VICTORIA BUSINESS PARK, BIDDULPH

UPDATED SETTLEMENT REPORT

for

ADVANTAGE WEST MIDLANDS
THE DEVELOPMENT AGENCY

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The conclusions reached are those which can be reasonably determined from the sources of information referred to in the report and from our knowledge of current professional practice and standards. Any limitations resulting from the data are identified where possible but both these and our conclusions may require amendment should additional information become available. The report is only intended for use in the stated context and should not be used otherwise.

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1.0 INTRODUCTION

As part of the development of the Victoria Business Park, Biddulph, IMC Consulting Engineers were appointed by Advantage West Midlands to carry out an estimate of the future creep settlement of the backfill of the former Brown Lees Opencast Site. A report on the monitoring of the instrumentation installed in the zone of compacted fill at the Brown Lees Opencast Coal Site was prepared by IMC and issued in August 2001 (IMC Report No D5249/E).

In that report an appraisal was made of all the data obtained from the monitoring exercise and estimates given of the future creep settlement to the year 2026 based on extrapolation of the data for each settlement marker position. In the design of individual buildings it will be necessary to take into account settlements due to other causes such as imposed load and inundation effects.

Since the completion of that report several additional sets of monitoring data have been obtained as well as the construction of access roads and development platforms. This site activity has lead to some disruption of the settlement markers and this report provides a factual assessment of the new settlement marker installatuion. No detailed reappraisal of the settlement rate indicated by the new markers has been made.

2.0 SETTLEMENT SURVEY AND MARKERS

2.1 Settlement Monitoring August 2001 to November 2002.

Since the last settlement monitoring report in August 2001 there have been another seven monitoring visits to site. These seven visits can be split into two groups of data with monitoring before and after May 2003. The settlement data obtained between the IMC report of August 2001 and November 2002 was obtained initially by MS Surveys and subsequently Forkers. MS Surveys obtained the last three data sets after the reinstallation of some of the settlement markers in May 2003. The settlement data obtained to date is presented in Appendix A. The highlighted data on this table represents data that IMC believe is valid, levels have been recorded in addition to those shown on the table but the results are not believed to indicate the magnitude of the ongoing creep settlement.

The engineering works that were undertaken on site immediately subsequent to the IMC report in August 2001 removed 16 of the settlement markers. The subsequent construction works on site disrupted or affected the majority of the monitoring locations. Attempts were made during the construction works to protect the individual locations by the placement of concrete rings around the markers to allow the earthwork operations to proceed. However the monitoring of the markers in June and November 2002 indicated some peculiar movements that were not indicative of the trends established prior to this date. Several monitoring station exhibited apparent heave (eg U4A, U6A, X3) whilst others showed some marked decrease in level (V4, W4, W3). As the magnitude of the settlement expected at some of these locations would be in the region of several millimetres it is considered that the construction activities has had an adverse effect on the settlement stations. The placement of the fill with the associated surcharging of the backfill as well as localised inundation of ground surrounding the markers where the concrete rings had been flooded may have lead to a misleading pattern of movement that is not indicative of the creep settlement of the opencast backfill.

2.2 Settlement Monitoring since November 2002

On completion of the redevelopment works replacement markers were installed at locations shown on IMC Drawing No D5249/26a to a specification shown on the drawing. The markers were replaced in area defined in the previous report as exhibiting the greatest amount of predicted settlement. The settlement markers were installed by MS Surveys in May 2003 and were subsequently surveyed in June and September 2003. All new settlement locations are labelled "-03" and the results of the initial monitoring are tabulated in Appendix A.

3.0 ONGOING SETTLEMENT PREDICITON

Plots of the settlement monitored for the zone defined in IMC Report D5249/E are given in Figures 2 to 6. These plots indicate that prior to the disruption of the markers caused by the construction works the settlement was continuing as predicted with the trends established before August 2001. The estimate of ongoing creep settlement is given in IMC Drawing No D5249/18 and the tabulated predictions of total creep settlement are given in Tables 1 and 2.

The markers installed in May 2003 have re-established the monitoring system across part of the site that is considered to exhibit the greatest amount of long term settlement. At the time of writing this report there has been four months monitoring of the new locations and the preliminary data set would seem to indicate that settlement trends exhibited before the construction works would be seem to be continuing. It is recommended that the settlement monitoring is continued on a quarterly basis for as long as the stations remain in existence.

4.0 SUMMARY AND CONCLUSIONS

- The construction activity that has occurred as part of the redevelopment of the site has lead to the disruption of the settlement markers.
- Settlement stations were reinstalled in the area defined in IMC's Report No D5249/E, August 2001 as exhibiting the greatest amount of future creep settlement.
- The new stations were installed in May 2003 and, to date, there have been three surveying visits to site.
- The preliminary results for these new stations indicate that the settlement trends are unchanged from the previous assessment.

5.0 REFERENCES

1. IMC Consulting Engineers. Brown Lees Development, Settlement Risk Assessment, August 2001

Table 1

Movement of Settlement Markers (Upto August 2001)

		Movement of settlement markers (mm)								
Row		1	2	3	4	5	6	7	8	9
Z	SWK d		2	5.3	n/a	8.9	6.5			
	S1		6	-1	1	22	11			
	S2		-1	-4	-2	24	8			
	Δ		-7	-5	-3	2	-3			
Y	SWK d	11	20.5	21.4	21.9	22.5	21.6			
	S1	27	25	27	29	8	11			
	S2	23	10	27	36	8	7			
	Δ	-4	-15	0	7	0	-4			
X	SWK d	26.9	35	37.7	40.1	38.9	28.7	1.1		
	S1	N/a	48	39	66	67	47	-6		
	S2	N/a	44	36	80	89	54	-18		
	Δ	(83)*	-4	-3	14	22	7	-12		
W	SWK d		45.8	46.9	51.3	45.2	28.5	13.8	5.5	
	S1		n/a	63	81	93	19	13	-8	
	S2		n/a	86	96	124	24	2	-27	
	Δ		(167)*	23	15	31	5	-11	-20	
V	SWK d			52.2	46.6	55.5	28.2	21.5	20	
	S1			n/a	84	92	55	35	21	
	S2			n/a	121	135	60	26	8	
	Δ			(94)*	37	43	5	-9	-13	
U	SWK d				37.7	45.1	37.2	32.3	25.8	2.4
	S1				n/a	n/a	45	37	34	-1
	S2				n/a	n/a	n/a	42	20	-20
	Δ				(71)*	(72)*	(55)*	5	-13	-19
T	SWK d								24	3.6
	S1								34	-7
	S2								32	-29
	Δ								-2	-22

d - Depth of compacted fill (m)
S1 - Settlement 31 May 1995 to 21 July 1997 (mm)
S2 - Settlement 31 May 1995 to 3 May 2001 (mm)
Δ - Settlement 21 July 1997 to 3 May 2001 [S2 - S1] (mm)
( )*- Settlement of replaced markers at crest of western slope 15 September 1999 to May 2001 (mm)

	Zone 1 : Settlement ≤ 0 mm (heave) – North
	Zone 2 : Settlement ≤ 0 mm (heave) – South
	Zone 3 : Settlement 0 – 10.5 mm – Central East
	Zone 4 : Settlement 0 – 10.5 mm – Central West
	Zone 5 : Edge Markers

(Table reproduced from IMC Report D5249/E)

Table 2

Estimate of Movement of Settlement Markers (Based on Data to August 2001)

		Estimate of movement of settlement markers (mm)								
Row		1	2	3	4	5	6	7	8	9
Z	IMC d α δS_{Pre} (25 yrs)		n/a	n/a	n/a	8.9 0.05 3	n/a			
Y	IMC d α δS_{Pre} (25 yrs)	n/a	n/a	n/a	19.4 0.1 13	18.9 0 0	n/a			
X	IMC d α δS_{Pre} (25 yrs)	23.2 0.6 93	n/a	n/a	33.6 0.15 34	33.3 0.2 45	24.0 0.1 16	n/a		
W	IMC d α δS_{Pre} (25 yrs)		47.1 2.9 912	44.9 0.2 60	47.7 0.1 32	46.2 0.2 62	24.0 0.05 8	n/a	n/a	
V	IMC d α δS_{Pre} (25 yrs)			54.2 0.6 217	60.1 0.2 80	62.0 0.2 83	24.0 0.05 8	n/a	n/a	
U	IMC d α δS_{Pre} (25 yrs)				29.6 0.6 119	35.0 0.6 140	33.7 0.05 11	31.2 0.05 10	n/a	n/a
T	IMC d α δS_{Pre} (25 yrs)								n/a	n/a

d - Depth of compacted fill (m)
α - Alpha value interpretated from Strain Graphs
δS_{Pre} (25 yrs) - Estimate of settlement in 25 years (May 2026) (mm)

Zone 1 : Settlement (δ) less than 0 mm (heave) – Northern Area
Zone 2 : Settlement (δ) less than 0 mm (heave) – Southern Area
Zone 3 : Settlement (δ) = 0 – 11.5 mm
Zone 4 : Settlement (δ) > 11.5 mm
Zone 5 : Replaced Markers (Western Crest)

(Table reproduced from IMC Report D5249/E)

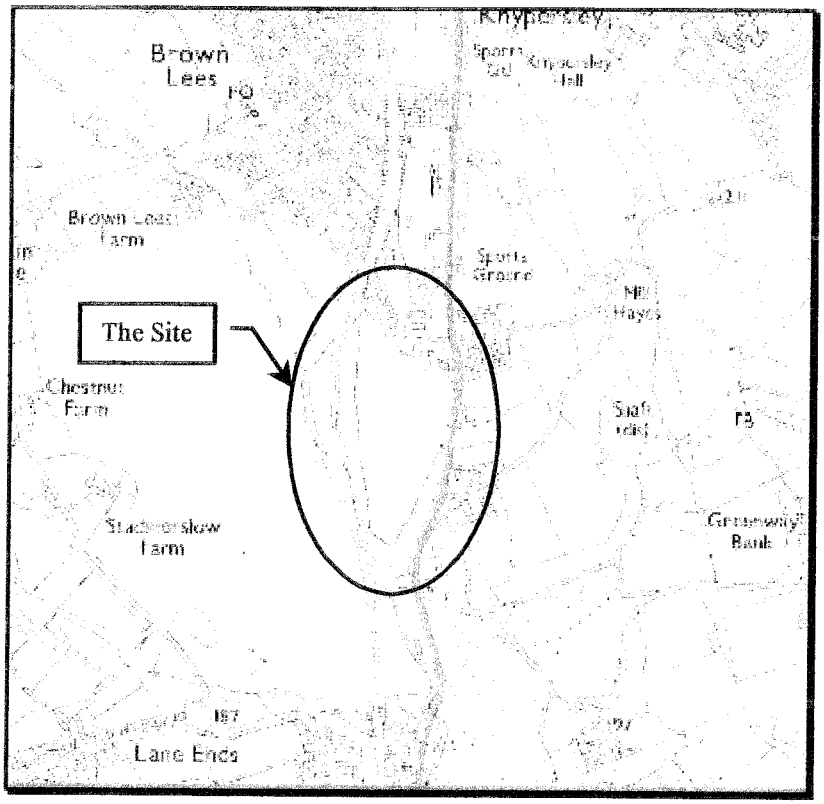
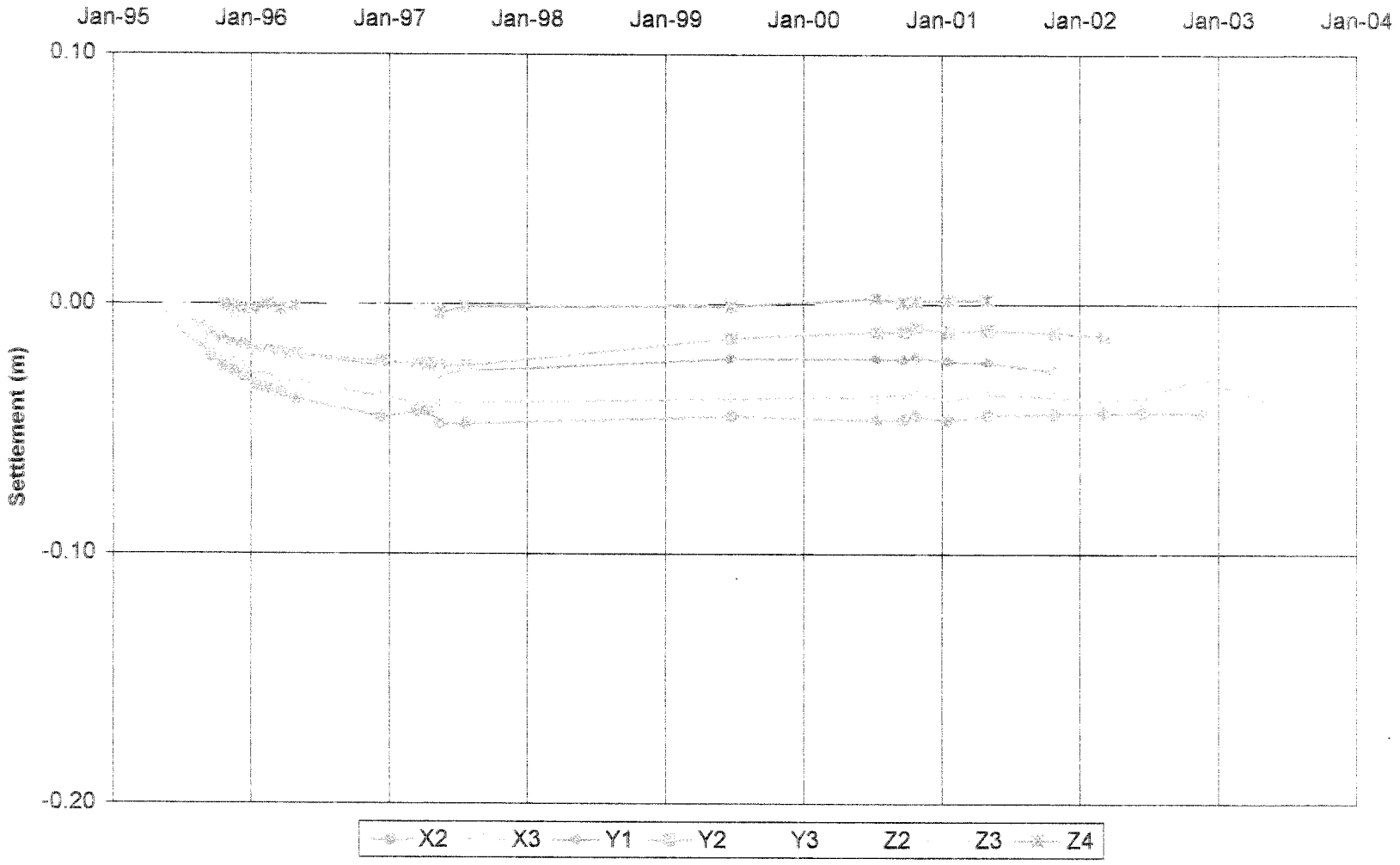


Figure 1 : Site Location Plan

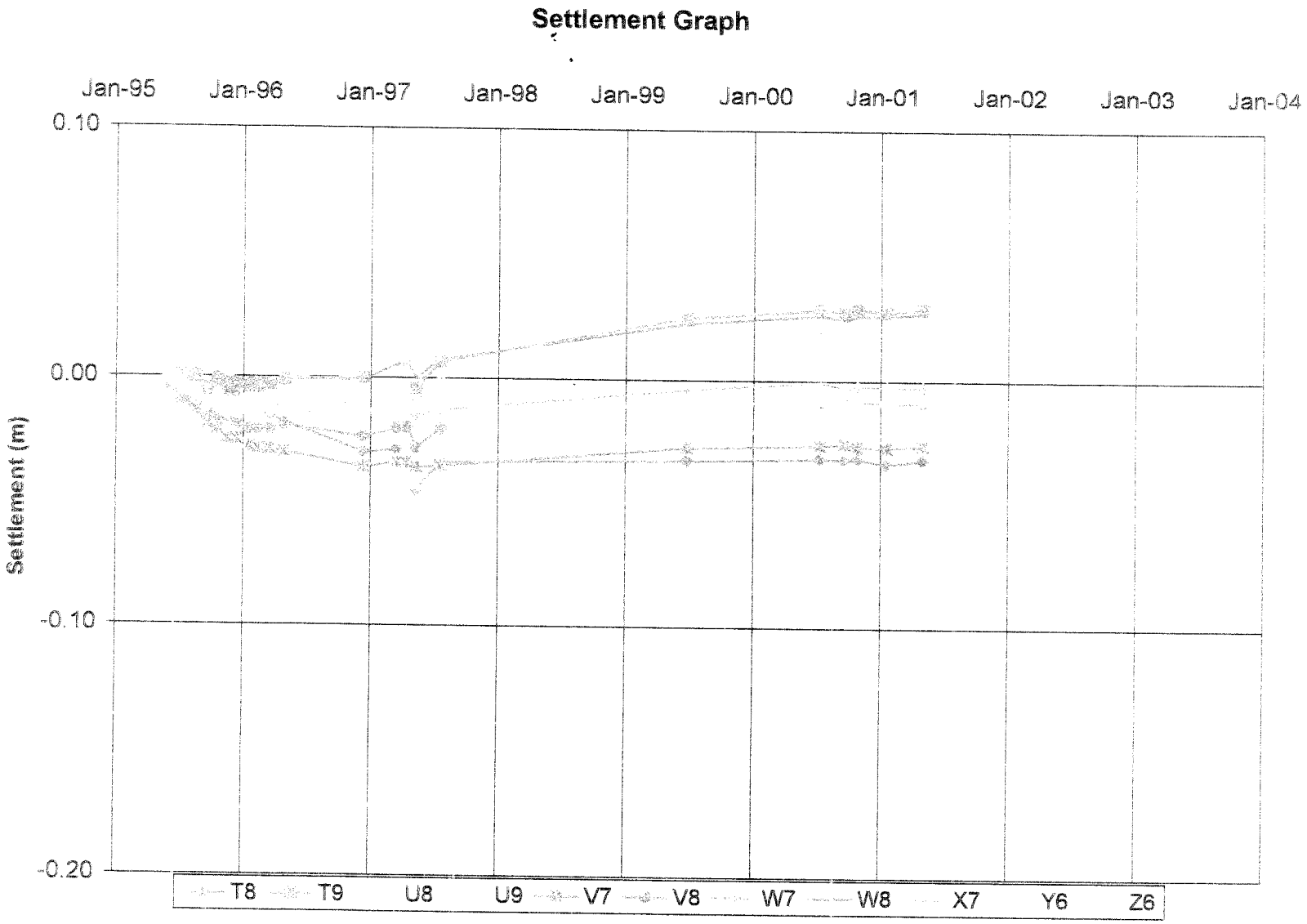
Settlement Graph



IMC

Brown Lees Redevelopment
Zone 1 : Settlement (mm)

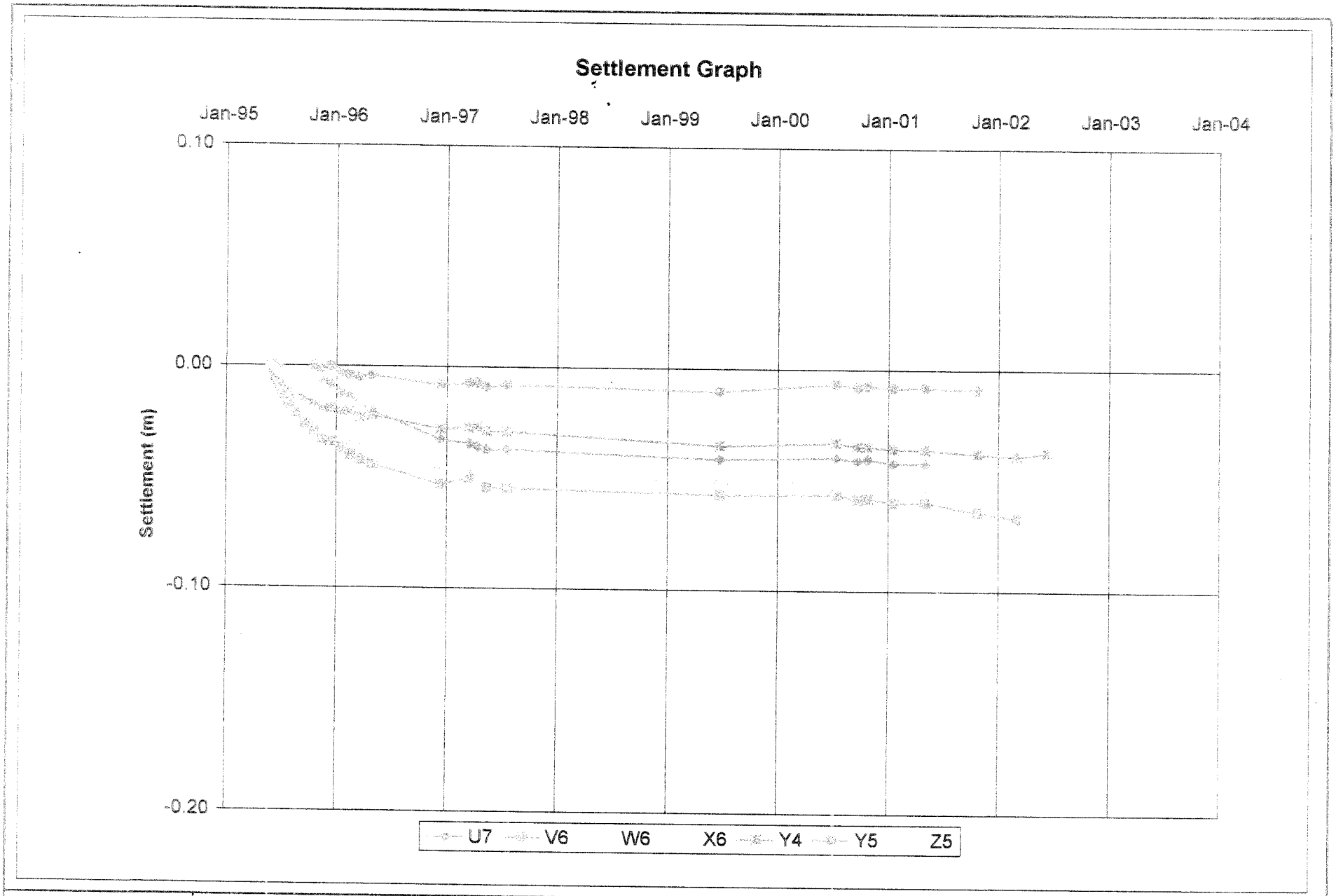
Fig No. 2



IMC

Brown Lees Redevelopment
Zone 2 : Settlement (mm)

Fig No.
3

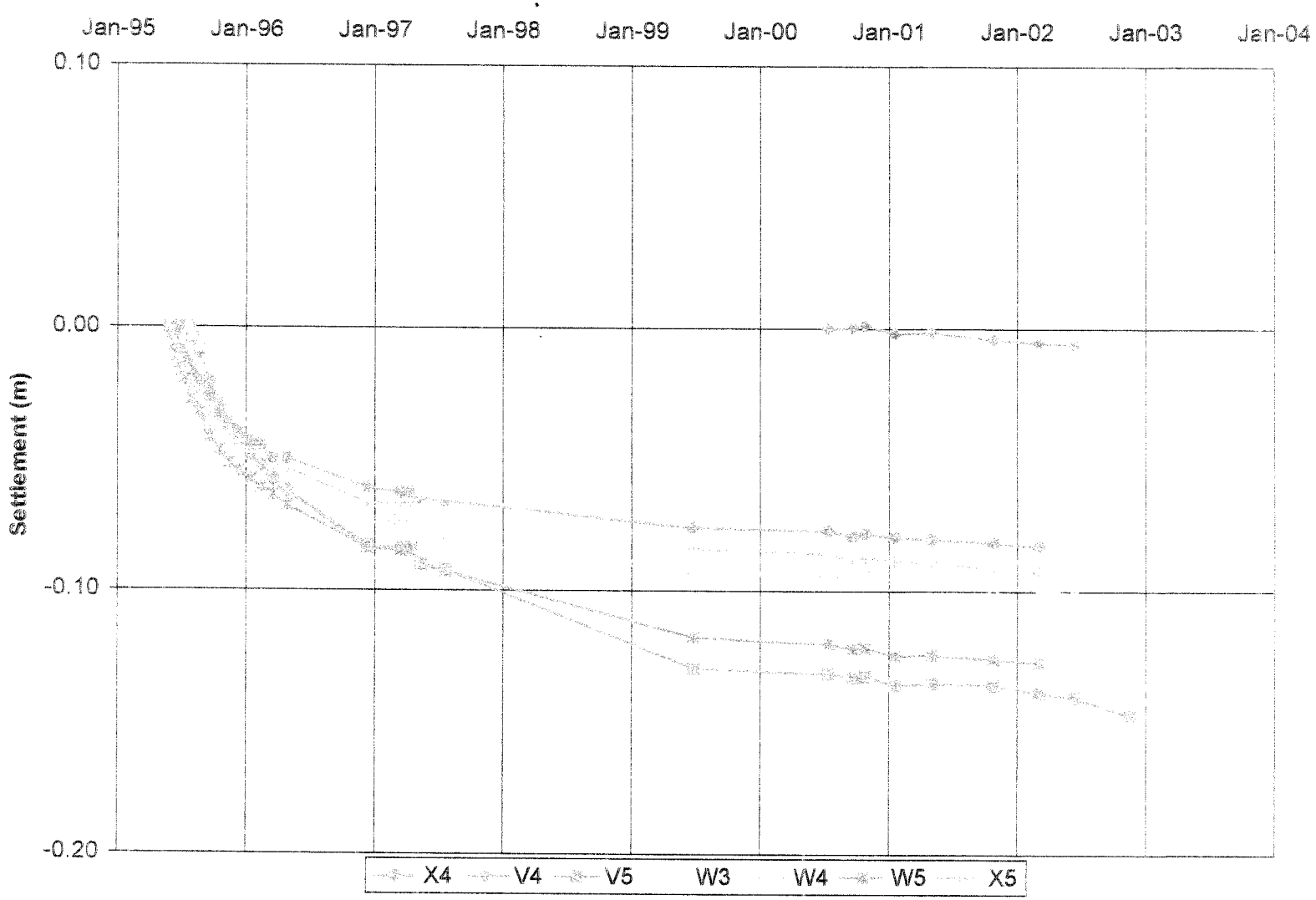


IMC

Brown Lees Redevelopment
Zone 3 : Settlement (mm)

Fig No. 4

Settlement Graph

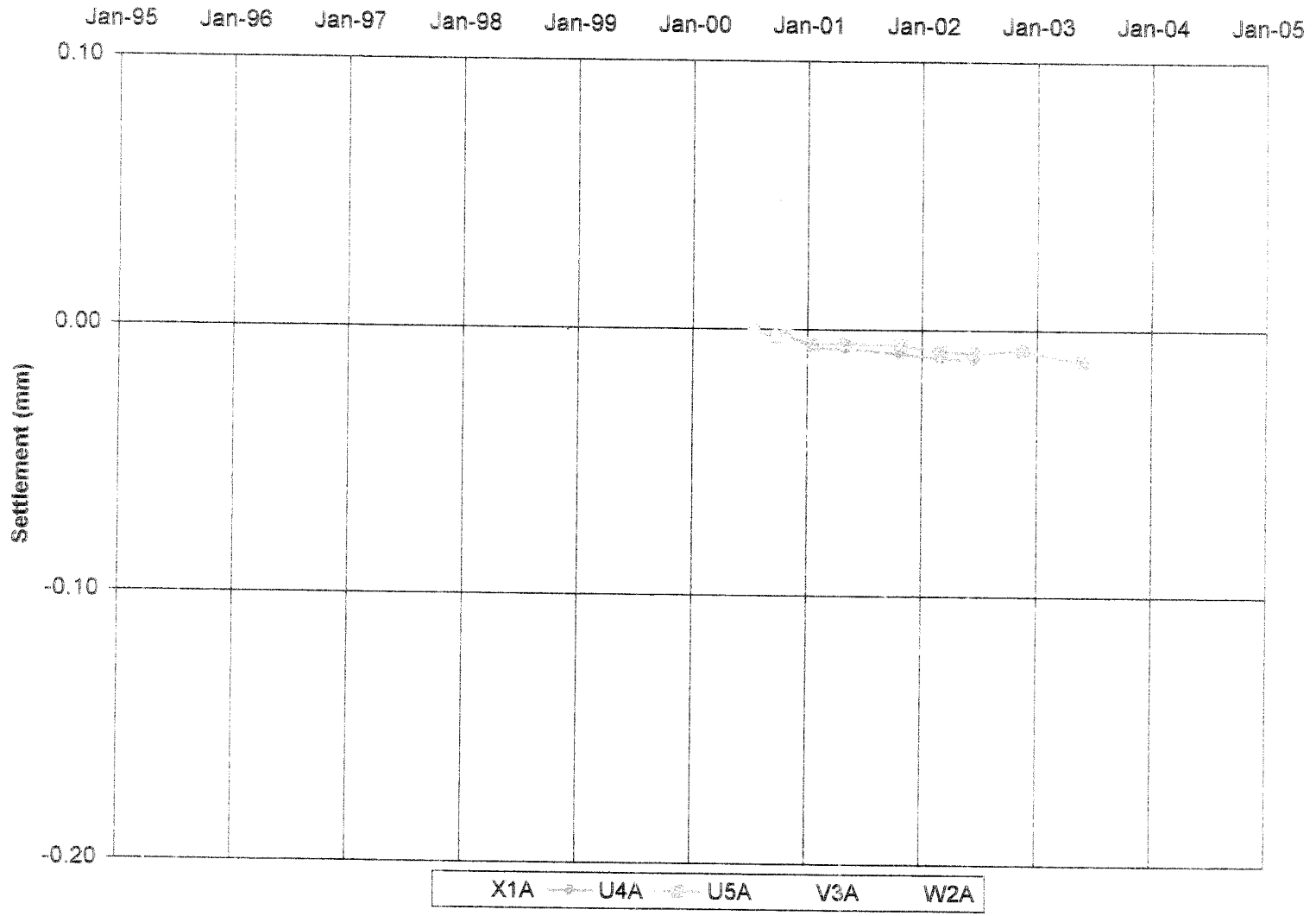


IMC

Brown Lees Redevelopment
Zone 4 : Settlement (mm)

Fig No. 5

Settlement Graph



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Brown Lees Redevelopment
Zone 5 : Settlement (mm)

Fig No. 6