





# Croxley Rail Link: Cost Report

Croxley Rail Link

*Document Ref:*  
1019324-ENG-NNN-RPT-KBW-115

7 September 2011

**mouchel**   
*Produced for*  
Hertfordshire County Council

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# Document Control Sheet

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## Record of Issue

Issue	Status	Author	Date	Check	Date	Authorised	Date
A	Final	K Wilson	24/8/11	M.Swan	24/8/11	K.Wilson	24/8/11
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C	Final	K Wilson	7/9/11	M.Swan	7/9/11	K Wilson	7/9/11

## Distribution

Organisation	Contact	Copies
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# 1 Executive Summary

	Item	(%)	Dec 10 Budget at 1Q07 (£)	(%)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	(%)	August 2011 estimate @ 2Q11 (£)	Extra/Saving (£)	Revenue potential (£)	Resale value (£)	Comments
1	Stations		7,658,850		8,424,735		11,690,000	3,265,265			Reflects current LU requirements of staffed stations. Previous assumption was for unstaffed. Target figures included
2	New structures		6,786,000		7,464,600		10,050,000	2,585,400			Design developed
3	Existing structures		1,717,675		1,889,443		1,760,000	-129,443			Design developed
4	Earthworks and retaining walls		2,500,000		2,750,000		2,600,000	-150,000			Design developed
5	Demolitions		86,000		94,600		230,000	135,400			Demolitions calculated based on detailed methodology
6	Permanent way		5,329,500		5,862,450		8,400,000	2,537,550			Design developed
7	Removal of ballast		125,630		138,193		0	-138,193			Assumed used in fill
8	Fencing		500,000		550,000		640,000	90,000			Design developed
9	Power		6,088,500		6,697,350		12,820,000	6,122,650			Includes £2.7m for substation. Design developed.
10	Service diversions		370,000		407,000		400,000	-7,000			Provisional sums pending further investigations
11	Signalling		10,800,000		11,880,000		16,920,000	5,040,000			Based on quotation
12	Telecomms		2,520,000		2,772,000		0	-2,772,000			Included in other cost items
13	Environmental		350,000		385,000		385,000	0			Not updated
14	Landscape/streetscape/highways alterations		0		0		0	0			Separate budget
	<b>Sub-Totals</b>	<b>C/F</b>	<b>44,832,155</b>		<b>49,315,371</b>		<b>65,895,000</b>	<b>16,579,630</b>			

	<b>Sub-Totals</b>	<b>B/F</b>	<b>44,832,155</b>		<b>49,315,371</b>		<b>65,895,000</b>	<b>16,579,630</b>			
15	Preliminaries	21.30%	9,549,249		10,504,174		10,320,000	-184,174			Includes target LU management costs
	<b>Sub-Totals</b>		<b>54,381,404</b>		<b>59,819,544</b>		<b>76,215,000</b>	<b>16,395,456</b>			
16	Profit & O/H	7.50%	4,078,605		4,486,466	5.00%	2,964,750	-1,521,716			Reduced Target figure included
17	Design	6.36%	3,458,657		3,804,523		3,300,000	-504,523			
18	PM inc legals	4.00%	2,175,256		2,392,782		2,150,000	-242,782			
19	Assurance	3.00%	1,631,442		1,794,586		500,000	-1,294,586			
20	Third party costs		7,780,951		8,559,046		0	-8,559,046			
21	Possession costs		500,000		550,000		540,000	-10,000			
	<b>Sub-Totals</b>		<b>74,006,316</b>		<b>81,406,947</b>		<b>85,669,750</b>	<b>4,262,803</b>			
22	Rolling stock		8,302,000		9,132,200		9,000,000	-132,200			Target figure included; Quotation awaited
23	Risk		12,700,000		13,970,000		5,100,000	-8,870,000			
24	Land		4,000,000		4,400,000		4,240,000	-160,000			Excluded
25	TWA		0		0		0	0			
26	Third party compensation		250,000		275,000		160,000	-115,000			
27	Monitoring		370,031		407,034		200,000	-207,034			Met Line and borehole monitoring during contract
	<b>Sub-Totals</b>	<b>@2007</b>	<b>99,628,347</b>	<b>@2011</b>	<b>109,591,182</b>		<b>104,369,750</b>	<b>-5,221,432</b>			
28	Inflation 2007-2014	20.27%	20,196,165	Inflation 2011-2015	10,233,330		12,470,000	2,236,670			Based on F&A indices
	<b>Total Estimated Cost</b>		<b>119,824,512</b>		<b>119,824,512</b>		<b>116,839,750</b>	<b>-2,984,762</b>			
	<b>Say Total Estimated Cost</b>						<b>116,800,000</b>				

## 2. Scope

Hertfordshire County Council commissioned Mouchel to prepare Stage C estimates for the Croxley Rail Link as part of a BAFB submission to the Department of Transport. This cost report sets out details of these estimates, details Value Engineering exercises undertaken, and sets down the approach to calculating Risk Allowances.



### 3. Estimate

The following information was used in preparation of this estimate:

#### Power Supplies

- 1 Croxley Rail Link - Preliminary High Level Traction Power Supply Equipment Quantities Prepared by Parsons Brinckerhoff Ltd
- 2 Croxley Rail Link - Preliminary High Level Traction Power Supply Equipment Quantities Prepared by Parsons Brinckerhoff Ltd dated 4 August 2011
- 3 Croxley Rail Link - Preliminary High Level Traction Power Supply Equipment Quantities Prepared by Parsons Brinckerhoff Ltd dated 11 August 2011

#### Earthworks Permanent Way and Platform Extensions

Drawing Prefix	Number	Rev.	Title
1019324/GEO/GEN/GEN/FOD/00/	20001		General Layout
1019324/GEO/GEN/GEN/FOD/00/	20002		Walkover Summary Details
1019324/GEO/GEN/GEN/FOD/00/	20003		Indicative Route Geology & Historical Exploratory Holes
1019324/GEO/GEN/GEN/FOD	20101	A	Layout showing extent of Earthworks
1019324/GEO/GEN/GEN/FOD	20102	A	Layout showing extent of Retaining Structures
1019324/GEO/GEN/GEN/FOD	20103	A	Layout - Viaduct to Ascot Rd Bridge
1019324/GEO/GEN/GEN/FOD	20104	A	Layout - Metropolitan LineTie-in
1019324/GEO/GEN/GEN/FOD	20201	A	Cross Section of Cuttings
1019324/GEO/GEN/GEN/FOD	20301	A	Cross Section of Embankments (Gabions)
1019324/GEO/GEN/GEN/FOD	20401	A	Cross Section of Embankments (Reinforced Soil)
1019324/GEO/EWK/GEN/FOD	20402	A	Cross Section - Modular Block Faced Vertical Reinforced Soil Wall
1019324/GEO/EWK/GEN/FOD	20403	A	Cross Section - Soil Wall & Culvert (Section B-B)
1019324/GEO/EWK/GEN/FOD	20404	A	Cross Section - Existing Section at 74Km 888m
1019324/GEO/EWK/GEN/FOD	20405	A	Cross Section - Proposed Section at 74Km 888m

Un-numbered	Un-numbered		Cross Section - Viaduct to Ascot Rd Bridge - Section Location Plan
Un-numbered	Un-numbered		Cross Section 33-37 Location Plan
Un-numbered	Un-numbered		Revised Cross Sections for Geotech (29/3/11)
1019324/ENG/PWY/GEN/FOD	12101	A	Indicative Track Geometry Details - Sheet 1
1019324/ENG/PWY/GEN/FOD	12102	A	Indicative Track Geometry Details - Sheet 2
1019324/ENG/PWY/GEN/FOD	12103	A	Indicative Track Geometry Details - Sheet 3
1019324/ENG/PWY/GEN/FOD	12104	A	Indicative Track Geometry Details - Sheet 4
1019324/ENG/PWY/GEN/FOD	12105	A	Indicative Track Geometry Details - Sheet 5
1019324/ENG/PWY/GEN/FOD	12106	A	Indicative Track Geometry Details - Sheet 6
1019324/ENG/PWY/GEN/FOD	12107	A	Indicative Track Geometry Details - Sheet 7
1019324/ENG/PWY/GEN/FOD	12108	A	Indicative Track Geometry Details - Sheet 8
1019324/ENG/PWY/WFJ/FOD	12213	A	Watford Junction Station - P.Way Layout Option 2
NR/CIV/SD	3012	P1	Standard Platform Design - Traditional Front Wall Platform - Sheet 3 of 10 - Typical Cross Section

## Existing Structures

### 1 Mouchel Conceptual Design Statements

Conceptual Design Statement for Bridge Strengthening to ELR WCG No.2 Brook - Document Number 1019324-ENG-BRI-CDS-FNF-039 Ver A

Conceptual Design Statement for Bridge Works to ELR WCG No.3 River Colne North Bridge - Document Number 1019324-ENG-BRI-CDS-BBS-040 Ver A

Conceptual Design Statement for Bridge Works to ELR CCG2 No.1 River Colne Side Channel - Document Number 1019324-ENG-BRI-CJY-041 Ver A

Conceptual Design Statement for Widening and Repairs to ELR CCG2 No.2 Stadium Station Approach - Document Number 1019324-ENG-BRI-GDM-042 Ver A

### 2 Mouchel Feasibility Reports

Mouchel Conceptual Design Statement for New Track Drainage - Document Number 1019324-ENG-DNG-CDS-LTD-095 Rev 01

Mouchel Feasibility Report for Overline Bridges Croxley Branch Line: Disused Section - Document Number 1019324-ENG-BRI-RPT-CJY-031 B

Mouchel Feasibility Report for Underline Bridges Croxley Branch Line: Operational Section - Document Number 1019324-ENG-BRI-RPT-FNF-048

Mouchel Feasibility Report for Overline Bridges Croxley Branch Line: Operational Section - Document Number 1019324-ENG-BRI-RPT-FNF-030 Ver B

### 3 Mouchel Drawings

1019324 - ENG-BRI-CMSC-GDM-020 Ver B - Croxley Rail Link Development - Bridge Location Plan

1019324 - ENG-BRI-WCG-FOD-10111 Rev A - Existing GA - Bridge ID WCG No.2 Brook

1019324 - ENG-BRI-WCG-FOD-10112 Rev A - Proposed GA - Bridge ID WCG No.2 Brook

1019324 - ENG-BRI-WCG-FOD-10212 Rev A - Existing GA - Bridge ID WCG No.3 River Colne (North)

1019324 - ENG-BRI-WCG-FOD-10213 Rev A - Proposed GA - Bridge ID WCG No.3 River Colne (North)

1019324 - ENG-BRI-WCG-S-10310 Rev A - GA - Bridge ID WCG No.3A River Colne South Bridge

1019324 - ENG-BRI-CCG2-FOD-10411 Rev A - Existing GA - Bridge ID CCG2 No.1 River Colne Side Channel

1019324 - ENG-BRI-CCG2-FOD-10412 Rev A - Proposed GA - Bridge ID CCG2 No.1 River Colne Side Channel

1019324 - ENG-BRI-CCG2-FOD-10513 Rev A - Existing GA - Bridge ID CCG2 No.2 (Sheet 1 of 3)

1019324 - ENG-BRI-CCG2-FOD-10514 Rev A - Existing GA - Bridge ID CCG2 No.2 (Sheet 2 of 3)

1019324 - ENG-BRI-CCG2-FOD-10515 Rev A - Existing GA - Bridge ID CCG2 No.2 (Sheet 3 of 3)

1019324 - ENG-BRI-CCG2-FOD-10516 Rev A - Proposed GA - Bridge ID CCG2 No.2 (Sheet 1 of 3)

1019324 - ENG-BRI-CCG2-FOD-10517 Rev A - Proposed GA - Bridge ID CCG2 No.2 (Sheet 2 of 3)

1019324 - ENG-BRI-CCG2-FOD-10518 Rev A - Proposed GA - Bridge ID CCG2 No.2 (Sheet 3 of 3)

Draft Plan and Section of CCG2 No.5 Ascot Road Bridge

**Drainage**

1019324/ENG/DNG/CCG/FOD/80101	REV A
1019324/ENG/DNG/CCG/FOD/80102	REV A
1019324/ENG/DNG/CCG/FOD/80103	REV A
1019324/ENG/DNG/CCG/FOD/80104	REV A
1019324/ENG/DNG/CCG/FOD/80105	REV A
1019324/ENG/DNG/CCG/FOD/80106	REV A
1019324/ENG/DNG/CCG/FOD/80107	REV A
1019324/ENG/DNG/CCG/FOD/80108	REV A
1019324/ENG/PWY/GEN/FOD/12304	REV A
1019324-ENG-DNG-CDS-LTD-095 Rev 01_draft5_.pdf	

**Viaduct**

1019324-ENG-BRI-ASR-FOD-11001	Version B
1019324-ENG-BRI-ASR-FOD-11002	Version B
1019324-ENG-BRI-ASR-FOD-11003	Version B
1019324-ENG-BRI-ASR-FOD-11005	Version B
1019324-ENG-BRI-ASR-FOD-11006	Version B
1019324-ENG-BRI-ASR-FOD-11007	Version B
1019324-ENG-BRI-ASR-FOD-11008	Version B
1019324-ENG-BRI-ASR-FOD-11009	Version B
1019324-ENG-BRI-ASR-FOD-11010	Version B
1019324-ENG-BRI-ASR-FOD-11011	Version B
1019324-ENG-BRI-ASR-FOD-11015	Version B

**Bridge**

1019324-ENG-BRI-ASR-FOD-11001	Version B
1019324-ENG-BRI-ASR-FOD-11002	Version B
1019324-ENG-BRI-ASR-FOD-11003	Version B
1019324-ENG-BRI-ASR-FOD-11005	Version B
1019324-ENG-BRI-ASR-FOD-11006	Version B
1019324-ENG-BRI-ASR-FOD-11007	Version B
1019324-ENG-BRI-ASR-FOD-11008	Version B
1019324-ENG-BRI-ASR-FOD-11009	Version B
1019324-ENG-BRI-ASR-FOD-11010	Version B
1019324-ENG-BRI-ASR-FOD-11011	Version B

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1019324-ENG-BRI-ASR-FOD-11015

Version B

**Ascot Road Station****1019324-ARC-STN-ARS-FOD-**

ASCOT ROAD SITE PLAN	A1	1:500	60100	
ASCOT ROAD KEY PLAN	A1	1:250	60110	B
ASCOT ROAD CONCOURSE PLAN	A1	1:100	60120	B
ASCOT ROAD PLATFORM PLAN 1OF3	A1	1:100	60125	B
ASCOT ROAD PLATFORM PLAN 2OF3	A1	1:100	60126	B
ASCOT ROAD PLATFORM PLAN 3OF3	A1	1:100	60127	B
ASCOT ROAD ROOF PLAN	A1	1:100	60130	
ASCOT ROAD ELEVATIONS	A1	1:100	60151	
ASCOT ROAD ELEVATIONS	A1	1:100	60152	
ASCOT ROAD PLATFORM ELEVATION	A1	1:100	60153	
ASCOT ROAD PLATFORM ELEVATION	A1	1:100	60154	
ASCOT ROAD SECTIONS	A1	1:100	60171	B
ASCOT ROAD SECTIONS	A1	1:100	60172	B

**Watford Hospital Station****1019324-ARC-STN-WWS-FOD-**

WATFORD HOSPITAL SITE PLAN	A1	1:500	60200	
WATFORD HOSPITAL KEY PLAN	A1	1:250	60210	B
WATFORD HOSPITAL CONCOURSE PLAN	A1	1:100	60220	B
WATFORD HOSPITAL PLATFORM PLAN 1OF3	A1	1:100	60225	B
WATFORD HOSPITAL PLATFORM PLAN 2OF3	A1	1:100	60226	B
WATFORD HOSPITAL PLATFORM PLAN 3OF3	A1	1:100	60227	B
WATFORD HOSPITAL PLATFORM PLAN 4OF4	A1	1:100	60228	B
WATFORD HOSPITAL ROOF PLAN	A1	1:100	60230	A
WATFORD HOSPITALELEVATIONS	A1	1:100	60251	A
WATFORD HOSPITALELEVATIONS	A1	1:100	60252	A
WATFORD HOSPITALL PLATFORM ELEVATION	A1	1:100	60253	
WATFORD HOSPITALL PLATFORM ELEVATION	A1	1:100	60254	
WATFORD HOSPITAL SECTIONS	A1	1:100	60271	B

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WATFORD HOSPITAL CURRENT PROPOSALS (1019324-ARC-STN-)	A1	1:200	WWS-FOD-60900	A
WATFORD HOSPITAL OPTION A PLAN (1019324-ARC-STN-)	A1	1:200	WWS-FOD-60901	A
WATFORD HOSPITAL OPTION B PLAN (1019324-ARC-STN-)	A1	1:200	WWS-FOD-60902	A
WATFORD HOSPITAL OPTION C PLAN (1019324-ARC-STN-)	A1	1:200	WWS-FOD-60903	A
WATFORD HOSPITAL OPTION APPRAISAL (1019324-ARC-STN-)	A1	1:200	WWS-FOD-60904	A
VIADUCT SUPPORT	A1	1:50	VDT-SKT-60905	

**Watford High Street Station**

**1019324-ARC-STN-WFH-FOD**

WATFORD HIGH STREET SITE PLAN	A1	1:500	60300	
WATFORD HIGH STREET KEY PLAN	A1	1:100	60310	A
WATFORD HIGH STREET CONCOURSE PLAN	A1	1:100	60320	A
WATFORD HIGH STREET PLATFORM PLAN	A1	1:100	60325	A
WATFORD HIGH STREET PLATFORM PLAN	A1	1:100	60326	A
WATFORD HIGH STREET PLATFORM PLAN	A1	1:100	60327	A
WATFORD HIGH STREET ELEVATION	A1	1:100	60351	
WATFORD HIGH STREET PLATFORM ELEV.	A1	1:100	60353	
WATFORD HIGH STREET SECTION	A1	1:100	60371	
WATFORD HIGH STREET KEY PLAN OPTION 2A	A1	1:100	60380	A
WATFORD HIGH STREET CONCOURSE PLAN OPTION 2A	A1	1:100	60381	A
WATFORD HIGH STREET PLATFORM PLAN OPTION 2A	A1	1:100	60382	A
WATFORD HIGH STREET KEY PLAN OPTION 2B	A1	1:100	60385	A
WATFORD HIGH STREET CONCOURSE PLAN OPTION 2B	A1	1:100	60326	A

**Watford Junction Station**

**1019324-ARC-STN-WFH-FOD**

WATFORD HIGH STREET SITE PLAN	A1	1:500	60300	
WATFORD HIGH STREET KEY PLAN	A1	1:100	60310	A
WATFORD HIGH STREET CONCOURSE PLAN	A1	1:100	60320	A
WATFORD HIGH STREET PLATFORM PLAN	A1	1:100	60325	A
WATFORD HIGH STREET PLATFORM PLAN	A1	1:100	60326	A
WATFORD HIGH STREET PLATFORM PLAN	A1	1:100	60327	A

WATFORD HIGH STREET ELEVATION	A1	1:100	60351	
WATFORD HIGH STREET PLATFORM ELEV.	A1	1:100	60353	
WATFORD HIGH STREET SECTION	A1	1:100	60371	
WATFORD HIGH STREET KEY PLAN OPTION 2A	A1	1:100	60380	A
WATFORD HIGH STREET CONCOURSE PLAN OPTION 2A	A1	1:100	60381	A
WATFORD HIGH STREET PLATFORM PLAN OPTION 2A	A1	1:100	60382	A
WATFORD HIGH STREET KEY PLAN OPTION 2B	A1	1:100	60385	A
WATFORD HIGH STREET CONCOURSE PLAN OPTION 2B	A1	1:100	60326	A

This estimate is based on:

- 1 Second quarter 2011 rates and prices  
Inflation has been calculated from second quarter 2011 up to first quarter 2015, being half way through
- 2 the proposed construction period
- 3 Inflation calculations have been based on Franklin & Andrews Rail Tender Indices July 2011
- 4 Alternative inflation calculations have been based on an allowance of 2.5% per annum
- 5 Procurement strategy has been assumed to be as follows:
  - 5.1 Traditional contract let by Hertfordshire County Council for all civils and rail works  
London Underground to procure rolling stock, signalling and telecommunications, gatelines and ticket machines
  - 5.2 Enabling works contracts to be let for treating Japanese Knotweed and other problem vegetation, as well as undergrowth clearance.
- 6 Risk allowance is based on calculations following a Risk Workshop session  
Station estimates for Ascot Road, Watford Hospital, Watford High Street and Watford Junction stations
- 7 are based on figures provided by Acanthus  
Signalling, telecommunications and rolling stock estimates are based on figures provided by London
- 8 Underground
- 9 Activity durations and gang sizes provided by Vinci
- 10 Outline programme dated 03-06-11 ref VINCI/CRL/PROG/001 provided by Vinci
- 11 Risk workshop held on 16th June 2011
- 12 Possessions being booked well in advance
- 13 Signalling being carried out between January and December 2014
- 14 Scope and cost review meeting held on 10th August 2011

### Ascot Road Station Assumptions

- 1 Glazed Elevations to be Schuco 50 or similar
- Expanded metal cladding to be galvanized expanded mesh attached to 100mm medium density block cavity wall
- 2 (uninsulated)
- External Masonry walls to be outer skin in facings pc £400 per 1000, non ferrous ties and 100mm
- 3 medium density block inner skin, uninsulated other than to habitable rooms
- 4 Public areas to have ceramic tiles PC £90 per m2 supplied and laid on 50mm cement and sand screed
- Platform finishes to be standard copers, blister tile tactile strip and precast concrete paved surfacing pc £50 per m2
- 5 laid
- 6 Metal tile suspended ceiling to public areas pc £120/m2
- 7 Platform canopy 180m2 at £1200 per m2 including structure
- 8 Station Totems pc £2,500 each
- 9 Platform seating PC £1500 each
- 10 Provisional sum for signage £100,000
- 11 Provisional sum for below ground drainage foul and surface water including connections £100,000
- 12 Internal walls to be left fair faced and undecorated

### Watford Hospital Station Assumptions

#### Architectural

- 1 Glazed Elevations to be Schuco 50 or similar
- Expanded metal cladding to be galvanized expanded mesh attached to 100mm medium density block cavity wall
- 2 (uninsulated)
- External Masonry walls to be outer skin in facings pc £400 per 1000, non ferrous ties and 100mm
- 3 medium density block inner skin, uninsulated other than to habitable rooms
- 4 Public areas to have ceramic tiles PC £90 per m2 supplied and laid on 50mm cement and sand screed
- Platform finishes to be standard copers, blister tile tactile strip and precast concrete paved surfacing pc £50 per m2
- 5 laid
- 6 Metal tile suspended ceiling to public areas pc £120/m2
- 7 Platform canopy 120m2 at £1200 per m2 including structure
- 8 Station Totems pc £2,500 each
- 9 56 Platform seats PC £280 each
- 10 Provisional sum for signage £100,000
- 11 Provisional sum for below ground drainage foul and surface water including connections £100,000
- 12 Platform back screens to be 1800mm high pallisade fences not metal panellised screens indicated
- 13 Internal walls to be left fair faced and undecorated

#### Structural

- 1 Provisional quantity of 2000m3 allowed for excavation and disposal



**Exclusions**

- 1 VAT
- 2 Local Authority and other fees
- 3 TWA costs
- 4 Client team costs
- 5 Finance charges
- 6 Public Enquiry costs

7 Any costs relating to closure of Metropolitan Line to Watford or for converting to stabling

8 EIA costs

9 Stamp duty

10 Planning application fees

11 Building Control fees

12 Section 106 & Section 278 payments

13 Special bonds

14 Special contract conditions

15 Hand held fire extinguishers

16 IT and infrastructure

17 Shopfronts and fire curtains to retail units

18 Tax allowances and grants

- 19 Capital allowances
- 20 Agency/appraisal and marketing costs
- 21 Stopping up orders
- 22 Optimism bias
- 23 Public highway work
- 24 Non eligible costs

Estimate Summary											
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1	Stations		7,658,850		8,424,735		11,690,000	3,265,265			Reflects current LU requirements of staffed stations. Previous assumption was for unstaffed. Target figures included
2	New structures		6,786,000		7,464,600		10,050,000	2,585,400			Design developed
3	Existing structures		1,717,675		1,889,443		1,760,000	-129,443			Design developed
4	Earthworks and retaining walls		2,500,000		2,750,000		2,600,000	-150,000			Design developed
5	Demolitions		86,000		94,600		230,000	135,400			Demolitions calculated based on detailed methodology
6	Permanent way		5,329,500		5,862,450		8,400,000	2,537,550			Design developed
7	Removal of ballast		125,630		138,193		0	-138,193			Assumed used in fill
8	Fencing		500,000		550,000		640,000	90,000			Design developed
9	Power		6,088,500		6,697,350		12,820,000	6,122,650			Includes £2.7m for substation. Design developed.
10	Service diversions		370,000		407,000		400,000	-7,000			Provisional sums pending further investigations
11	Signalling		10,800,000		11,880,000		16,920,000	5,040,000			Based on quotation
12	Telecomms		2,520,000		2,772,000		0	-2,772,000			Included in other cost items
13	Environmental		350,000		385,000		385,000	0			Not updated
14	Landscape/streetscape/highways alterations		0		0		0	0			Separate budget
	<b>Sub-Totals</b>	<b>C/F</b>	<b>44,832,155</b>		<b>49,315,371</b>		<b>65,895,000</b>	<b>16,579,630</b>			

	<b>Sub-Totals</b>	<b>B/F</b>	<b>44,832,155</b>		<b>49,315,371</b>		<b>65,895,000</b>	<b>16,579,630</b>			
15	Preliminaries	21.30%	9,549,249		10,504,174		10,320,000	-184,174			Includes target LU management costs
	<b>Sub-Totals</b>		<b>54,381,404</b>		<b>59,819,544</b>		<b>76,215,000</b>	<b>16,395,456</b>			
16	Profit & O/H	7.50%	4,078,605		4,486,466	5.00%	2,964,750	-1,521,716			Reduced Target figure included
17	Design	6.36%	3,458,657		3,804,523		3,300,000	-504,523			
18	PM inc legals	4.00%	2,175,256		2,392,782		2,150,000	-242,782			
19	Assurance	3.00%	1,631,442		1,794,586		500,000	-1,294,586			
20	Third party costs		7,780,951		8,559,046		0	-8,559,046			
21	Possession costs		500,000		550,000		540,000	-10,000			
	<b>Sub-Totals</b>		<b>74,006,316</b>		<b>81,406,947</b>		<b>85,669,750</b>	<b>4,262,803</b>			
22	Rolling stock		8,302,000		9,132,200		9,000,000	-132,200			Target figure included; Quotation awaited
23	Risk		12,700,000		13,970,000		5,100,000	-8,870,000			
24	Land		4,000,000		4,400,000		4,240,000	-160,000			Excluded
25	TWA		0		0		0	0			
26	Third party compensation		250,000		275,000		160,000	-115,000			
27	Monitoring		370,031		407,034		200,000	-207,034			Met Line and borehole monitoring during contract
	<b>Sub-Totals</b>	<b>@2007</b>	<b>99,628,347</b>	<b>@2011</b>	<b>109,591,182</b>		<b>104,369,750</b>	<b>-5,221,432</b>			
28	Inflation 2007-2014	20.27%	20,196,165	Inflation 2011-2015	10,233,330		12,470,000	2,236,670			Based on F&A indices
	<b>Total Estimated Cost</b>		<b>119,824,512</b>		<b>119,824,512</b>		<b>116,839,750</b>	<b>-2,984,762</b>			
	<b>Say Total Estimated Cost</b>						<b>116,800,000</b>				

Estimate Summary With Inflation at 2.5% per annum											
Ref	Item	(%)	Dec 10 Budget at 1Q07 (£)	(%)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	(%)	August 2011 estimate @ 2Q11 (£)	Extra/Saving (£)	Revenue potential (£)	Resale value (£)	Comments
1	Stations		7,658,850		8,424,735		11,690,000	3,265,265			Reflects current LU requirements of staffed stations. Previous assumption was for unstaffed. Target figures included
2	New structures		6,786,000		7,464,600		10,050,000	2,585,400			Design developed
3	Existing structures		1,717,675		1,889,443		1,760,000	-129,443			Design developed
4	Earthworks and retaining walls		2,500,000		2,750,000		2,600,000	-150,000			Design developed
5	Demolitions		86,000		94,600		230,000	135,400			Demolitions calculated based on detailed methodology
6	Permanent way		5,329,500		5,862,450		8,400,000	2,537,550			Design developed
7	Removal of ballast		125,630		138,193		0	-138,193			Assumed used in fill
8	Fencing		500,000		550,000		640,000	90,000			Design developed
9	Power		6,088,500		6,697,350		12,820,000	6,122,650			Includes £2.7m for substation. Design developed.
10	Service diversions		370,000		407,000		400,000	-7,000			Provisional sums pending further investigations
11	Signalling		10,800,000		11,880,000		16,920,000	5,040,000			Based on quotation
12	Telecomms		2,520,000		2,772,000		0	-2,772,000			Included in other cost items
13	Environmental		350,000		385,000		385,000	0			Not updated
14	Landscape/streetscape/highways alterations		0		0		0	0			Separate budget
	<b>Sub-Totals</b>		<b>44,832,155</b>		<b>49,315,371</b>		<b>65,895,000</b>	<b>16,579,630</b>			

	<b>Sub-Totals</b>		<b>44,832,155</b>		<b>49,315,371</b>		<b>65,895,000</b>	<b>16,579,630</b>			
15	Preliminaries	21.30%	9,549,249		10,504,174		10,320,000	-184,174			Includes target LU management costs
	<b>Sub-Totals</b>		<b>54,381,404</b>		<b>59,819,544</b>		<b>76,215,000</b>	<b>16,395,456</b>			
16	Profit & O/H	7.50%	4,078,605		4,486,466	5.00%	2,964,750	-1,521,716			Recalculated; excluding Signalling & Telecomms
17	Design	6.36%	3,458,657		3,804,523		3,300,000	-504,523			Target figure included
18	PM inc legals	4.00%	2,175,256		2,392,782		2,150,000	-242,782			
19	Assurance	3.00%	1,631,442		1,794,586		500,000	-1,294,586			Target figure included
20	Third party costs		7,780,951		8,559,046		0	-8,559,046			Excluded - ineligible costs
21	Possession costs		500,000		550,000		540,000	-10,000			
	<b>Sub-Totals</b>		<b>74,006,316</b>		<b>81,406,947</b>		<b>85,669,750</b>	<b>4,262,803</b>			
22	Rolling stock		8,302,000		9,132,200		9,000,000	-132,200			Target figure included;
23	Risk		12,700,000		13,970,000		5,100,000	-8,870,000			Based on Monte Carlo simulation calculation;
24	Land		4,000,000		4,400,000		4,240,000	-160,000			
25	TWA		0		0		0	0			Excluded
26	Third party compensation		250,000		275,000		160,000	-115,000			
27	Monitoring		370,031		407,034		200,000	-207,034			Met Line and borehole monitoring during contract
	<b>Sub-Totals</b>	<b>@2007</b>	<b>99,628,347</b>	<b>@2011</b>	<b>109,591,182</b>		<b>104,369,750</b>	<b>-5,221,432</b>			
28	Inflation 2007-2014	20.27%	20,196,165	Inflation 2011-2015	10,233,330		6,980,000	-3,253,330			Based on 2.5% inflation per annum
	<b>Total Estimated Cost</b>		<b>119,824,512</b>		<b>119,824,512</b>		<b>111,349,750</b>	<b>-8,474,762</b>			
	<b>Say Total Estimated Cost</b>						<b>111,350,000</b>				

Stations								
Ref	Element		Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1.0	Watford Hospital Station		5,500,000	Target agreed at meeting on 10.8.11 based on Cyril Sweett estimate dated 12.8.11 but with reduced specification and areas				Greater area to allow for staff
	Less O/H&P	5.00%	-275,000					
	<b>Total</b>		<b>5,225,000</b>		<b>4,134,850</b>	<b>4,548,335</b>	<b>676,665</b>	
2.0	Ascot Road Station		5,700,000	Target agreed at meeting on 10.8.11 based on Cyril Sweett estimate dated 18.7.11 but with reduced specification Drainage to back of platform only				Greater area to allow for staff
	Add Drainage		20,000					
	<b>Sub-Total</b>		<b>5,720,000</b>					
	Less O/H&P	5.00%	-286,000					
	<b>Total</b>		<b>5,434,000</b>		<b>3,524,000</b>	<b>3,876,400</b>	<b>1,557,600</b>	
3.0	Watford High Street							
	Work to out of gauge platforms		60,195	See platform extension buildup				Additional requirement
	Add Signage		2,000	From Cyril Sweett base estimate 27.7.11				Additional requirement
	CIS		50,000	From Cyril Sweett base estimate 27.7.11				Additional requirement
Less O/H&P	5.00%	-2,600						
	<b>Total</b>		<b>109,595</b>		<b>0</b>	<b>0</b>	<b>109,595</b>	

Stations (Contd)								
Ref	Element		Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
4.0	<b>Watford Junction</b> Platform extensions to platforms 3&4 Regauging work to platforms 1&2  Cyril Sweett estimate Less O/H&P Network signing	5.00%	489,968	See platform extension buildup				Additional requirement  Additional requirement Additional requirement for signage, CIS and lighting to platform extensions  Additional requirement
			60,000					
			183,000	From Cyril Sweett base estimate 27.7.11				
			-9,150					
			200,000	Changes to signing and other information systems at non-CRL stations served by the Metropolitan line (meeting 10.8.11)				
	<b>Total</b>		<b>923,818</b>		<b>0</b>	<b>0</b>	<b>923,818</b>	
	<b>Station Totals</b>		<b>11,692,413</b>					
	<b>Say Station Totals</b>		<b>11,690,000</b>		<b>7,658,850</b>	<b>8,424,735</b>	<b>3,265,265</b>	



<b>New Structures</b>							
<b>Ref</b>	<b>Element</b>	<b>Total (£)</b>	<b>Comment</b>	<b>Dec 10 Budget at 1Q07 (£)</b>	<b>Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)</b>	<b>Extra/Saving (£)</b>	<b>Changes to Dec 10 specification</b>
1	Viaduct	6622078	See viaduct buildup				Design developed
2	Drainage	465217	See drainage buildup				Design developed
3	Bridge	2175614	See bridge buildup				Design developed
4	Drainage	229524	See drainage buildup				Design developed
5	Ascot Road Embankment	507814	See earthworks buildup				Design developed
6	Drainage	50512	See drainage buildup				Design developed
	<b>New Structures Total</b>	<b>10,050,759</b>					
	<b>Say New Structures Total</b>	<b>10,050,000</b>		<b>6,786,000</b>	<b>7,464,600</b>	<b>2,585,400</b>	

## Existing Structures

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
<b>1</b>	<b>Existing structures</b>						
	CWJ66-Water Lane	28,710	See existing structures buildup	0	0	28,710	New requirement
1.1	WCG1-Wiggenhall Road	106,833	See existing structures buildup	18,340	20,174	86,659	Wiggenhall overbridge
1.2	WCG2-Brook	308,581	See existing structures buildup		0	308,581	
1.3	WCG3-River Colne (N)	362,928	See existing structures buildup	503,602	553,962	-191,034	River Colne (N) Underbridge
1.4	WCG3A-River Colne (S)	118,686	See existing structures buildup		0	118,686	New requirement
1.5	CCG2/1-River Colne Side Channel	247,278	See existing structures buildup	239,777	263,755	-16,477	River Colne (S) Underbridge
1.6	CCG2/2-Stadium approach road (Cardiff Road)	240,842	See existing structures buildup	386,222	424,844	-184,002	Cardiff Road Underbridge and Arch Underbridge
1.7							
<b>Sub Total</b>	<b>C/F</b>	<b>1,413,858</b>		<b>1,147,941</b>	<b>1,262,735</b>	<b>151,123</b>	

	<b>Existing Structures (Contd)</b>						
<b>Sub Total</b>	<b>B/F</b>	<b>1,413,858</b>		<b>1,147,941</b>	<b>1,262,735</b>	<b>151,123</b>	
1.8	CCG2/3 - Vicarage Road	108,183	See existing structures buildup	14,672	16,139	92,044	Vicarage Road Overbridge
1.9	CCG2/4 - Tolpits Lane	109,463	See existing structures buildup	15,065	16,572	92,892	Tolpits Lane Overbridge
1.10	CCG2/5B - Culvert	130,000	See existing structures buildup	77,026	84,729	45,271	Culvert Extension
				462,971	509,268	-509,268	Ascot Road Underbridge omitted and being demolished - see demolitions
	<b>Existing Structures Total</b>	<b>1,761,504</b>					
	<b>Say Existing Structures Total</b>	<b>1,760,000</b>		<b>1,717,675</b>	<b>1,889,443</b>	<b>-127,939</b>	

## Earthworks

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Earthworks & Retaining Walls	3,720,938	See earthworks buildup				Design developed
2	Less: Ascot Road Embankment	-507,814	See earthworks buildup				
3	Fencing	-639,934	See earthworks buildup				
	<b>Earthworks Total</b>	<b>2,573,190</b>					
	<b>Say Earthworks Total</b>	<b>2,600,000</b>		<b>2,500,000</b>	<b>2,750,000</b>	<b>-150,000</b>	

**Demolitions**

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
<b>1</b>	<b>Demolitions</b>						
1.1	CCG2/5 - Ascot Road	105,610	See demolitions buildup			105,610	
1.2	CCG2/5B - Culvert	95,000	See demolitions buildup			95,000	
1.3	Watford West Station	27,500	See demolitions buildup	18,000	19,800	7,700	
	Croxley Green Station			18,000	19,800	-19,800	Not now demolished
	Canal and River Gade bridges			50,000	55,000	-55,000	Not now demolished
	<b>Demolitions Total</b>	<b>228,110</b>					
	<b>Say Demolitions Total</b>	<b>230,000</b>		<b>86,000</b>	<b>94,600</b>	<b>135,400</b>	

**Permanent  
Way**

<b>Ref</b>	<b>Element</b>	<b>Total (£)</b>	<b>Comment</b>	<b>Dec 10 Budget at 1Q07 (£)</b>	<b>Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)</b>	<b>Extra/Saving (£)</b>	<b>Changes to Dec 10 specification</b>
1	Permanent Way	6,133,053	See permanent way buildup				Design developed
2	Track Drainage	2,263,896	See drainage buildup				
3	Less removal of ballast	0	Used as fill				
	<b>Permanent Way Total</b>	<b>8,396,949</b>					
	<b>Say Permanent Way Total</b>	<b>8,400,000</b>		<b>5,329,500</b>	<b>5,862,450</b>	<b>2,537,550</b>	

## Fencing

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	<b>Fencing:</b> Palisade	444,505	See earthworks buildup				Design developed
2	Handrail	195,429	See earthworks buildup				
	<b>Fencing Total</b>	<b>639,934</b>					
	<b>Say Fencing Total</b>	<b>640,000</b>		<b>500,000</b>	<b>550,000</b>	<b>90,000</b>	

**Traction  
Power**

<b>Ref</b>	<b>Element</b>	<b>Total (£)</b>	<b>Comment</b>	<b>Dec 10 Budget at 1Q07 (£)</b>	<b>Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)</b>	<b>Extra/Saving (£)</b>	<b>Changes to Dec 10 specification</b>
1	Traction power	12,819,000	See traction power buildup				Design developed
	<b>Traction Power Total</b>	<b>12,819,000</b>					
	<b>Say Traction Power Total</b>	<b>12,820,000</b>		<b>6,088,500</b>	<b>6,697,350</b>	<b>6,122,650</b>	



## Service Diversions

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Service diversions	400,000	See existing structures and demolitions buildup				Provisional sums pending further investigations
	<b>Service Diversions Total</b>	<b>400,000</b>					
	<b>Say Service Diversions Total</b>	<b>400,000</b>		<b>370,000</b>	<b>407,000</b>	<b>-7,000</b>	

**Signalling**

Ref	Element	(%)	Value (£)	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	<b>LU signalling</b>								
	Bombardier		11,848,000		Estimate from LU 16.8.11				Design developed
1.1	Wayside sub project		500,000		Estimate from LU 16.8.11				
1.2	Train fit sub project		60,000		Estimate from LU 16.8.11				
1.3	SCCI sub project		50,000		Estimate from LU 16.8.11				
1.4	CIS		272,000		Estimate from LU 16.8.11 not duplicated with station comms				
1.5	LVAC		1,039,666		Estimate from LU 16.8.11				
1.6	CRMS (cable route management system)		797,331		Estimate from LU 16.8.11				
1.7	Estimate @ 2014 Less inflation allowance	17.59%		14,566,997 2,562,335					
	<b>Sub-Total</b>		<b>C/F</b>	<b>12,004,662</b>					

	<b>Signalling (Contd)</b>								
	<b>Sub-Total</b>		<b>B/F</b>	<b>12,004,662</b>					
<b>2</b>	<b>NR Signalling</b> 41 nr SEUs		120,000	4,920,000	As Steve Bissell estimate 20.7.11				
2.1									
	<b>Sub-Total</b>			<b>4,920,000</b>					
	<b>Signalling Total</b>			<b>16,924,662</b>					
	<b>Say Signalling Total</b>			<b>16,920,000</b>		<b>10,800,000</b>	<b>11,880,000</b>	<b>5,040,000</b>	

## Telecomms

Ref	Element	Value (£)	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Telecomms Included in other cost items		0					
	<b>Telecomms Total</b>		<b>0</b>					
	<b>Say Telecomms Total</b>		<b>0</b>		<b>2,520,000</b>	<b>2,772,000</b>	<b>-2,772,000</b>	

## Environmental

Ref	Element	Value (£)	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Environmental As previous estimate		385,000					
	<b>Environmental Total</b>		<b>385,000</b>					
	<b>Say Environmental Total</b>		<b>385,000</b>		<b>350,000</b>	<b>385,000</b>	<b>0</b>	

## Preliminaries

Ref	Element	Value (£)	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Preliminaries		7,774,591	See preliminaries buildup				Preliminaries now calculated
2	Additional surveys		50,000	Added at meeting 10.8.11				
3	LU management and assurance	2,500,000	2,500,000	Target figure decided at meeting 10.8.11				
	<b>Preliminaries Total</b>		<b>10,324,591</b>					
	<b>Say Preliminaries Total</b>		<b>10,320,000</b>		<b>9,549,249</b>	<b>10,504,174</b>	<b>-184,174</b>	

## Design

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Design	3,300,000	Target cost as agreed at meeting on 10.8.11				
	<b>Design Costs Total</b>	<b>3,300,000</b>					
	<b>Say Design Costs Total</b>	<b>3,300,000</b>		<b>3,458,657</b>	<b>3,804,523</b>	<b>-504,523</b>	

## PM Costs

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Project Management costs	1,000,000					
2	Legal fees (Agreements)	450,000	Say 3nr Agreements @ £150,000				
3	QS fees	700,000					
	<b>PM Costs Total</b>	<b>2,150,000</b>					
	<b>Say PM Costs Total</b>	<b>2,150,000</b>		<b>2,175,256</b>	<b>2,392,782</b>	<b>-242,782</b>	



## Assurance

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1 1.1	Assurance Assurance	500,000	Figure from HCC				
	<b>Third Party Costs Total</b>	<b>500,000</b>					
	<b>SayThird Party Costs Total</b>	<b>500,000</b>		<b>1,631,442</b>	<b>1,794,586</b>	<b>-1,294,586</b>	

## Third Party Costs

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1 1.1	<b>Third Party Costs</b> Part 1 claims	0					
	<b>Third Party Costs Total</b>	<b>0</b>					
	<b>Say Third Party Costs Total</b>	<b>0</b>		<b>7,780,951</b>	<b>8,559,046</b>	<b>-8,559,046</b>	

## Possessions

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Possession costs	541,479	See possession buildup				Now calculated
	<b>Possessions Total</b>	<b>541,479</b>					
	<b>Say Possessions Total</b>	<b>540,000</b>		<b>500,000</b>	<b>550,000</b>	<b>-10,000</b>	

## Rolling Stock

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Rolling stock	9,000,000	As instructed at meeting 10.8.10 by LU				
	<b>Rolling Stock Total</b>	<b>9,000,000</b>					
	<b>Say Rolling Stock Total</b>	<b>9,000,000</b>		<b>8,302,000</b>	<b>9,132,200</b>	<b>-132,200</b>	

## Risk

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Risk allowance at 90% probability	5,100,000	See risk buildup				
	<b>Risk Total</b>	<b>5,100,000</b>					
	<b>Say Risk Total</b>	<b>5,100,000</b>		<b>12,700,000</b>	<b>13,970,000</b>	<b>-8,870,000</b>	

## Land Costs

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
<b>1</b>	<b>Land Costs</b>						
1.1	Viaduct	1,500,000					
1.2	NR land between Ascot Road and LOROL line	1,800,000					
1.3	NR land between Ascot Road and Croxley Green						
1.4	HCC owned land for car park at Ascot Road	928,000					
1.5	Watford Hospital station land	15,000					
	<b>Land Costs Total</b>	<b>4,243,000</b>					
	<b>Say Land Costs Total</b>	<b>4,240,000</b>		<b>4,000,000</b>	<b>4,400,000</b>	<b>-160,000</b>	

## Third Party Compensation Costs

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1 1.1	<b>Third Party Compensation Costs</b> Surveyors fees	160,000					
	<b>Third Party Compensation Costs Total</b>	<b>160,000</b>					
	<b>Say Third Party Compensation Costs Total</b>	<b>160,000</b>		<b>250,000</b>	<b>275,000</b>	<b>-115,000</b>	

## Monitoring

Ref	Element	Total (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)	Changes to Dec 10 specification
1	Monitoring						
1.1	Monitoring	200,000	Met Line and borehole monitoring during contract				
	<b>Monitoring Costs Total</b>	<b>200,000</b>					
	<b>Say Monitoring Costs Total</b>	<b>200,000</b>		<b>370,031</b>	<b>407,034</b>	<b>-207,034</b>	



## Inflation

Ref	Element	Current Net Value (2Q 2011) (£)	Annual Adjustment (%)	Total Increase (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)
			<b>2Q11-1Q15</b>					
1	Civils & Stations	27,355,000	15.80%	4,322,090	See inflation buildup			
2	Signalling	16,920,000	17.59%	2,976,228	See inflation buildup			
3	Telecomms	2,772,000	17.86%	495,079	See inflation buildup			
4	Traction Power	12,820,000	17.30%	2,217,860	See inflation buildup			
5	Rolling Stock	9,000,000	16.82%	1,513,800	See inflation buildup			
6	Permanent Way	8,400,000	17.11%	1,437,240	See inflation buildup			
	<b>Inflation Total</b>			<b>12,962,297</b>				
	<b>Say Inflation Total</b>			<b>12,960,000</b>		<b>20,196,165</b>	<b>10,233,330</b>	<b>2,726,670</b>

Note: Based on F&A rail tender indices July 2011

**Alternative  
Inflation  
Calculation  
Based on 2.5%  
per annum**

Ref	Element	Current Net Value (2Q 2011) (£)	Annual Adjustment (%)	Total Increase (£)	Comment	Dec 10 Budget at 1Q07 (£)	Dec 10 Budget at 2Q11 based on allowance of 2.5%/annum in Business Case (£)	Extra/Saving (£)
			<b>2Q11-1Q15</b>					
1	Civils & Stations	27,355,000	9.38%	2,564,531				
2	Signalling	16,920,000	9.38%	1,586,250				
3	Telecomms	2,772,000	9.38%	259,875				
4	Traction Power	12,820,000	9.38%	1,201,875				
5	Rolling Stock	9,000,000	9.38%	843,750				
6	Permanent Way	8,400,000	9.38%	787,500				
	<b>Inflation Total</b>			<b>7,243,781</b>				
	<b>Say Inflation Total</b>			<b>7,240,000</b>		<b>20,196,165</b>	<b>10,233,330</b>	<b>-2,993,330</b>

Note: Based on 2.5% inflation per annum as instructed by HCC

## 4. Value Engineering

### 25.1 Value Engineering Meeting

A Value Engineering meeting was held on 16<sup>th</sup> June 2011 facilitated by Mouchel.

The following items were identified:

Action No	Brief Description of Actions by Mouchel	Outcome
1	Single Line Working	Not feasible
4	Omit turnback at Watford Hospital	Omitted at meeting on 10.8.11. Saving £263k net
5	Reduce Level of Network Resilience	Included in the QRA as an “Opportunity”. Not appropriate to review at this time.
6	Completely close Watford Met branch	No alternative stabling location has been identified so this is not appropriate at this time.
11	Examine feasibility of reusing existing NR track	Scheme identified that maximises reuse of track and incorporated into GRIP 3 report.
12	Share power facility with proposed Hospital site.	Not feasible
13	Challenge LU preference for conventional build sub-station	To be considered at detailed design stage
14	Reduce Platform Canopy and Furniture Requirements	Reductions agreed in target costs for stations at meeting on 10.8.11
16	Review options for reducing costs on viaduct	Loading for viaduct and bridge reduced from RU to RL. No saving by removing cladding and having “dirty” structure. No saving by replacing

Action No	Brief Description of Actions by Mouchel	Outcome
		viaduct span and piers with embankment and abutments.
17	Review practicality of omitting walkways on existing bridges	Opportunity included in Risk Register
19	Options for junction with MET line	No saving in overall cost
20	Track Drainage	Opportunity included in Risk Register to omit 90% of track drainage in cuttings and on the flat.
21	Traction Power – Assess effect of different TPH	New substation needed for 6 trains per hour running

## 25.2 Other Value Engineering exercises

4.2.1 An exercise was carried out to compare precast with steel construction for the viaduct. Steel was chosen as the more economic.

4.2.2 An option study was carried out on different methods of construction for the tie-in between the viaduct and the Metropolitan Line. A reinforced solution was identified as the most economic.

4.2.3 An option study was carried out on the cost of different gradients at Watford Hospital Station.

4.2.4 An option study was undertaken on track layouts at Watford Junction station.

4.2.5 Option studies were undertaken on different layouts for Ascot Road, Watford Hospital, Watford High Street and Watford Junction stations.

## 5. Risk

In order to calculate Risk Allowances for the estimate a Risk Workshop was held, facilitated by Mouchel.

Attendees were as follows:

David Leboff – Project Sponsor London Underground

Ian Chambers – Project Sponsor Network Rail

Ian Barnicoat – DPE Network Rail

Chris Deal – TfL London Overground

Michael Watkins – Director Acanthus Architects

Tom Palfreyman – Principal Traction Power Engineer Parsons Brinkerhoff

Jonathan Pitman – Senior Planning Engineer Vinci

Sam Luke – Technical Director Mouchel

Tom Duckmanton – Project Manager Mouchel

Steve Parkinson – Divisional Manager/Engineering Project Manager Mouchel Rail Limited

Kim Wilson – Principal Quantity Surveyor Mouchel

Martin Morris – Principal Engineer Permanent Way Mouchel Rail Limited

Tony Paraskeva –Principal Geotechnical Engineer Mouchel

John Houghton – Assistant Project Manager Mouchel

Sabekq Alateeqi – Mouchel

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Methodology used at the Workshop was as follows:

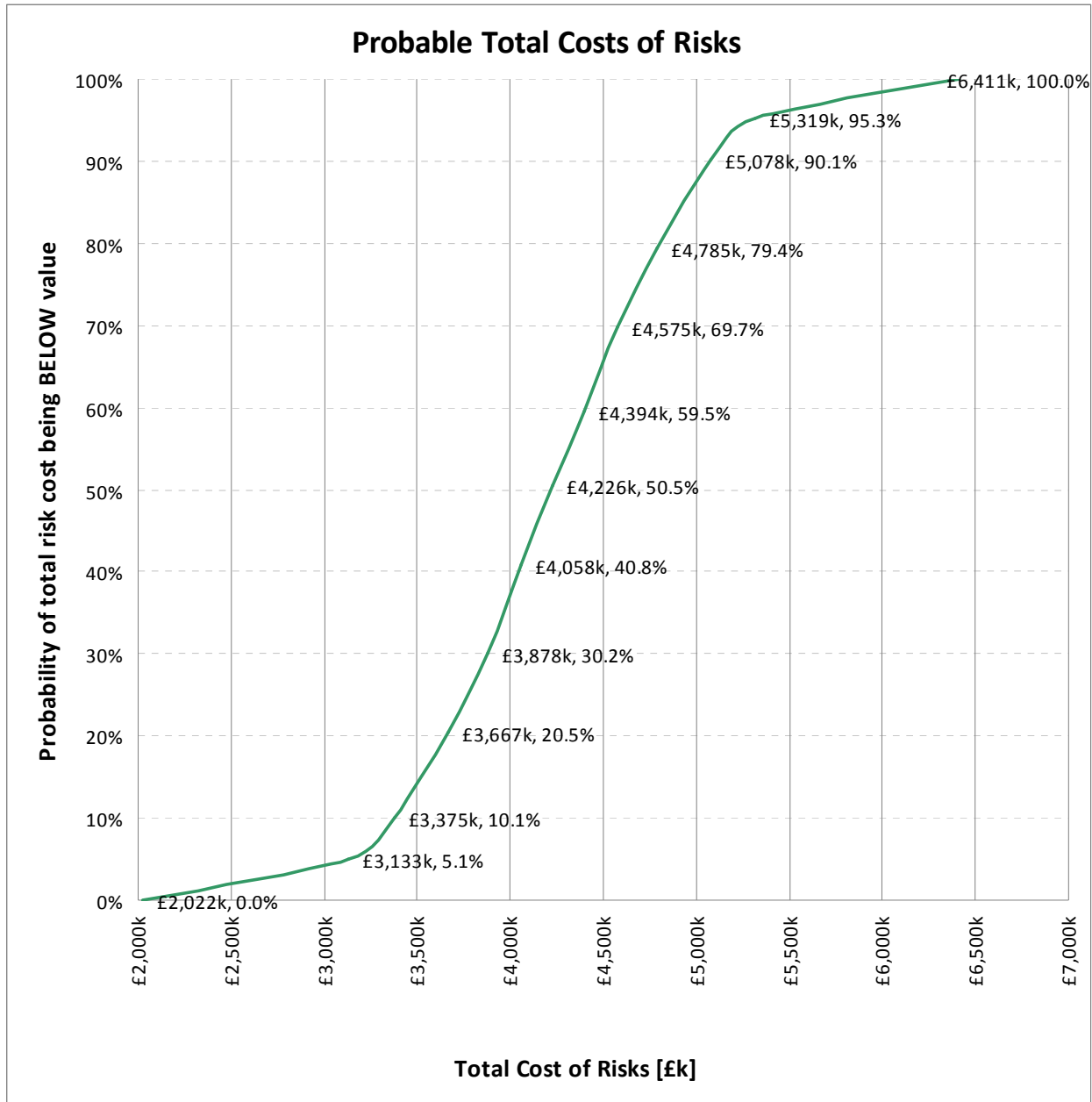
1. The existing Risk Register was discussed and any risks which had expired were closed.
2. Attendees were given time to set down new risks and opportunities. These were collected and discussed, and agreed additions were made to the risk register.
3. Probabilities and impacts were agreed after the meeting.

Methodology used in the risk estimation calculation was as follows:

1. Risk items classified as L (low) for both 'Probability' and 'Impact', and risks with zero cost were excluded from the estimation calculation.
2. 'Opportunity' costs were taken as negative and off-set the risks in the estimation.
3. Probabilities of occurrence were input as bands (L, M, H) representing ranges of probability:
 

L	Low	0%	to	40%
M	Medium	40%	to	60%
H	High	60%	to	100%
4. Costs of risks were input as 'minimum', 'most likely' and 'maximum', given in £1,000s, for each risk item.
5. The estimation of the likely total out-turn cost of all the risks was made using a Monte Carlo method which takes random values, within specified limits, for the occurrence and value of each risk. The random probability of occurrence was multiplied by the randomised cost to give a possible cost of each risk. The resulting costs for all the risk items were added to give a likely out-turn total. This calculation was repeated 2000 times to give a spread of out-turn totals.
6. It was assumed that the probability of occurrence of each risk would fall uniformly within the band L, M or H given for that item. This distribution was implemented as a random value between the limits given for the appropriate band.
7. It was assumed that the cost of each item would lie on a triangular distribution between the 'minimum' and 'maximum' with the 'most likely' cost being the most probable.
8. The out-turn totals were counted to find the number of instances below each selected values. These counts were converted to the percentage probability of the out-turn total falling below the selected values.

9. Recalculation of the spreadsheet selects a different set of random values, but the summary distribution of out-turn values remains substantially static indicating that taking 2000 samples is sufficient to provide a good indication of the expected total cost of risk.
10. The distribution of the out-turn totals is presented as a cumulative graph showing the probability that a given out-turn total will not be exceeded.





**Input features**

Cost items included: 51  
 Maximum possible sum of costs: £23,030k

**Randomised Estimates**

Samples 2000

**Estimated**  
 Minimum £2,022k  
 Mean £4,226k  
 Maximum £6,411k  
 Std Deviation £664k

**PLOT DATA**

**Estimates falling below given cost**

Cost	Estimates	Probabilities
£2,022k	0	0.0%
£3,133k	102	5.1%
£3,375k	202	10.1%
£3,667k	409	20.5%
£3,878k	603	30.2%
£4,058k	816	40.8%
<b>£4,226k</b>	<b>1010</b>	<b>50.5%</b>
£4,394k	1190	59.5%
£4,575k	1394	69.7%
£4,785k	1587	79.4%
<b>£5,078k</b>	<b>1802</b>	<b>90.1%</b>
£5,319k	1905	95.3%
<b>£6,411k</b>	<b>1999</b>	<b>100.0%</b>

**Normal distribution probabilities**

<b>Probabilities</b>	<b>SDs</b>	<b>Normal cum.</b>
2.5%	-1.960	£2,924k
5.0%	-1.645	£3,133k
10.0%	-1.282	£3,375k
20.0%	-0.842	£3,667k
30.0%	-0.524	£3,878k
40.0%	-0.253	£4,058k
<b>50.0%</b>	<b>0.000</b>	<b>£4,226k</b>
60.0%	0.253	£4,394k
70.0%	0.524	£4,575k
80.0%	0.842	£4,785k
90.0%	1.282	£5,078k
95.0%	1.645	£5,319k
97.5%	1.960	£5,528k

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk £k	Most Likely Risk £k	Minimum Risk £k	Mitigation/Notes
	<b>1</b>	<b><u>EMPLOYER'S RISKS</u></b>						
	<b>1.1</b>	<b>Scope</b>			<b>550</b>	<b>330</b>	<b>100</b>	
HCC	1.1.1	Change in high level Project Requirements						Closed
HCC	1.1.2	Reorganisation of NR/TFL structure. Loss of expertise, support, comms, understanding, loss of continuity.	M	L	150	110	50	Governance in place. Work delivered under agreements
HCC	1.1.3	Objections to TWAO application/ public enquiry. Rework and re submission leading to delay and increased costs.	M	M	400	220	50	Delay and extra cost. If significant objections would stop scheme. Only manageable changes considered. Maximum risk reflects only whatever recommendations HCC is willing to take on.
HCC	1.1.4	Failure to agree performance regime, could lead to a delay in project.	L	L				Insignificant risk
HCC	1.1.5	Delay in obtaining track access agreement (delay starts on service date)	L	L				Insignificant risk
HCC	1.1.6	Delay to agreeing connection agreement at infrastructure boundary.	L	L				Insignificant risk
HCC	1.1.7	ROGS (certificate of safety verification) interface not fully understood	L	L				Insignificant risk
HCC	1.1.8	Objections to new LU substation as part of the planning/TWAO process. - see 1.1.3	L	L				Insignificant risk

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk £k	Most Likely Risk £k	Minimum Risk £k	Mitigation/Notes
	1.2	<b>Contract Strategy / Programme</b>	-	-	800	250	150	
HCC	1.2.1	Onerous commercial conditions may lead to contractors building additional risk allowance into price.	L	M	500	100	50	Civil works costs based upon standard form of contract. Onerous conditions may affect civil estimate. Contract strategy should minimise this risk.
HCC	1.2.2	Delay in starting the Project results in additional inflation to project costs.						If there was a delay which affected inflation it would be a delay of 12 months or more which would be a showstopper
HCC	1.2.3	Programme delays lead to additional project management costs.	M	M	300	150	100	Fully detailed programme to be developed to include appropriate levels of float; and programme to be managed to schedule. Maximum risk reflects only stand-by costs charged for Project Management.
HCC	1.2.4	Delays due to funding problems - see 1.2.3					0	
HCC	1.2.5	Delays due to CPO issues/land disputes - see 1.2.3					0	
HCC	1.2.6	Delays due to legal challenge - see 1.2.3					0	
HCC	1.2.7	Delays due to other developments - see 1.2.3					0	
HCC	1.2.8	Delays due to late approvals - see 1.2.3					0	
	1.3	<b>LUL / NR/Train Ops Interfaces</b>	-	-	0			
LU		LUL / NR/Train Ops Interfaces						Could delay implementation of service not construction works
	1.4	<b>Rolling Stock</b>	-	-	750	600	100	
LU	1.4.1	Uncertainty regarding cost of rolling stock	M	H	750	600	100	Discussions taking place with LU contractor to produce +/-20% estimate by August 2011. Maximum risk to be reviewed after price and conditions received.

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
	<b>1.5</b>	<b>Additional Regulatory requirements</b>			<b>290</b>	<b>100</b>	<b>20</b>	
HCC	1.5.1	Existing overline road bridges - provision of steps up & down cutting to cross the road above and provision of lockable gates						Closed
HCC	1.5.2	Existing 3 No. underline bridge decks - steps down embankments to cross the road below						Closed
HCC	1.5.3	Watford Junction Station - Buffers						Closed
HCC	1.5.4	Watford Junction Station - Increased platform length						Closed
HCC	1.5.5	Watford Junction Station - Station – Increased Platform Lengths - Changes to track and signalling						Closed
HCC	1.5.6	Watford Junction Station – Increased Platform Lengths - revisions to track connections						Closed
HCC	1.5.7	Provision of remotely controlled DC track isolating switches in lieu of hook switches						Closed
HCC	1.5.8	Other HMRI requirements	L	M	290	100	20	Other HMRI requirements not identified at this stage
	<b>1.6</b>	<b>Inflation ( Start - Spring 14 Completion Autumn 15)</b>			<b>2000</b>	<b>1200</b>	<b>100</b>	
HCC	1.6.1	Estimating error in assumption about future inflation rate leads to additional project costs.	M	H	1000	600	50	Need to regularly check and update cost estimate to reflect latest industry predictions.
HCC	1.6.2	Scarcity of rail resource results in higher inflation	L	H	1000	600	50	Need to regularly check and update cost estimate to reflect latest industry predictions.
HCC	1.6.3	Inflation in tender prices post recession						Covered by 1.6.1

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
HCC	1.7	<b>Technology / Standards change during project</b>	L	M	0	0	0	See 3.1.27 below
		Moving from BS to Euro standards						
	2	<b><u>SITE RISKS</u></b>						
	2.1	<b>Ground Conditions / Ground Water</b>			850	590	170	
HCC	2.1.1	Additional dewatering works due to higher than anticipated water tables / permeability of underlying soils.						Closed
HCC	2.1.2	Potential of finding significant obstructions during earthworks leading to additional site investigation and alternative works.	M	M	250	175	50	Carry out site investigation
	2.1.2A	Dealing with two hidden NR subways	H	L	100	65	20	Carry out site investigation
HCC	2.1.3	Uncertainty relating to the condition of embankments and cuttings and infrastructure owner's requirements	L	M	250	175	50	Carry out investigations
HCC	2.1.4	Greater than anticipated settlement of new embankment leads to additional secondary ground works.	L	M	250	175	50	Carry out site investigation. Design ground improvement as required and construct early in the programme
HCC	2.1.5	Viaduct - Ground conditions are less competent than expected leading to change in pile type						Closed
HCC	2.1.6	2 New Stations - Ground conditions are less competent than expected resulting in piles required						Closed
HCC	2.1.7	Other unforeseen ground conditions leading to additional SI and or site earth works.	L	L				Undertake thorough site investigation and feed interpretative report into design.
HCC	2.1.8	Potential of finding munitions or archaeological find leads to protracted extension of the works and additional costs.	L	L				Assume not on critical path

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
	<b>2.2</b>	<b>Contaminated Ground</b>			<b>100</b>	<b>80</b>	<b>20</b>	
HCC	2.2.1	Extra over for the disposal of contaminated material from existing earthworks operations	M	M	100	80	20	Carry out site investigation to determine level of contamination. Disposal of hazardous material where necessary
	<b>2.3</b>	<b>Asset Conditions</b>	M	L	<b>0</b>	<b>0</b>	<b>0</b>	
HCC	2.3.1	Discovery and hence disposal of asbestos in demolished station (Watfor West)					0	Closed
	<b>2.4</b>	<b>Access</b>			<b>0</b>	<b>0</b>	<b>0</b>	
HCC	2.4.1	Rail	-	-	0	0	0	Included in cost estimate
	2.4.2	Civils	-	-	0	0	0	Included in cost estimate
HCC	2.4.2.1	Health Campus Site is found not to be available for site compound and access – alternative facility required incurring additional cost						Closed
HCC	2.4.2.2	Access to viaduct foundation work zone is more restricted than anticipated and results in higher costs being incurred.	L	L				Seek formal agreement for land use at earliest opportunity and explore suitable alternatives.
	<b>2.5</b>	<b>Environmental</b>			<b>650</b>	<b>380</b>	<b>100</b>	
HCC	2.5.1	Additional vegetation clearance required due to length of delay in commencing works.	L	L				Carry out survey
HCC	2.5.2	Extra over for dealing with Japanese Knotweed	M	L	150	80	50	Carry out survey and commence treatment at earliest opportunity.
HCC	2.5.3	Environmental constraints associated with vegetation removal including SSSI risks	L	L				Carry out survey and consultation with relevant bodies
HCC	2.5.4	Site runoff - polluting incident	L	L				Insignificant risk
HCC	2.5.5	Protected species being discovered on site - construction delay	L	H	500	300	50	Carry out survey
HCC	2.5.6	Fly tipping before and during construction	L	L				Insignificant risk
HCC	2.5.7	Noise/air pollution during construction	L	L				Insignificant risk
HCC	2.5.8	Damage to chalk aquifer - polluting incident	L	L				Insignificant risk

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
HCC	<b>2.6</b>	<b>Land Costs</b>	-	-	0	0	0	
	<b>2.7</b>	<b>Restricted Working Hours</b>			0	0	0	
HCC	2.7.1	Additional restrictions on working hours due to close proximity of live rail and other rail projects being implemented during the same period.	L	L				Communicate planned works adjacent to NR / LU live rails at the earliest opportunity and adjust programme accordingly.
	<b>2.8</b>	<b>Building over live roads, rails etc</b>			0	0	0	
HCC	2.8.1	Traffic management – extra over for additional traffic management requirements to reflect timing or complexity of final design solution - see above						Closed
HCC	2.8.2	Restricted site access - extra over for additional traffic management requirements to reflect timing or complexity of final design solution						Closed
	<b>2.9</b>	<b>Unforeseen services</b>			500	350	250	
HCC	2.9.1	Extra Over for determining Way leave issues	L	L				Early consultation with landowners.
HCC	2.9.2	Extra Over for diversion of existing services	M	H	500	350	250	Undertake detailed investigations
HCC	2.9.3	Extra Over for repairs to existing services - construction - contractor's risk						Carry out condition survey of existing services
	<b>2.10</b>	<b>Interfaces to existing roads / paths / drains / services</b>	L	L	0	0	0	Insignificant risk
HCC	2.10.1	Interfaces to existing roads/paths/drains/services						To be incorporated into design



Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
	<b>3</b>	<b><u>DESIGN RISKS</u></b>						
HCC	3.1	Design development			<b>11230</b>	<b>6525</b>	<b>2345</b>	
HCC	3.1.1	Tolpits Lane Overbridge - 65mm departure from absolute minimum may not be granted - cut back abutment faces by 33mm each side, otherwise rebuild bridge	L	L				Mitigation is to cut back abutment faces. Maximum risk is to rebuild the bridge if 65mm departure from absolute minimum is not granted
HCC	3.1.2	Tolpits Lane Overbridge - Provision of metal safety fences on road approaches and over bridge decks if cutting back the abutment faces, or 65mm departure, are accepted - see 3.1.1						If P6 parapets are not required metal safety fences will be constructed on road approaches and over bridge. If P6 parapets are required the bridge deck will need to be reconstructed. These costs are included in the rebuild costs
HCC	3.1.3	Unknown buried services on overline bridge decks to be replaced						Closed
HCC	3.1.4	Vicarage Road Overbridge - Provision of metal safety fences on road approaches and over bridge decks - see 3.1.1						If P6 parapets are not required metal safety fences will be constructed on road approaches and over bridge. If P6 parapets are required the bridge deck will need to be reconstructed.
HCC	3.1.5	Wiggenhall Road Overbridge - Departure from absolute minimum by 206mm may not be granted - risk of having to rebuild the entire bridge						Closed
HCC	3.1.6	Wiggenhall Road Overbridge - Provision of metal safety fences on road approaches and over bridge decks if the 206mm departure is accepted - see 3.1.1						If P6 parapets are not required metal safety fences will be constructed on road approaches and over bridge. If P6 parapets are required the bridge deck will need to be reconstructed. These costs are included in the rebuild costs
HCC	3.1.7	Ascot Road Station - Provision of pedestrian controlled crossing to car park and pedestrian guard rails both side of road						Closed

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
HCC	3.1.8	Extra Over for complying with additional DDA requirements such as Platform and Train Access						Closed
HCC	3.1.9	General design development	M	M	2000	1000	500	General changes to design through the design development process. Assessed financial impact represents 2% of the base estimate
HCC	3.1.10	Planning requires noise suppression baffles and other measures etc at station/viaduct.	M	L	100	70	20	Discussions with Local Authority
HCC	3.1.11	Watford junction track layout is not compatible with S class/NR train.	L	M	250	100	20	Use rail grinding train to reprofile rail heads and change switch blades for new
HCC	3.1.12	Insufficient consultation with rail stakeholders /customers results in scope creep, costs increase.	L	L				Insignificant risk
HCC	3.1.13	S class/NR train wheel profiles not compatible if track relayed.	L	L				Insignificant risk
HCC	3.1.14	Global stability of met line embankment i.e. opposite slope to new earthwork.	L	M	250	150	20	Further investigation
HCC	3.1.15	Flood risk on River Colne bridges concession is not granted.	L	L				Insignificant risk
HCC	3.1.16	NR signalling design is not capable of ascertaining LU trains without new interlocking.						Closed
HCC	3.1.17	Import of larger quantities of earthwork fills.	M	L	250	170	50	Site investigation
HCC	3.1.18	Access points not adequately defined/agreed - potential delays	L	L				Insignificant risk
HCC	3.1.19	Additional surveys required - time and cost implications.	L	L				Insignificant risk
HCC	3.1.20	Noise during service (train wheels/ rail interface/ substation plant.	L	L				Insignificant risk
HCC	3.1.21	PA announcement at stations, volume control etc.	L	L				Insignificant risk

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
HCC	3.1.22	Delays/design changes due to assurance issues.	M	L	150	100	20	Sort out in design process
NR	3.1.23	Signal sighting issues on NR infrastructure. Sighting of signals from trains and location of signals.	L	L				Insignificant risk
LU	3.1.24	Integration of customer information system at Watford Junction.	L	L				Insignificant risk
LU/NR	3.1.25	Delay in obtaining derogations/concessions or not granted. See 3.1.22						
HCC	3.1.26	Uncertainty regarding eurocode rail loading on existing bridges.	M	H	4100	3000	1000	Agree loading requirements with LU
HCC	3.1.27	Third party issues due to adjacent NG/DNO substation (at watford hospital); eg EMC, earthing requiring special measures.	M	L	200	100	50	Further investigation
HCC	3.1.28	Structural; bridge abutments require replacement rather than modification.	L	M	300	220	100	Further investigation
HCC	3.1.29	Additional drainage costs to EA or Thames Water requirements	L	M	200	150	50	Further investigation
HCC	3.1.30	Difficulty in providing required road access to LU substation and similar locations.	M	L	100	70	20	Substation location to be identified
HCC	3.1.31	Presence of water courses requiring special containment and discharge measures (transformer oil)	L	L				Insignificant risk
HCC	3.1.32	EMC issues on NR Euston - Watford lines ( reusing stock, signalling , electrification, telecoms), associated with joint running etc.	L	M	600	250	50	Further investigation
HCC	3.1.33	Signalling and telecoms power supply requirements undefined. (LU)						Closed
HCC	3.1.34	Capacity at electrical control rooms to accommodate C&I, alarms	M	H	1000	300	100	

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
HCC	3.1.35	Delay in securing approval for the viaduct design planning and assurance. See above planning and assurance risks						
HCC	3.1.36	Use of eurocodes in the design process see 1.7						
HCC	3.1.37	EMC with respect to neighbourhood on new LU line (eg impact on sensitive apparatus, equipment, cabling).	L	L				Insignificant risk
HCC	3.1.38	Command/control/ops implementation precipitates step change in peripheral service supply.	L	L				Insignificant risk
NR	3.1.39	SFO do not agree with station changes at Watford Jn/high street. See above						
HCC	3.1.40	Problematic trackside cable routes for 11KV cables (NR) requiring elevated trough/GRP at additional costs, or alternative non rail route.	M	L	200	80	25	
HCC	3.1.41	Unknown ground conditions require extensive/special foundations provisions (Piling etc), eg substation see above						
HCC	3.1.42	Need for junction lighting at new and replaced junction.	M	M	300	125	50	
LU	3.1.43	Change of scope re operational requirements see 1.1.4						
LU	3.1.44	Insufficient trains to operate services.						Show stopper
HCC	3.1.45	Tender prices exceed funding allowance. -see 1.6.1						
HCC	3.1.46	Regrading required near River Colne - flood levels much higher than when railway was first installed - see 3.1.15						
HCC	3.1.47	Ground conditions for platform extensions at Watford Junction and Watford High Street unsuitable for strip foundations	L	L				Insignificant risk

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
HCC	3.1.48	Lack of space for fabrication of steelwork for viaduct see 2.4.2.2						
HCC	3.1.49	Acceptability of extending of bare top contact conductor rail system.	L	L				Show stopper
	3.1.50	Additional noise barriers	M	H	480	240	120	added Aug 2011 (v9)
	3.1.51	Increased number of possessions	M	L	250	100	50	added Aug 2011 (v9)
	3.1.52	Existing NR signalling control point at Wembley proves inadequate	M	M	500	300	100	
	<b>3.2</b>	<b>Adequate Power</b>			<b>5500</b>	<b>2800</b>	<b>1600</b>	
HCC	3.2.1	Power supply to new substation from Croxley hall substation						Closed
LU	3.2.2	Sufficient capacity does not exist within existing LU 11kV system (post SSL Upgrade), via Croxley Hall substation, for additional traction power load (and associated disturbance e.g. harmonics)	L	H	2500	1000	500	To be modelled by LU
LU	3.2.3	Sufficient space does not exist within Croxley Hall substation for housing additional 11kV feeder circuit breakers and existing 11 kV switchboards are recent LU approved type.	L	L				To be modelled by LU
HCC	3.2.4	A suitable location for a new traction substation cannot be found/obtained which is no further east than Watford West station	L	L				To be investigated by PB
HCC	3.2.5	Requirements within LU Std 1-124 are applicable on joint running section up to Watford Junction in terms of minimum DC voltage levels & outage conditions to be designed for, <u>without</u> exception of providing for an HV busbar or bus-section outage condition	M	M	500	300	100	TQ to be raised with LU
HCC	3.2.6	Requirement arising from modelling to reinforce NR DC traction power supply system south of Watford substation						Closed
HCC	3.2.7	11kV switchboard at Watford substation cannot be extended by using additional switchgear panels within existing substation.						Closed

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
HCC	3.2.8	11kV cable feeder system cannot be reconfigured at Bushey substation so that one of the existing 2 feeder cables (to Bushey) bypasses Bushey and is extended to connect to Watford substation.	L	L				Agreement to be sought from NR by sharing outline proposal with NR.
HCC	3.2.9 (Additional)	Insufficient capacity exists on NR Euston to Watford 11kV system, with source at Acton Lane grid, for additional traction power load (and associated disturbance e.g. harmonics)	M	H	2500	1500	1000	This risk relates to the last assumption listed in section 3.3 of PB Preliminary High Level Traction Power Equipment Quantities Report
	<b>3.3</b>	<b>Signalling</b>			<b>795</b>	<b>500</b>	<b>100</b>	
LU	3.3.1	Risk of programme being out of alignment with the LU signalling upgrade works leading to separate package of work having to be initiated for this project.	M	H	795	500	100	Discussions to be held with LU contractor. Maximum risk to be reviewed once estimate received.
	<b>3.4</b>	<b>Safety / other requirements for rail operators</b>			<b>0</b>	<b>0</b>	<b>0</b>	
HCC	3.4.1							Closed
	<b>4</b>	<b><u>THIRD PARTY RISKS</u></b>						
HCC	4.1	<b>Planning / public enquiries</b>			0	0	0	Covered above
	<b>5</b>	<b><u>CONSTRUCTION RISKS</u></b>			<b>1650</b>	<b>1170</b>	<b>250</b>	
HCC	5.1	Security of the site breached	L	L				Insignificant risk
HCC	5.2	Delays by statutory undertakers	M	L	150	120	50	Move this risk to HCC contractor
HCC	5.3	Terrorism, strikes etc	L	L				Insignificant risk
HCC	5.4	Protesters/squatters	L	L				Insignificant risk
HCC	5.5	Delay in construction results in delayed start to service						Not construction risk
HCC	5.6	Contractors single source/supplier going bust timescale for sourcing replacement	L	M	500	350	100	Carry out thorough financial checks on key companies

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
HCC	5.7	Serious accident during construction phase may stop works	L	L				Insignificant risk
HCC	5.8	London overground objection to possession requests	L	L				Insignificant risk
LU	5.9	Met line Tie In temp works sequencing with LU operations.	L	L				Insignificant risk
HCC	5.10	Damage to existing Met/NR infrastructure during construction works, finance penalties reputation	L	L				Insignificant risk
HCC	5.11	Temporary works design of viaduct - how will the bridge be constructed/installed. - see restricted access	L	L				Insignificant risk
HCC	5.12	Poor electrical soil resistivity at substation site requiring extensive additional earthing measures.	L	L				Insignificant risk
HCC	5.13	Issues in existing DL substation at watford (asbestos,PCBs etc) preventing installation of equipment, connection thereto	L	L				Insignificant risk
LU	5.14	Problems within overall SSL signal upgrade mean we have to pick up development costs or design from new, i.e. there is no Richmond solution.	L	M	1000	700	100	Discussions with LU contractor
HCC	5.15	Lack of skilled resource due to Crossrail/Thameslink and other projects. - see 1.6.2						
HCC	5.16	Noise during construction	L	L				Insignificant risk
HCC	5.17	Theft of materials - delay to works/costs of replacement.	L	L				Insignificant risk

Risk Owner	Ref	Risk Description	Probability High / Medium / Low	Impact High / Medium / Low	Maximum Risk	Most Likely Risk	Minimum Risk £k	Mitigation / Notes
	<b>6</b>	<b>OPPORTUNITIES</b>			<b>8340</b>	<b>5604</b>	<b>2635</b>	
HCC	6.1	Prefabrication, common station design elements.	M	L	250	80	50	Further investigation
HCC	6.2	Descoping of track drainage on disused section.	M	H	1500	1000	500	Further investigation
HCC	6.3	Use of existing radio masts for communications	L	L				Insignificant risk
HCC	6.4	Simplified arangements to provide DC feeding of Watford Met 'Spur Lines'	L	L				Insignificant risk
HCC	6.5	Early reinforcement of traction power on NR Euston - Watford line (to assist with funding/finance.) Also 'part' on LUL						No effect on capital costs
HCC	6.6	Provide new 11 KV supply for new LU traction substation (combined with Hospital)	L	L				Insignificant risk
HCC	6.7	Provide new 11KV DNO supply for Watford sub (vs reinforce existing 11KV system).	L	L				Insignificant risk
HCC	6.8	Modular housings for new LU substation (challenge masonry/brick built preferences).	L	M	300	250	100	Discussions
HCC	6.9	Build over stations, property and land., e.g. Watford West	H	H				Business case item
HCC	6.10	Reduced resilience for rail systems i.e. under equipment outage conditions (challenge need for redundant equipment, and in relation to when maintenance is taking place eg night time only).	L	M	250	200	50	Discussions with LU
HCC	6.11	Combine new LU substation with track parallelling ' HUT' / location at croxley junction (met line).	M	M	250	170	50	Further investigation
		<b>Added (v9) 15 Aug 2011</b>						
	6.12	Reuse of buffers from Watford Met	M	L	100	50	25	added Aug 2011 (v9)
	6.13	Reduction of extent of drainage	M	H	1872	1000	50	added Aug 2011 (v9)
	6.14	Omission of walkway to existing bridges	M	L	100	50	25	added Aug 2011 (v9)
	6.15	Possibility of modifying NR interlocking signalling	L	M	3400	2500	1500	
	6.16	Omission of walkways to existing structures	H	M	318	304	285	
					<b>Running Total</b>	<b>17325</b>	<b>9271</b>	<b>2670</b>



## 6. Scope and Cost Review

A Scope and Cost Review meeting was held on 10th August 2010.

### Attendees:

Mike Younghusband - HCC  
David Leboff – LU  
Jon Kirkup – LU  
Rob Tamkin – LU  
Retha Olivier – LU  
Michael Watkins - Acanthus  
Tom Duckmanton - Mouchel  
Kim Wilson – Mouchel

The following were agreed and incorporated into the Cost Plan:

### 1. Stations

#### 1.1 Watford Hospital

Agreed to reduce areas (e.g. review need for police interview room, SCR, etc)  
Reduction in finishes (£500/m<sup>2</sup> over station)  
Reduce length of canopy - £100k saving  
Reduce CCTV spec  
Reduction by use of prefabrication methods

**Agreed target reduction £800k**

#### 1.2 Ascot Road

Reduction in specification – target £100k  
Use ticket gates, seats etc from Watford Met station  
Reduce length of canopy – target £100k

**Overall target reduction £600k**

### 1.3 Watford High Street

Omit platform extensions – saving £147k

Omit concrete paviers – saving £6k

Omit services to platform extensions – saving £15k

**Overall reduction £168k**

### 1.4 Watford Junction

Omit platform extensions to Platforms 1&2 – saving £200k

Omit staff accommodation – saving £80k

Reduce allowance for CIS from £100k to £50k – saving £50k

Omit benches – saving £13,500

Omit totems – saving £15,000

Omit building services to Platform 1&2 extensions and welfare – saving £50k

Omit services to new welfare facilities – saving £20k

Omit demolition works – saving £20k

Reduction of general LU signage allowance from £50k to £48.5k – saving £1,500

**Overall reduction £450k**

## 2. Permanent Way

Omit turnback at Watford Hospital station – saving £263k

**Overall reduction £263k**

## 3. Signage generally

Add £200,000 for changes to signing and other information systems at non-CRL stations served by the Metropolitan Line.

**Overall addition £200k**

## 4. Design costs

Reduce to £3,300,000

**Overall saving £664,961**

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**5. PM costs**

Reduce to £2,000,000 to include legal costs.

**Overall saving £493,686**

**6. Assurance**

Reduce to £1,500,000

**Overall saving £370,265**

**7. Risk**

Opportunities to be priced:

Drainage reduction

Buffers omission

Omission of one walkway to existing bridges

Risks to be priced:

Additional noise barriers

Increased number of possessions

The risk allowance calculation was rerun and incorporated into the Cost Plan.

**9. Telecomms**

Definition to be established and estimate to be reviewed. This is still being reviewed.

**10. Signalling**

A revised estimate was received from LU and this was incorporated into the Cost Plan.

**11. Rolling Stock**

Reduce estimate to £9m.

**Overall saving £3m**

**12. Station External Works**

HCC to consider whether these could be included in separate budget.

**13. Preliminaries**

LU management costs and assurance on rolling stock, telecoms, signalling, and Prestige reduced to £2,500,000.

**Overall saving £3,102,560**