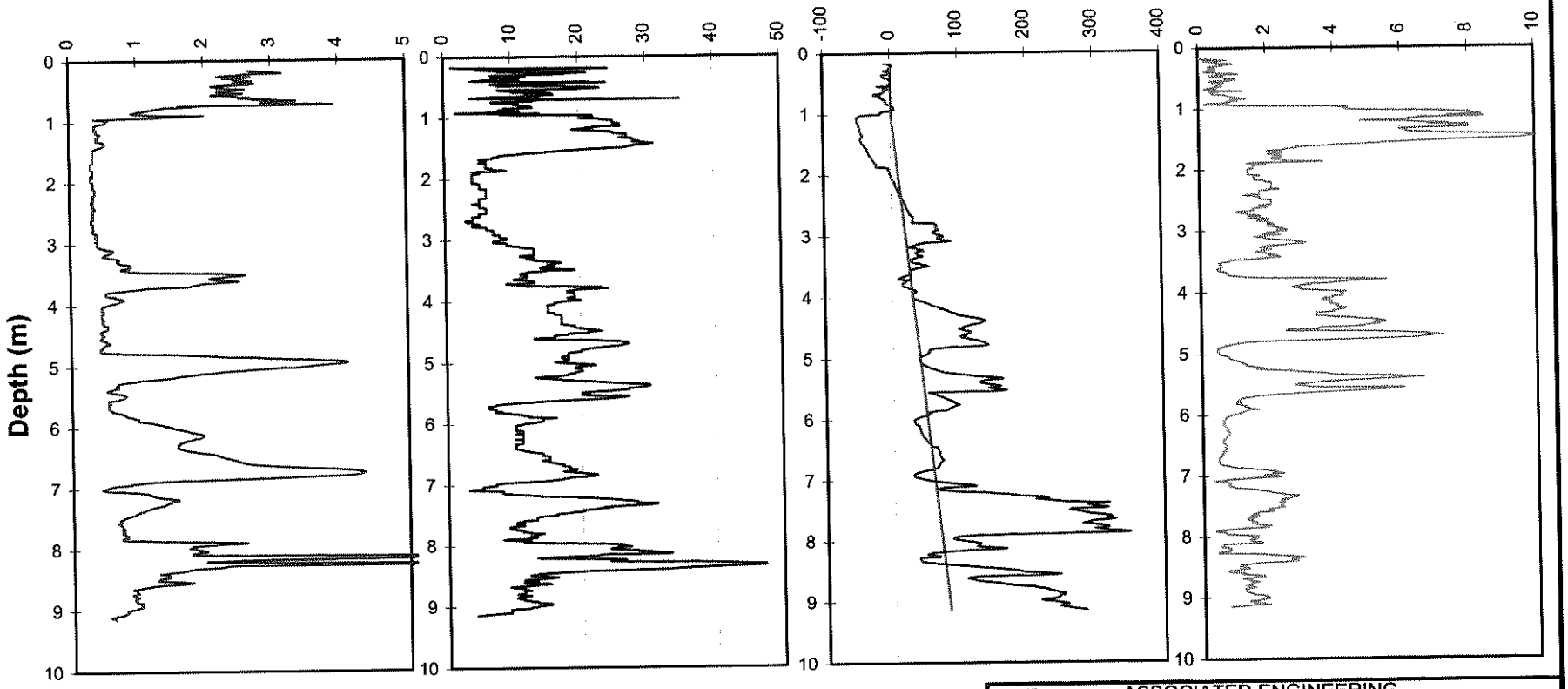
2007 RECORD OF CONE PENETRATION TESTS

qc (MPa)
Uncorrected Cone Resistance

fs (kPa)
Uncorrected Sleeve Friction

u2 (kPa)
Pore Water Pressure

R_F(%)
Corrected Friction Ratio



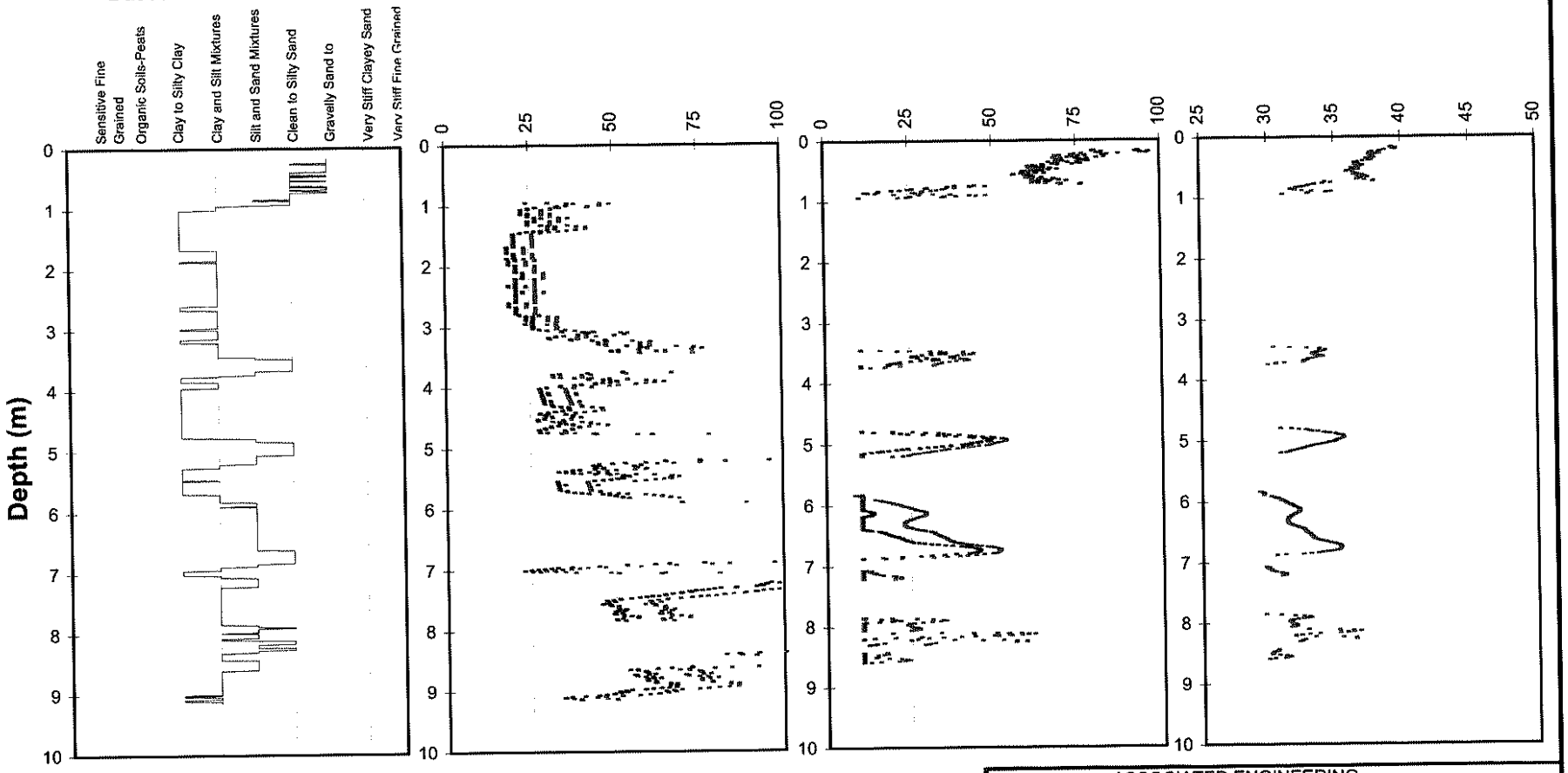
PROJECT: ASSOCIATED ENGINEERING
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER ROAD, PORT COQUITLAM, BC

TITLE: Coquitlam River Dike
Cone Petetration Test Results
Measured Parameters
CPT-07-01 STA: 0+275

Golder Associates

PROJECT No.	07-1411-0098	PHASE / TASK No.	2000
DESIGN	JIP	06/06/07	SCALE / REV.
CADD	JIP	06/06/07	
CHECK	JIP	06/06/07	
REVIEW	RW	06/06/07	

Figure 1A



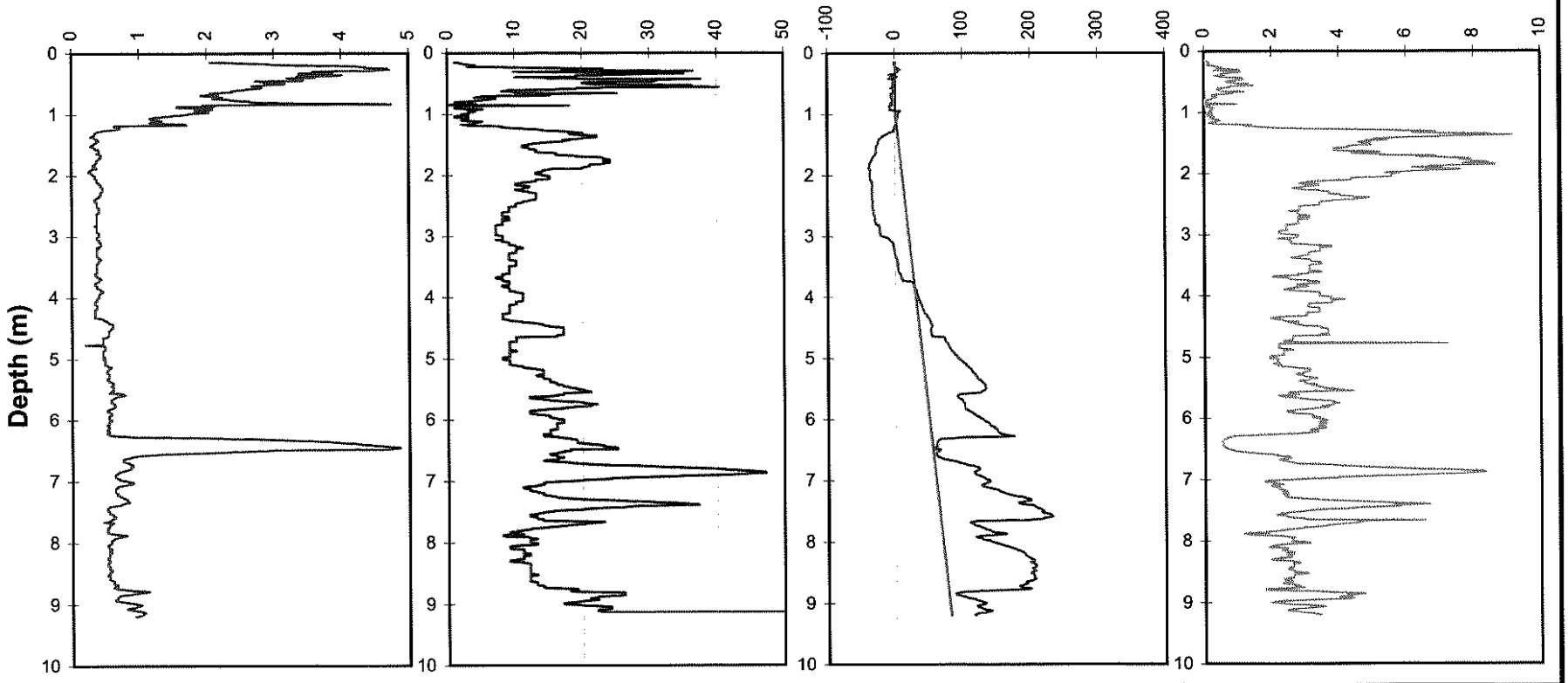
PROJECT	ASSOCIATED ENGINEERING URGENT MITIGATIVE FLOOD WORKS PITT RIVER ROAD, PORT COQUITLAM, BC		
TITLE	Coquitlam River Dike Cone Petetration Test Results Interpreted Parameters CPT-07-01 STA: 0+275		
Golder Associates	PROJECT No. 07-1411-0098	PHASE / TASK No. 2000	
	DESIGN JIP 06/06/07	SCALE	REV.
	CADD JIP	Figure 1B	
	CHECK JIP 06/06/07		
	REVIEW RW 06/06/07		

qc (MPa)
Uncorrected Cone Resistance

fs (kPa)
Uncorrected Sleeve Friction

u2 (kPa)
Pore Water Pressure

R_F(%)
Corrected Friction Ratio

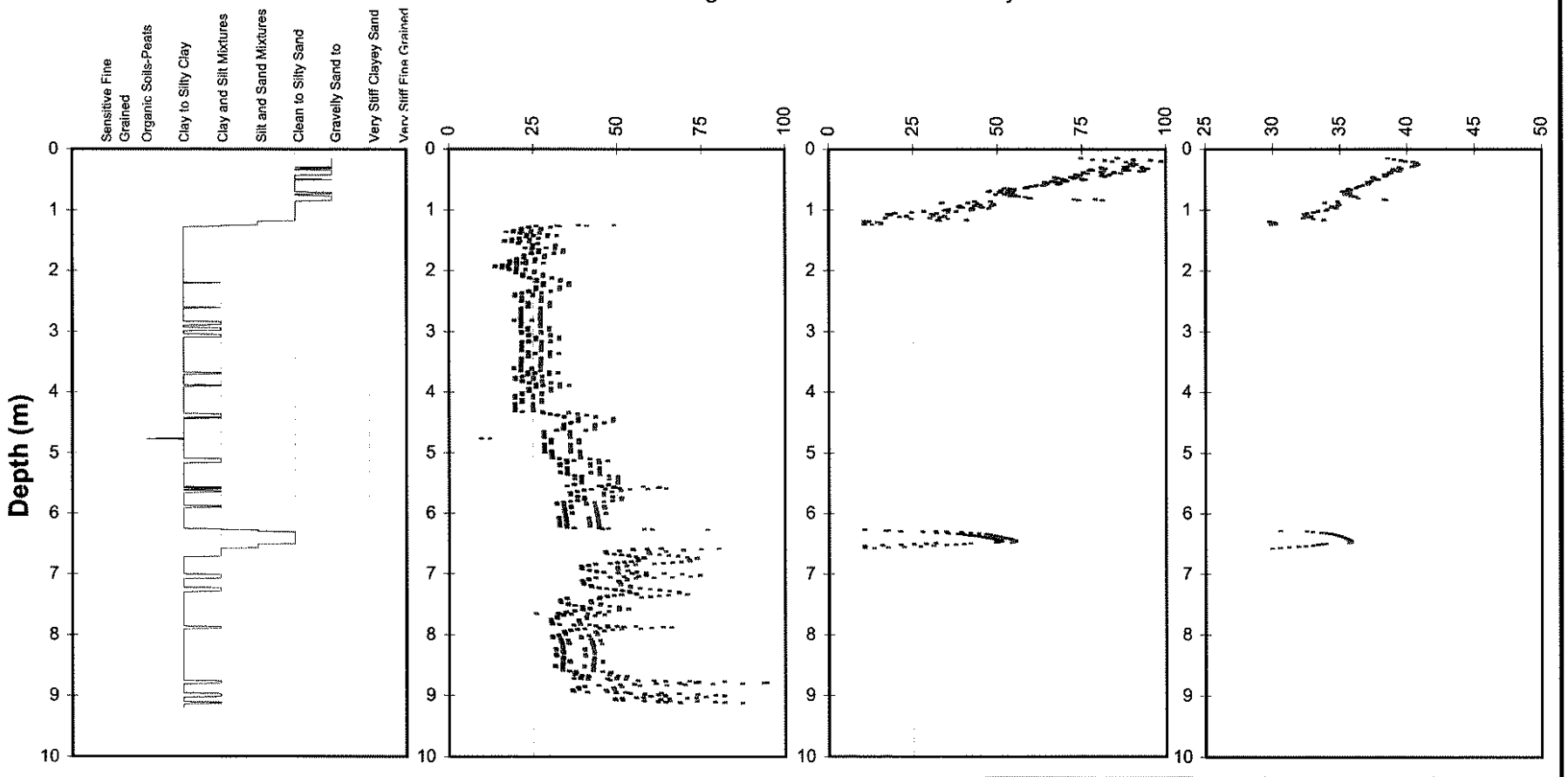


PROJECT	ASSOCIATED ENGINEERING URGENT MITIGATIVE FLOOD WORKS PITT RIVER ROAD, PORT COQUITLAM, BC
TITLE	Coquitlam River Dike Cone Petetration Test Results Measured Parameters CPT-07-02 STA: 0+425

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	06/06/07	SCALE	REV.
CADD	JIP	06/06/07		
CHECK	JIP	06/06/07		
REVIEW	RW	06/06/07		

Figure 2A



PROJECT: ASSOCIATED ENGINEERING
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER ROAD, PORT COQUITLAM, BC

TITLE: Coquitlam River Dike
Cone Petetration Test Results
Interpreted Parameters
CPT-07-02 STA: 0+425

Golder Associates

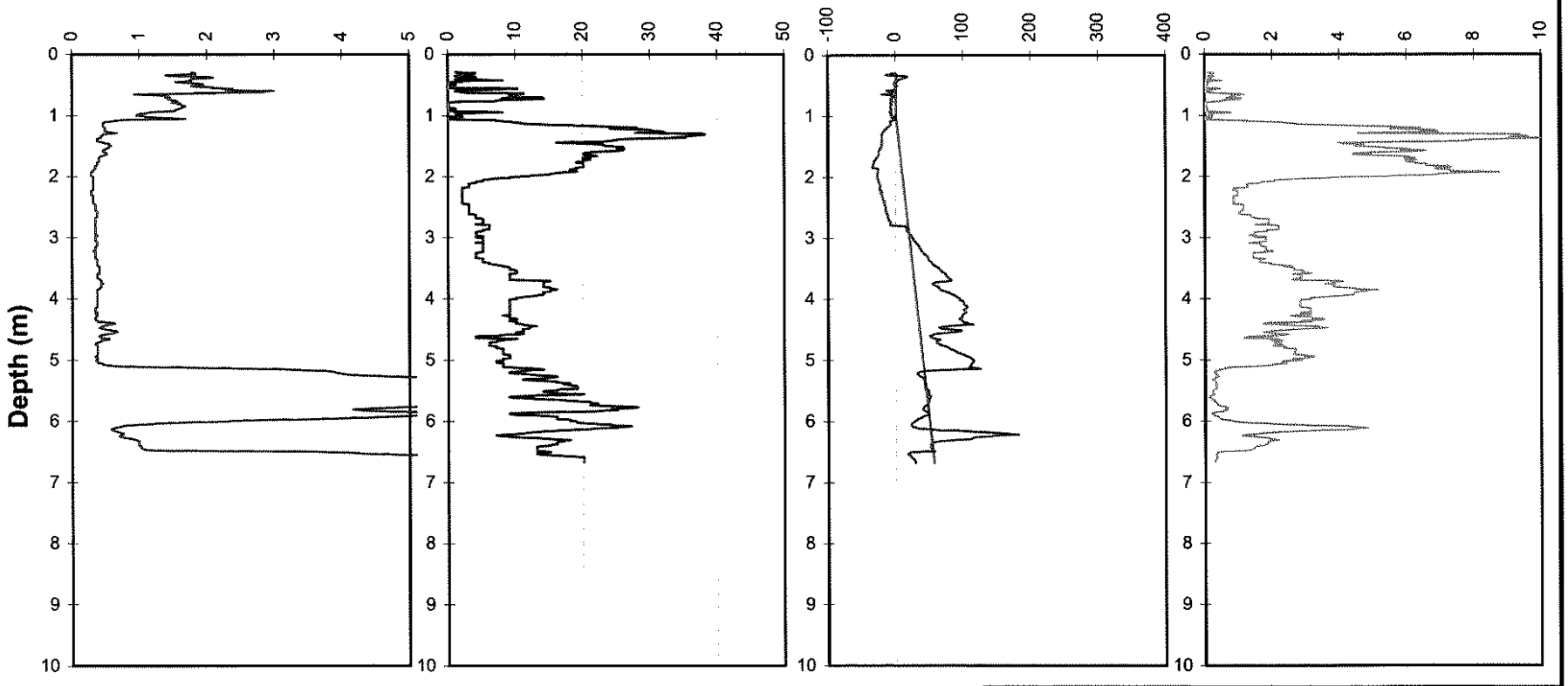
PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	06/06/07	SCALE	REV.
CADD	JIP			
CHECK	JIP	06/06/07	Figure 2B	
REVIEW	RW	06/06/07		

qc (MPa)
Uncorrected Cone Resistance

fs (kPa)
Uncorrected Sleeve Friction

u2 (kPa)
Pore Water Pressure

R_F(%)
Corrected Friction Ratio

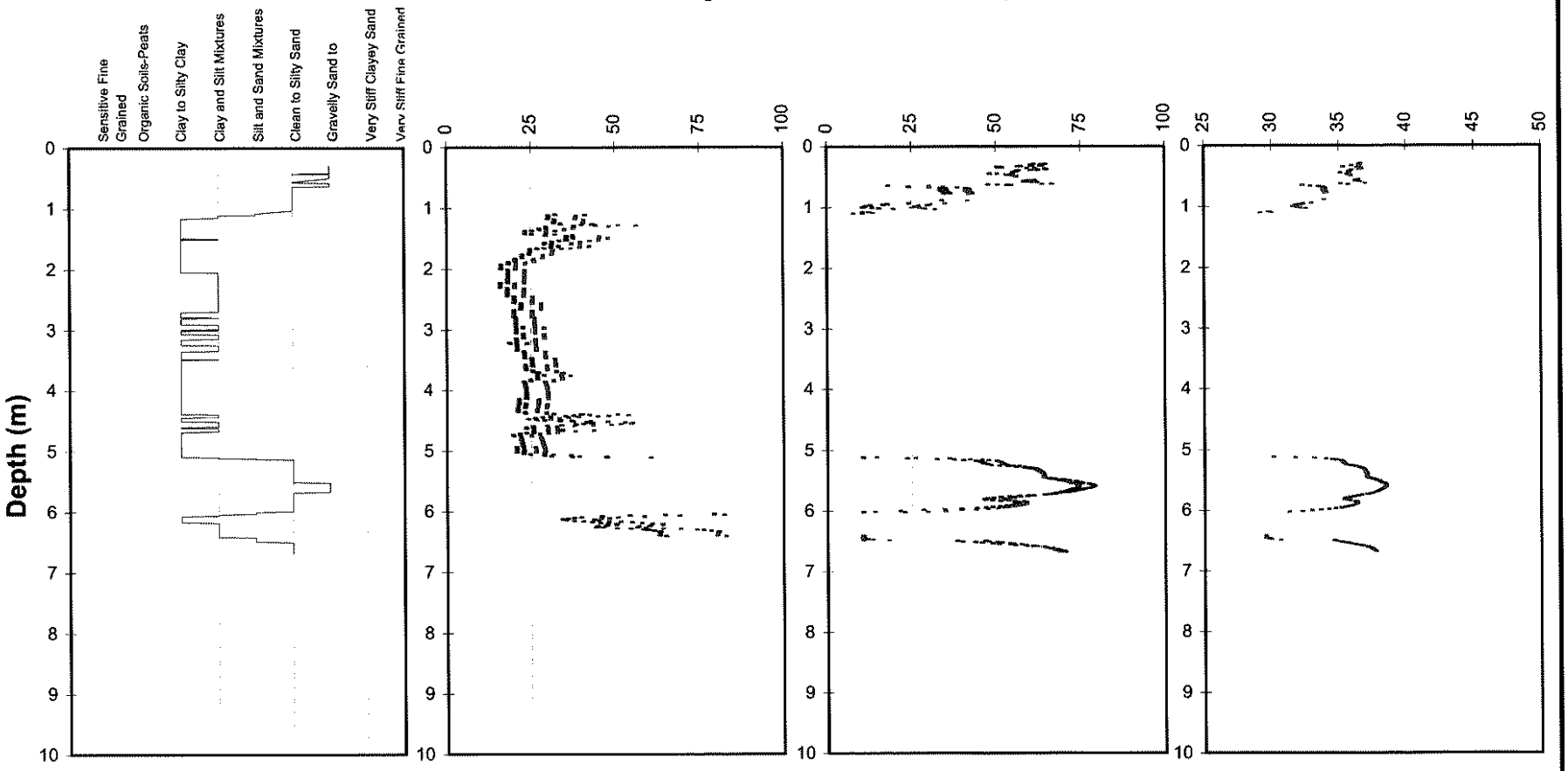


PROJECT	ASSOCIATED ENGINEERING URGENT MITIGATIVE FLOOD WORKS PITT RIVER ROAD, PORT COQUITLAM, BC
TITLE	Coquitlam River Dike Cone Petetration Test Results Measured Parameters CPT-07-03 STA: 0+575

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	06/06/07	SCALE	REV.
CADD	JIP	06/06/07		
CHECK	JIP	06/06/07		
REVIEW	RW	06/06/07		

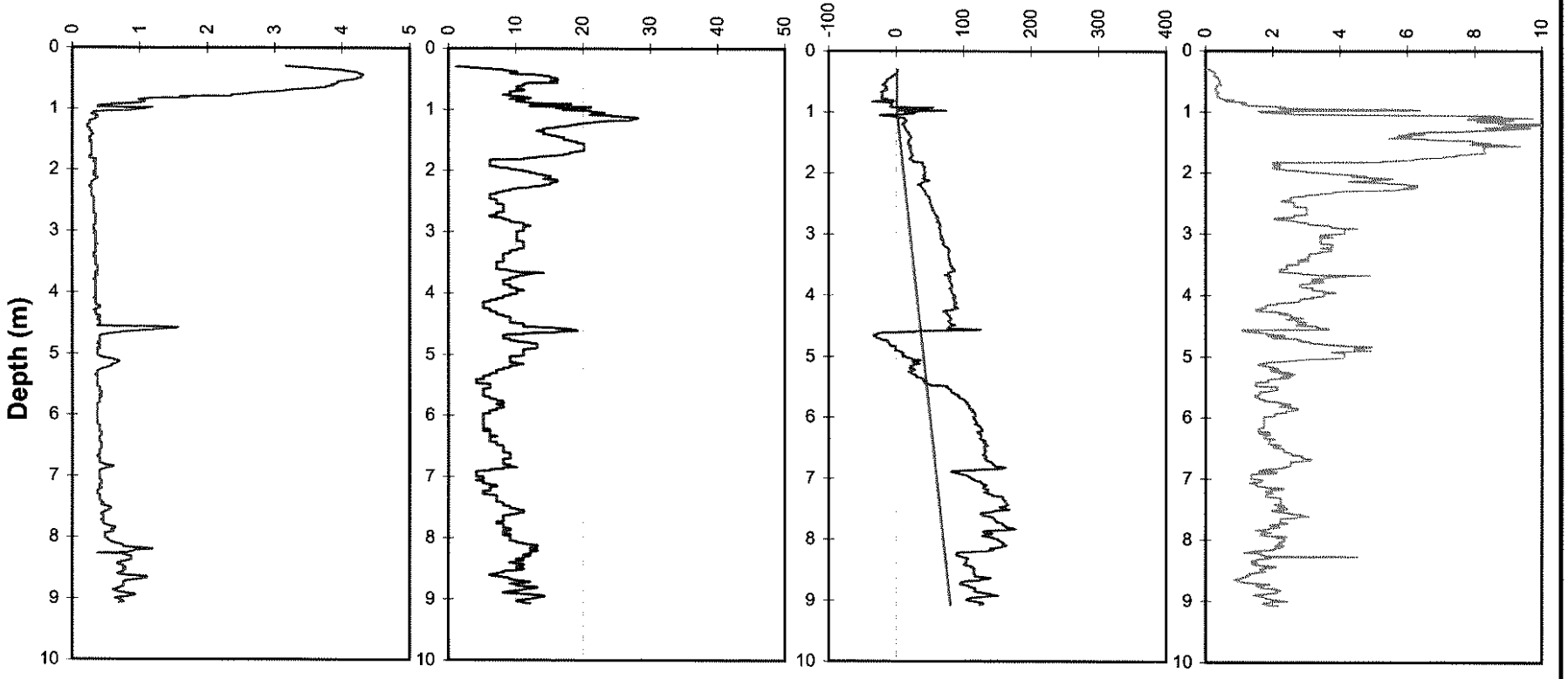
Figure 3A



PROJECT	ASSOCIATED ENGINEERING URGENT MITIGATIVE FLOOD WORKS PITT RIVER ROAD, PORT COQUITLAM, BC
TITLE	Coquitlam River Dike Cone Petetration Test Results Interpreted Parameters CPT-07-03 STA: 0+575

Golder Associates

PROJECT No.	07-1411-0098		PHASE / TASK No.	2000
DESIGN	JIP	06/06/07	SCALE	REV.
CADD	JIP		Figure 3B	
CHECK	JIP	06/06/07		
REVIEW	RW	06/06/07		



PROJECT	ASSOCIATED ENGINEERING URGENT MITIGATIVE FLOOD WORKS PITT RIVER ROAD, PORT COQUITLAM, BC
TITLE	Coquitlam River Dike Cone Petetration Test Results Measured Parameters CPT-07-04 STA: 0+700

Golder Associates

PROJECT No.	07-1411-0098		PHASE / TASK No.	2000	
DESIGN	JIP	06/06/07	SCALE		REV.
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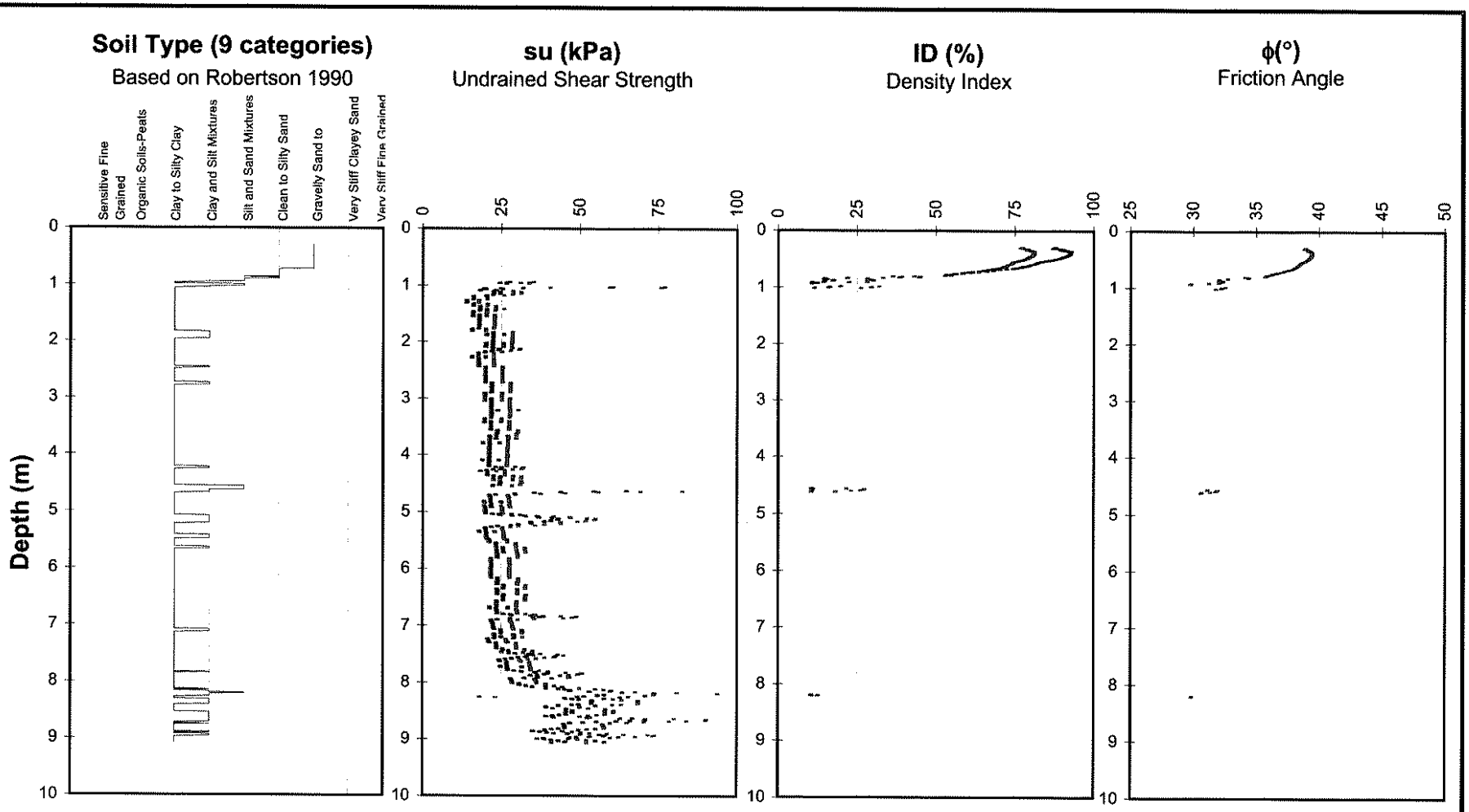
CHECK	JIP	06/06/07			
REVIEW	RW	06/06/07			



PROJECT	ASSOCIATED ENGINEERING URGENT MITIGATIVE FLOOD WORKS PITT RIVER ROAD, PORT COQUITLAM, BC
TITLE	Coquitlam River Dike Cone Petetration Test Results Interpreted Parameters CPT-07-04 STA: 0+700

Golder Associates

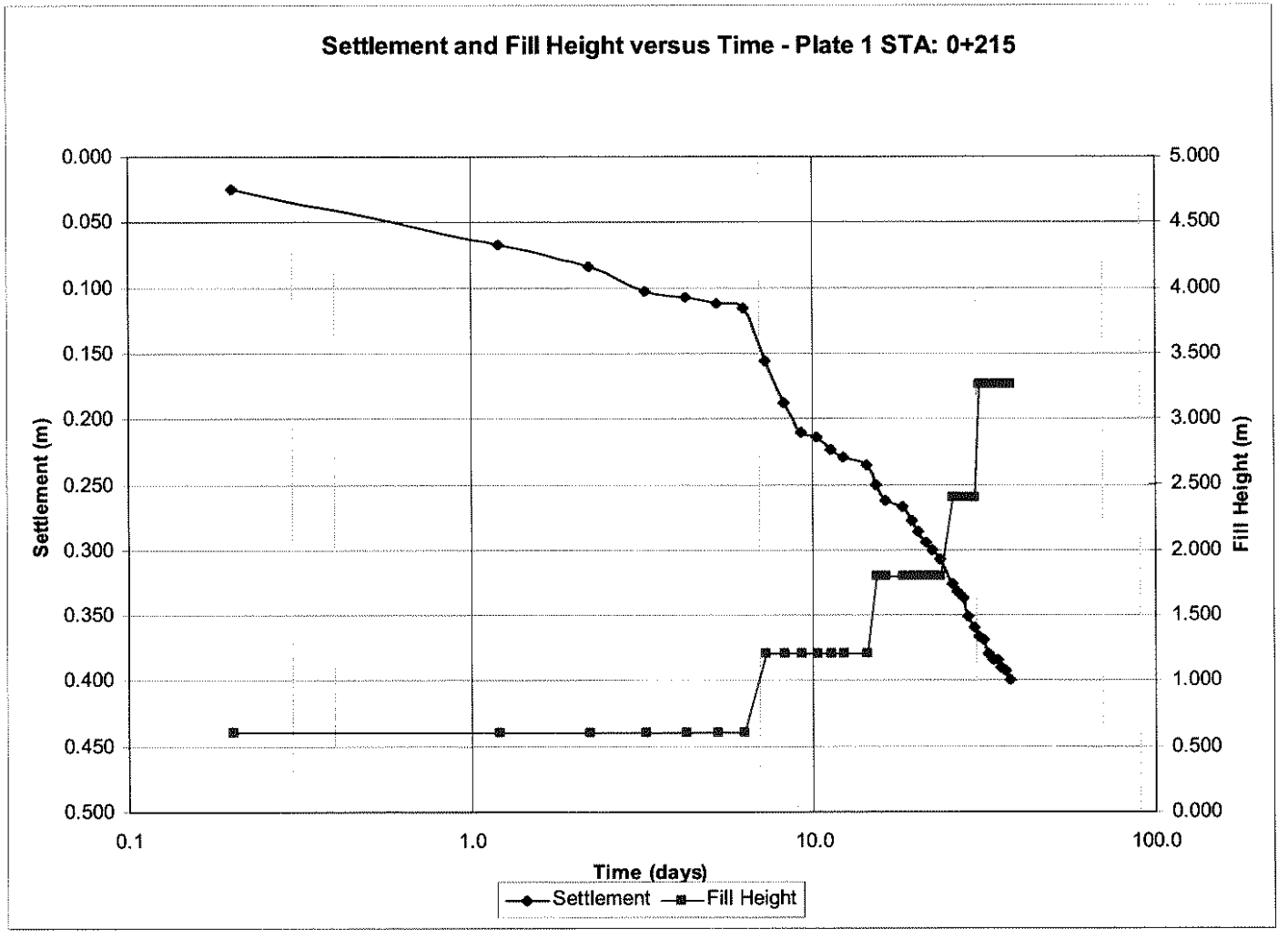
PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	06/06/07	SCALE	REV.
CADD	JIP			
CHECK	JIP	06/06/07		
REVIEW	RW	06/06/07		

Figure 4B

APPENDIX IV

2007 RECORD OF SETTLEMENT PLATES AND PIEZOMETER MONITORING

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



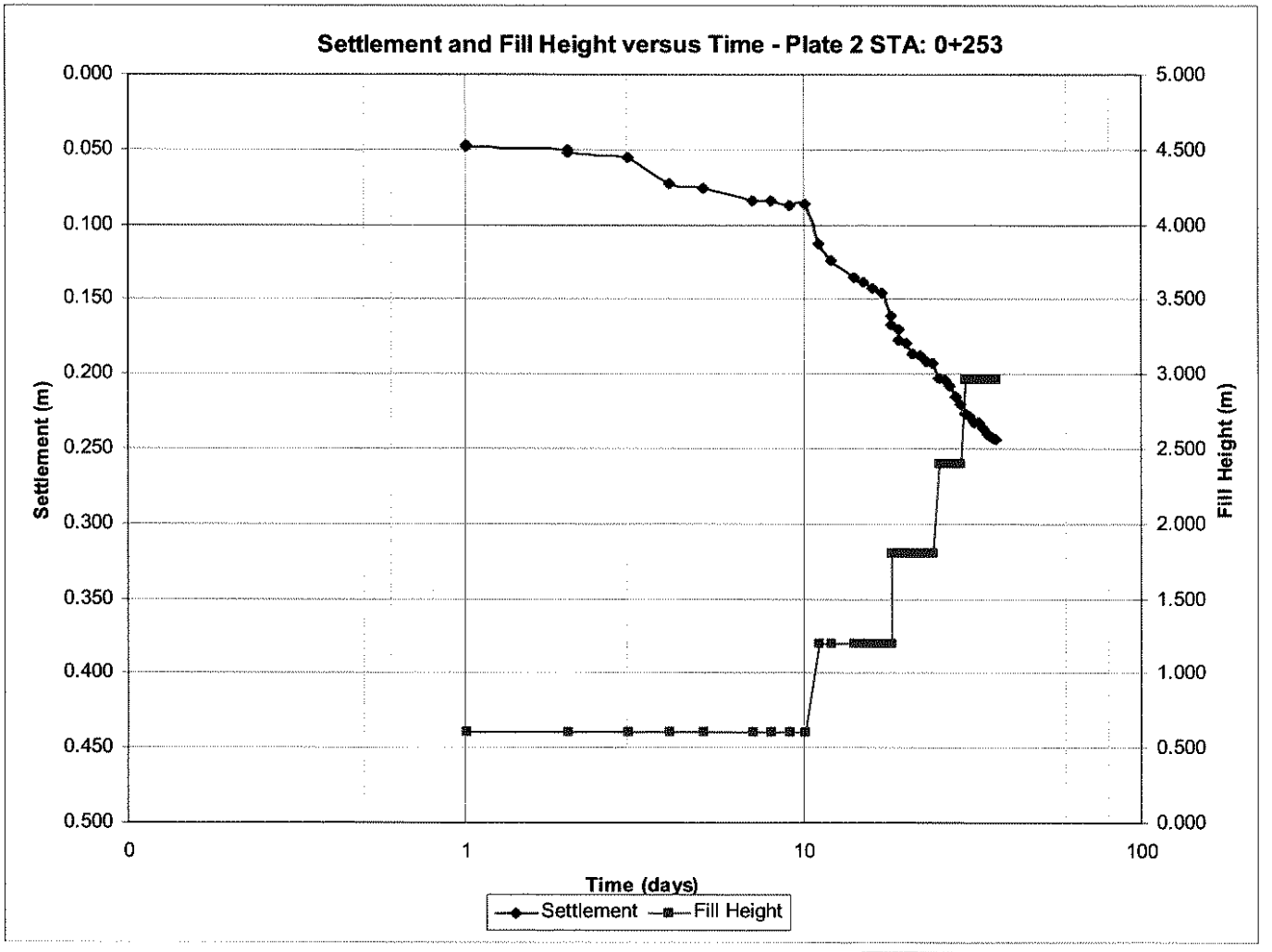
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07		
CHECK	JIP	28JUN07	**FIGURE IV-1**	
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



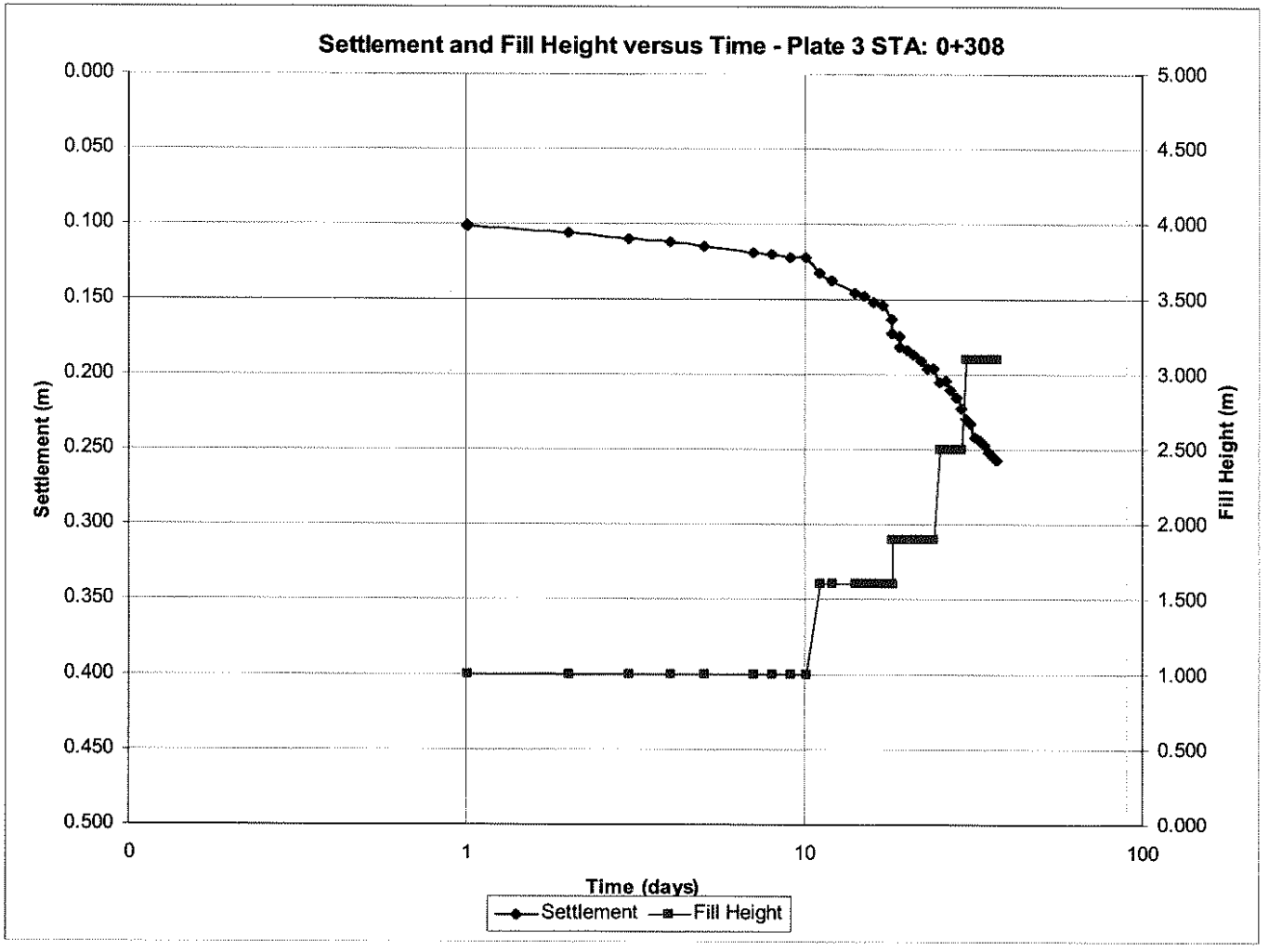
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000		
DESIGN	JIP	28JUN07	SCALE NTS	REV.	**FIGURE IV-2**
CADD	GGG	28JUN07			
CHECK	JIP	28JUN07			
REVIEW					

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



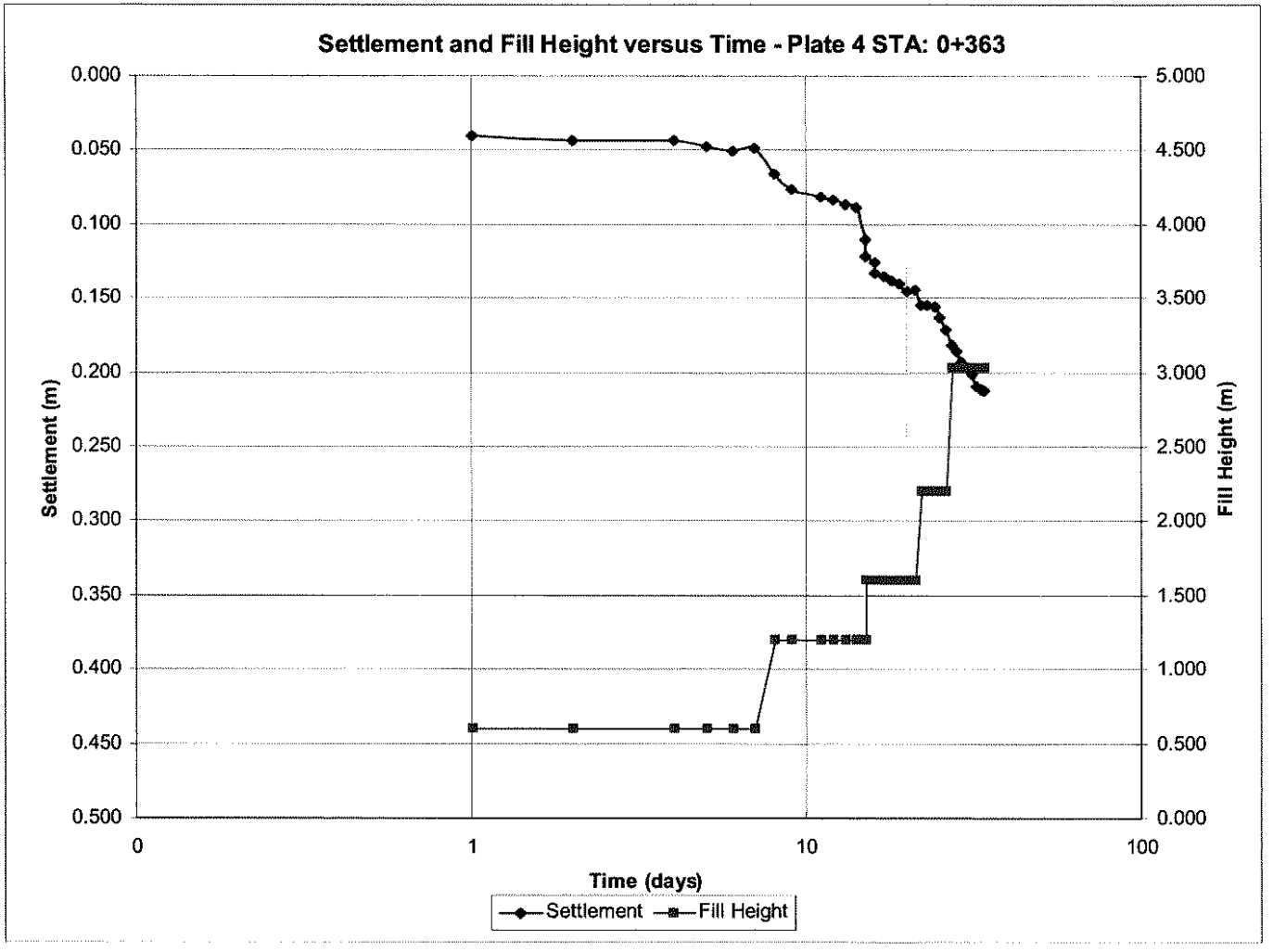
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000		
DESIGN	JIP	28JUN07	SCALE NTS	REV.	
CADD	GGG	28JUN07	**FIGURE IV-3**		
CHECK	JIP	28JUN07			
REVIEW					

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



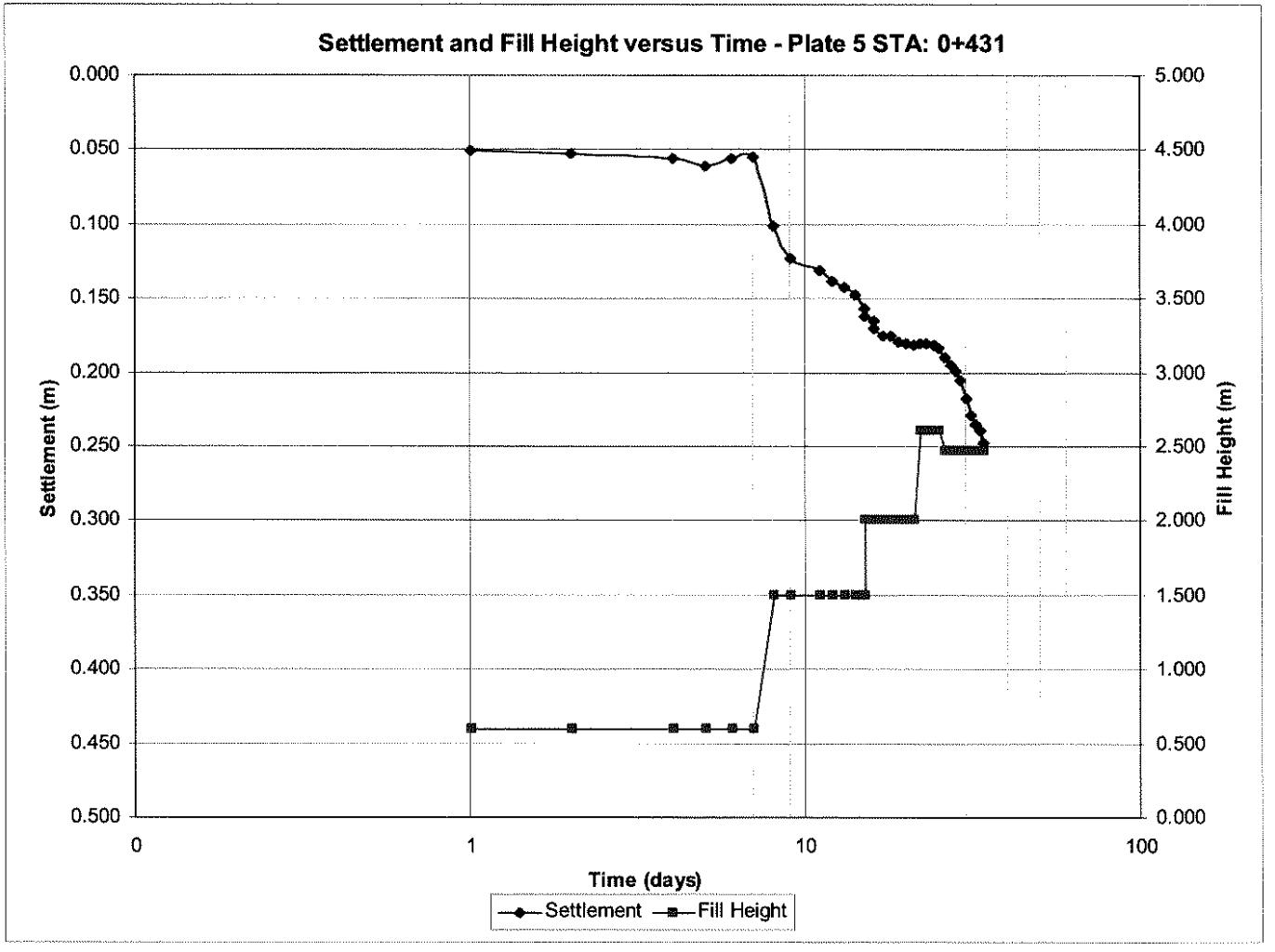
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	**FIGURE IV-4**	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

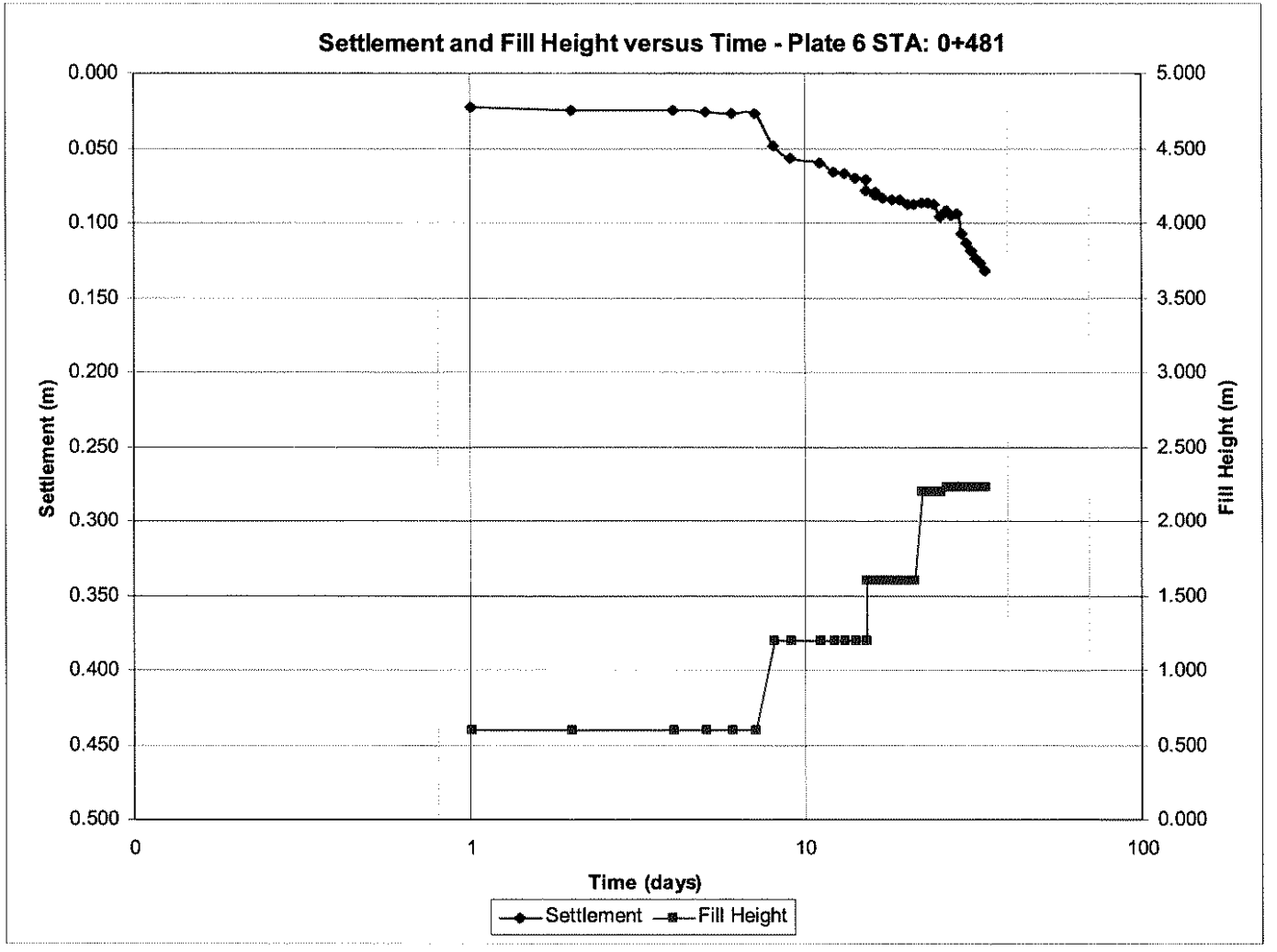
TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000		
DESIGN	JIP	28JUN07	SCALE NTS	REV.	
CADD	GGG	28JUN07			
CHECK	JIP	28JUN07			
REVIEW					

FIGURE IV-5

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



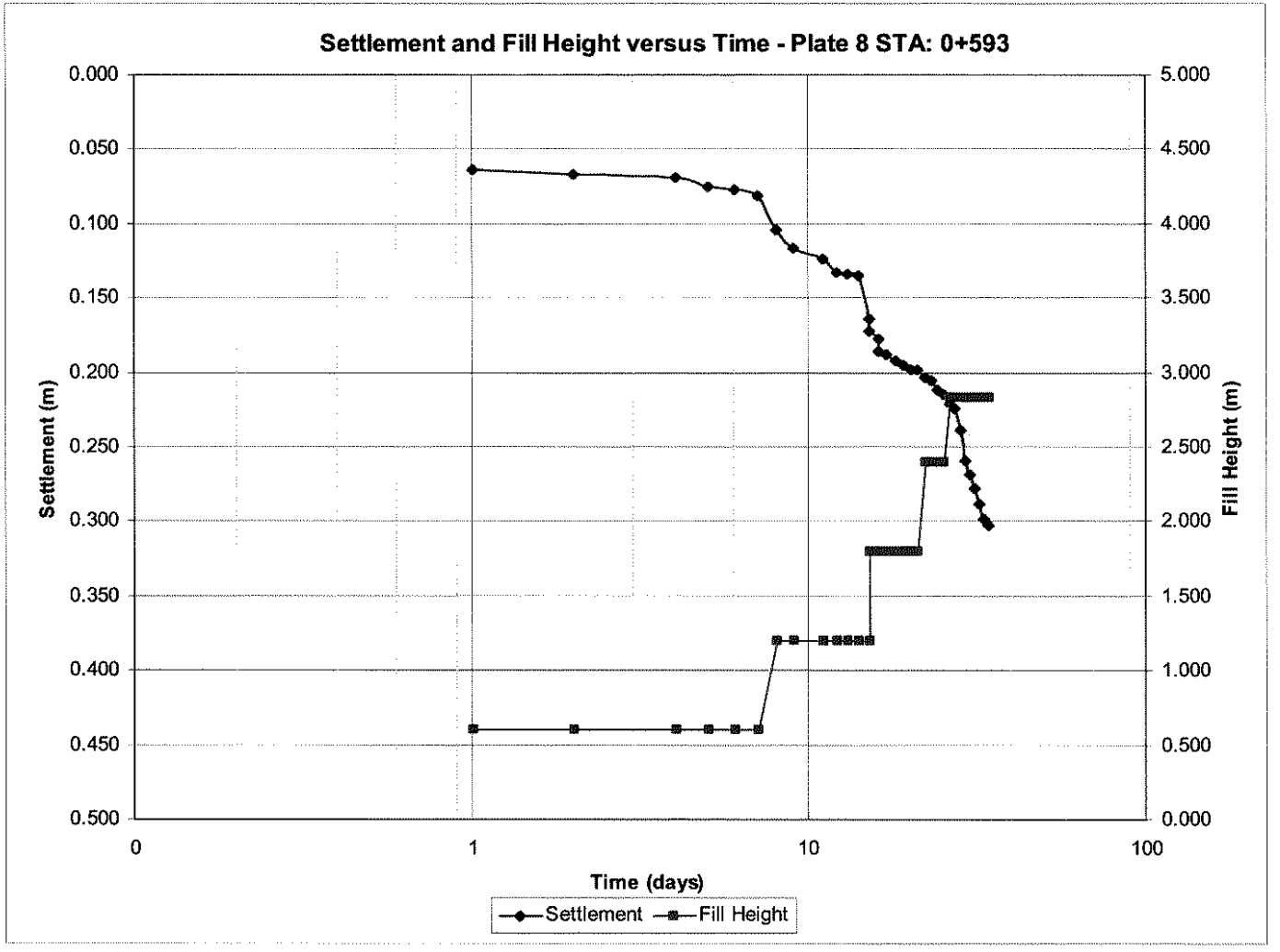
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000		
DESIGN	JIP	28JUN07	SCALE NTS	REV.	**FIGURE IV-6**
CADD	GGG	28JUN07			
CHECK	JIP	28JUN07			
REVIEW					

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



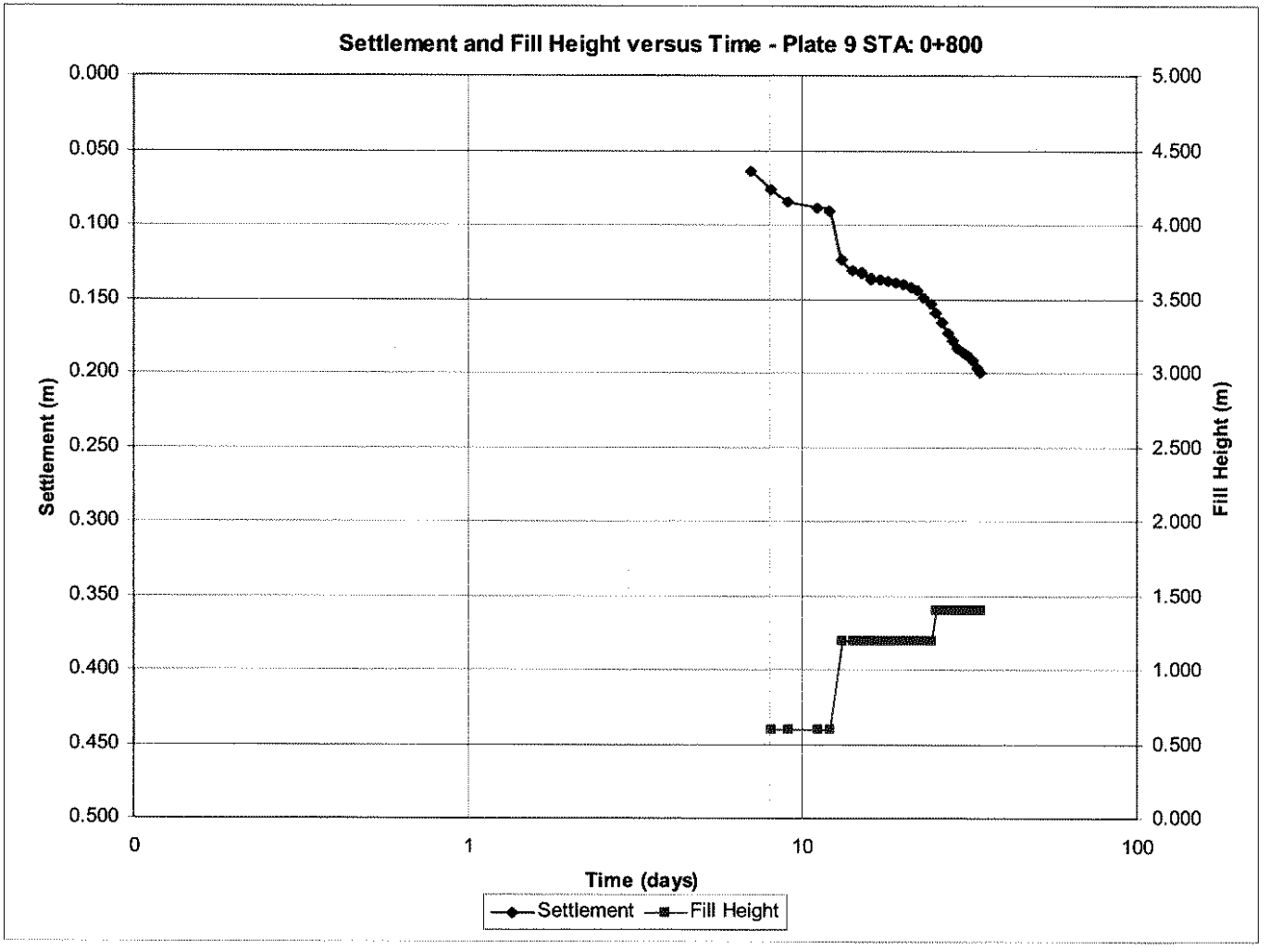
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	**FIGURE IV-8**	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



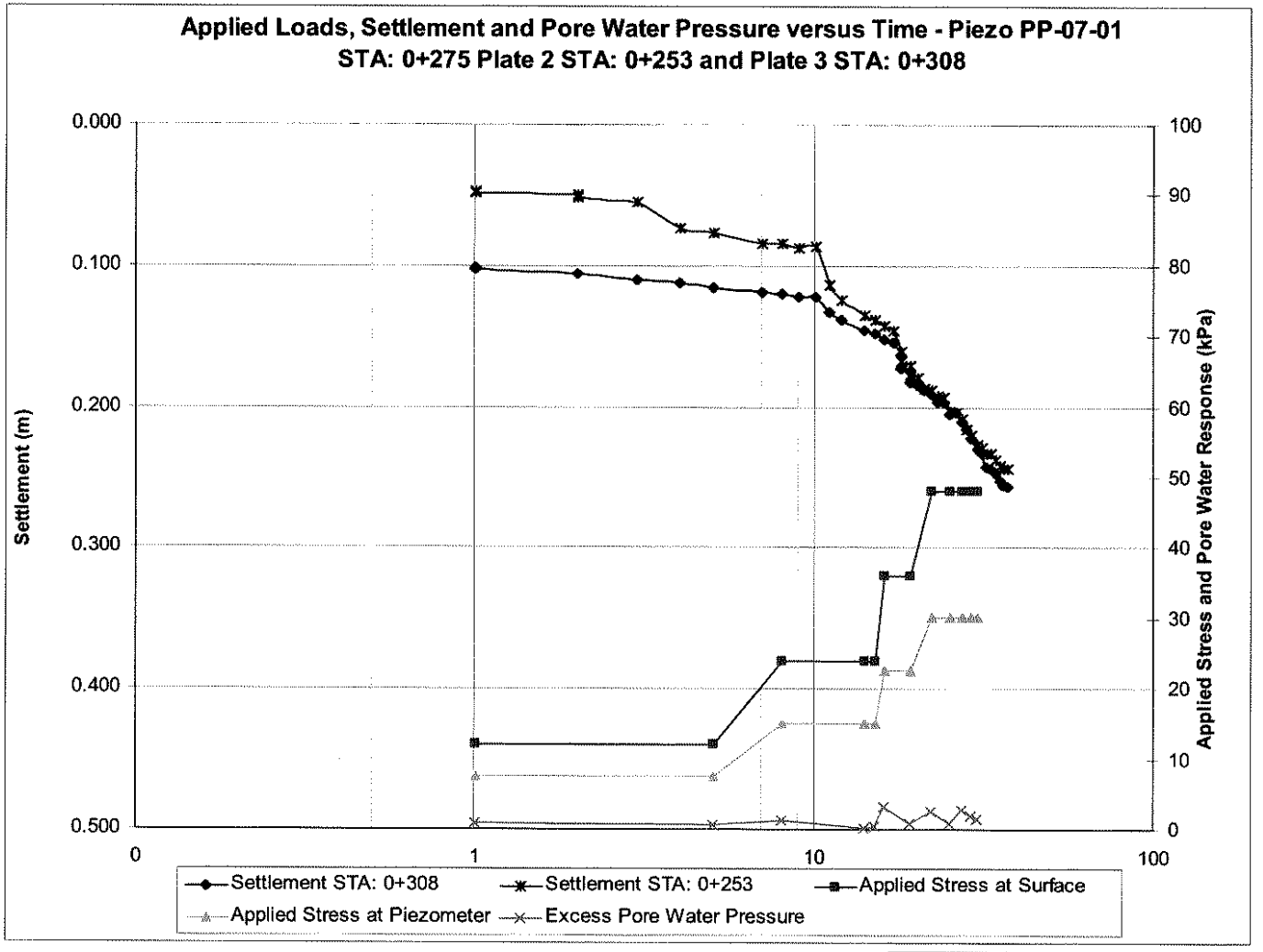
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07		
CHECK	JIP	28JUN07	**FIGURE IV-9**	
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



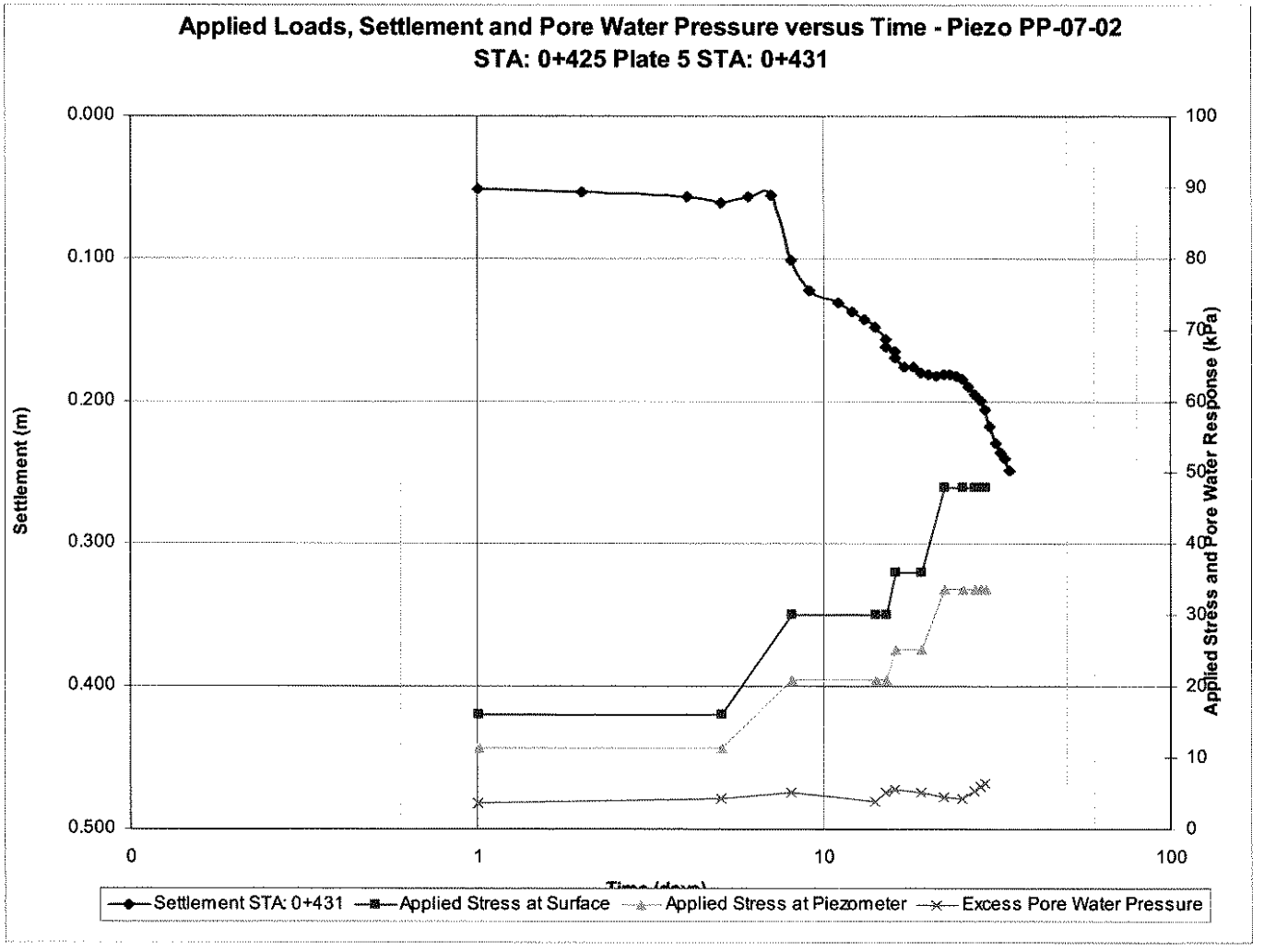
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07	**FIGURE IV-10**	
CHECK	JIP	28JUN07		
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



PROJECT **ASSOCIATED ENGINERING (BC) LTD.**
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

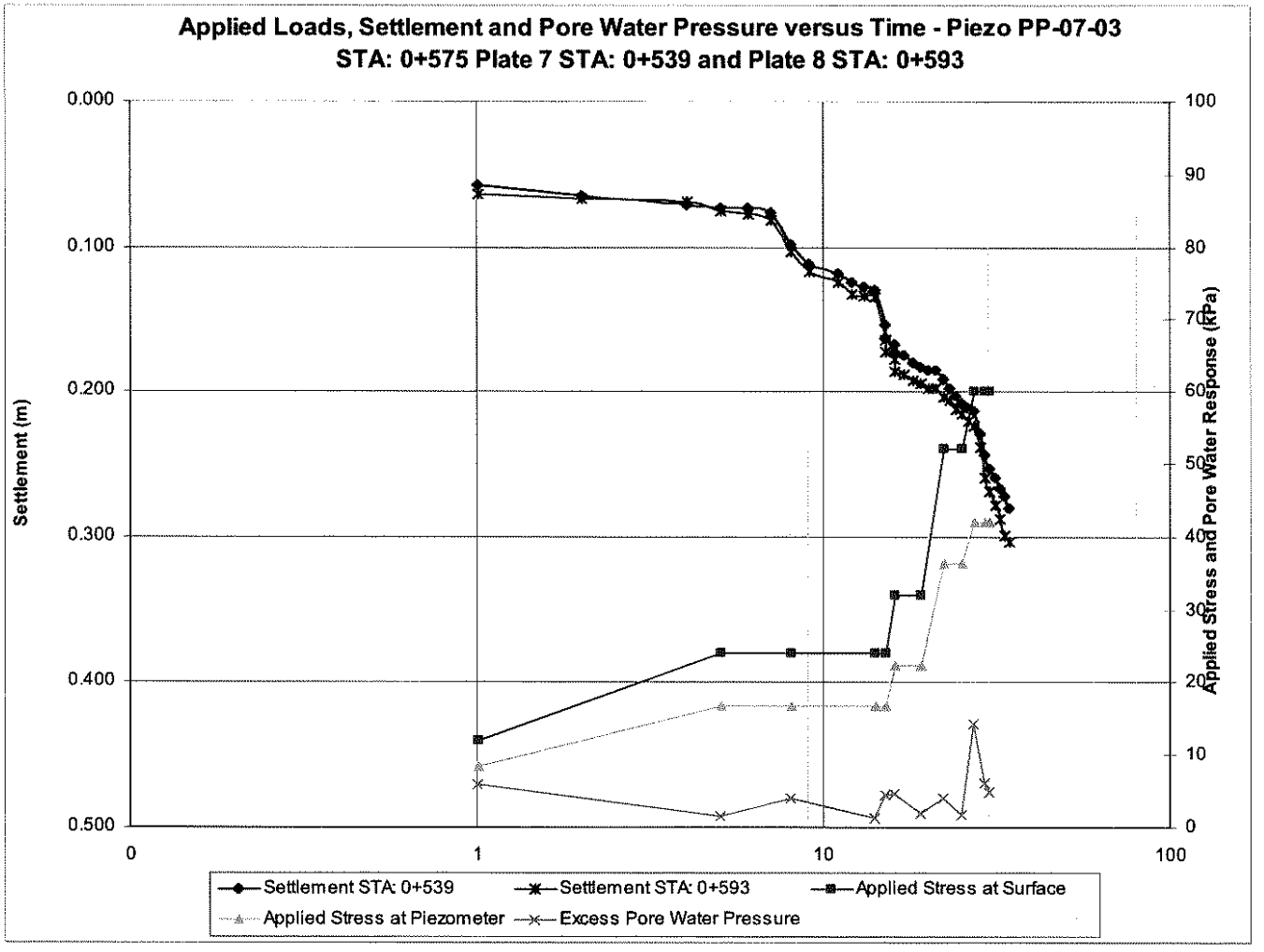
TITLE

Coquitlam River – Colony Farms Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07		
CHECK	JIP	28JUN07	**FIGURE IV-11**	
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



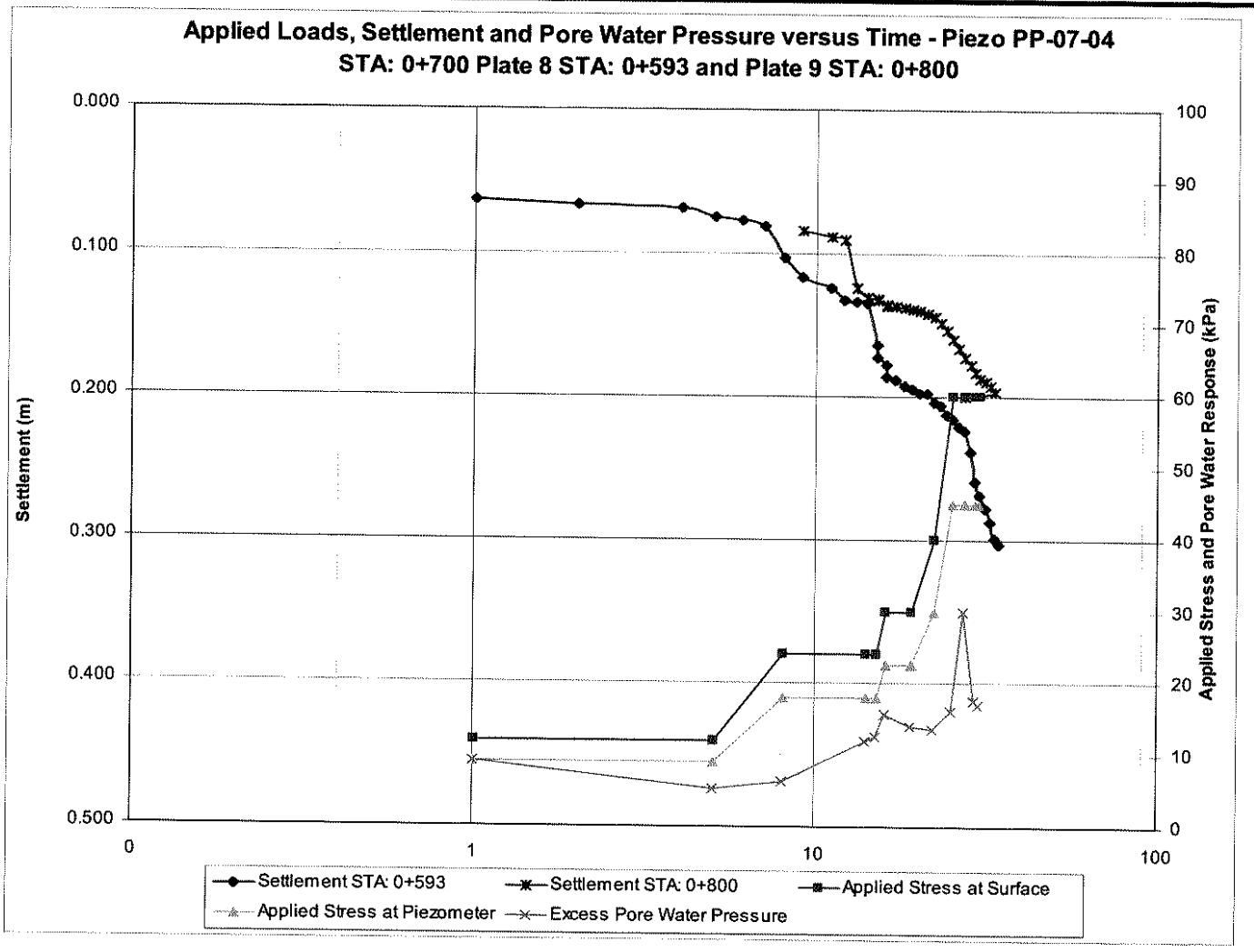
PROJECT
ASSOCIATED ENGINERING (BC) LTD.
URGENT MITIGATIVE FLOOD WORKS
PITT RIVER

TITLE
Coquitlam River – Colony Farms
Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07		
CHECK	JIP	28JUN07	**FIGURE IV-12**	
REVIEW				

REVISION DATE: June 28, 2007 BY: GGG FILE: O:\Final\2007\1411\07-1411-0098\2000\Rep 0705 Mitigative Flood Works\Appendix IV\ Figures IV-1 to IV-13.ppt



PROJECT	ASSOCIATED ENGINERING (BC) LTD. URGENT MITIGATIVE FLOOD WORKS PITT RIVER
TITLE	Coquitlam River – Colony Farms Instrumentation Monitoring Results

Golder Associates

PROJECT No. 07-1411-0098			PHASE / TASK No. 2000	
DESIGN	JIP	28JUN07	SCALE NTS	REV.
CADD	GGG	28JUN07		
CHECK	JIP	28JUN07	FIGURE IV-13	
REVIEW				

APPENDIX V

2007 MATERIALS TESTING RESULTS

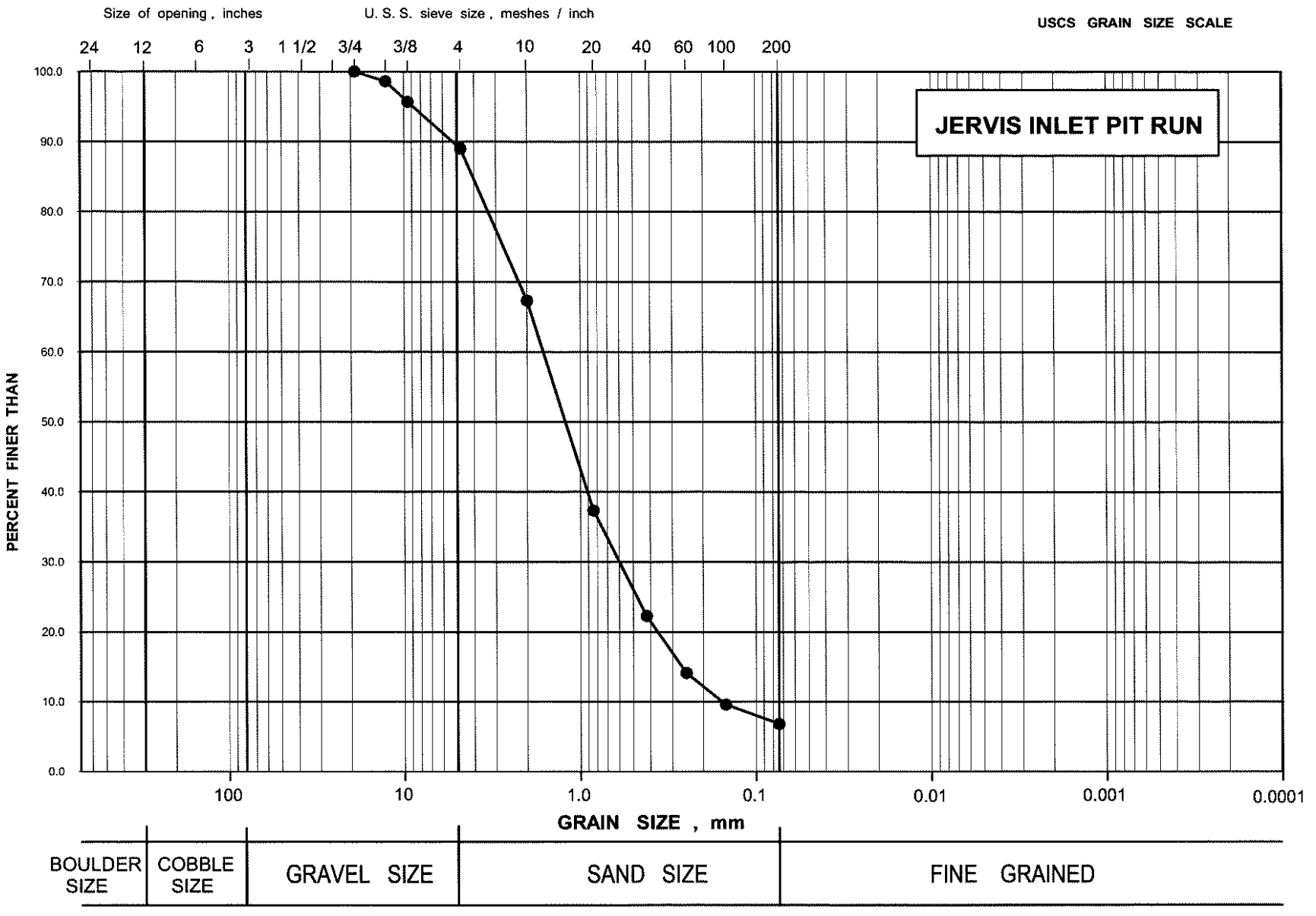
SIEVE ANALYSIS

Project No.	07-1416-0039	**Client**	Associated Engineering	Sample	Jervis Inlet Pit Run
Sch#	74	**Project**	Pitt River Dyke		March 30, 2007
Lab Work	TM	**Location**			

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	287.5
Total weight	1547.2	Wash Sieve (Y/N)	Y	Weight after wash	266.1
Total Wt -#4	1376.7	Total Wt of -#4 sieved	287.5	Pan Weight	0.6

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	0.0	0.0			0.0	**25.4**	**100.0**
3/4"	0.0	0.0			0.0	**19.1**	**100.0**
1/2"	21.6	1.4			1.4	**12.7**	**98.6**
3/8"	45.4	2.9			2.9	**9.50**	**95.7**
#4	103.5	6.7			6.7	**4.76**	**89.0**
#10			70.0	24.3	21.7	**2.00**	**67.3**
#20			96.9	33.7	30.0	**0.84**	**37.3**
#40			48.6	16.9	15.0	**0.42**	**22.3**
#60			26.4	9.2	8.2	**0.25**	**14.1**
#100			14.6	5.1	4.5	**0.149**	**9.6**
#200			9.0	3.1	2.8	**0.074**	**6.8**
-200			22.0	7.7	6.8		

REMARKS :



Project No. 07-1416-0039 **Drawn** TM **Reviewed** LL **Date** 07/03/07	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

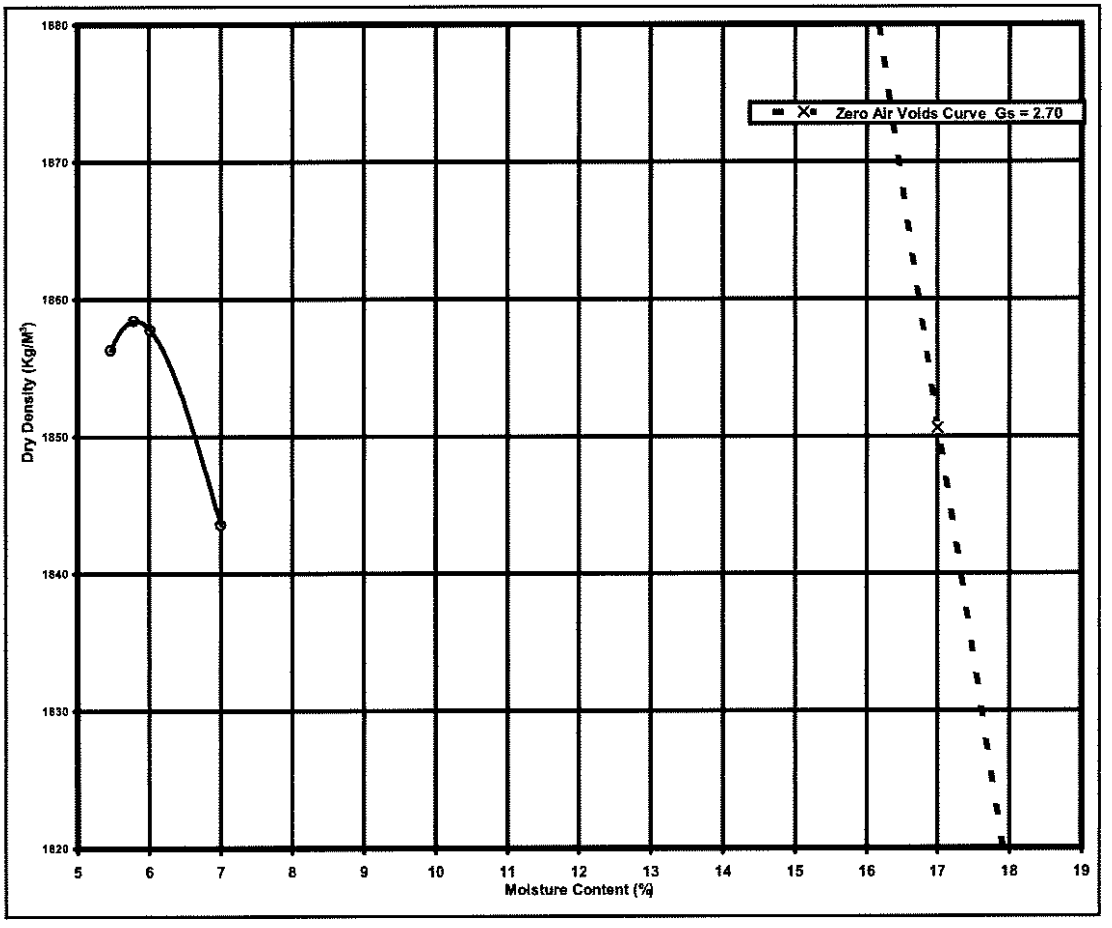
Test Method for Laboratory Compaction Charateristics of Soil

Project #	07-1416-0039	**Sample Identification :**		ASTM D 698-91 Standard Proctor		
Client	Associated Engineering	Sample	Jervis Inlet Pit Run	*Method*	B	
Project	Pitt River Dyke		March 30, 2007	*Optimum WC =*	5.8	%
Location				*Max ρ_{dry} =*	1858	Kg/M³

Technician	TM	**Sample Description :**				*ASTM D 4718-87*		
Schedule #	74	Natural Moisture Content = 5.5%				*Correction for oversize particles*		
Proctor Type (S/M)	S					*Optimum WC =*	5.6	%
		Mould Volume =	0.000944	m^3		*Max ρ_{dry} =*	1883	Kg/M³

TRIAL NO.	*1*	*2*	*3*	*4*			*Percent Oversize :*		
WT SOIL WET + MOULD	6109	6117	6120	6123			SCREEN SIZE :	9.50	mm
WEIGHT OF MOULD	4261	4261	4261	4261			*Coarser Fraction*		
WT OF SOIL WET	1848	1856	1859	1862			P_c =	4.3	%
WET DENSITY (Kg/M³)	1958	1966	1970	1973			Gs =	2.70	assumed
DRY DENSITY (Kg/M³)	***1856***	***1858***	***1858***	***1844***			W_c =	1.5	%

CONTAINER NO.							*Finer Fraction*		
WT OF WET SOIL + TARE	643.9	736.9	473.2	714.6			P_f =	95.7	%
WT OF DRY SOIL + TARE	628.5	716.4	457.3	691.7			Gs =	2.70	assumed
WEIGHT OF WATER	15.4	20.5	15.9	22.9			W_f =	5.8	%
TARE WEIGHT	346.8	362.3	193.2	364.8			Zero Air Voids Curve Gs =		2.70
WEIGHT OF DRY SOIL	281.7	354.1	264.1	326.9			Bulk Gs =	2.70	
MOISTURE CONTENT (	***5.5***	***5.8***	***6.0***	***7.0***			Saturation =	100.0	%



Permeability of Granular Soils (Constant Head)
ASTM D 2434-68 (1993)

Project #	07-1416-0042	Task 1000		Location	Jervis Inlet Pit Run			Panel No.	4		
Client	Associated Engineering			Sample	Barge Sample			Cell No.	Soiltest		
Project	Dyke Upgrades			Depth				Sch No.	132		
Location	Coquitlam										
Dimensions - Initial					**Initial**	**Final**					
D_o	15.24	cm		Wet Wt	5651.7	5975.1	g	**Method of sample preparation**			
H_o	14.77	cm		Dry Wt	5310.9	5310.9	g	Assumed Optimum W% of 7%			
A_o	182.41	cm^2		w	6.4	12.5		Compaction to Est. Standard Proctor Energy			
V_o	2694.5	cm^3		ρ_{dry}	1977	1977	Kg/M^3	**Standard Proctor Compaction**			
Dimensions - After Consolidation				e	0.37	0.37		$\rho_{dry\ Max(Est.)}$	1960	Kg/M^3	
δH_c	0.05	cm		G_s	2.7	2.7	assumed				
H_c	14.73	cm		Saturation	47.4	92.3	%	**Distance between manometers**			
V_c	2686.2	cm^3		Compaction	100.9	100.9	%	L_{man}	—	cm	

Constant Head Permeability Test Data

Test	Head		Head	Flow	Time	Velocity	Gradient			Temp	
No.	H_1	H_2	h	Q	t	Q/At	h/L	k	Temp	Correction	k_{20}
	cm	cm	cm	cc	min	cm/s		cm/s	C_{deg}	η_t/η_{20}	cm/s
1	61.6	29.0	32.6	423.7	25.0	0.002	2.21	7.0E-04	20.0	0.9995	7.0E-04
2	69.4	29.0	40.4	323.6	25.0	0.001	2.74	4.3E-04	20.0	0.9995	4.3E-04
3	79.4	29.0	50.4	295.9	16.0	0.002	3.42	4.9E-04	20.0	0.9995	4.9E-04
4	99.6	29.0	70.6	605.6	7.0	0.008	4.79	1.6E-03	20.0	0.9995	1.6E-03
5	99.6	29.0	70.6	683.9	12.0	0.005	4.79	1.1E-03	20.0	0.9995	1.1E-03
6	120.4	29.0	91.4	904.7	10.0	0.008	6.21	1.3E-03	20.0	0.9995	1.3E-03
7	120.4	29.0	91.4	676.9	10.0	0.006	6.21	1.0E-03	20.0	0.9995	1.0E-03
8	120.4	29.0	91.4	515.3	10.0	0.005	6.21	7.6E-04	20.0	0.9995	7.6E-04
										Avg k_{20}	**9.3E-04**

Remarks :

Sand & Gravel

Sample as received

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

ASTM C 136

April 5, 2007

Valley Geotechnical Engineering

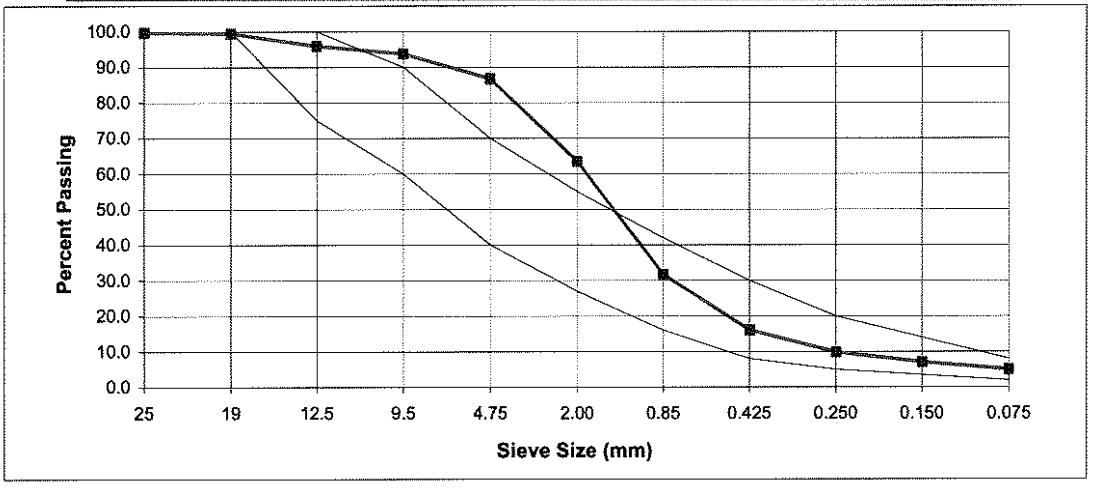
Project number: 07-1416-0039

PROJECT: **Coquitlam Dyke**

Sample:	**Jervis Inlet Pit Run**

DATE SAMPLED: April 3, 2007 SAMPLED BY: **AL**

SIEVE ANALYSIS					MMCD, GRANULAR BASE	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 4.75	- 4.75		
25	0.0	100.0	0.0			
19	0.3	99.7	2.2		100.0	100.0
12.5	3.5	96.2	26.8		75.0	100.0
9.5	2.2	94.0	16.8		60.0	90.0
4.75	7.1	87.0	54.2		40.0	70.0
2.00	23.2	63.8		26.7	27.0	55.0
0.85	31.8	32.0		36.6	16.0	42.0
0.425	15.7	16.3		18.1	8.0	30.0
0.250	6.1	10.1		7.1	5.0	20.0
0.150	2.8	7.3		3.2		
0.075	2.0	5.3		2.3	2.0	8.0
PAN	5.3			6.0		
Total	100.0					



Reported by: S. Sahai Reviewed by: N. Mwitta

Notice: The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING STANDARD EFFORT (12,400 ft-lbf/ft3)

ASTM D698

April 8, 2007

Associated Engineering
Suite 300 - 4940 Canada Way
Burnaby, BC V5G 4M5

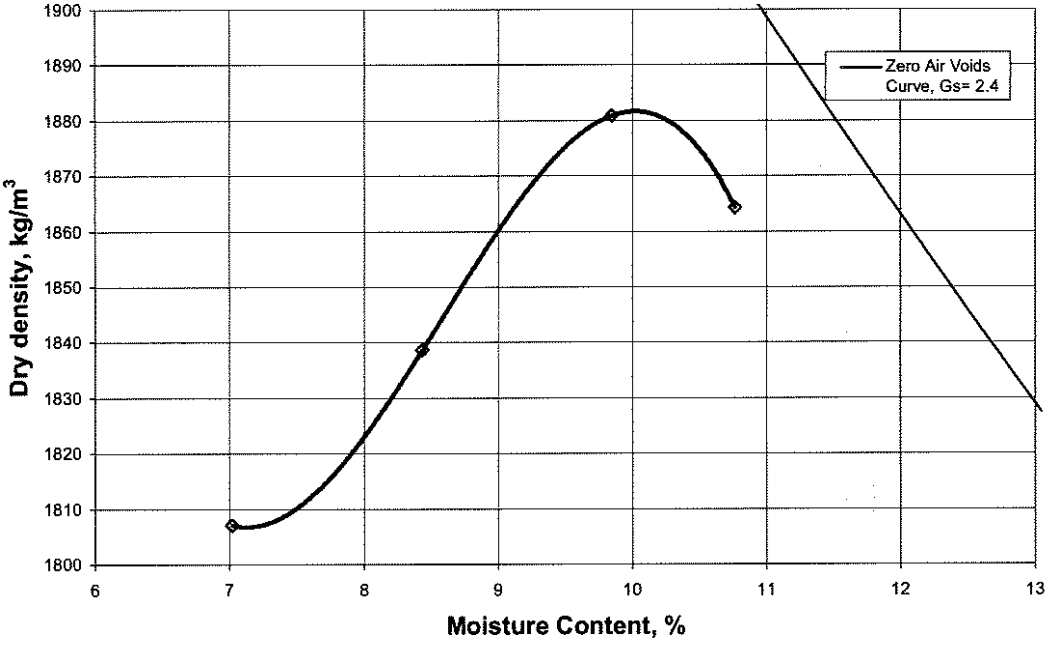
Attention: Mr. Wayne Zhan

		Project No.:	07-1416-0038
Project:	Pitt River Dyke	Sampled:	April 3, 2007
Location:	Pitt River Dyke	Test:	2
Material Description:	Jervis Inlet Pit Run	Sampled by:	AL
Source:	Coast Meridian	Method:	A

Trial No.	1	2	3	4
Dry Density, kg/m^3	1807	1839	1881	1864
Moisture Content,%	7.0	8.4	9.8	10.8

Maximum Dry Density	**1882.0**	kg/m^3	Gs (assumed)	2.40
Optimum Moisture	**10.0**	%	Oversize	13.0 %
Rock Corrected Dry Density	**1936**	kg/m^3		
Rock Corrected Moisture	**9.0**	%		

Moisture - Density Relationship



Reported by: Satinder Sahai

Reviewed by: N. Mwitta

Reporting of these test results constitutes a testing service only. Interpretation may be provided upon request.

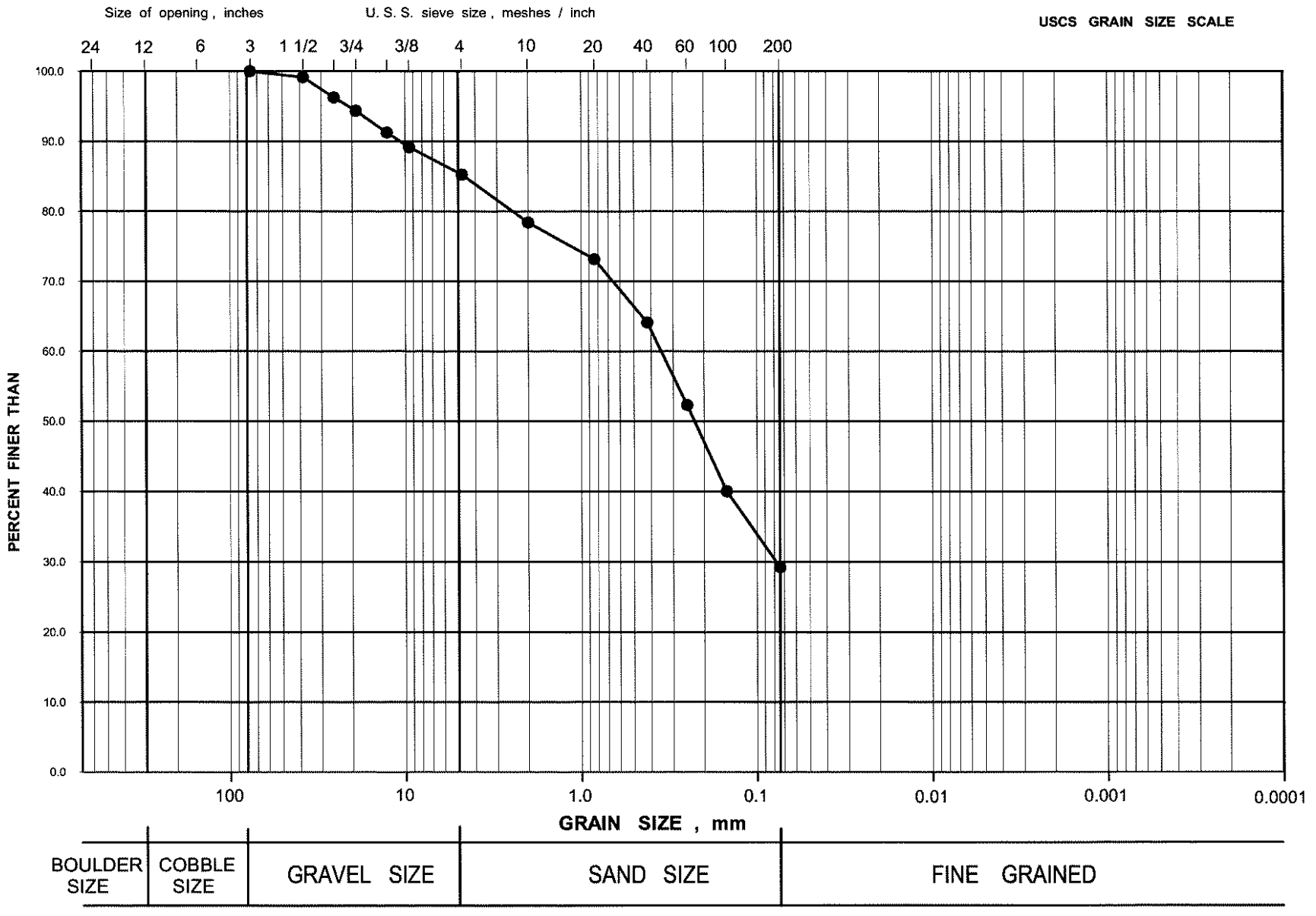
SIEVE ANALYSIS

Project No.	07-1416-0042	**Client**	Associated Engineering	Location	CEWE Pipeline Road
Sch#	132	**Project**	Dike Upgrade	Sample	Pit Run (unscreened)
Lab Work	GP	**Location**	Coquitlam	Depth	Stockpile

1st & 2nd SIEVING		**3rd SIEVING -No.4**		**Wash Sieving -No.4**	
Weight before sieving		Quarter - 3/4 (Y/N)	Y	Weight before wash	342.1
Total weight	22973.1	Wash Sieve (Y/N)	Y	Weight after wash	242.5
Total Wt -3/4	20067.0	Total Wt of -No.4 sieved	342.1	Pan Weight	17.2

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	197.4	0.9			0.9	**38.1**	**99.1**
1"	663.6	2.9			2.9	**25.4**	**96.3**
3/4"	433.2	1.9			1.9	**19.1**	**94.4**
1/2"	668.1	3.3			3.1	**12.7**	**91.2**
3/8"	442.5	2.2			2.1	**9.50**	**89.1**
#4	825.8	4.1			3.9	**4.76**	**85.3**
#10			27.5	8.0	6.9	**2.00**	**78.4**
#20			21.0	6.1	5.2	**0.84**	**73.2**
#40			36.3	10.6	9.0	**0.42**	**64.1**
#60			47.4	13.9	11.8	**0.25**	**52.3**
#100			49.3	14.4	12.3	**0.149**	**40.0**
#200			43.2	12.6	10.8	**0.074**	**29.3**
-200			116.8	34.1	29.1		

REMARKS :



Project No. 07-1416-0042
Drawn GP
Reviewed LL
Date 07/03/07

Golder Associates

GRAIN SIZE DISTRIBUTION

CEWE Pipeline Rd
Pit Run

Measurement of Hydraulic Conductivity of Porous Material
Using a Rigid-Wall, Compaction-Mould Permeameter - ASTM D 5856-95

Project No.	07-1416-0042	**Client :**	Associated Engineering	**Source :**	Cewe
Sch#	132	**Project :**	Dyke Upgrades	**Sample :**	Pipeline Road
Lab Work:	RB	**Location:**	Coquitlam		Pit Run (unscreened)
Method:	Method B, Constant Tailwater Pressure				

Dimensions	**Initial**	**After Consolidation**
D (cm) =	10.25	10.25
H (cm) =	7.67	7.67
A (cm^2) =	82.44	82.44
V (cm^3) =	632.2	632.1
Void Ratio =	0.401	0.400

		After Consolidation
Wet Wt (g) =	1333.1	1372.8
Dry Wt (g) =	1218.7	1218.7
w (%) =	9.4	12.6
ρ_{dry} (kg/m^3) =	1928	1928
G_s (assumed) =	2.70	2.70
Saturation (%) =	63.3	85.3
Compaction (%) =	99.5	99.5

Compaction Data

Sample Preparation =	Standard Proctor
Target Compaction Degree =	
$\rho_{max\ dry}$ (kg/m^3) =	1938
Type of Permeameter =	Single Ring Base Plate

Pipette Geometry

Height to base (cm) =	23.2
$a_{pipette}$ (cm^2) =	0.291

Permeability Test Data

Test	Graduated Pipette		Temperature		Applied Pressure to Headwater	Head		Time	Gradient	Hydraulic Conductivity	
No.	h_1 (cm)	h_2 (cm)	T_1 (°C)	T_2 (°C)	(kPa)	h_1 (cm)	h_2 (cm)	Δt (min)	h_{avg}/H_c	k (cm/sec)	k_{20} (cm/sec)
1	39.7	37.3	21.0	21.0	0.0	62.9	60.5	5.0	8.04	3.4E-06	**3.4E-06**
	39.7	34.6	21.0	21.0	0.0	62.9	57.8	11.0	7.87	3.4E-06	**3.4E-06**
	39.7	30.8	21.0	21.0	0.0	62.9	54.0	20.0	7.62	3.4E-06	**3.3E-06**
	39.7	24.9	21.0	21.0	0.0	62.9	48.1	36.0	7.23	3.4E-06	**3.3E-06**
	39.7	19.9	21.0	21.0	0.0	62.9	43.1	52.0	6.91	3.3E-06	**3.2E-06**
	39.7	10.9	21.0	21.0	0.0	62.9	34.1	89.0	6.32	3.1E-06	**3.0E-06**
	39.7	9.5	21.0	21.0	0.0	62.9	32.7	96.0	6.23	3.1E-06	**3.0E-06**
2	39.0	36.8	21.0	21.0	0.0	62.2	60.0	5.0	7.97	3.2E-06	**3.2E-06**
	39.0	34.7	21.0	21.0	0.0	62.2	57.9	10.0	7.83	3.3E-06	**3.2E-06**
	39.0	32.3	21.0	21.0	0.0	62.2	55.5	16.0	7.67	3.2E-06	**3.2E-06**
	39.0	28.9	21.0	21.0	0.0	62.2	52.1	25.0	7.45	3.2E-06	**3.1E-06**
	39.0	25.4	21.0	21.0	0.0	62.2	48.6	35.0	7.23	3.2E-06	**3.1E-06**
	39.0	23.8	21.0	21.0	0.0	62.2	47.0	40.0	7.12	3.2E-06	**3.1E-06**
	39.0	7.7	21.0	21.0	0.0	62.2	30.9	110.0	6.07	2.9E-06	**2.8E-06**
3	38.2	36.7	21.0	21.0	6.9	131.7	130.2	1.0	17.08	5.2E-06	**5.0E-06**
	38.2	35.2	21.0	21.0	6.9	131.7	128.7	2.0	16.98	5.2E-06	**5.1E-06**
	38.2	32.1	21.0	21.0	6.9	131.7	125.6	4.0	16.78	5.4E-06	**5.3E-06**
	38.2	29.0	21.0	21.0	6.9	131.7	122.5	6.0	16.58	5.4E-06	**5.3E-06**
	38.2	24.1	21.0	21.0	6.9	131.7	117.6	10.0	16.26	5.1E-06	**5.0E-06**
	38.2	17.7	21.0	21.0	6.9	131.7	111.2	15.0	15.84	5.1E-06	**5.0E-06**
	38.2	11.1	21.0	21.0	6.9	131.7	104.6	21.0	15.41	4.9E-06	**4.8E-06**
	38.2	6.1	21.0	21.0	6.9	131.7	99.6	26.0	15.08	4.8E-06	**4.7E-06**
										Average k_{20} =	**3.75E-06**

Sample Description Silty SAND, some gravel

Comments

Applied Vertical Stress 33.8 kPa

Permeant Liquid Tap Water

$$k_{20} = \frac{aL}{At} \ln\left(\frac{h_1}{h_2}\right) R_T$$

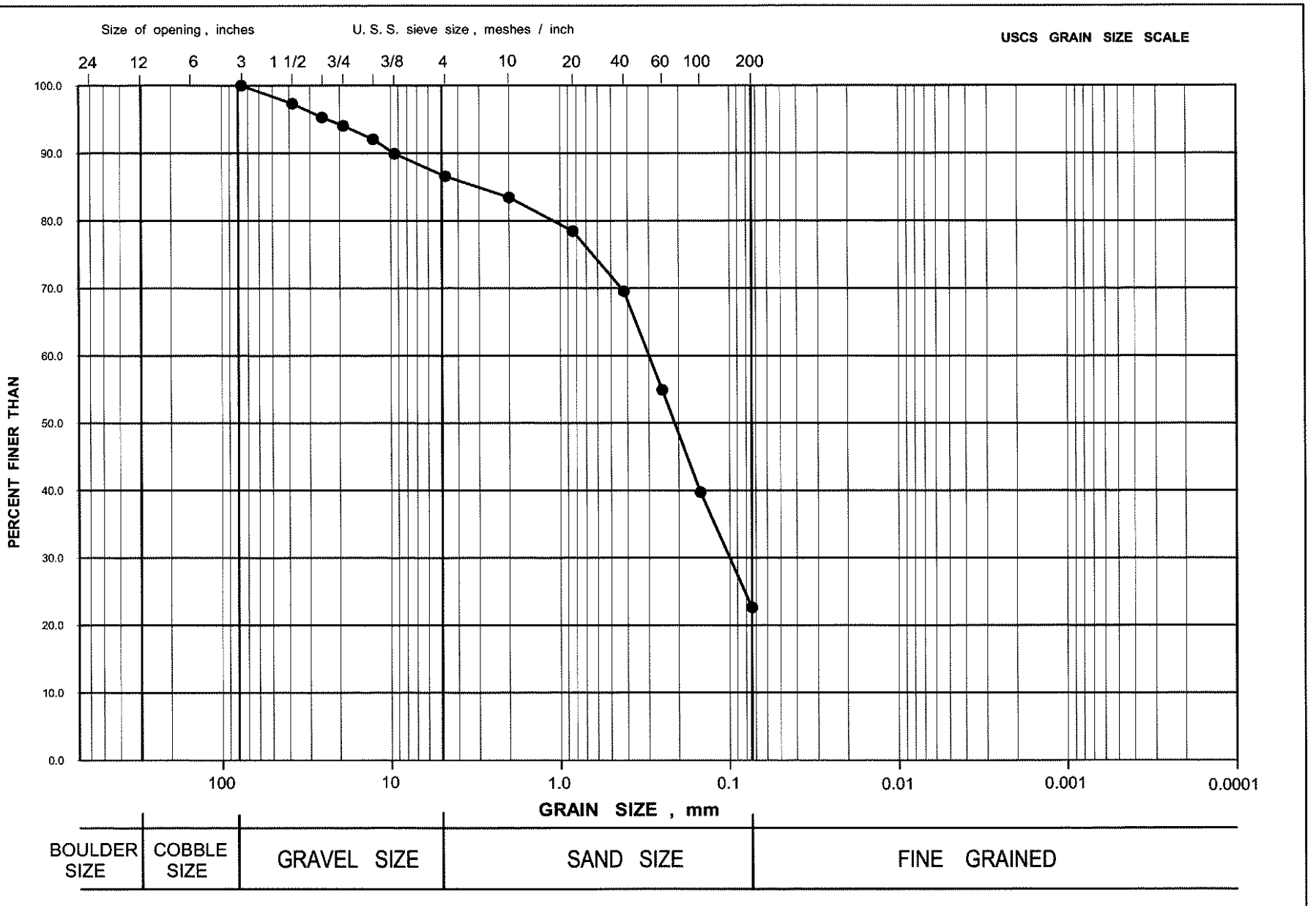
SIEVE ANALYSIS

Project No.	07-1411-0098	**Client**	Associated Engineering	**Type**	Pipeline Rd Pit Run (unscreened)
Sch#	126	**Project**	Urgent Dyke Upgrade	**Location**	24m N of Conveyor, on Bank
Lab Work	RB	**Location**	Pitt River	**Depth**	0.0 - 0.2m

1st & 2nd SIEVING		**3rd SIEVING -No.4**		**Wash Sieving -No.4**	
Weight before sieving		Quarter - 3/4 (Y/N)	Y	Weight before wash	228.7
Total weight	16740.4	Wash Sieve (Y/N)	Y	Weight after wash	177.4
Total Wt -3/4	4077.6	Total Wt of -No.4 sieved	228.7	Pan Weight	9.4

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	452.0	2.7			2.7	**38.1**	**97.3**
1"	343.4	2.1			2.1	**25.4**	**95.2**
3/4"	203.6	1.2			1.2	**19.1**	**94.0**
1/2"	87.2	2.1			2.0	**12.7**	**92.0**
3/8"	91.6	2.2			2.1	**9.50**	**89.9**
#4	144.7	3.5			3.3	**4.76**	**86.6**
#10			8.3	3.6	3.1	**2.00**	**83.4**
#20			13.1	5.7	5.0	**0.84**	**78.5**
#40			23.6	10.3	8.9	**0.42**	**69.5**
#60			38.6	16.9	14.6	**0.25**	**54.9**
#100			40.1	17.5	15.2	**0.149**	**39.7**
#200			45.2	19.8	17.1	**0.074**	**22.6**
-200			60.7	26.5	23.0		

REMARKS :



Project No. 07-1411-0098 Drawn RB Reviewed LL Date 07/03/07	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Road Pit Run (unscreened)**

LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING STANDARD EFFORT (12,400 ft-lbf/ft3)

ASTM D698

May 18, 2007

Associated Engineering
Suite 300-4940 Canada Way
Burnaby , BC V5G 4M5

Project No.: 07-1416-0038

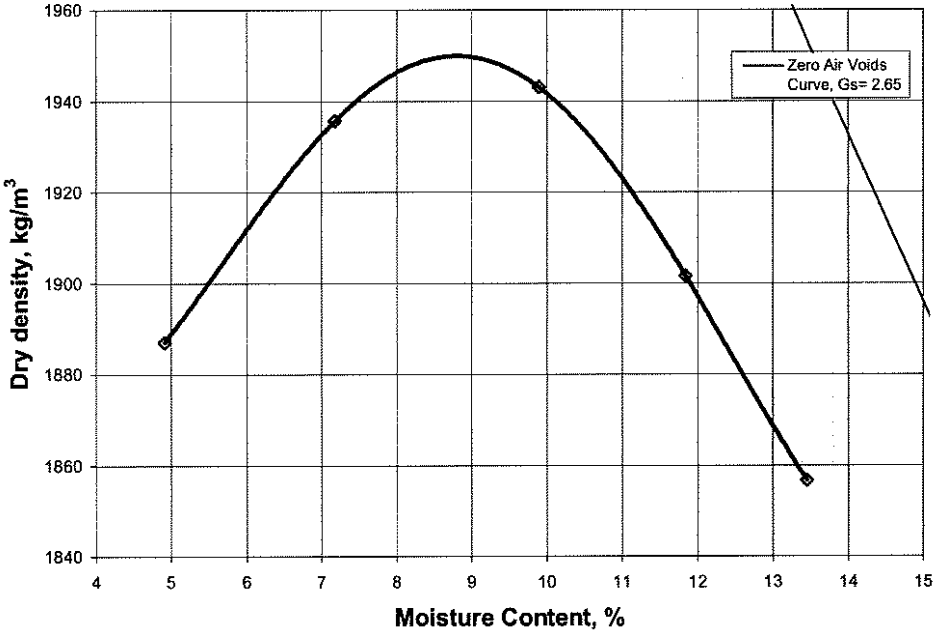
Attention: Mr. Wayne Zhan

Project:	Pitt River Dyke	Sampled:	May 17, 2007
Location:	West Side of Pitt River, between bridges	Tested:	May 18, 2007
Material Description:	Sand with mixed gravel	Sampled by	JP
Source:	Pipeline Road Pit Run (unscreened)	Method:	B
Proposed Use:	Embankment - Emergency Dyke		

Trial No.	1	2	3	4	5
Dry Density, kg/m^3	1887	1936	1943	1857	1902
Moisture Content,%	4.9	7.2	9.9	13.5	11.8

Maximum Dry Density	**1950.0**	kg/m^3	Gs (assumed)	2.65
Optimum Moisture	**8.8**	%	Oversize	18.3 %
Rock Corrected Dry Density	2049	kg/m^3		
Rock Corrected Moisture	7.7	%		

Moisture - Density Relationship



Reported by: Kosei Fukuoka Reviewed by: N. Mwitta

Reporting of these test results constitutes a testing service only. Interpretation may be provided upon request.

LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING STANDARD EFFORT (12,400 ft-lbf/ft3)

ASTM D698

April 12, 2007

Associated Engineering
Suite 300 - 4940 Canada Way
Burnaby, BC V5G 4M5

Project No.: 07-1416-0038

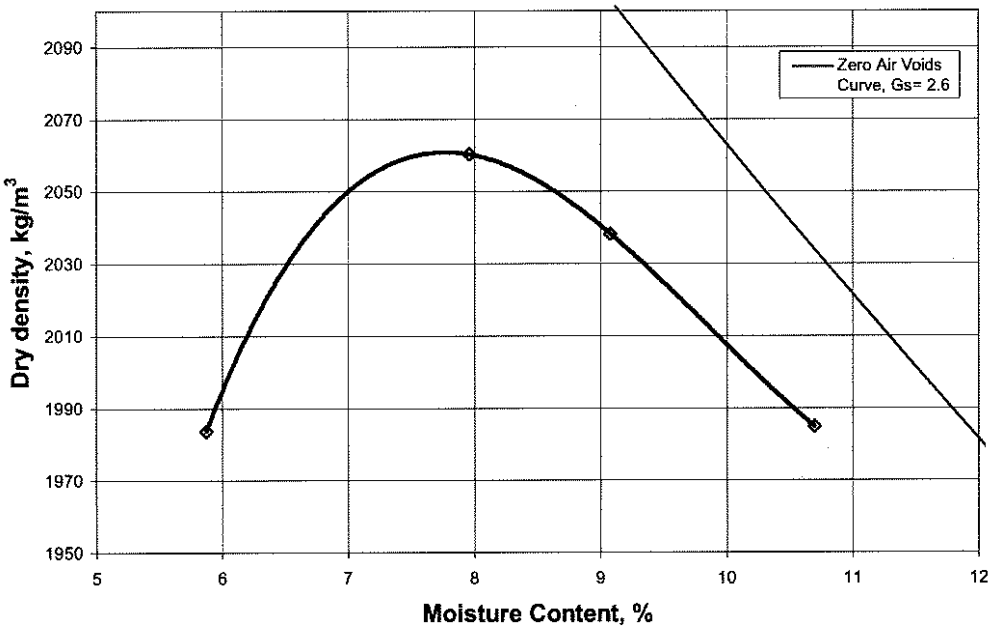
Attention: Mr. Wayne Zhan

Project:	Pitt River Dyke	Sampled:	April 11, 2007
Location:	STA 3+ 050	Test:	3
Material Description:	Sand (Brown)	Sampled by:	GANI
Source:	Cewe Pit - Pipeline Road Pit Run (unscreened	Method:	C

Trial No.	1	2	3	4	
Dry Density, kg/m^3	1984	2060	2038	1985	
Moisture Content,%	5.9	8.0	9.1	10.7	

Maximum Dry Density	**2062.0**	kg/m^3	Gs (assumed)	2.60
Optimum Moisture	**7.8**	%	Oversize	10.4 %
Rock Corrected Dry Density	2107	kg/m^3		
Rock Corrected Moisture	7.3	%		

Moisture - Density Relationship



Reported by: Satinder Sahai

Reviewed by: N. Mwitta

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

ASTM C 136

April 5, 2007

Valley Geotechnical Engineering

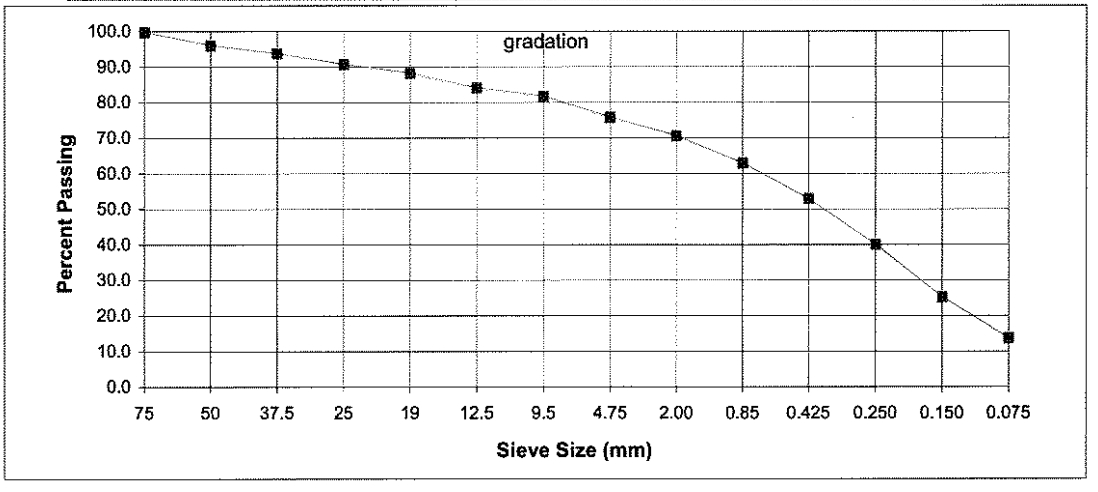
Project number: 07-1416-0039

PROJECT: **Coquitlam Dyke**

Sample:	**CEWE Pipeline Rd Pit Run (screened)**

DATE SAMPLED: April 3, 2007 SAMPLED BY: **AL**

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	3.7	96.3	15.3	
37.5	2.3	94.0	9.5	
25	3.1	91.0	12.8	
19	2.6	88.4	10.6	
12.5	4.1	84.4	17.0	
9.5	2.3	82.0	9.7	
4.75	6.0	76.0	25.0	
2.00	5.1	70.9		6.8
0.85	7.7	63.2		10.1
0.425	10.0	53.2		13.2
0.250	12.9	40.3		17.0
0.150	14.7	25.5		19.4
0.075	11.5	14.0		15.2
PAN	13.9			18.3
Total	100.0			



Reported by: S. Sahai Reviewed by: N. Mwitta

Notice: The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING STANDARD EFFORT (12,400 ft-lbf/ft3)

ASTM D698

April 8, 2007

Associated Engineering
Suite 300 - 4940 Canada Way
Burnaby, BC V5G 4M5

Project No.: 07-1416-0038

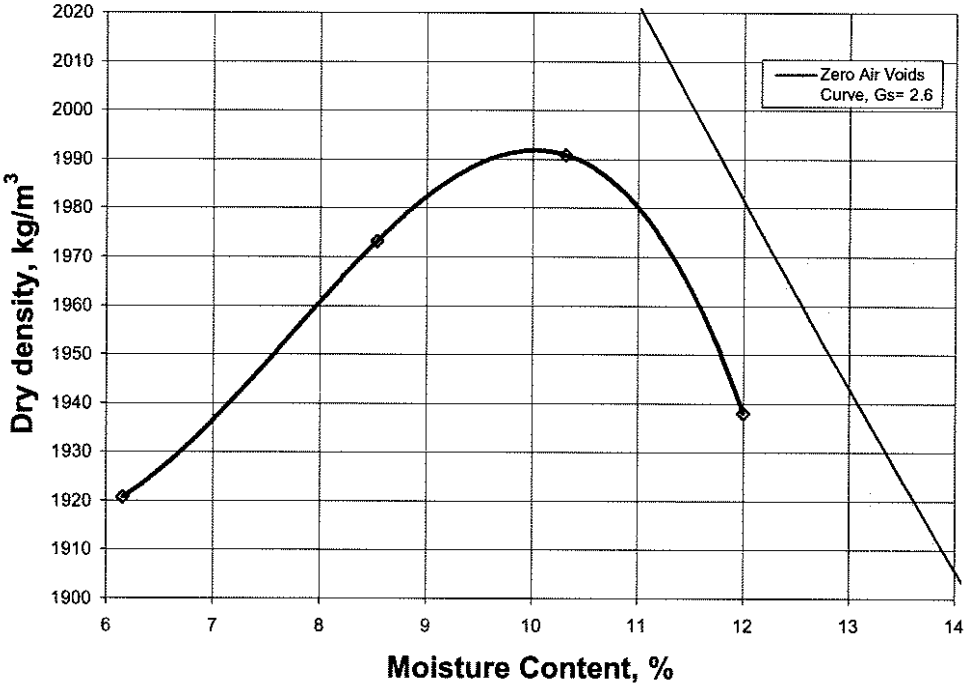
Attention: Mr. Wayne Zhan

Project:	Pitt River Dyke	Sampled:	April 3, 2007
Location:	Pitt River Dyke	Test:	1
Material Description:	CEWE Pipeline Rd Pit Run (screened)	Sampled by:	AL
Source:	Unknown	Method:	C

Trial No.	1	2	3	4
Dry Density, kg/m^3	1921	1973	1991	1938
Moisture Content,%	6.2	8.5	10.3	12.0

Maximum Dry Density	**1992.0**	kg/m^3	Gs (assumed)	2.60
Optimum Moisture	**10.0**	%	Oversize	11.6 %
Rock Corrected Dry Density	**2047**	kg/m^3		
Rock Corrected Moisture	**9.1**	%		

Moisture - Density Relationship



Reported by: Satinder Sahai

Reviewed by: N. Mwitta

LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING STANDARD EFFORT (12,400 ft-lbf/ft3)

ASTM D698

April 8, 2007

Associated Engineering
Suite 300 - 4940 Canada Way
Burnaby, BC V5G 4M5

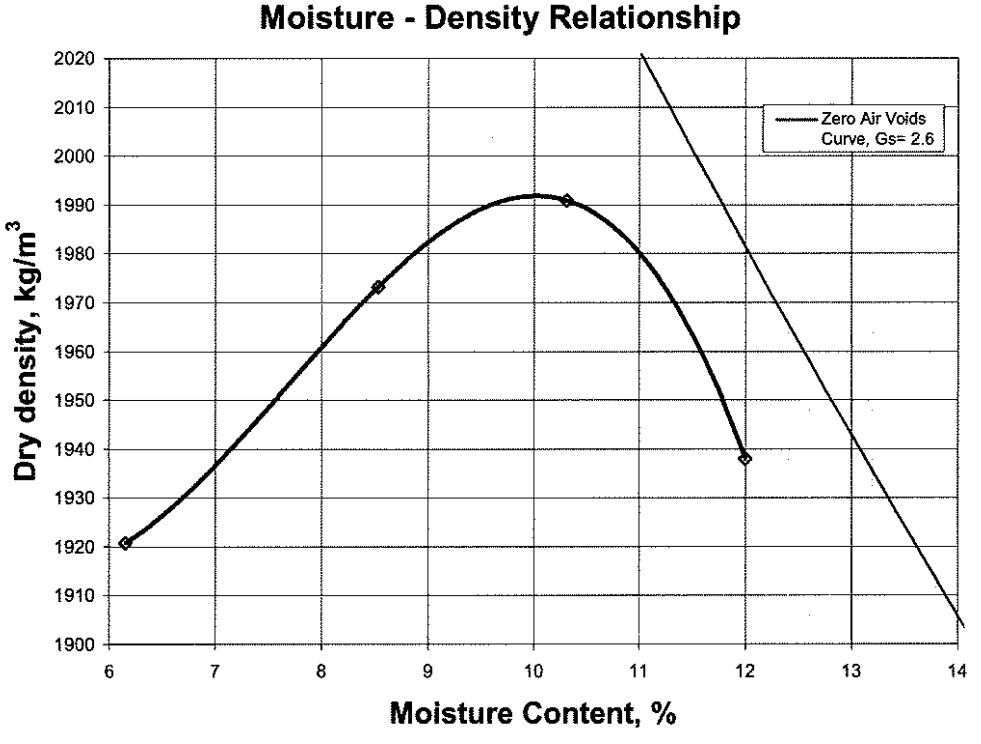
Project No.: 07-1416-0038

Attention: Mr. Wayne Zhan

Project:	Pitt River Dyke	Sampled:	April 3, 2007
Location:	Pitt River Dyke	Test:	1
Material Description:	CEWE Pipeline Rd Pit Run (screened)	Sampled by:	AL
Source:	Unknown	Method:	C

Trial No.	1	2	3	4
Dry Density, kg/m^3	1921	1973	1991	1938
Moisture Content,%	6.2	8.5	10.3	12.0

Maximum Dry Density	**1992.0**	kg/m^3	Gs (assumed)	2.60
Optimum Moisture	**10.0**	%	Oversize	11.6 %
Rock Corrected Dry Density	**2047**	kg/m^3		
Rock Corrected Moisture	**9.1**	%		



Reported by: Satinder Sahai

Reviewed by: N. Mwitta