Appendix F Conceptual Stormwater Management Plan

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F I N A L R E P O R T

Conceptual Stormwater Management Plan

Prepared for

Queensland Coke Energy

380 Queen Street, Brisbane
QLD 4005

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URS

environmental
and engineering
professional services

Project Manager:

James MacDermott
Principal Engineer

Project Director:

Chris Pigott
Senior Principal

Author:

Simon Gaskell
Project Hydrologist

URS Australia Pty Ltd
Level 14, 240 Queen Street
Brisbane, QLD 4000 Australia
GPO Box 302, Queensland 4001
Tel: 61 7 3243 2111
Fax: 61 7 3243 2199

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Introduction

SECTION 1

The construction and operation of a combined coke plant and power station at Stanwell Energy Park may lead to a range of potential environmental impacts that need to be mitigated. These include possible effects on the surface water environment from fine particulates and associated contaminants in stormwater runoff from those areas where coal and coke is to be used and stockpiled. Without management of this runoff, an increased sediment/contaminant load may be discharged to the downstream creek system leading to potential environmental harm. This report presents the results of water balance modelling for the development of a conceptual stormwater management plan at the Coke Plant.

2.1 Summary of Operations

At this stage, the Coke Plant may develop in a number of different ways. The project may involve a two-stage development, with an initial design capacity of approximately 1.6 million tonnes per annum (Mtpa) of dry coke expanded to a total of 3.2Mtpa during Stage 2. It has not yet been finalised whether both stages will go ahead or whether only the first stage will be completed. It is also possible that the development will progress with or without the construction of a Heat Recovery Steam Generator (HRSG) Power Plant. The construction of the power plant will not affect the concept stormwater management plan as effluent and stormwater discharges from this area will be managed separately.

In simplified terms, coke production at the site will involve the following processes:

1. Coking coal delivered to the site by rail;
2. Coal stored in stockpiles until required;
3. Coal transported to coke ovens by conveyor;
4. Coke produced by the carbonization of coking coal within coke ovens;
5. Coke pushed out of ovens onto quench bed car;
6. Coke quenched at quenching tower;
7. Coke stored in stockpiles; and,
8. Coke collected and transported off-site by rail.

The plant will therefore require large coal and coke stockpiles and, if Stage 2 is completed, eight coke oven batteries to be constructed. In the event that only Stage 1 is completed, the plant will only need half the area of stockpiles and half of the coke oven batteries. Maintenance and process areas for chemicals (including fuels and oil) storage and handling will also be required. Construction, activities will include earthworks and excavations, heavy lift cranes, concrete batch production, hammering, welding, painting and equipment installation. During Stage 1, approximately 1,385 mega litres (ML) per year will be necessary for coke quenching. This will rise to approximately 2,770ML per year after completion of Stage 2. Water balance modelling carried out for this plan has allowed for either scenario.

2.2 Environmental Issues

Neerkol and Quarry Creek are the two closest watercourses to the site. The flow regime in these creeks has been altered by extraction of water for agricultural purposes and since 1993, continuous discharge of combined cooling tower blowdown and stormwater from Stanwell Power Station totalling approximately 3-4ML/day. The Department of Natural Resources and Mines (DNRM) has stated that for long periods in the year, flows in the creek are entirely dependent on the power station discharge. Water chemistry is variable and biological indicators suggest that water quality is generally poor, characterised by high

salinity and some nutrient enrichment. However the creek does support local ecosystems and there are a number of licensed abstractions. More than 20 licenses have been issued by the DNRM within the Neerkol Creek catchment, predominantly for agricultural irrigation.

The proposed development site has already been largely cleared of vegetation exposing soil to wind and rain. Sediment may be easily mobilised during construction activities and enter surface water runoff which in turn may lead to deleterious effects on downstream water quality and aquatic habitats. There are also a range of potential pollutants to be used on-site during the construction phase on-site associated both with the machinery used for excavation and construction (including diesel and other petroleum-based fuels and lubricants) and the operation of the Coke Plant.

Coal and coke particulates will be the most widespread potential contaminants associated with the project. Accumulated coal and coke particulates may enter runoff after rainfall or be blown by the wind into surface water bodies. Increasing the concentration of suspended solids downstream can impact natural ecosystems directly by increasing turbidity and from toxicants associated with the particulates. For example, coal contains many metals such as mercury, arsenic, chromium and selenium and Polynuclear Aromatic Hydrocarbons (PAHs) are linked to coal burning. PAHs are burned off during the coking process and are not present in coke. Australian thermal coals are considered to have low levels of toxic trace elements in comparison with coals from other countries and naturally radioactive isotopes are generally at a level equivalent to background levels (ACARP, 1996). However, by-products of the conversion of coal to coke include coal-tar (high in PAHs), ammonia and light oils.

A number of other potential aqueous waste streams are associated with Coke Plant operations. Stormwater and wash water runoff from chemical (including fuel oil) storage areas plus process, maintenance and transformer yard areas may contain contaminants from leaks and spills, either through the accumulation of several minor events (possibly attached to dust particles) or from a larger accidental release. Most chemicals will be used at relatively low rates and only small storage inventories will be necessary. Water used for coke quenching will largely evaporate during dousing. Any surplus water will be recycled back into the process.

Sewage from the Coke Plant will be directed to the Stanwell Power Station anaerobic sewage treatment plant which then discharges to evaporation ponds within the Power Station. This system has capacity to treat additional effluent from the Coke Plant operational-phase workforce but not necessarily for the overall construction workforce for the entire project. If capacity is insufficient for this purpose, alternative arrangements including temporary toilet facilities will be provided. Sewage from these temporary arrangements would be disposed of using a licensed waste contractor.

Due to the ephemeral flow regime, discharges from the Coke Plant into Neerkol Creek would comprise a potentially significant proportion of the flow throughout the year. Any contaminants within that discharge could therefore impact on downstream water quality. Under the *Environmental Protection (Water) Policy 1997* (*EPP (Water)*) environmental values, including the biological integrity of modified aquatic ecosystems and suitability of water for agricultural use must be enhanced or protected.

2.3 Strategy

In order to minimise the environmental risks identified, the concept stormwater management plan aims to reduce releases of potential pollutants to the natural environment as far as practicable. Surface drainage from the coal and coke stockpiles and the main Coke Plant area will be isolated from natural drainage. This will be achieved by siting the stockpiles and main Coke Plant on hardstand with the surface graded either side of drainage channels from these areas to prevent both the runoff of potentially contaminated 'dirty' water and the ingress of relatively 'clean', naturally occurring runoff from the surrounding area. Hardstand will need to be constructed to allow for the maximum plant turnover during the lifespan of the project (i.e. Stage 1 or Stage 2) allowing a buffer zone so that coal and coke will not spill over and into drainage channels.

Drainage channels around the stockpiles and Coke Plant will discharge into a series of large settlement and evaporation ponds with sufficient capacity to contain all stormwater runoff such that overflows will only occur with an Average Recurrence Interval (ARI) of approximately 10 years. The ponds will be constructed with either a compacted earthen base or synthetic liner to minimise seepage. The overall strategy is therefore one of risk-based containment.

By minimising the number of overflows from the pond, this also reduces the volume of potentially contaminated stormwater released into the environment. The 10 year ARI design criteria for overflows will also mean that these only occur during extreme storm events or after a period of persistent rainfall over many days. Under these circumstances, local creek systems are likely to experience significant flows that will provide dilution. Overflows are also likely to have been greatly diluted by the volume and rate of runoff on-site and will be from relatively sediment-free decant at the pond surface.

The ponds will also provide some degree of water treatment, removing contaminants and therefore improving its amenity value and reducing pollution risks from overflows. The primary mechanism for contaminant removal in all pond systems is through settling or sedimentation. Effectiveness is variable dependent on the type of detention system. Generally, longer detention times within the system lead to greater potential for contaminant removal. The overall strategy for pond design will be to provide a combination of extended detention and a permanent wet pool. All discharges initially drain into the wet pool area where flow velocity is slowed allowing sediments to settle out. The wet pool overflows into an extended detention area to contain as much of the flow as possible during larger or more persistent discharges (Figure 2.1).

Maintenance and process areas where chemicals (including fuels and oil) are stored or handled and minor operational spillages may occur will be built on bunded concrete slabs. It may be possible to house these areas under a roof and discharge stormwater via a 'clean' drainage system. Otherwise, runoff (including stormwater and washdown water) will be contained within the bunds and then flow through separation equipment to remove free oil. This water will be collected in sumps and periodically inspected. In the event of spills or leaks or if water appears to be contaminated, the area will be drained to a waste water collection pit. This effluent will be collected by tanker for off-site disposal at a licensed facility either within Fitzroy Shire or in Rockhampton. If inspection indicates that runoff is not contaminated then it will be discharged into the main settlement and evaporation ponds.

There are considerable opportunities for stormwater re-use that can be exploited to reduce the Coke Plant's reliance on external water supplies and improve the sustainability of the project. Although the primary function of the system will be to capture runoff and allow water to evaporate, it is envisaged that through the course of the year a significant amount of standing water will be available for re-use as dust suppression water at the stockpiles and possibly also in coke quenching. Maximising water re-use is a key objective of the *Fitzroy Basin Water Resource Plan* (FBWRP). Harvesting overland flow and efficient water use (i.e. decreasing the amount of water 'wasted' on-site through evaporation) may be critical to any application for water supply from available resources within the Fitzroy Basin.

A conceptual diagram of operational-phase water use and disposal is presented in Figure 2.2.

The topography of the site was significantly altered during preliminary works for the proposed Australian Magnesium Corporation Pty. Ltd. (AMC) magnesium plant in 2002-2003. The site has been extensively cleared and a range of water management structures are already in place. Drainage ditches were excavated to convey surface runoff around and away from construction areas and these drain into two settlement ponds in the middle of the site (Figure 2.3). During the construction phase, existing infrastructure should be utilised where suitable. If construction works for Stage 2 production are commissioned, it is envisaged that separate construction- and operational-phase stormwater management structures will be required at the same time.

The area of land available for the construction of settlement and evaporation ponds is likely to be to the north between the main Coke Plant area and Brickworks Road. Approximately 12 hectares (Ha) of this land has already been largely cleared during preliminary groundwork for the proposed AMC magnesium plant. Land adjacent to this area has largely been undisturbed and would require significant clearing in order for infrastructure to be constructed. The dimensions of the pond system will be designed to balance minimising the 'footprint' of the project with pond efficiency.

3.1 General

A numerical water balance model was created in order to simulate stormwater management at the Coke Plant. Broadly based on the principles of the hydrologic cycle, this was developed according to the following steps:

- Delineation of independent hydrological 'catchments' (e.g. coke stockpile, coal stockpile, Coke Plant area etc.);
- Identification of runoff coefficients according to land use and application to catchment areas;
- Estimation of pan evaporation factor to apply to raw data;
- Outline design of settlement and evaporation pond dimensions;
- Estimation of seepage loss to groundwater from settlement and evaporation ponds; and
- Stormwater re-use strategy.

Local meteorological data was obtained from DNRM and input to the model to allow an approximation of actual climate conditions. A schematic diagram outlining the flow of water in the model is presented in Figure 3.1. Further information on the model is provided below.

3.1 Specifications, Assumptions and Parameters

3.1.1 Catchment Areas

A conceptual layout of the stormwater drain network, to allow the separation of dirty and clean catchments, was drafted and the area of each catchment area was estimated (Figure 3.2). These catchments were assumed in the model to be hydrologically independent units representing the coal stockpile 'dirty' water catchment, the coke stockpile 'dirty' water catchment, the Coke Plant 'dirty' water catchment and the stormwater pond direct catchment. Other 'clean' water catchments were assumed to be diverted via stormwater drains around and away from the 'dirty' areas and the pond. Inputs and losses to the system such as rainfall and evaporation in mm were assumed to occur evenly over the surface area of individual catchments but not always at the same rate in each. For example, the ratio of runoff to rainfall is dependent on the permeability, average slope and nature of ponding and will not be the same for the stockpiles as for the main Coke Plant area or the direct pond catchment (Section 3.1.3).

The model was designed to allow individual catchment areas to be included or excluded dependent on which simulation was run. Different catchment areas were input to the model depending on the plant configuration scenario modelled as follows:

Table 3-1

Catchment Areas for Stage 1 and Stage 2 Production

Coke Production Stage	Coke Stockpile Area (m^2)	Coal Stockpile Area (m^2)	Coke Plant Area (m^2)
1	67,620	53,570	230,000
1	101,600	77,035	457,565

3.1.2 Stormwater Re-use

There are opportunities for water re-use at the Coke Plant. These are highly dependent on the final configuration of the project so various options have been considered. It is possible that quench water for the Coke Plant may be partially sourced (up to 10% of the daily quench requirement) from stormwater. The quality requirement for water used in quenching is not considered to be prohibitive if water from the ponds is used in a dilute form. Water will also be required at the stockpiles for dust suppression.

When available, standing water in the settlement and evaporation ponds will be utilised for dust suppression first. This water is applied in the model at a rate roughly equal to the rate of evaporation from the stockpiles. Only if dust suppression needs have been met and sufficient water is available will this water be used for quenching. All re-use processes will be consumptive as water evaporates during quenching and/or dust suppression.

During modelling, the amount of stormwater re-use for quenching was varied between zero and 10% to examine the impact on pond area. Water re-use for dust suppression was assumed to be possible for all scenarios modelled.

3.1.3 Rainfall Runoff

Daily rainfall data for Rockhampton Airport (Australian Bureau of Meteorology Station Number 039082) between 1939-2005 was utilised in the model. Average monthly and annual data are summarised in Table 3-2.

Table 3-2

Rainfall Statistics for Rockhampton Airport (mm)

	Rockhampton Airport			
	Mean	Median*	Wet*	Dry*
January	131	87	300	34
February	141	98	348	16
March	99	65	236	11
April	45	32	110	5
May	49	32	119	3
June	36	23	86	1
July	30	14	94	1
August	29	18	67	1
September	23	11	69	1
October	50	45	110	7
November	70	64	124	14
December	103	81	182	27
Annual	**805**	**755**	**1,179**	**504**

Notes: * - Median values are based on 50th Percentile rainfall data;

Wet values are based on 90th Percentile rainfall data; and

Dry values are based on 10th Percentile rainfall data.

Varying runoff factors were considered for the coal and coke stockpiles to reflect likely variability under changing rainfall conditions. Due to the capacity for rainfall to be absorbed by coal and coke, runoff will progressively increase as saturation increases. The minimum runoff factor, for a rainfall intensity of 0mm/day was 0% increasing to a maximum of 80% for rainfall intensities of 50mm/day or greater. The Coke Plant area will consist of entirely impermeable hard stand and the runoff coefficient (75%) will be the same for all rainfall conditions. This was set as 75%. A runoff factor was also defined for the perimeter area of the stormwater pond system not underwater. This was also a constant rate set at 70% to allow for short-term ponding, seepage and evaporation.

3.1.4 Evaporation

Average monthly pan evaporation data for Rockhampton Airport (Australian Bureau of Meteorology Station Number 039082) between 1939-2004 (Table 3-3) was utilised in the model. A pan factor of 0.8 was used for the pond to derive open water evaporation. As coal and coke can absorb solar energy and increase evaporation, the stockpile evaporation factor was assumed to be equal to pan evaporation.

Table 3-3

Evaporation Statistics for Rockhampton Airport (mm)

	Mean Daily Pan Evaporation	Mean Monthly Pan Evaporation
January	7.2	223
February	6.5	184
March	6.2	192
April	5.3	159
May	4.1	127
June	3.6	108
July	3.6	112
August	4.4	136
September	5.8	174
October	6.8	211
November	7.5	225
December	7.6	236
Annual	**5.7**	**2,081**

3.1.5 Outline Pond Design

Outline pond dimensions were required to determine the relationship between depth of water in the ponds and volume. Batter slope gradient was set at 1:3 and adopted for all scenarios/options modelled. Average pond depth was varied between 2.5m and 3.5m to test the impact on surface area and obtain the optimum pond size, consistent with the overall strategy. Pond depth will vary considerably over its entire surface area in order to provide both deep pools to slow flow rates and allow sedimentation and shallow areas to promote evaporation. Further scenarios were modelled by varying surface area but keeping average pond depth the same.

3.1.6 Seepage Losses

The base of the settlement and evaporation pond system will be constructed either with a compacted earthen base or synthetic liner to minimise seepage to groundwater. It will not however be feasible to reduce these losses to zero. A constant seepage loss of 0.2mm/day was assumed for all scenarios modelled. Only the surface area of the pond underwater was considered to be subject to seepage losses.

3.2 Modelled Scenarios

Modelling was carried out for both Stage 1 and Stage 2, at first by varying the dimensions of the pond (i.e. average depth and surface area) to obtain an optimum layout consistent with the strategy. Sensitivity testing of the majority of other variables was subsequently carried out. Table 3-4 outlines the scenarios modelled:

Table 3-4

Modelled Scenarios for Stormwater Management

Coke Production Stage	Scenario	Average Depth of Pond (m)	Surface Area of Pond (Ha)	Quench Demand (m^3)	Quench Demand taken from Ponds (%)
1	1.1	3	9.5	3,792	10
1	1.2	2.5	11.5	3,792	10
1	1.3	3.5	8	3,792	10
1	1.4	3	10	3,792	10
1	1.5	3	9	3,792	10
1	1.6	3	13.5	3,792	5
1	1.7	3	11.5	3,792	5
1	1.8	3	16	3,792	0
1	1.9	3	18	3,792	0
2	2.1	3	16	7,584	10
2	2.2	2.5	20	7,584	10
2	2.3	3.5	13.5	7,584	10
2	2.4	3	17	7,584	10
2	2.5	3	15	7,584	10
2	2.6	3	16	7,584	5
2	2.7	3	23	7,584	5
2	2.8	3	28	7,584	0
2	2.9	3	32	7,584	0

Sensitivity testing was subsequently carried out for seepage loss, the pan evaporation conversion factor and runoff parameters. These were each modified by a 10% increase and a 10% decrease to observe potential error in the model. A summary of sensitivity testing is presented in Table 3-4.

Table 3-4

Modelled Scenarios – Sensitivity Testing

Scenario	Seepage Loss	Pan Evaporation Conversion Factor	Runoff Parameters
1.1a	+10%	-	-
1.1b	-10%	-	-
1.1c	-	+10%	-
1.1d	-	-10%	-
1.1e	-	-	+10%
1.1f	-	-	-10%
2.1a	+10%	-	-
2.1b	-10%	-	-
2.1c	-	+10%	-
2.1d	-	-10%	-
2.1e	-	-	+10%
2.1f	-	-	-10%

4.1 Overflows

When the ponds are full, any additional inflows will cause overflows. An overflow event is defined in the model from when the ponds first begin to discharge until 7 days have passed. If discharge continues for longer than 7 days then it is considered to be a new event. For example, overflows lasting for 9 days would be considered to be two overflows. Total overflows are calculated for the entire modelling period and divided by the number of overflows to give the average overflow volume per event. Complete results featuring all input data and specifications, simulation details, statistics and summary information are presented in Appendix A. Summary overflow results are presented in Tables 4-1 and 4-2.

Table 4-1

Summary of Modelling Results

Scenario	Number of Overflows	Overflow ARI (years)	Total Overflow Volume in megalitres (ML)	Average Overflow Volume per event (ML)
1.1	5	13	150	29
1.2	6	11	140	23
1.3	6	11	150	25
1.4	4	17	130	31
1.5	7	9	170	24
1.6	6	11	110	17
1.7	11	6	210	19
1.8	11	6	180	17
1.9	6	11	90	15
2.1	6	11	250	42
2.2	7	9	270	38
2.3	7	9	250	35
2.4	4	17	240	59
2.5	9	7	330	36
2.6	16	4	660	41
2.7	7	9	190	27
2.8	11	6	350	32
2.9	6	11	150	25

For the majority of scenarios modelled, the design criterion of overflow on average only once every 10 years is met. However, the average overflow volume and total overflow volume are variable. Of the scenarios that met design criteria, the maximum average overflow per event was 60ML (Scenario 2.4) and the minimum average overflow per event was 15ML (Scenario 1.9). The maximum total overflow volume was Scenario 2.6 (660ML). The minimum total overflow volume was Scenario 1.9 (90ML). Plots of pond water levels and overflows over time for Scenarios 1.1 and 2.1 are presented in Figures 4.1 and 4.2.

Table 4-2

Summary of Sensitivity Testing Results

Scenario	Number of Overflows	Overflow ARI (years)	Total Overflow Volume (ML)	Average Overflow Volume per event (ML)
1.1	5	13	150	29
1.1a	5	13	140	29
1.1b	5	13	150	30
1.1c	4	17	120	31
1.1d	6	11	180	30
1.1e	12	6	310	26
1.1f	1	66	30	32
2.1	6	11	250	42
2.1a	6	11	250	41
2.1b	7	9	260	37
2.1c	5	13	230	46
2.1d	7	9	310	45
2.1e	12	6	570	48
2.1f	2	33	100	48

More detailed description of the results for Stage 1 and 2 coke production including analysis of the sensitivity testing is presented below.

4.1.1 Stage 1 Coke Production

Scenarios 1.1-1.9 all modelled the situation for Stage 1 production with representative surface areas for the coal and coke stockpiles and the Coke Plant. Quench water demand was set at 3.8ML per day. The storage pond dimensions were varied to meet design criteria for different scenario specifications.

Varying average pond depth only between 2.5m (Scenario 1.2) and 3.5m (Scenario 1.3) increased the total surface area required by 3.5Ha. Keeping the average pond depth constant at 3m and varying surface area also showed marked variation. An increase from 9Ha (Scenario 1.4) to 10Ha (Scenario 1.5) changed the overflow ARI from 9 years to 17 years.

Changes to the proportion of quench water that could be sourced from the stormwater runoff significantly impacted on the dimensions of the ponds. In comparison with Scenario 1.1, reducing the quench demand supplied from the ponds from 10% to 5% (Scenarios 1.6 and 1.7) meant that the surface area had to be enlarged an extra 4Ha in order to meet design criteria. In the scenarios where no quench water was sourced from the ponds (Scenarios 1.8 and 1.9), the surface area of the pond had to be doubled in comparison with Scenario 1.1 to 18Ha (Scenario 1.9) in order to meet design criteria. However, the average overflow volume per event for Scenario 1.9 (15ML) was just under half that of Scenario 1.1 (29ML).

4.1.2 Stage 2 Coke Production

Modelling Stage 2 production showed a similar pattern of results to Stage 1 scenarios. Surface areas for the stockpiles and main Coke Plant plus total quench demand were enlarged. In comparison with Scenario 1.1, total pond surface area had to be increased by 5.5Ha (Scenario 2.1) in order to meet design criteria with all other parameters (percentage quench demand taken from ponds, average depth of pond) the same.

Varying average pond depth between 2.5m (Scenario 2.2) and 3.5m (Scenario 2.3) led to an increase in surface area required by 6.5Ha. Alterations made to surface area also had a correspondingly more significant impact on overflow ARI than for Stage 1 production. Keeping pond depth the same at 3m and increasing surface area to 17Ha (Scenario 2.4) increased the overflow ARI to 17 years in comparison with Scenario 2.1. A decrease to 15Ha (Scenario 2.5) reduced the overflow ARI to 7 years in comparison with Scenario 2.1.

Changing the percentage of quench demand supplied from the ponds again had a significant impact on surface area. With 5% of daily quench demand met from pond water, surface area had to be increased to 23Ha in order to meet design criteria. With none of the daily quench demand met from pond water, surface area had to be increased to 32Ha in order to meet design criteria (double the area required in Scenario 2.1).

4.1.3 Sensitivity Testing

Increasing or decreasing seepage by 10% made a negligible difference to overflow recurrence and volume. This is as expected due to the very limited seepage rates allowed by the base/liner at the evaporation ponds and the insignificance of these losses relative to inflows and overflows. All of the scenarios where seepage was changed met the overflow criterion with the exception of Scenario 2.1b (overflow ARI of 9 years). Alterations made to pan evaporation rate had a larger impact on the number of overflows although this had minimal effect on average overflow volume per event. Scenario 2.1d (overflow ARI of 9 years) was the only instance where pan evaporation was altered and overflow recurrence was less than 10 years.

As the majority of water entering the ponds is derived from runoff, during sensitivity testing the greatest impact was found by varying runoff rates by ±10%. Increasing runoff rates by 10% in Scenarios 1.1e and 2.1e led to the overflow ARI decreasing to only 6 years in both cases compared with baseline Scenarios 1.1 (overflow ARI of 13 years) and 2.1 (overflow ARI of 11 years). Decreasing runoff rates by 10% in Scenarios 1.1f and 2.1f led to the overflow ARI increasing to 66 years and 33 years respectively.

4.2 Water Re-use

Key summary water re-use results for Scenarios 1.1 and 2.1 are presented in Table 4-3.

Table 4-3

Summary of Water Re-use Results

Scenario	Quench Demand (ML/year)	Quench Supplied from Ponds (ML/year)	Volume Required to Supplement Shortage (ML/year)	Dust Suppression Demand (ML/year)	Dust Suppression Supplied from Ponds (ML/year)	Volume Required to Supplement Shortage (ML/year)
1.1	140	90	50	110	60	40
2.1	280	180	100	210	120	90

Quench and dust suppression demand are roughly doubled between Scenario 1.1 and Scenario 2.1. However, the volume of water available for supply to either of these purposes in Scenario 2.1 is slightly less than double that for Scenario 1.1. The volume of water required to supplement the shortfall between what is supplied from the ponds and demand would therefore be proportionately greater for Stage 2 production than for Stage 1.

5.1 Pond Dimensions

In accordance with the broader surface water strategy (Section 2.3), the overall pond 'footprint' should be minimised in order to limit land clearance and environmental disturbance. Pond dimensions that are relatively small in surface area are preferable as long as the pond can meet design criteria without an excessive requirement for excavation. Analysis of the results presented in Section 4 shows that surface area can be minimised with greater average pond depth. For example, Scenarios 2.1 to 2.3 all meet design criteria but reducing the Scenario 2.1 pond depth (3m) by 0.5m (Scenario 2.2) leads to an increase in surface area of 4Ha. An increase in pond depth of the same amount (Scenario 2.3) leads to a reduction in surface area of 2.5Ha. Greater pond depths were not considered to be optimal for reducing excavation involved in constructing ponds. An average pond depth of 3m was adopted for all other scenarios.

Surface area was varied with average pond depth at 3m. For Stage 1 coke production, surface area was increased and decreased by 0.5Ha (Scenarios 1.4 and 1.5) and for Stage 2, surface area was increased and decreased by 1Ha (Scenarios 2.4 and 2.5) with the following results:

- Reductions in surface area for both Stages 1 and 2 increased the overflow ARI to 9 years (greater than that allowed by design criteria);
- Increases in surface area raised the overflow ARI considerably to 17 years for both Stages 1 and 2; and,
- Average overflow volume for both Scenarios 1.4 and 2.4 (31ML and 59ML) were the highest for Stage 1 and Stage 2 production respectively.

During a storm or series of storms large enough to cause an overflow, the rate of overflow from the pond is unlikely to cause significant environmental impact relative to those caused elsewhere in the catchment. However, measures would need to be taken at the outflow to the creek and/or within the drainage system to ensure these flows do not create erosion or watercourse instability.

Changes to the proportion of quenching water taken from the ponds had a large impact on design criteria. For example with 5% of daily quench demand taken from the ponds, ponds area is 4Ha larger than Scenario 1.1 (10% of quench demand supplied from ponds) for Stage 1 coke production (Scenario 1.6). and 7Ha larger than Scenario 2.1 for Stage 2 (Scenario 2.7) in order to meet design criteria. With no quench demand sourced from the ponds (Scenarios 1.8, 1.9, 2.8, 2.9), surface area had to be doubled in comparison with those scenarios with 10% quench demand sourced from the ponds in order to meet overflow design criteria.

All subsequent discussion of the implications of the stormwater management strategy on the Coke and Power Plant project are made with the assumption that pond dimensions and demand specifications for Scenarios 1.1 and 2.1 would be adopted.

5.2 Pond Location and Management

It is likely that the ponds will need an area of between approximately 9Ha (Stage 1) and 16Ha (Stage 2) during the operational phase of the project. The land available for settlement and evaporation ponds is likely to be to the north between the main Coke Plant area and Brickworks Road. Of this land, 12Ha has already been largely cleared during preliminary groundworks for the proposed AMC magnesium plant. If only Stage 1 is completed then the cleared area will be sufficient for the ponds and no further clearing will be required. However, in the event that a larger pond area is needed or the 10% water re-use target cannot be met, then some clearance is likely. Land in the north of the site adjacent to that identified is largely undisturbed. A vegetation clearing assessment and permits would therefore be necessary.

In order to meet water re-use targets, operational water management plans must be set up and implemented. These will include monitoring the requirement for dust suppression and co-ordinating this with water supply from the ponds. Water should be applied to the coal and coke stockpiles at a rate roughly equal to the rate of evaporation to prevent excessive runoff. It is envisaged however that not all of the dust suppression water can be supplied from the ponds. In Scenario 2.1 for example, an extra 98ML of raw water supply would be required to supplement the shortfall or dust suppression would need to be scaled back (Appendix A). Further co-ordinated efforts will be needed to predict the volume of pond water needed for dust suppression and determine whether there is adequate availability for quenching. Water quality for quenching does not need to be demineralised but there are likely to be constraints regarding Total Dissolved Solids (T.D.S). Any water to be used for this purpose may require some form of treatment prior to use. This may be achieved in part by locating the off-take downstream of the deep wet pools section of the settlement and evaporation ponds to allow sediment to precipitate out.

5.3 Water Use

Several different configurations for the Coke Plant are possible, each with a different water requirement. Coke quenching will make up a significant component of overall water use between approximately 25% and 90% depending on the scale of coke production and whether the power plant is constructed. In order to reduce the project's consumptive use of water transferred from outside the Neerkol Creek catchment and enhance sustainability, opportunities for water re-use and recycling should be explored and implemented wherever possible. The results of modelling suggest the following:

- For Scenario 1.1 (Stage 1), on average approximately 63ML/year dust suppression water and 92ML/year quench water could be supplied from the ponds;
- For Scenario 2.1 (Stage 2) approximately 120ML/year dust suppression water and 179ML/year quench water could be supplied from the ponds;
- Maximising the volume of water supplied from the ponds will reduce the overall raw water demand for the project by a similar amount;
- Rainfall is highly variable in Central Queensland however and in some years the volume of water supplied from the ponds may be much lower;

- For example, the results of modelling for Scenario 1.1 (Stage 1) indicate that, as a long-term average, only 6.7% of the total annual quench demand could be achieved from the ponds. For Scenario 2.1 this figure falls to 6.4%; and,

- The maximum portion of daily quench demand that could be supplied would be 10% at times during the year all quench demand would need to come from raw water supply.

Obtaining a new water allocation within the Fitzroy Basin from DNRM will be dependent on a number of factors including the type of allocation (water harvesting or direct diversion from the river), timescales for the release of allocations, security of supply and cost. To meet the objectives of the FBWRP, the project must also demonstrate that water use will be managed as efficiently as possible including water recycling. Opportunities for storm water to be retained and reused within the provisions of the overland flow amendment of the FBWRP are a favourable aspect of this project. It is not clear whether retaining a portion of the site's stormwater in the settlement and evaporation ponds would be classified as water harvesting or whether re-use will be permitted.

Due to the potential for environmental impacts associated with pollutants in runoff from certain areas of the proposed Coke Plant development, a management plan for on-site stormwater is required. The main potential pollutants of concern are from coal and coke particulates at the coal and coke stockpiles and within the main Coke Plant area around the coke ovens. In order to manage stormwater a strategy of risk-based containment is proposed to prevent stormwater from discharging off-site except during extreme rainfall or after persistent rain over many days. These are relatively infrequent events when significant dilution is provided by runoff from the broader catchment receiving the overflow.

In order to implement the strategy, 'clean' and 'dirty' areas of the site and surrounding area will be separated by drainage channels. Potentially contaminated runoff will be prevented from flowing off-site and clean water will be prevented from flowing into the dirty drains. All stormwater from 'dirty' areas (i.e. the coal and coke stockpiles and the main Coke Plant area) will drain into a settlement and evaporation pond system with sufficient volume storage to contain stormwater runoff such that there are no overflows more frequent than an average recurrence interval (ARI) of 10 years. Stormwater from clean areas will drain into the creek system as at present. Dependent on the final configuration of the plant, settlement and evaporation ponds with a total surface area of between 9.5Ha (Stage 1 coke production) and 16Ha (Stage 2 coke production) will be required with dust suppression water and up to 10% of quench demand sourced from the ponds. These will have an average depth of 3m although this will not be the same across the entire surface area of the ponds. Some areas deeper than 3m will be constructed to assist sedimentation with other areas shallower than 3m to promote evaporation.

Management systems must also be set up to ensure effective management of the pond water including providing for the use of pond water in dust suppression at the coal and coke stockpiles and for coke quenching. The ponds must also be regularly inspected for potential contaminants and to check the stability of embankments and seepage from the ponds. Drainage plans should be maintained on-site with the drains themselves clearly marked at the inlet using paint/stencil (or equivalent), to indicate whether they flow directly to a stormwater drain (e.g. "No Solid or Liquid Waste"). Erosion control and energy dissipation measures such as matting, riprap and/or gabions must be installed at the overflow from the ponds to the creek system to minimise erosion or watercourse instability. The quality of water in the ponds should be monitored for sediments and associated particulate contaminants with a review of data carried out after one year of monitoring. Ongoing assessment of the stormwater management strategy should be undertaken to assess and adapt the strategy as necessary. These actions should be co-ordinated with the overall surface water environmental management plan for the site.

Limitations

SECTION 7

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Queensland Coke Energy and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 4 May 2005.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 10 May and 20 September and is based on the information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Figures

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QUEENSLAND COKE & ENERGY

QUEENSLAND COKE AND POWER PLANT PROJECT
CONCEPTUAL STORM WATER MANAGEMENT PLAN

Drawn: LL | Approved: DRAFT | Date: 20/09/2005

Job No.: **42625626** | File No. 42625626-g-026.cdr

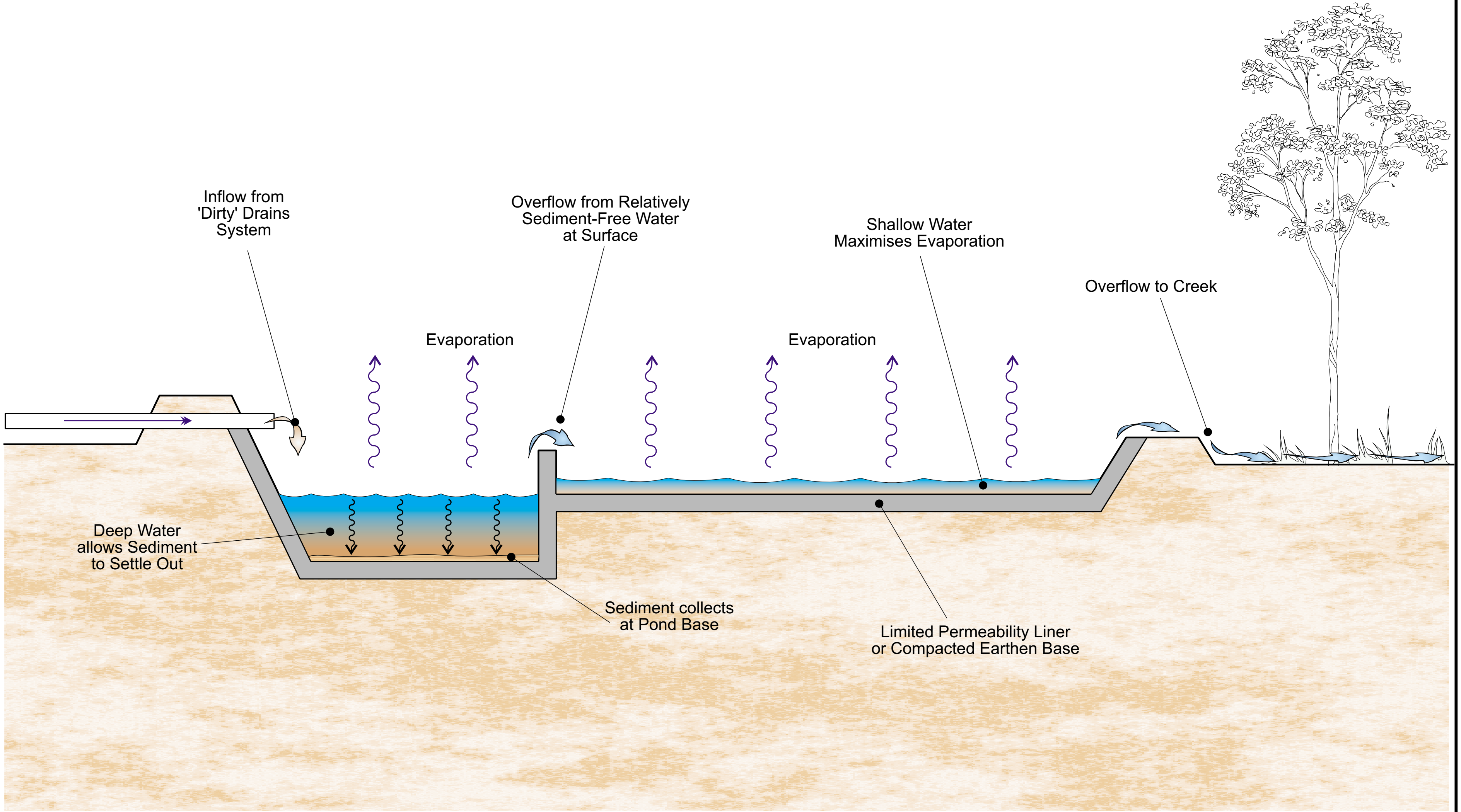


ILLUSTRATION TO SHOW CONCEPTUAL LAYOUT OF SETTLEMENT AND EVAPORATION PONDS

Draft

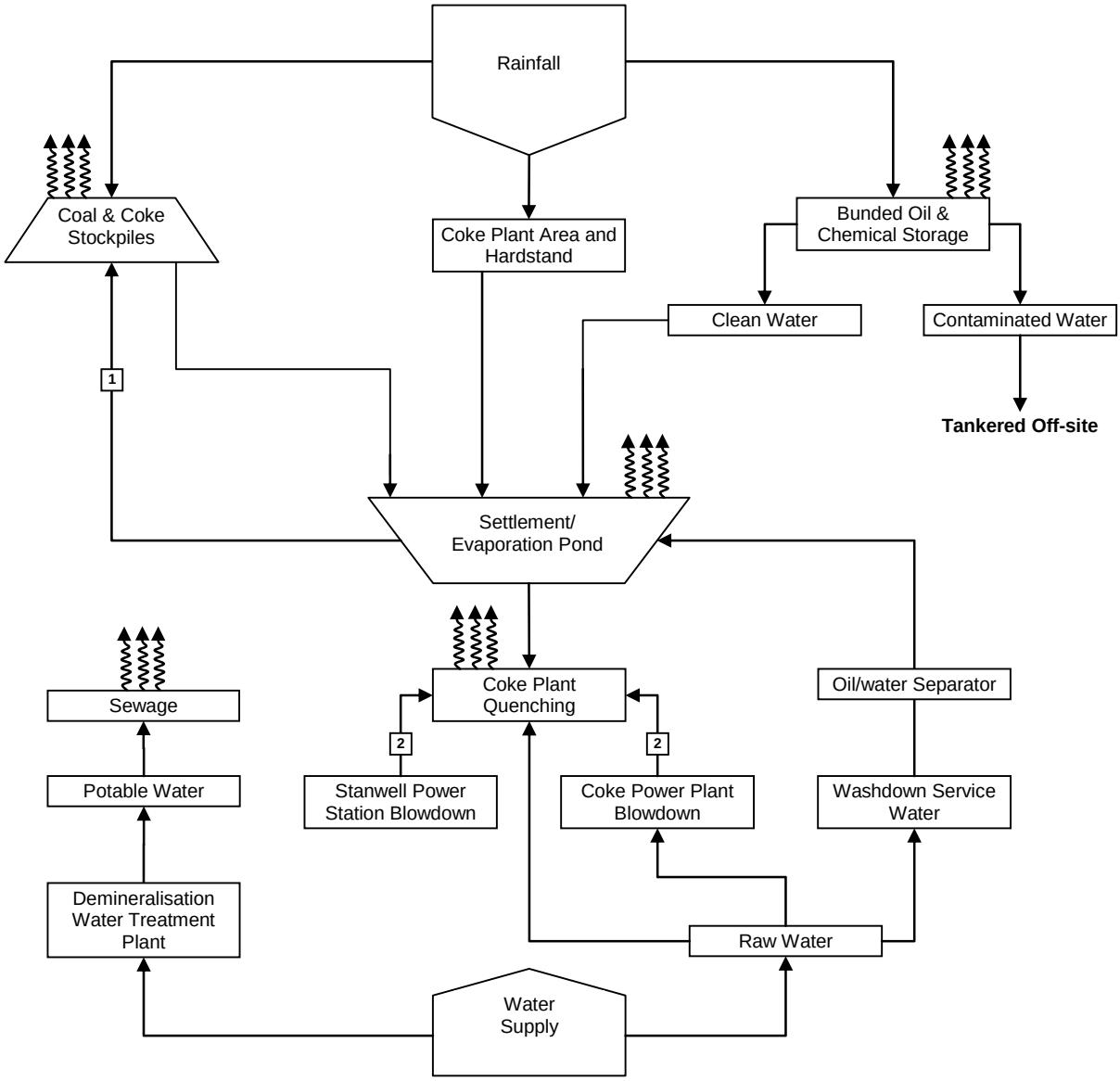
Figure: **2.1**

Rev. A

A4

Figure 2.2

Coke Plant

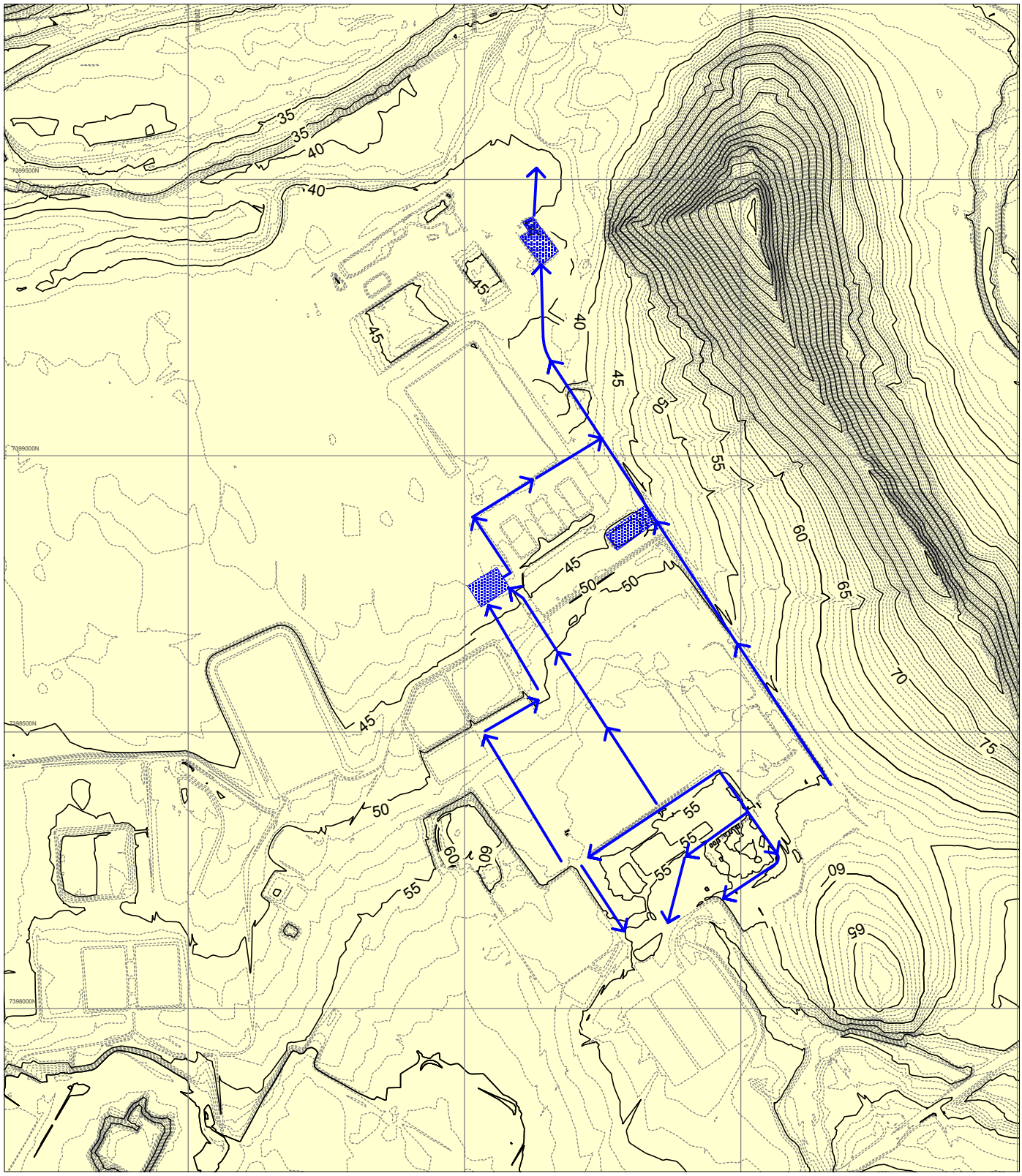


Key:

Evaporative losses.

Notes:

1 Water for dust suppression.
2 Use of blowdown from either power station is yet to be confirmed.



N

0 100 200m

Scale 1:10 000 (A4)

Horizontal Datum GDA94 Zone 56

LEGEND

Drainage Channels

Settling Ponds

STANWELL CORPORATION LIMITED

QUEENSLAND COKE & ENERGY

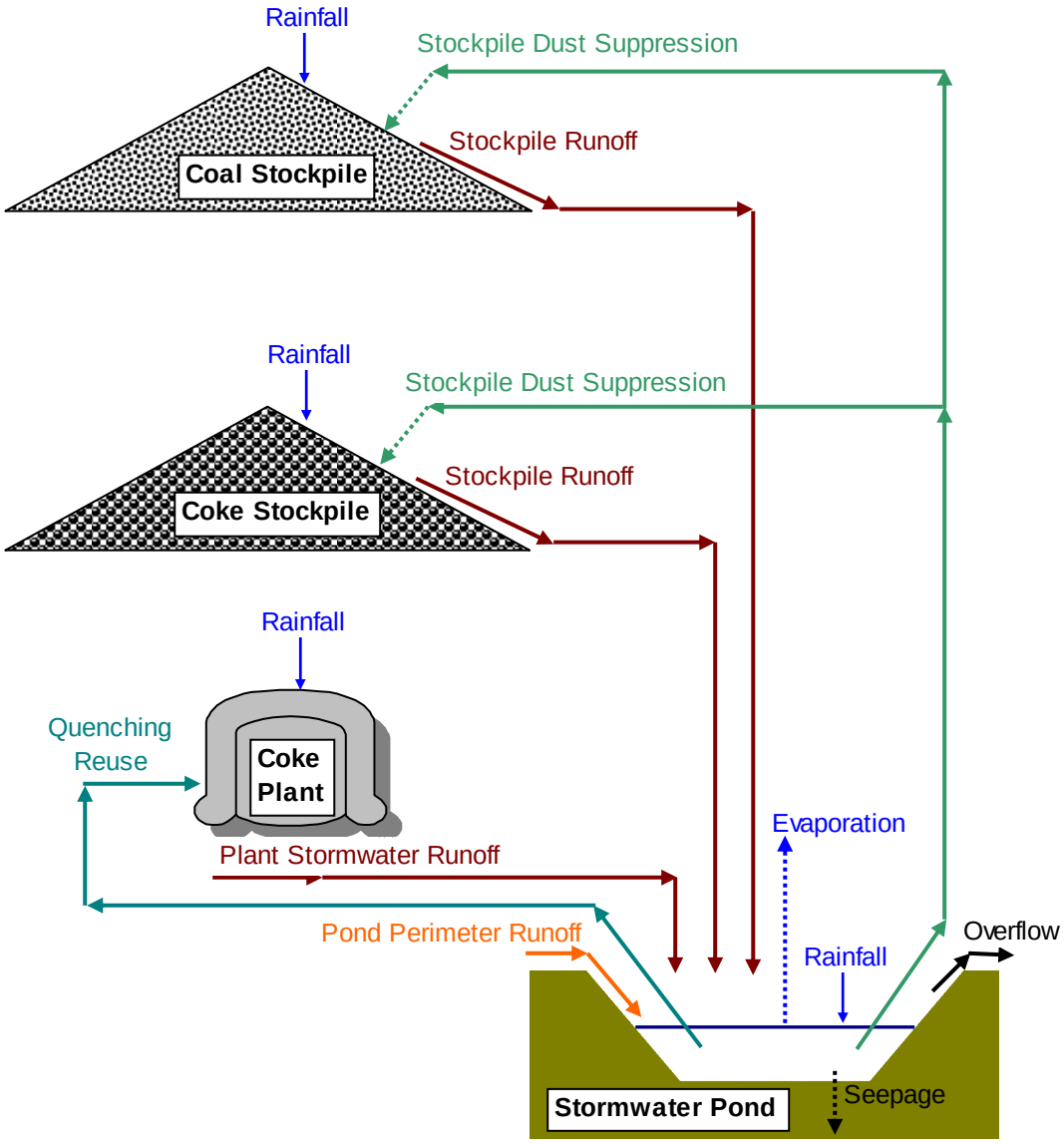
URS

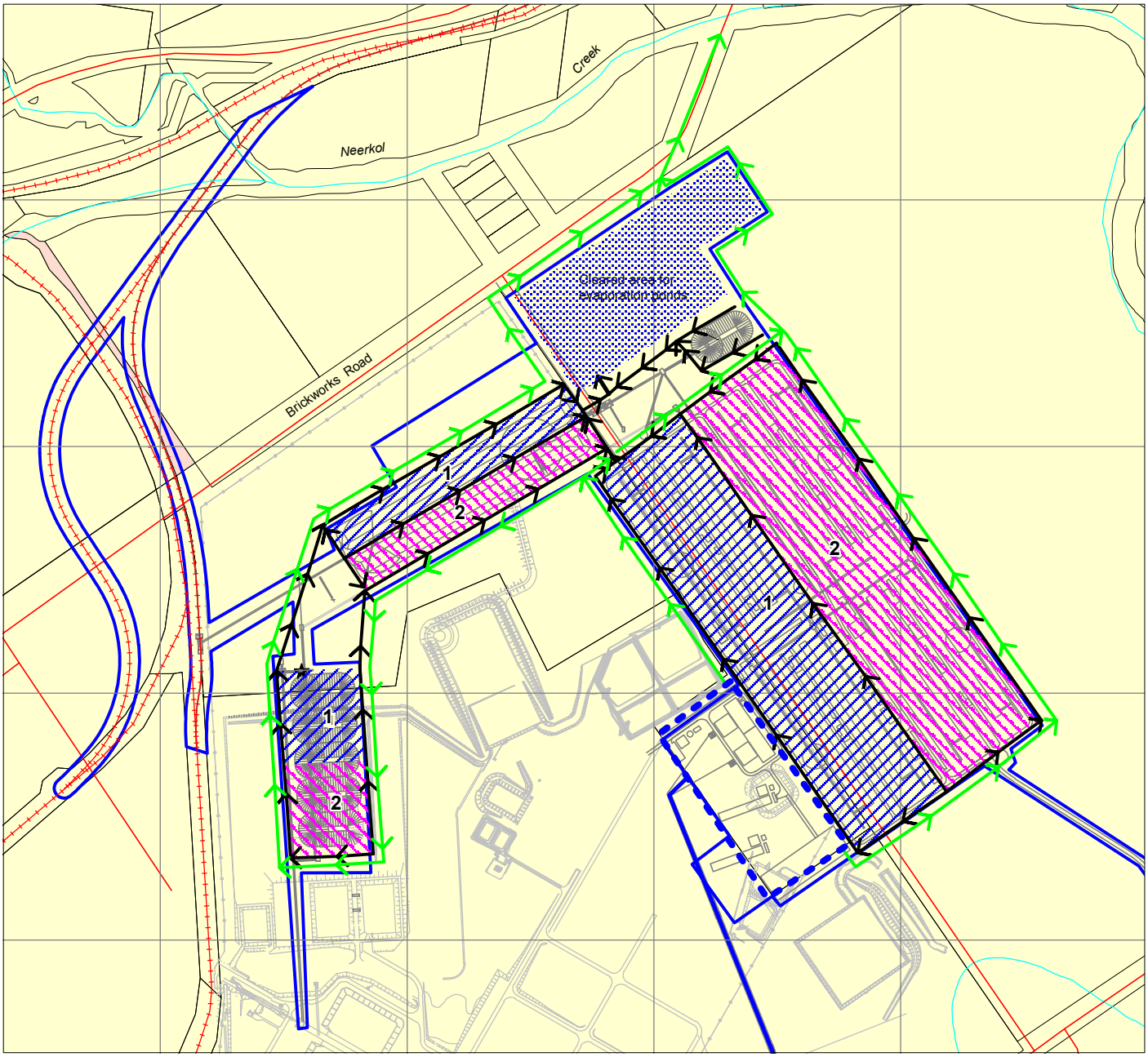
QUEENSLAND COKE
AND POWER PLANT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

EXISTING TOPOGRAPHY AND STORMWATER MANAGEMENT FEATURES - STANWELL

Drawn: VH	Approved: DRAFT	Date: 31-08-05	Figure: 2.3	Rev:A
Job No: **42625626**	File No: 42625626-g-018.wor			**A4**

Figure 3.1


Rainfall
Stockpile Dust Suppression
Stockpile Runoff
Coal Stockpile
Rainfall
Stockpile Dust Suppression
Stockpile Runoff
Coke Stockpile
Rainfall
Quenching
Reuse
Coke
Plant
Plant Stormwater Runoff
Evaporation
Pond Perimeter Runoff
Rainfall
Overflow
Seepage
Stormwater Pond



LEGEND

- 'Dirty' Drains/Direction of Flow
- 'Clean' Drains/Direction of Flow
- Power Plant (seperate drainage system)
- Stage 1 Layout
- Stage 2 Layout
- Settlement and Evaporation Ponds Area

N

0 125m 250m

Scale 1:12 500 (A4)

Horizontal Datum GDA94 Zone 56

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QUEENSLAND COKE & ENERGY

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QUEENSLAND COKE
AND POWER PLANT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

SITE LAYOUT AND TOPOGRAPHY

Draft

Drawn: VH	Approved: DRAFT	Date: 15-07-05	Figure: **3.2**	Rev:A
Job No: **42625626**	File No: 42625626-g-020.wor			**A4**

Figure 4.1: Scenario 1.1 Pond Water Level and Overflows for Simulation Period

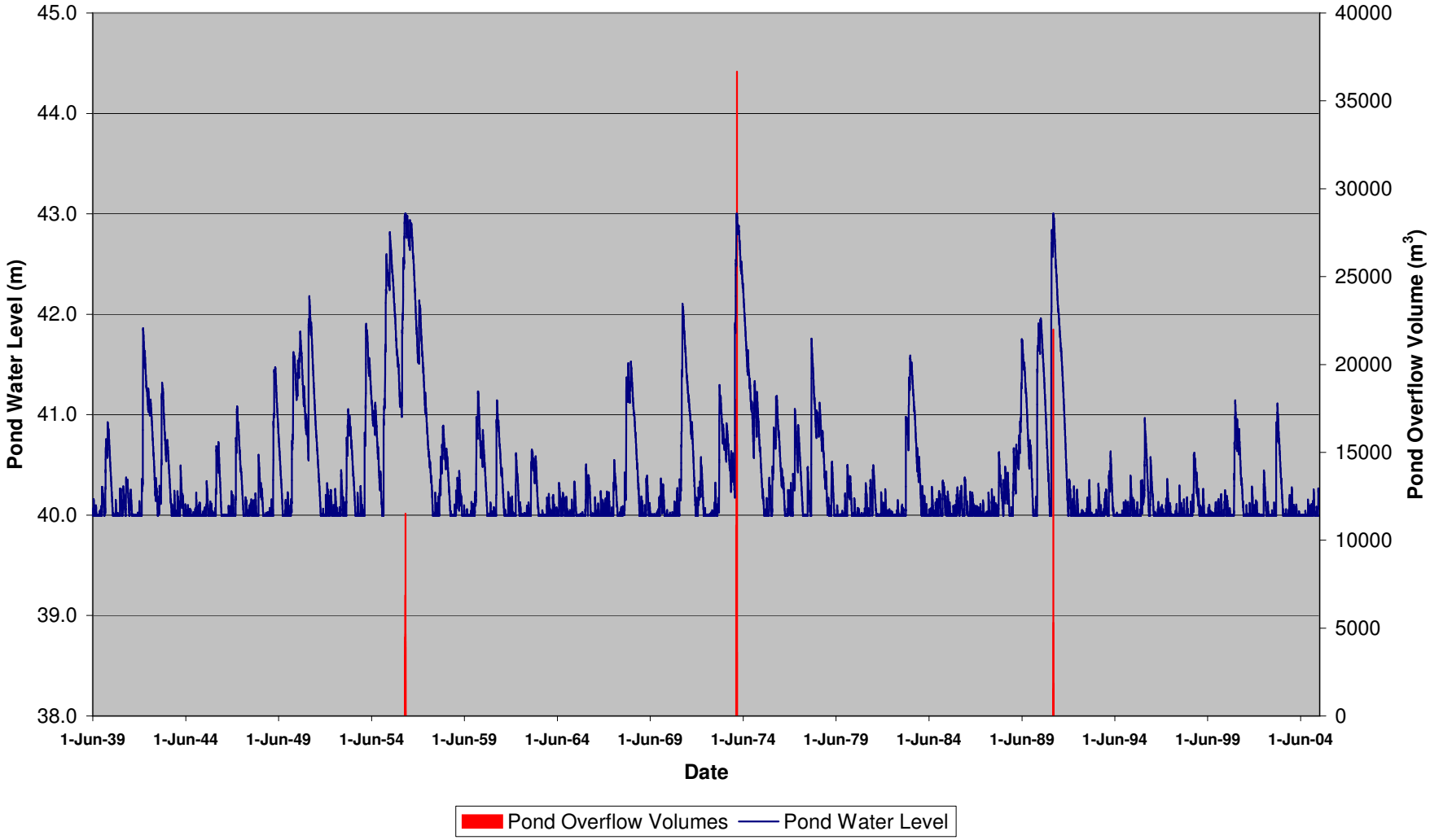
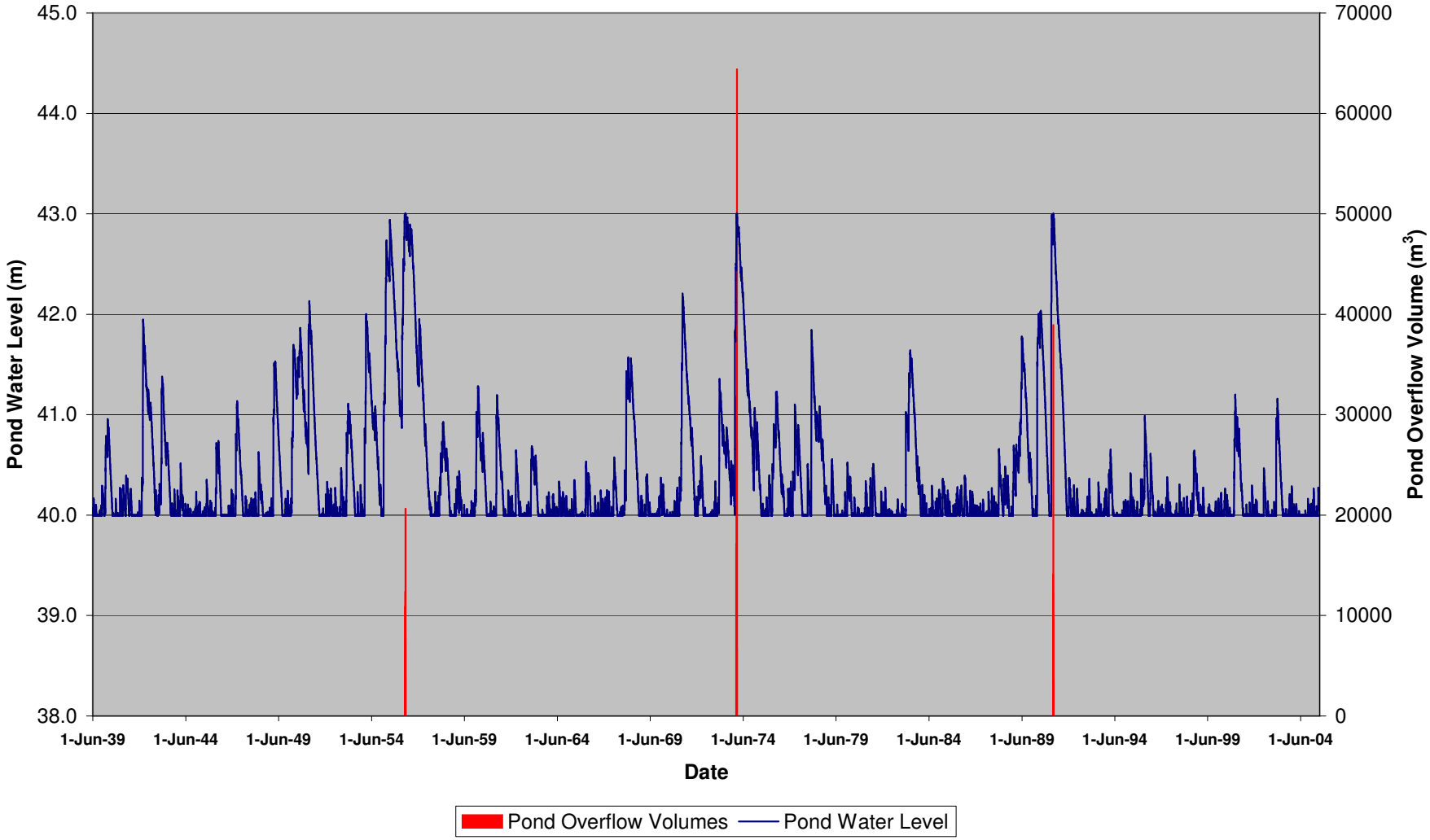


Figure 4.2: Scenario 2.1 Pond Water Level and Overflows for Simulation Period



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Appendix A
Modelling Results

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QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.1**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	95000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	90018.21	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	6438.02	0.74	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		89294	0
Overflow Level	43.0		94894	277289

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

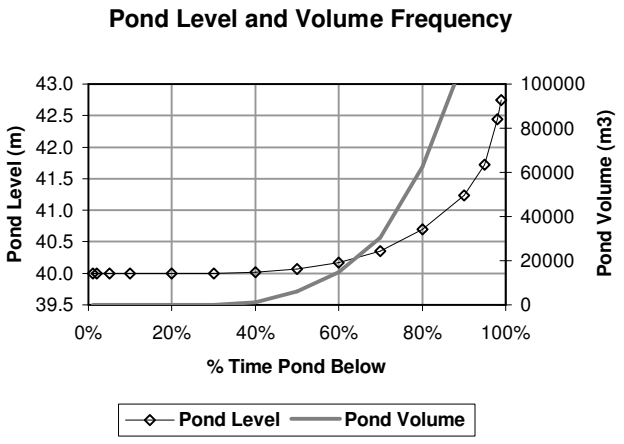
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.1

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
277289 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	1090
50%	40.1	6160
60%	40.2	14724
70%	40.3	30519
80%	40.7	62495
90%	41.2	111410
95%	41.7	156881
98%	42.4	224131
99%	42.8	253744



Pond Overflow Results		
Number of Overflows	5	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**13 years**	
Average Volume of Pond Overflow	29193 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	138,503	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	92,322	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	46,180	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	62,787	m^3/year
Dust suppression water required to supplement stormwater shortage	43,102	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	2,672	m^3/year
Direct Rainfall onto Stormwater Pond	72,271	m^3/year
Evaporation from Stormwater Pond	-95,229	m^3/year
Seepage from Stormwater Pond	-4,200	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-2,212	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-155,110	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*717,418*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.1%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.2**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	115000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	110484.36	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	10154.56	0.67	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		109675	0
Overflow Level	42.5		114859	281767

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

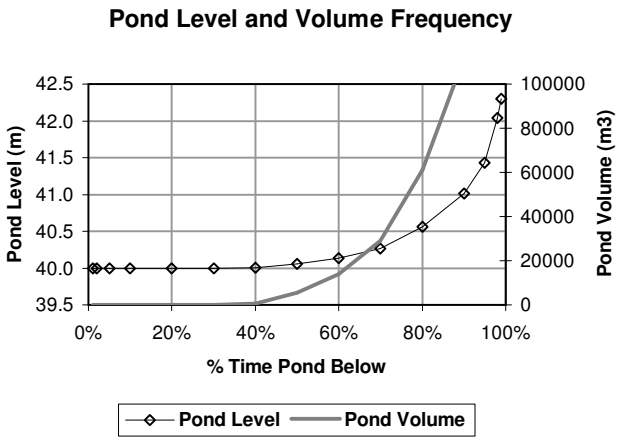
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.2

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
281767 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **42.5**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	675
50%	40.1	5456
60%	40.1	13870
70%	40.3	28865
80%	40.6	61026
90%	41.0	111952
95%	41.4	159209
98%	42.0	228456
99%	42.3	258622



Pond Overflow Results		
Number of Overflows	6	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**11 years**	
Average Volume of Pond Overflow	23322 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	138,503	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	90,480	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	48,023	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	61,073	m^3/year
Dust suppression water required to supplement stormwater shortage	44,817	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	2,503	m^3/year
Direct Rainfall onto Stormwater Pond	88,532	m^3/year
Evaporation from Stormwater Pond	-113,840	m^3/year
Seepage from Stormwater Pond	-5,032	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-2,120	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-151,552	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*720,976*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.2%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.3**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	80000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	74563.08	1.03	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	4139.92	0.81	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		73909	0
Overflow Level	43.5		79846	269754

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

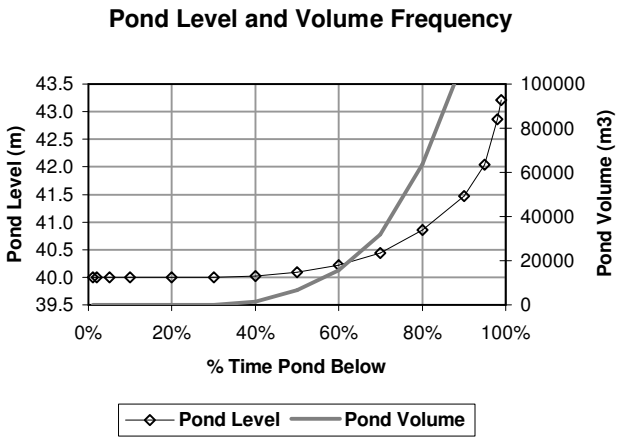
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.3

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
269754 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.5**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	1552
50%	40.1	6757
60%	40.2	15555
70%	40.4	31856
80%	40.9	63886
90%	41.5	111209
95%	42.0	154552
98%	42.9	219591
99%	43.2	247250



Pond Overflow Results		
Number of Overflows	6	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**11 years**	
Average Volume of Pond Overflow	24939 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	138,503	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	93,912	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	44,591	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	64,308	m^3/year
Dust suppression water required to supplement stormwater shortage	41,581	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	2,845	m^3/year
Direct Rainfall onto Stormwater Pond	60,011	m^3/year
Evaporation from Stormwater Pond	-80,644	m^3/year
Seepage from Stormwater Pond	-3,553	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-2,267	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-158,220	m^3/year
1938 **sum check error (Net Balance / Sum Inputs)**	0.1%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.4**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	90000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications

Elevation - Storage Relationship

$$Volume = A\ (H - H_o)^B + C$$

VolHo	VolA	VolB	VolC
40	84398.76	1.02	0

Elevation - Surface Area Relationship

$$Area = A\ (H - H_o)^B + C$$

AreaHo	AreaA	AreaB	AreaC
5	5549.19	0.76	0

Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		83699	0
Overflow Level	43.0		89121	260203

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

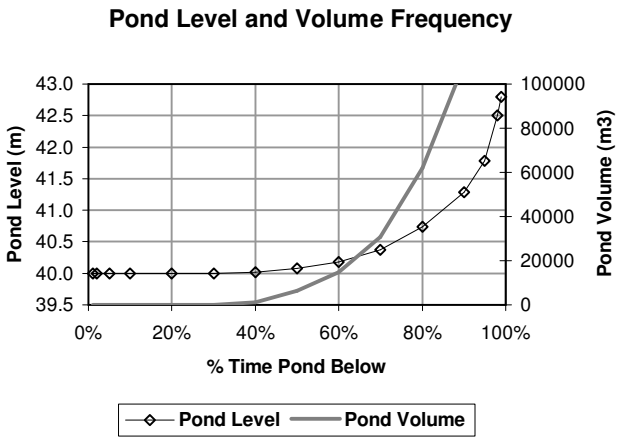
Water Balance Simulation	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.4

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
260203 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	1190
50%	40.1	6239
60%	40.2	14817
70%	40.4	30590
80%	40.7	62111
90%	41.3	109376
95%	41.8	152253
98%	42.5	215928
99%	42.8	241913



Pond Overflow Results		
Number of Overflows	7	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**9 years**	
Average Volume of Pond Overflow	24489 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	138,503	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	92,748	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	45,755	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	63,211	m^3/year
Dust suppression water required to supplement stormwater shortage	42,678	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	2,999	m^3/year
Direct Rainfall onto Stormwater Pond	67,801	m^3/year
Evaporation from Stormwater Pond	-89,785	m^3/year
Seepage from Stormwater Pond	-3,959	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-2,597	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-155,959	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*716,569*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.2%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.5**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	100000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	94633.73	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	7211.80	0.72	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		93889	0
Overflow Level	43.0		99632	291318

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

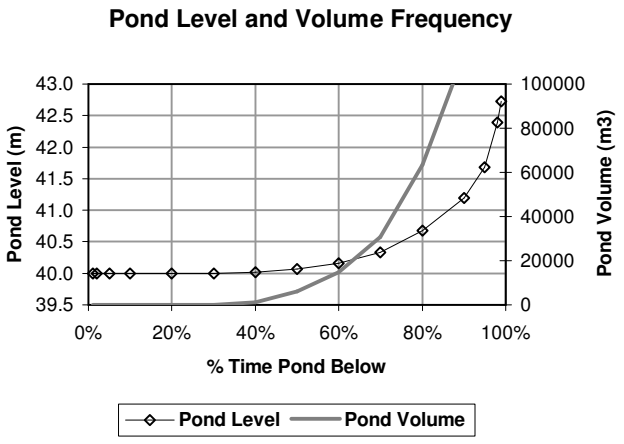
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.5

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
291318 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	1054
50%	40.1	6184
60%	40.2	14801
70%	40.3	30640
80%	40.7	63413
90%	41.2	113654
95%	41.7	161147
98%	42.4	231461
99%	42.7	264255



Pond Overflow Results		
Number of Overflows	4	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**17 years**	
Average Volume of Pond Overflow	31455 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	138,503	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	92,133	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	46,369	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	62,617	m^3/year
Dust suppression water required to supplement stormwater shortage	43,273	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	2,903	m^3/year
Direct Rainfall onto Stormwater Pond	75,947	m^3/year
Evaporation from Stormwater Pond	-99,805	m^3/year
Seepage from Stormwater Pond	-4,405	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-1,906	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-154,750	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*717,778*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.0%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.6**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	135000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	129039.19	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	14119.92	0.62	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		128160	0
Overflow Level	43.0		134868	395769

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			5%	

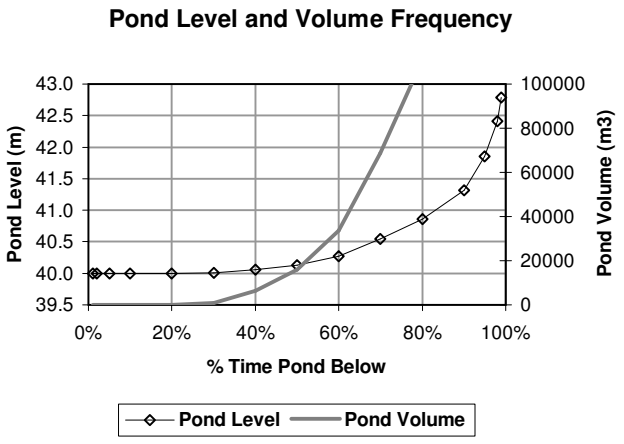
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.6

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
395769 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	840
40%	40.1	6522
50%	40.1	16072
60%	40.3	33760
70%	40.5	68809
80%	40.9	111017
90%	41.3	170455
95%	41.9	242065
98%	42.4	316621
99%	42.8	366641



Pond Overflow Results		
Number of Overflows	6	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**11 years**	
Average Volume of Pond Overflow	17457 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	69,251	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	52,025	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	17,226	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	73,373	m^3/year
Dust suppression water required to supplement stormwater shortage	32,517	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	3,156	m^3/year
Direct Rainfall onto Stormwater Pond	103,618	m^3/year
Evaporation from Stormwater Pond	-154,944	m^3/year
Seepage from Stormwater Pond	-6,861	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-1,587	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-125,398	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*747,130*	*m^3/year*

1938 **sum check error (Net Balance / Sum Inputs)** 0.0% **O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.7**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	115000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	109180.34	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	9896.39	0.67	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		108376	0
Overflow Level	43.0		114546	335503

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			5%	

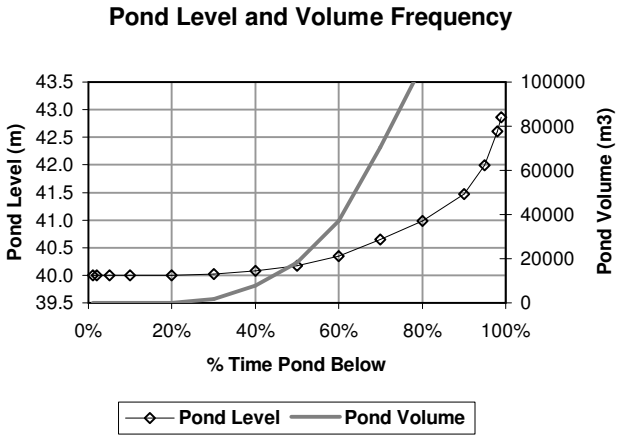
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.7

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
335503 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	1626
40%	40.1	7741
50%	40.2	18168
60%	40.3	37116
70%	40.7	70513
80%	41.0	107860
90%	41.5	161704
95%	42.0	221442
98%	42.6	290214
99%	42.9	319425



Pond Overflow Results		
Number of Overflows	11	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**6 years**	
Average Volume of Pond Overflow	18770 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	69,251	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	53,223	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	16,029	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	75,380	m^3/year
Dust suppression water required to supplement stormwater shortage	30,510	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	3,001	m^3/year
Direct Rainfall onto Stormwater Pond	87,820	m^3/year
Evaporation from Stormwater Pond	-134,589	m^3/year
Seepage from Stormwater Pond	-5,960	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-3,128	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-128,602	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*743,926*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.2%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.8**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	160000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	152803.95	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	19933.05	0.57	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		151842	0
Overflow Level	43.0		159144	467822

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			0%	

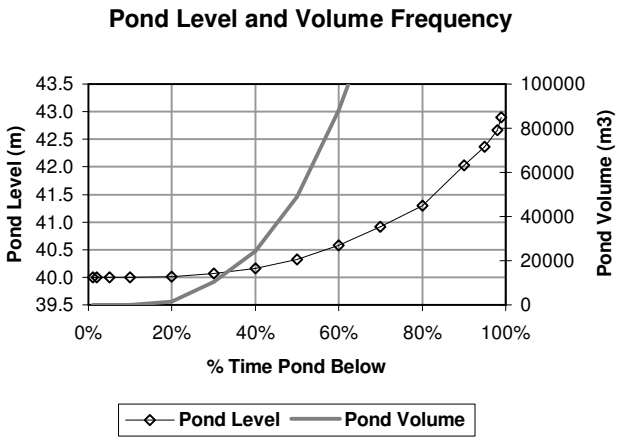
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.8

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
467822 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	1566
30%	40.1	10310
40%	40.2	24370
50%	40.3	49030
60%	40.6	88147
70%	40.9	138945
80%	41.3	199946
90%	42.0	313382
95%	42.4	367112
98%	42.7	414111
99%	42.9	451624



Pond Overflow Results		
Number of Overflows	11	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**6 years**	
Average Volume of Pond Overflow	16524 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	-	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	-	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	-	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	85,680	m^3/year
Dust suppression water required to supplement stormwater shortage	20,209	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	3,521	m^3/year
Direct Rainfall onto Stormwater Pond	123,120	m^3/year
Evaporation from Stormwater Pond	-210,252	m^3/year
Seepage from Stormwater Pond	-9,351	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-2,754	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-85,680	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*786,848*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.2%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 1.9**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	53570	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	67620	m^2	1	TRUE
Coke Plant Dirty Water Catchment	230000	m^2	1	TRUE
Stormwater Pond Direct Catchment	180000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	172554.02	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	25324.84	0.54	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		171528	0
Overflow Level	43.0		179288	527659

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	27842.5	m^2	1	TRUE
Coke Stockpile irrigation area	31000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			3792	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			0%	

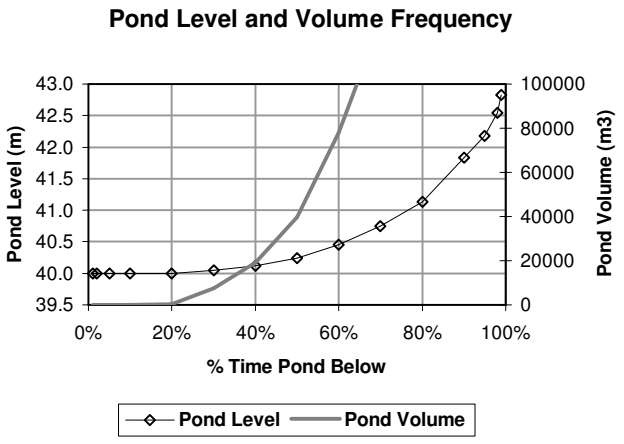
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 1.9

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
527659 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	324
30%	40.0	7530
40%	40.1	19255
50%	40.2	39807
60%	40.5	77830
70%	40.7	128100
80%	41.1	195523
90%	41.8	319835
95%	42.2	381604
98%	42.5	445370
99%	42.8	497583



Pond Overflow Results		
Number of Overflows	6	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**11 years**	
Average Volume of Pond Overflow	14585 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	-	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	-	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	-	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	105,889	m^3/year
Actual annual average stormwater supplied for dust suppression	83,015	m^3/year
Dust suppression water required to supplement stormwater shortage	22,874	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	19,383	m^3/year
Runoff from Coke Stockpile	24,466	m^3/year
Runoff from Coke Plant Area	138,162	m^3/year
Runoff from Pond Perimeter	3,766	m^3/year
Direct Rainfall onto Stormwater Pond	138,789	m^3/year
Evaporation from Stormwater Pond	-229,891	m^3/year
Seepage from Stormwater Pond	-10,260	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-1,326	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-83,015	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*789,513*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.0%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 2.1**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	160000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	152803.95	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	19933.05	0.57	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		151842	0
Overflow Level	43.0		159144	467822

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

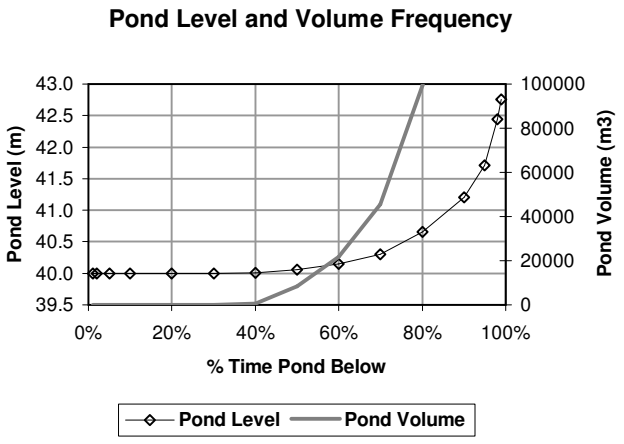
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.1

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
467822 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	611
50%	40.1	8444
60%	40.1	21845
70%	40.3	45576
80%	40.7	99542
90%	41.2	184769
95%	41.7	263454
98%	42.4	379580
99%	42.8	429337



Pond Overflow Results		
Number of Overflows	6	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**11 years**	
Average Volume of Pond Overflow	41614 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	277,006	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	178,663	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	98,342	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	120,162	m^3/year
Dust suppression water required to supplement stormwater shortage	91,617	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	3,895	m^3/year
Direct Rainfall onto Stormwater Pond	122,585	m^3/year
Evaporation from Stormwater Pond	-155,633	m^3/year
Seepage from Stormwater Pond	-6,847	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-3,783	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-298,825	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*1,958,731*	*m^3/year*

1938 **sum check error (Net Balance / Sum Inputs)** 0.2% **O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
File Reference: J:\Jobs\42625626\Studies\Surface Water\Stormwater Management\Pond Water Balance\QCE Stormwater Balance Template 2
Case Description: **Scenario 2.2**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	200000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors		Rainfall	Runoff
Minimum Runoff Factor for		0 mm/day	0%
Maximum Runoff Factor for		50 mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	193403.86	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	31511.52	0.51	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		192314	0
Overflow Level	42.5		199184	490853

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

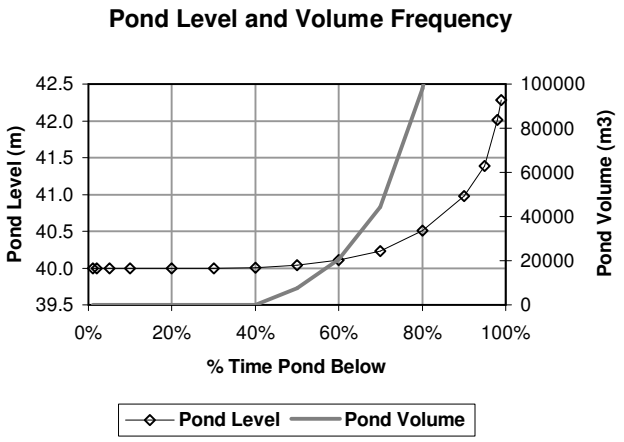
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.2

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
490853 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **42.5**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	5
50%	40.0	7525
60%	40.1	20665
70%	40.2	44305
80%	40.5	97967
90%	41.0	188287
95%	41.4	270403
98%	42.0	393016
99%	42.3	447737



Pond Overflow Results		
Number of Overflows	7	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**9 years**	
Average Volume of Pond Overflow	38378 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	277,006	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	175,329	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	101,677	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	117,188	m^3/year
Dust suppression water required to supplement stormwater shortage	94,591	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	3,688	m^3/year
Direct Rainfall onto Stormwater Pond	154,919	m^3/year
Evaporation from Stormwater Pond	-192,363	m^3/year
Seepage from Stormwater Pond	-8,487	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-4,070	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-292,517	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*1,965,039*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.1%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 2.3**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	135000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	127334.33	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	13733.60	0.62	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		126461	0
Overflow Level	43.5		134216	457122

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

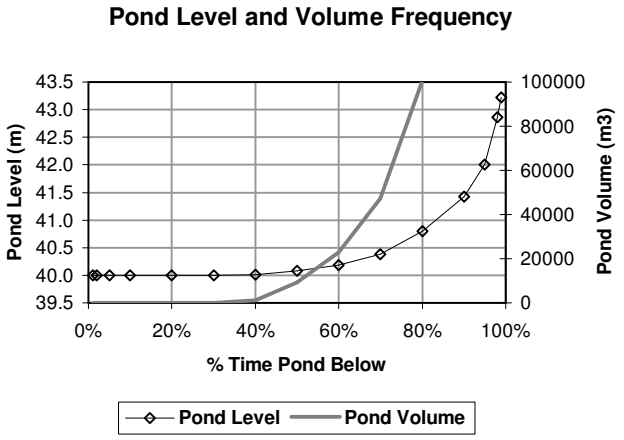
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.3

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
457122 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.5**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	1089
50%	40.1	9139
60%	40.2	22892
70%	40.4	47310
80%	40.8	100754
90%	41.4	183076
95%	42.0	258878
98%	42.9	373068
99%	43.2	419962



Pond Overflow Results		
Number of Overflows	7	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**9 years**	
Average Volume of Pond Overflow	35460 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	277,006	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	181,128	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	95,878	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	122,368	m^3/year
Dust suppression water required to supplement stormwater shortage	89,411	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	4,056	m^3/year
Direct Rainfall onto Stormwater Pond	102,333	m^3/year
Evaporation from Stormwater Pond	-131,953	m^3/year
Seepage from Stormwater Pond	-5,799	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-3,761	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-303,496	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*1,954,060*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.2%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 2.4**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	170000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	162528.99	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	22528.05	0.55	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		161535	0
Overflow Level	43.0		169066	497291

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

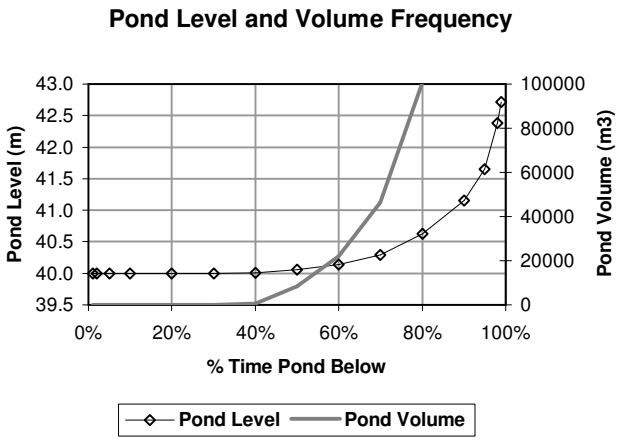
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.4

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
497291 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	522
50%	40.1	8406
60%	40.1	21979
70%	40.3	46232
80%	40.6	100909
90%	41.2	188579
95%	41.7	270909
98%	42.4	393055
99%	42.7	449479



Pond Overflow Results		
Number of Overflows	4	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**17 years**	
Average Volume of Pond Overflow	59499 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	277,006	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	178,285	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	98,720	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	119,726	m^3/year
Dust suppression water required to supplement stormwater shortage	92,053	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	4,073	m^3/year
Direct Rainfall onto Stormwater Pond	130,340	m^3/year
Evaporation from Stormwater Pond	-165,001	m^3/year
Seepage from Stormwater Pond	-7,267	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-3,606	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-298,012	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*1,959,544*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.0%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 2.5**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	150000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	142977.83	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	17435.38	0.59	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		142049	0
Overflow Level	43.0		149112	438038

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			10%	

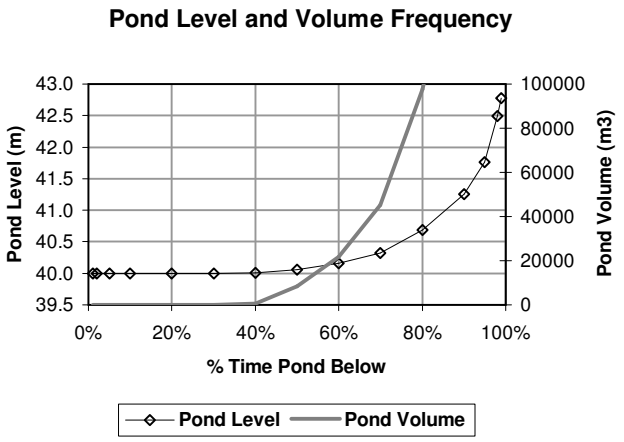
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.5

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
438038 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	0
40%	40.0	676
50%	40.1	8467
60%	40.2	21748
70%	40.3	45253
80%	40.7	97820
90%	41.3	180126
95%	41.8	254573
98%	42.5	361963
99%	42.8	404606



Pond Overflow Results		
Number of Overflows	9	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**7 years**	
Average Volume of Pond Overflow	36068 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	277,006	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	179,114	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	97,891	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	120,561	m^3/year
Dust suppression water required to supplement stormwater shortage	91,217	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	3,775	m^3/year
Direct Rainfall onto Stormwater Pond	114,748	m^3/year
Evaporation from Stormwater Pond	-146,112	m^3/year
Seepage from Stormwater Pond	-6,424	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-4,918	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-299,676	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*1,957,880*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.2%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 2.6**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	160000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	152803.95	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	19933.05	0.57	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		151842	0
Overflow Level	43.0		159144	467822

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			5%	

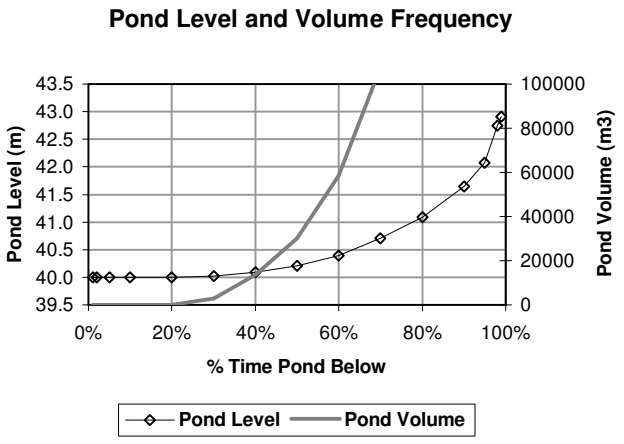
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.6

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
467822 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	2847
40%	40.1	13484
50%	40.2	30283
60%	40.4	58651
70%	40.7	107211
80%	41.1	166037
90%	41.6	252857
95%	42.1	320866
98%	42.7	427801
99%	42.9	452458



Pond Overflow Results		
Number of Overflows	16	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**4 years**	
Average Volume of Pond Overflow	41470 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	138,503	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	106,519	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	31,983	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	150,862	m^3/year
Dust suppression water required to supplement stormwater shortage	60,917	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	3,636	m^3/year
Direct Rainfall onto Stormwater Pond	122,956	m^3/year
Evaporation from Stormwater Pond	-188,732	m^3/year
Seepage from Stormwater Pond	-8,341	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-10,053	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-257,381	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*2,000,175*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.3%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 2.7**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	230000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	221466.86	1.02	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	40557.58	0.48	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		220297	0
Overflow Level	43.0		229091	675719

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			5%	

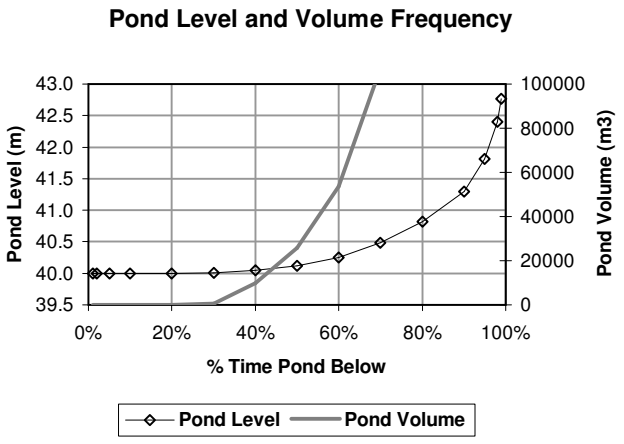
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.7

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
675719 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	0
30%	40.0	629
40%	40.0	9979
50%	40.1	25784
60%	40.2	53728
70%	40.5	106861
80%	40.8	179693
90%	41.3	288688
95%	41.8	405403
98%	42.4	539875
99%	42.8	622988



Pond Overflow Results		
Number of Overflows	7	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**9 years**	
Average Volume of Pond Overflow	26699 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	138,503	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	102,378	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	36,124	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	143,709	m^3/year
Dust suppression water required to supplement stormwater shortage	68,070	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	4,571	m^3/year
Direct Rainfall onto Stormwater Pond	177,686	m^3/year
Evaporation from Stormwater Pond	-260,949	m^3/year
Seepage from Stormwater Pond	-11,551	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-2,832	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-246,087	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*2,011,469*	*m^3/year*
1938	**sum check error (Net Balance / Sum Inputs)**	0.1% **O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 2.8**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	280000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	271069.15	1.01	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	58295.61	0.43	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		269768	0
Overflow Level	43.0		279500	825724

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			0%	

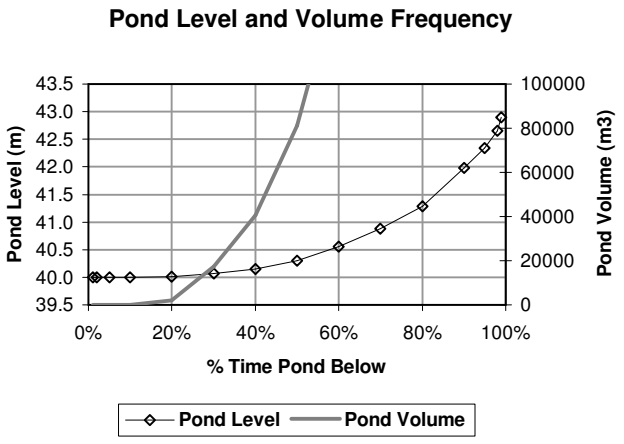
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.8

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
825724 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	2141
30%	40.1	17267
40%	40.2	40652
50%	40.3	81058
60%	40.6	150222
70%	40.9	237717
80%	41.3	348501
90%	42.0	542375
95%	42.3	640730
98%	42.7	729986
99%	42.9	796678



Pond Overflow Results		
Number of Overflows	11	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**6 years**	
Average Volume of Pond Overflow	31651 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	-	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	-	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	-	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	169,813	m^3/year
Dust suppression water required to supplement stormwater shortage	41,966	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	4,357	m^3/year
Direct Rainfall onto Stormwater Pond	218,039	m^3/year
Evaporation from Stormwater Pond	-369,269	m^3/year
Seepage from Stormwater Pond	-16,431	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-5,275	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-169,813	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*2,087,743*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.2%	**O.K. within 2%**

QCE - Coke Plant - Stormwater Management Plan
Water Balance for Pond Sizing and Overflow Risk Assessment

URS Project: 42625626
Date: 27-Oct-05
Case Description: **Scenario 2.9**

Water Balance Input Specifications

Catchments			1=incl, 0=no	
Coal Stockpile Dirty Water Catchment	77035	m^2	1	TRUE
Coke Stockpile Dirty Water Catchment	101600	m^2	1	TRUE
Coke Plant Dirty Water Catchment	457565	m^2	1	TRUE
Stormwater Pond Direct Catchment	320000	m^2	1	TRUE
Stormwater Pond Catchment Check	**Catchment area O.K.**			

Runoff Parameters			
Coal and Coke Stockpiles varying runoff factors	Rainfall		Runoff
Minimum Runoff Factor for	0	mm/day	0%
Maximum Runoff Factor for	50	mm/day	80%
Coke Plant Area (constant runoff coefficient - all rainfall conditions)			75%
Stormwater Pond Catchment Runoff (surrounding area - excluding pond surface)			70%

Evaporation Parameters			
Pan factor for pond evaporation	0.8	Stockpile Evaporation factor	1.00

Stormwater Containment Pond Specifications				
Elevation - Storage Relationship				
$Volume = A\ (H - H_o)^B + C$	VolHo	VolA	VolB	VolC
	40	310944.74	1.01	0
Elevation - Surface Area Relationship				
$Area = A\ (H - H_o)^B + C$	AreaHo	AreaA	AreaB	AreaC
	5	73940.28	0.40	0
Upper and Lower Levels	Level (m)		Area (m^2)	Volume (m^3)
Minimum Level	40.0		309547	0
Overflow Level	43.0		319971	946237

Seepage Losses from Containment Pond	
Constant seepage loss (mm/day) applied to pond surface area	0.2

Stormwater Reuse Specifications				
1. Stockpile Dust Control Irrigation when rainfall < evaporation			1=incl, 0=no	
Coal Stockpile irrigation area	55685	m^2	1	TRUE
Coke Stockpile irrigation area	62000	m^2	1	TRUE
2. Stormwater Reuse for Coke Plant Quenching				
Total Coke Plant Water Demand			7584	m^3/day
Portion of Total Demand to be supplied from Stormwater Pond			0%	

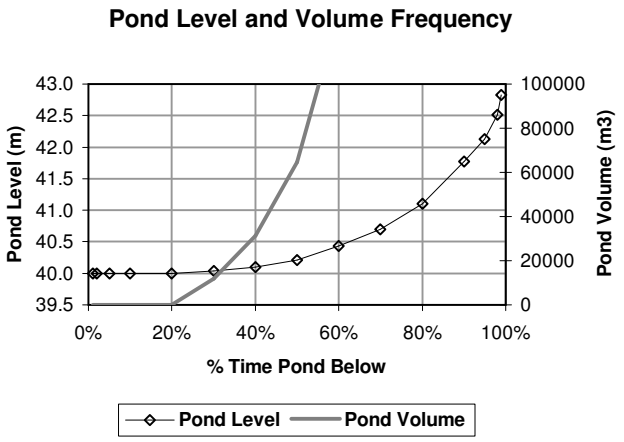
Water Balance Simulation				
	Year	Month	Day	
Simulation Start	1939	6	1	1-Jun-39
Simulation End	2005	6	1	1-Jun-05
Starting Water Level in Pond	40			

QCE - Coke Plant - Stormwater Management Plan
Water Balance Modelling Results
Scenario 2.9

Simulation Details		
66 years total simulation period	Start 1-Jun-39	End 1-Jun-05
946237 m^3 max pond capacity	Minimum Level **40.0**	Overflow level **43.0**

Pond Water Level and Volume Statistics

% time	level below (m)	volume (m3)
1%	40.0	0
2%	40.0	0
5%	40.0	0
10%	40.0	0
20%	40.0	49
30%	40.0	11775
40%	40.1	31180
50%	40.2	64521
60%	40.4	131951
70%	40.7	216045
80%	41.1	341812
90%	41.8	555394
95%	42.1	668962
98%	42.5	791720
99%	42.8	891212



Pond Overflow Results		
Number of Overflows	6	*Note: multiple overflows in seven day period counted as one overflow event and summed*
Average Frequency of Pond Overflow	**11 years**	
Average Volume of Pond Overflow	25113 m^3	

Stormwater Reuse Results - Coke Plant Quenching Supply		
Nominated water demand for reuse as quenching supply in Coke Plant	-	m^3/year
Actual water supplied to Coke Plant from Stormwater Pond (average)	-	m^3/year
Coke Plant quenching water required to supplement stormwater shortage	-	m^3/year

Stormwater Reuse Results - Stockpile Dust Suppression (Coal and Coke Combined)		
Calculated average annual water demand for stockpile dust suppression	211,779	m^3/year
Actual annual average stormwater supplied for dust suppression	164,033	m^3/year
Dust suppression water required to supplement stormwater shortage	47,746	m^3/year

Summary Key Water Balance Results - Annual Average		
Runoff from Coal Stockpile	27,873	m^3/year
Runoff from Coke Stockpile	36,761	m^3/year
Runoff from Coke Plant Area	274,861	m^3/year
Runoff from Pond Perimeter	4,580	m^3/year
Direct Rainfall onto Stormwater Pond	249,757	m^3/year
Evaporation from Stormwater Pond	-409,121	m^3/year
Seepage from Stormwater Pond	-18,264	m^3/year
Overflow from Stormwater Pond (averaged over simulation period)	-2,283	m^3/year
Stormwater reused from Pond for Quenching and Dust Suppression	-164,033	m^3/year
Total Supplemental Water Required for Coke Plant Quenching	*2,093,523*	*m^3/year*
1938 **sum check error (Net Balance / Sum Inputs)**	0.0%	**O.K. within 2%**

Appendix F
References

Department of Natural Resources and Mines (1999) *Fitzroy Basin Water Resource Plan*, Department of Natural Resources and Mines