Elk Valley Water Quality Plan

Annex D.5
Site Conditions

Teck

ELK VALLEY WATER QUALITY PLAN

SITE CONDITIONS

July 2014

Teck

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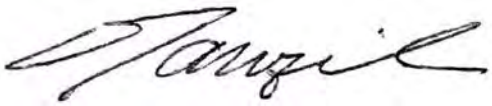

Dicksen Tanzil, Ph.D.
Senior Engineer

Summary

Teck is using a water quality model to support the development of the Elk Valley Water Quality Plan (the Plan). As shown in Table S-1, the model incorporates current mine development plans for Teck's five coal operations in the Elk Valley. Information on these projects was obtained from the 2013 mine plans, with the understanding that these will change over time, and that the model will be updated accordingly.

Table S-1 Mine Plans Considered in Developing the Plan

Operation	Existing or Future Development Project
Fording River	Turnbull South
	Eagle (including existing pits and Eagle Pushback)
	Swift Phases 1-4
	Castle
Greenhills	Cougar South
	Cougar North Extension [(a)]
	Greenhills Ridge Phase 2
	West Spoil Expansion
Line Creek	Mine Service Area Extension, North Line Creek Extension, Burnt Ridge South pits and Burnt Ridge Extension in Phase I
	Line Creek Operations Phase II
Elkview	Natal, Baldy Ridge Pits 1 and 2 and South Pit and Adit Pit
	Baldy Ridge Extension [(b)]
Coal Mountain	Coal Mountain
	Coal Mountain Phase 2 [(c)]

[(a)] Also known as Greenhills Ridge Phase 1.

[(b)] Including the Baldy Ridge Pits 3, 4, 6 and 7 and Adit Ridge Pit.

[(c)] Formerly known as the Marten Wheeler Project.

Anticipated changes in watersheds associated with the above-mentioned mine plans were incorporated into the model, namely:

- work in current mining areas, including those involving increase in the sizes of existing mine pits or spoils; and
- Extension to new areas previously unaffected by mining, involving the development of new mine pits or new spoils.

The historical and future placement of waste rock at each watershed was defined and incorporated into the model, based on historical operational records and the above-mentioned mine plans. Large open pits and their associated pit water management activities (i.e., pit dewatering, filling and spilling) were also incorporated into the model to simulate current and future flows at the Fording and Elk River mainstems and their tributaries.

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ACRONYMS AND ABBREVIATIONS

ARP	Adit Ridge Pit
AWTP	Active Water Treatment Plant
BC	British Columbia
BRN	Burnt Ridge North
BRP	Baldy Ridge Pit
BRS	Burnt Ridge South
CCR	Coarse Coal Rejects
CMO	Coal Mountain Operations
CPN	Cougar Pit North
CPNX	Cougar Pit North Extension
CPS	Cougar Pit South
DC	Dry Creek
EVO	Elkview Operations
the Plan	Elk Valley Water Quality Plan
FRO	Fording River Operations
GHO	Greenhills Operations
GW	Groundwater
LCB	Lower Carbon Creek
LCO	Line Creek Operations
LLW	Lower Little Wheeler Creek
LML	Lake Mountain Creek Lower
LMU	Lake Mountain Creek Upper
LOM	Life of Mine
LSS	Lower Snowslide Creek
MM	Mount Michael
MRP	Marten Ridge Pit
MSAX	Mine Service Area Extension
MWO	Marten Wheeler Operations
NLX	North Line Creek Extension
NTF	North Tailing Facility
NTS	North Turnbull Spoil
SPMT	South Pit, Milligan and Thresher Creeks

STP	South Tailings Pond
the Order	Ministerial Order No. M113
UCB	Upper Carbon Creek
ULC	Upper Line Creek
ULCD	Upper Line Creek Diversion
ULW	Upper Little Wheeler Creek
USS	Upper Snowslide Creek
UTM	Universal Transverse Mercator
WFTF	West Fork Tailings Storage Facility
WLC	West Line Creek

UNITS OF MEASUREMENT

%	percent
BCM	bank cubic metres
km	kilometres
m^3	cubic metres
masl	metres above sea level
MBCM	million bank cubic metres

1 Introduction

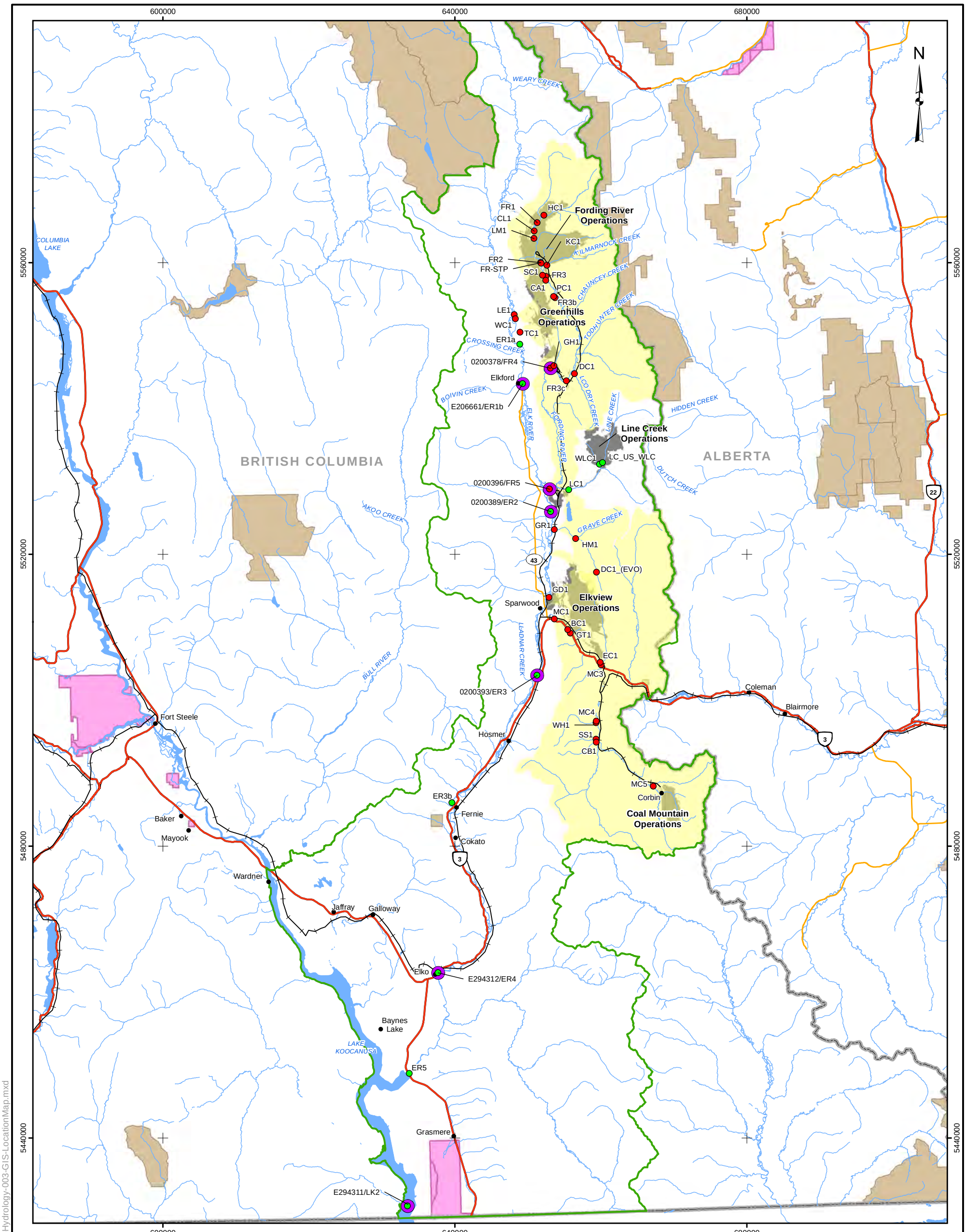
1.1 Background

Teck Coal Limited (Teck) operates five open-pit steelmaking coal mines in the Elk River watershed (also known as Elk Valley) in southeastern British Columbia (Figure 1-1):

- Fording River Operations (FRO)
- Greenhills Operations (GHO)
- Line Creek Operations (LCO)
- Elkview Operations (EVO)
- Coal Mountain Operations (CMO).

On 15 April 2013, Ministerial Order No. M113 (the Order) was issued by the BC Minister of the Environment. The Order requires Teck to develop an area-based management plan for the Elk Valley for the purpose of managing water quality concentrations of selenium, cadmium, nitrate and sulphate and the rate of calcite formation. Teck is referring to this area based management plan as the Elk Valley Water Quality Plan (the Plan). As part of the Plan, Teck must develop targets for water quality at specified locations in the Fording River, Elk River and Lake Koocanusa. The Order also requires Teck to develop a detailed implementation plan to demonstrate how water quality concentrations targets will be met at the specified locations.

To support the planning process, Teck has developed a regional planning and assessment tool described as the Elk Valley Water Quality Planning Model (the model). At its core, the model is a water quality mass balance model. The main inputs to the model include surface water flows, geochemical source terms and operational mine information (such as rate and placement of waste rock). The outputs include estimates of concentrations of water quality constituents of interest at selected locations in the Elk Valley. The model was used to support the identification of water quality management measures to meet the long-term water quality targets in the initial implementation plan.



LEGEND

- CITY / TOWN / COMMUNITY
- FLOWS AT MODELLING NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- MODELLING NODE
- ORDER STATION
- CANADIAN PACIFIC RAILWAY
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- WATERCOURSE
- BRITISH COLUMBIA - ALBERTA BORDER
- COAL MINING OPERATION
- DESIGNATED AREA
- FIRST NATIONS RESERVE
- PROVINCIAL PARK
- WATERBODY
- WATERSHED FLOWS SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD

15 0 15

SCALE 1:500,000 KILOMETRES

REFERENCE

Communities obtained from The Atlas of Canada, Natural Resources Canada. Roads obtained from Geobase. Parks/ protected areas, First Nations and railroad data obtained from Geogratis. Provincial boundary and hydrography data obtained from IHS Energy Inc. USA data obtained from ESRI. Projection: UTM Zone 11 Datum: NAD 83

PROJECT

TECK COAL ELK VALLEY WATER QUALITY PLAN

TITLE

DESIGNATED AREA, ORDER STATIONS AND MODELLING NODES

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	27 Feb. 2013	FIGURE 1-1	
GIS	DR	27 Jun. 2014		
CHECK	JC	27 Jun. 2014		
REVIEW	AC	27 Jun. 2014		

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1.2 Purpose and Scope

This report provides information on the historical and potential future conditions in local watersheds affected by Teck's steelmaking coal mining operations in the Elk Valley. The information was used to simulate historical and potential future flows, concentrations and loadings in local and regional watercourses, as well as to develop an initial implementation plan to meet long-term water quality targets.

This report is part of a series of supporting documents that provide additional technical information on the development of the Plan, including:

- *Water Quality Modelling Methods* (Teck 2014b), which describes the setup and configuration of the model and the results of the calibration
- Consolidation of Geochemical Source Term Inputs and Methods for Elk Valley Water Quality Modelling (SRK 2014), which describes the geochemical inputs to the model
- *Hydrology* report (Teck 2014c), which describes the hydrology inputs to the model
- *Water Quality Modelling for the Initial Implementation Plan* (Teck 2014d), which describes the selection of water quality management measures for the implementation plan and the future water quality conditions predicted by the model.

An overview of the Plan is provided in the main report, described herein as the Plan Document (Teck 2014a).

2 Overview

2.1 Mine Plan

To simulate and evaluate potential future water quality conditions, the model incorporates mine development plans for Teck's operations in the Elk Valley as presently understood. These plans include the completion of mining in existing areas, as well as the development of reasonably foreseeable new areas. Information on these development projects were obtained from the long-range 2013 mine plans developed by the operations. Future projects have less detail and certainty, but are included to reflect a consistent production rate. It is understood that mine plans will change over time and that the model will be updated to reflect new information.

This section provides an overview of the mine development projects with respect to the information incorporated in the model, namely:

- waste rock placement schedule by watershed
- changes in topography including increase in pit and spoil sizes
- changes to mining features (e.g., the creation of pits and the deposition of coal rejects)
- water management measures incorporated in current mine plans (both operational and closure).

Table 2-1 summarizes planned mine development projects organized by operation. For each project, the following information is listed:

- the currently planned timeframe of active mining (i.e., up to and including 2034)
- the anticipated volume of waste rock to be generated corresponding to the above-listed timeframe (Table 2-2)
- the anticipated placement of waste rock corresponding to the above-listed timeframe (with additional details provided in Appendix A).

Table 2-1 Mine Plans Considered in Developing the Plan

Operation	Existing or Future Development Project	Waste Rock to 2034 [million BCM]	Watershed(s) - Waste Rock Placement
Fording River	Turnbull South	16	Turnbull Spoil
	Eagle (including existing pits and Eagle Pushback)	718	Clode Creek, Kilmarnock Creek
	Swift Phases 1-4	1,192	Turnbull/North Spoil, Swift/Cataract Creek, backfill in Swift pit
	Castle[(a)]	369	Kilmarnock Creek, Eagle Pit backfill
Greenhills	Cougar South	411	Leask/Wolfram/Thompson (i.e., West Spoil), Greenhills, Porter, Cataract/Swift, and backfill in Cougar pits
	Cougar North Extension [(b)]	211	
	Greenhills Ridge Phase II	500	
	West Spoil Expansion	– [(e)]	Leask/Wolfram/Thompson
Line Creek	MSAX, NLX, BRS pits in Phase I and BRX	178	Line Creek, North Line Creek pit backfill
	LCO Phase II	532	LCO Dry Creek, MSAX pit backfill, Mount Michael and Burnt Ridge North pit backfill
Elkview	Natal, Baldy Ridge Pits 1 and 2 and South Pit and Adit Pit	737	Erickson Creek, EVO Dry Creek, pit backfill
	Baldy Ridge Extension [(c)]	665	
Coal Mountain	Coal Mountain	53	Coal Mountain
	Coal Mountain Phase II [(d)]	583	Wheeler Creek watershed, Wheeler pit and Marten pit backfill

(a) Waste rock data for the Castle project incorporated up to 2037.

(b) Also known as Greenhills Ridge Phase 1.

(c) Including the Baldy Ridge Pits 3, 4, 6 and 7 and Adit Ridge Pit.

(d) Formerly known as the Marten Wheeler Project.

(e) Waste rock to be placed at the West Spoil Expansion is included in the waste rock for the Cougar South project.

BCM = bank cubic metre; MSAX = Mine Service Area Extension; NLX = North Line Creek Extension; BRS = Burnt Ridge South; BRX = Burnt Ridge Extension.

Table 2-2 Changes in Waste Rock Considered in Developing the Plan

Operation	Waste Rock [million BCM] [(a)]	
	2013	2034
Fording River [(b)]	2,674	4,901
Greenhills[(b)]	441	1,507
Line Creek	601	1,411
Elkview	1,444	2,847
Coal Mountain	272	893
Total	**5,432**	**11,559**

(a) Annual water rock placement schedules are included in Appendix A.

(b) Waste rock placed in the Swift and Cataract watersheds by both FRO and GHO are listed in this table as part of FRO.

At this time, detailed mine plans are not developed for the FRO Castle Project, GHO Greenhills Ridge Phase 2 Project or LCO BRX Project. As a result, these projects were incorporated into the model at a conceptual level of detail (i.e., waste rock placement schedule and volumes only). No changes to watershed conditions associated with these three projects are included in the model at this time.

Anticipated changes in watersheds associated with the above-mentioned mine plans can be summarized as (1) work in current mining areas, including those involving an increase in the sizes of existing mine pits

or spoils, and (2) extensions to new areas previously unaffected by mining, involving the development of new mine pits or new spoils.

A number of the development projects will result in open pits. Larger open pits are explicitly incorporated in the model; understanding that short-term flow effects from smaller pits will be negligible for the planning timeframe. Open pits that are incorporated into the model are shown in Table 2-3. Upon completion, one of these pits will serve as a tailings storage facility; some will be completely backfilled with waste rock; and others will be partially backfilled with waste rock. Both backfilled and partially backfilled pits will fill with water to the spill elevation defined by the underlying topography. Partially backfilled pits will have visible water storage. Anticipated pit completion and pit spilling dates provide estimates of the timeframe over which watersheds upstream of open pits will not contribute flows and loadings to downstream environments.

Table 2-3 Open Pits in the Mine Plan Incorporated into the Model

Operation	Pit	Pit Configuration at End-of-Mining	Pit Completion Date	Pit Spilling Date
Fording River	Turnbull Pit	Tailings storage	2014	2035 [(a)]
	Eagle 6 Pit	Backfilled	2023	2036
	Swift Pit	Partially backfilled	2040	> 2060
Greenhills	Cougar Pit	Partially backfilled	2030	2056
Line Creek	Burnt Ridge North 2 Pit	Partially backfilled	2031	2058
Elkview	Natal Pit	Partially backfilled	2046	> 2060
Coal Mountain	Wheeler Pit	Partially backfilled	2039	> 2060
	Marten Pit	Backfilled	2022	2024

[(a)] Year when Turnbull Pit is filled with tailings.

Mining of several pits, including Turnbull and Eagle 6 at FRO, Cougar at GHO, Burnt Ridge North 2 at LCO and Marten at CMO, is anticipated to be completed during the planning timeframe (i.e., up to and including 2034). Upon completion, these pits will begin filling with water and will not contribute flows and loadings to downstream environments. Marten is the only pit anticipated to spill during the planning timeframe.

Information on the placement of coal rejects is provided in Appendix A. Further details on planned mining activities, and operational and closure water management measures (e.g., pumping of pit waters to adjacent watersheds and planned pit decants), are discussed for each mine operation in Sections 3 through 6.

Future conditions are discussed with reference to mine plans, and include pit filling times and other activities that extend beyond the planning timeframe. This provides a complete picture of how current mine plans may affect future conditions, recognizing that the Plan focuses on the next 20 years, because developments in water management, as well as Teck's mine plans, are likely to change over time. As such, conditions over the next 20 years have been considered in the Plan.

2.2 Data Sources and Assumptions

Information on historical and potential future site conditions was used to define inputs to the model, including the flow model (Teck 2014c) and water quality model (Teck 2014b). This information focused on locations and volumes of waste rock at each operation, as well as the underlying (i.e., without waste rock) topography and how water is managed (i.e., conveyed, diverted, discharged and stored) at each of those sites.

Planned future development, site information, and data sources are summarized in Table 2-4. Historical waste rock data from 1971 to 2012 were provided by Teck's operations. Future mining plans include projects that are reasonably foreseeable, with adjustments made to maintain production profiles consistent with Teck's plans.

The Plan also makes use of knowledge developed for recent Teck permitting projects in the Elk Valley, including:

- Elkview Operations Baldy Ridge Extension Water Balance (Golder 2010)
- Line Creek Operations Phase II Project Environmental Assessment Certificate Application (Teck 2011)
- Valley-wide Selenium Management Actions Plan for Teck Coal Limited Operations in the Elk Valley – Summary Report (Teck 2013)
- FRO Swift Project Environmental Assessment Certificate Application (in progress).

Table 2-4 Sources of Site Information

Operation	Future Development included in Mine Plan (for the Plan)	Available Information for Defining Watershed Conditions	
		Mining Plan	Water Management Plan
Fording River	**FRO Mine Plan** (includes Turnbull South, Eagle Pushback, Swift Phases 1-4 and waste rock from Castle placed in Kilmarnock Creek and Eagle Pit)	• 5-year snapshots of surface contours for most areas • End-of-mine life surface and mined-out contours • Details on Mine Plan sequencing	• 5-year snapshots for most areas • Discussions with Teck personnel • Information on plans for a tailing storage facility in Turnbull Pit
Greenhills	**GHO Mine Plan** (includes Cougar South, Cougar North Extension[(a)], Greenhills Ridge Phase 2, and West Spoil Expansion)	• Snapshots of surface contours (excluding some waste rock from Greenhills Ridge Phase 3) • End-of-mine life surface contours (excluding some waste rock from Greenhills Ridge Phase 3) • End-of-mine life mined-out contours for Cougar pits[(b)]	• Discussions with site personnel
Line Creek	**LCO Mine Plan** (includes MSAX, NLX, BRS pits and BRX in Phase I and Phase II[(c)])	• Snapshots of surface contours for 2009 LOM, used in LCO Phase II Environmental Assessment (Teck 2011) • End-of-mine life surface and mined-out contours • Details on LOM sequencing	• From LCO Phase II Environmental Assessment (Teck 2011) • Discussions with site personnel
Elkview	**EVO Mine Plan** (includes Baldy Ridge, Natal and Adit Ridge)	• 5-year snapshots of surface contours • End-of-mine life surface and mined-out contours • Details on LOM sequencing	• 5-year snapshots • Information on plans for Natal Pit dewatering
Coal Mountain	**CMO Mine Plan** (includes Phase I - last year of mining in 2018 and Phase II[(d)] - 2013 LOM Summary Report)	• Phase II: • 5-year snapshots of surface contours (mine plan dated August 2013) • End-of-mine life surface and mined-out contours (mine plan dated August 2013)	• Not required for Phase I • Not available for Phase II

(a) Cougar North Extension is referred to as Greenhills Ridge Phase 1 in the mine plan.

(b) From 2011 LOM, provided for the Valley-wide Selenium Management Plan Project (Teck 2013).

(c) Phase II consistent with LCO Phase II Environmental Assessment (Teck 2011), with a start date of 2014.

(d) Formerly known as the Marten Wheeler Project.

General assumptions relevant to site conditions include the following:

- The drainage system is driven by the topography of the underlying mined-out or original surface, and therefore the placement of backfill and waste rock spoils (and current reclamation practice) does not affect drainage paths or spill elevations of flooded pits and backfilled pits.
- Watershed areas are constant from 1995 to 2010 (fixed to 2010 watershed areas).
- Increases in mining area from 1995 to 2010 are proportional to historical waste-rock volumes.
- Future areas of spoils and watersheds vary linearly between snapshots.
- Short-term, temporary watershed events and upsets that may affect flows will have a limited effect on water quality planning, and are not included in the flow model.

2.3 Management Options

As described in the Plan Document (Teck 2014a), a range of water quality management options were reviewed. Specific active water treatment plants and clean water diversions, as well as water management to support active treatment, have been identified as part of the initial implementation plan. Active water treatment reduces the concentrations of one or more constituents of interest in the water directed for treatment, while clean-water diversion, which routes clean (i.e., non mine-affected) water around waste-rock spoils or other mining activities. The process for developing the initial implementation plan is discussed in the Plan Document (Teck 2014a), with supporting technical information provided in the *Water Quality Modelling for the Initial Implementation Plan* (Teck 2014d). Summaries of the water quality management measures selected for each mining operation are provided as part of Sections 3 through 7.

3 Fording River Operations

Fording River Operations has been in operation since 1971 and is situated near the upper end of the Fording River watershed. This section describes the site conditions at FRO, including the current and future watershed conditions, waste rock, pit water management, and predicted current and future flows. The project description included in the Plan is subject to revision and reflects the plans for the project as of August 2013.

3.1 Current and Future Watershed Conditions

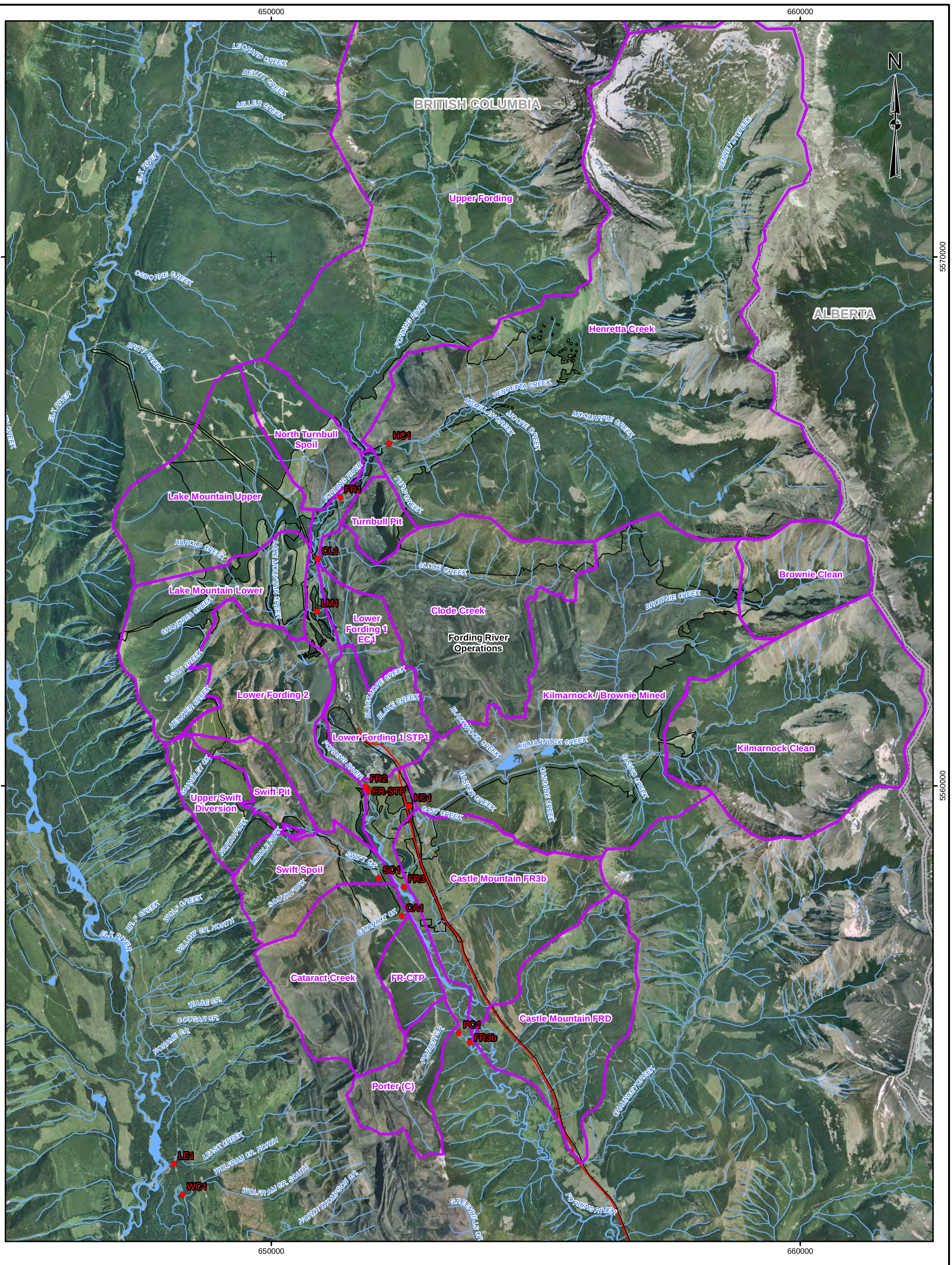
Tributaries of the Fording River that have been disturbed by mining and spoil placement include Henretta, Clode, Lake Mountain, Kilmarnock, Swift and Cataract Creeks. Swift, Cataract and Porter Creeks also have historical disturbance from GHO, which is adjacent to FRO. Current (i.e., 2010 Snapshot) and future watershed boundaries are shown in Figures 3-1 and 3-2.

A summary of historical and planned future watershed changes at FRO, that are included in the model, is presented in Table 3-1.

The following mining activities were included in the model:

- Completion of the Turnbull and Eagle pits, and placement of associated waste rock.
- Creation of a new tailings storage facility in the mined-out Turnbull Pit.
- Completion of the Swift Project, on the western side of the Fording River Valley, which involves reactivating and expanding an historical mining area to make a large new pit (Swift Pit Phases 1 to 4), and placement of waste rock to the north (North Spoil), south (in Swift/Cataract watershed) and as backfill in the pit. As a result, Lake Mountain Creek watershed will be mined out.

As discussed in Section 2.1, detailed mine plans have not been developed for the FRO Castle Project. To that end, future mining activities in relation to the Castle Project were included in the model at the conceptual level (i.e., production and waste rock only, with large uncertainty regarding waste rock placement and mine sequencing). This approach considers consistent production levels, recognizing that the detail associated with each of the specific projects will continue to evolve. Waste rock information for Castle was developed from 2025 to 2037, with waste rock placed in spoils in Kilmarnock Creek watershed and backfill in Eagle pits. No changes to watershed conditions associated with Castle are included in the model. Spoiling is assumed to occur on top of existing waste rock.



LEGEND

- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- CANADIAN PACIFIC RAILWAY
- ROAD
- WATERCOURSE
- BRITISH COLUMBIA - ALBERTA BORDER
- CURRENT FORDING RIVER OPERATIONS PERMITTED AREA
- SUB-WATERSHED
- WATERBODY
- Clode Creek SUB-WATERSHED NAME

2 0 2

SCALE 1:70,000 KILOMETRES

REFERENCE

Provincial boundaries obtained from The Atlas of Canada, Natural Resources Canada. Alberta hydrography data obtained from Canvec. BC hydrography and transportation obtained from Teck Coal Limited. Imagery obtained from The Orthoshop.
Projection: UTM Zone 11 Datum: NAD 83

PROJECT
TECK COAL ELK VALLEY WATER QUALITY PLAN

TITLE
FORDING RIVER OPERATIONS WATERSHEDS (2010 SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 3-1	
GIS	DR	09 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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650000
660000
5570000
5560000
N
BRITISH COLUMBIA
ALBERTA
MILLER CREEK
OSBORNE CREEK
BRITT CREEK
FORSYTH CREEK
ELK RIVER
FORDING RIVER
HENRETTA CREEK
Upper Fording
Henretta Creek
HENRETTA CREEK
MCMILLAN CREEK
MOORE CREEK
MCQUARRIE CREEK
HC1
North Turnbull Spoil
FORDING RIVER
FR1
TUAW CREEK
Turnbull Pit
HAROLD CREEK
LAKE MOUNTAIN CREEK
CL1
CLODE CREEK
Clode Creek
Brownie Clean
BROWNIE CREEK
LM1
CHANDREA CREEK
Lower Fording 1 EC1
Eagle 6 Pit
Kilmarnock / Brownie Mined
JASON CREEK
HEATHER CREEK
Lower Fording 2 LF2
BLACKMORE CREEK
BLAKE CREEK
BLACKWOOD CREEK
KILMARNOCK CREEK
Kilmarnock Clean
Upper Swift Clean
Swift Pit
Lower Fording 1 STP1
FORDING RIVER
CASPER CREEK
CASCADE CREEK
CASINO CREEK
FR2
FR-STP
KC1
CAST CREEK
SHANDLEY CK.
NORTH FORK
MIDDLE FORK
SWIFT CK.
SC1
FR3
Castle Mountain FR3b
SOUTH FORK
Cataract / Swift
CA1
CATARACT CK.
BR. F CREEK
WOLF CREEK
ELK RIVER
WILLOW CR. NORTH
WILLOW CR. SOUTH
WILDE CR.
WILDE CR.
WADE CR.
COUGAR CR.
NONAME CR.
FR-CTP
Castle Mountain FRD
PO1
FR3b
PORTER CR.
Porter Creek
CHAUNCEY CREEK
LE1
LEASK CREEK
WOLFRAM CR. NORTH
WOLFRAM CR. SOUTH
WC1
NORTH THOMPSON CR.
GREENHILLS CR.
FORDING RIVER
THOMPSON CR.
TC1

LEGEND

- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- CANADIAN PACIFIC RAILWAY
- ROAD
- WATERCOURSE
- BRITISH COLUMBIA - ALBERTA BORDER
- CURRENT FORDING RIVER OPERATIONS PERMITTED AREA
- SUB-WATERSHED
- WATERBODY
- Clode Creek SUB-WATERSHED NAME

2 0 2
SCALE 1:70,000 KILOMETRES

REFERENCE

Provincial boundaries obtained from The Atlas of Canada, Natural Resources Canada. Alberta hydrography data obtained from Canvec BC hydrography and transportation obtained from Teck Coal Limited. Imagery obtained from The Orthoshop.
Projection: UTM Zone 11 Datum: NAD 83

PROJECT
TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE
FORDING RIVER OPERATIONS WATERSHEDS
(END OF MINE SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 3-2	
GIS	DR	09 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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Table 3-1 FRO Watershed Summary

Flow Model Watershed Name	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Upper Fording	• predominantly natural watershed • for simplification, the very small amount of historical waste rock in the watershed was lumped into Henretta Creek historical waste rock	• no planned changes
Henretta Creek	• predominantly natural watershed • some existing mining disturbance, including Henretta pit and waste rock dumps	• completion of Henretta pit • waste rock placement until 2016 • revegetation of dumps[(a)]
North/Turnbull Spoil	• upper watershed currently natural • Turnbull Spoil located in lower watershed	• total watershed area increases • Turnbull Spoil expands to become the North Spoil as part of the Swift Project (from current spoil area of about 1.2 km^2 to 11.8 km^2 in 2040) • watershed boundary is defined by the water management system for clean and mine-affected water • mine-affected water will be directed to a new sediment pond • revegetation of dump[(a)]
Clode Creek	• part of the upper watershed is currently natural • extensive mine disturbance, including Eagle Pits and waste rock dumps • discharges through Clode Pond	• more mining activity and waste rock placement until 2017 • upper watershed becomes Eagle 6 pit sub-watershed from 2013 onwards (Eagle 6 pit sub-watershed discharges to Clode Creek) • revegetation of dump[(a)] • see note[(b)]
Eagle Pit	• not applicable (no watershed during the historical period)	• upper watershed of Clode Creek becomes Eagle 6 pit sub-watershed from 2013 onwards (Eagle 6 pit sub-watershed discharges to Clode Creek) • pit filling from 2024 to 2035 • filled pit discharges to Clode Creek from 2036 onwards • see note[(b)]
Turnbull Pit	• Turnbull Pit is currently being mined down	• groundwater inflows from other watersheds from 2011 onwards • pit mining will be complete in 2014 • utilized as a closed-circuit tailings storage facility from 2015 to 2034 (zero discharge) • filled pit discharges to the Fording River from 2035 onwards
Lake Mountain Creek Upper	• predominantly natural watershed • assumed that all historical waste rock is located in Lake Mountain Lower watershed	• watershed changes as the Swift Pit, North Spoil and associated water management system modify the watershed • no watershed remaining after 2026 (becomes part of North Spoil watershed)

Table 3-1 FRO Watershed Summary (continued)

Flow Model Watershed Name	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Lake Mountain Creek Lower	• some existing mining disturbance, including historical pits, waste rock and a small quantity of CCR	• watershed changes as the Swift Pit, North Spoil and associated water management system modify the watershed • no watershed remaining after 2016 (becomes part of Swift Pit watershed)
Lower Fording Rv1 EC1	• predominantly mine disturbed area, mostly waste rock, on the east side of the Fording River • watershed area drains to Eagle Pond	• revegetation of dump[(a)]
Lower Fording Rv1 STP1	• predominantly mine disturbed area on the east side of the Fording River • includes the South Tailings Facility	• revegetation of dump and tailings facility[(a)]
Lower Fording Rv2 LF2	• predominantly mine disturbed area on the west side of the Fording River, between Lake Mountain Creek and Swift Creek watersheds, discharging to Smith Ponds • includes historical pits, waste rock, and the North Tailings Facility	• watershed area reduces as Swift Pit watershed increases • from 2017 onwards, the remnant watershed consists of waste rock adjacent to the Fording River and the North Tailings Facility (which will be repurposed as a new sediment pond) • revegetation of dump and tailings pond
Swift Creek upper diversion	• clean water diversion active from 2005 onwards	• clean water diversion is extended north during Swift Pit mining period, increasing the watershed size • flows through new clean water pond and discharges to lower Swift Creek during operations (up to 2040) • discharges to the Swift Pit at end of mining (2041 onwards)
Swift Pit	• historical Swift/Ben's Pit	• groundwater inflows from other watersheds from 2022 onwards • new Swift Pit mining expands the watershed (by reducing the Lower Lake Mountain and Lower Fording Rv2 LF2 sub-watersheds) • partial backfill in the pit • operational pumping of pit water will be directed to the new North Tailing Facility (NTF) sediment pond • beginning in 2041, the Swift Pit is filling, with pumping rate of 8,000 m^3/day to the Fording River to maintain flows during pit filling period • flooded pit at closure and revegetation of dump
Swift Spoil	• historical waste rock from FRO and GHO including rock drain • discharges through Swift Ponds	• watershed is combined with Cataract Creek from 2017 onwards

Table 3-1 FRO Watershed Summary (continued)

Flow Model Watershed Name	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Cataract Creek	• predominantly mine disturbed watershed • historical waste rock from FRO and GHO including rock drain • Cougar North Pit (GHO) in upper watershed started filling in 2009, reducing the contributing watershed area • discharges through Cataract Pond	• combined Swift/Cataract Creek watershed from 2017 onward, defined by the water management system for mine-affected water • mine-affected water will be directed to a new sediment pond • revegetation of dump[(a)]
Porter Creek	• historical waste rock in upper watershed	• watershed area reduced by GHO mining activities from 2017 onwards • revegetation of dump[(a)]
Castle Mnt FR3b	• natural watershed contributing to Fording River (north half of Castle Mountain)	• no changes in the flow model • see note[(b)]
Castle Mnt FRD	• natural watershed contributing to Fording River (south half of Castle Mountain)	• no changes in the flow model • see note[(b)]
FRCTP	• natural watershed contributing to Fording River (between Cataract Creek and Porter Creek)	• no planned changes
Brownie Clean	• natural watershed in upper Brownie Creek that historically drains to Brownie rock drain (part of Kilmarnock Brownie Mined sub-watershed)	• no planned changes
Kilmarnock Clean	• natural watershed in upper Kilmarnock Creek that historically drains to Kilmarnock Brownie Mined sub-watershed	• no planned changes
Kilmarnock Brownie Mined	• predominantly mine disturbed watershed • historical mining and waste rock and rock drains on Kilmarnock and Brownie Creeks • discharges through sediment ponds	• revegetation of dump[(a)]
Additional to FR3c	• additional natural area contributing to the Fording River between FR3b and FR3c	• no planned changes

(a) Revegetation of waste rock spoils and tailings facilities is not included in the final water quality model used for the initial implementation plan. As these facilities are not available for revegetation/rehabilitation until the placement of waste rock or tailings is completed, the potential benefits of revegetation over the 20-year planning timeframe (of the Plan) are very limited and not modelled.

(b) Waste rock from Castle (2025 to 2037) in Kilmarnock/Brownie and Clode/Eagle watersheds is included in the model. No changes to watershed conditions were included in the flow model. The spoiling was assumed to occur on top of existing waste rock.

3.2 Waste Rock Volumes

Table 3-2 summarizes current and future waste rock volumes at FRO with consideration for the mine development projects described in Sections 2.1 and 3.1. This table shows cumulative waste rock in each watershed in 2013 and 2034 in BCM, and as percentages of total waste rock at FRO and at Teck operations in the Elk Valley. The cumulative waste rock in each watershed at the end of mining is also provided for reference.

Waste rock placed in the Swift, Cataract and Porter watersheds by both FRO and GHO are considered as part of FRO, and are listed in Table 3-2. The Swift, Cataract and Porter watersheds drain to the Fording River. The Swift and Cataract watersheds are planned for waste rock placement as part of the proposed FRO Swift Project. Based on this allocation, FRO currently accounts for approximately 51% of total waste rock in the Elk Valley, the most of any Teck mining operation. By 2034, FRO will account for approximately 43% of total waste rock.

Table 3-2 Cumulative Waste Rock Placement at FRO

Watershed	2013			2034			End-of-Mine for the Plan[a]
	Waste Rock (MBCM)	Percent of Site Total	Percent of Elk Valley Total	Waste Rock (MBCM)	Percent of Site Total	Percent of Elk Valley Total	Waste Rock (MBCM)
North (Turnbull) Spoil	66	2	1	863	17	7	965
Lake Mountain Creek	30	1	1				
Lower Fording 2/ Swift Pit	152	6	3	242	5	2	421
Swift Creek [b]	219	8	4	1,020	20	9	1,020
Cataract Creek [b]	451	16	8				
Clode Creek [c]	308	11	6	816	16	7	883
Kilmarnock & Brownie Creek	1,193	43	22	1,706	34	15	1,797
Henretta Creek	159	6	3	159	3	1	159
Lower Fording 1 [d]	96	3	2	96	2	1	96
Porter Creek	81	3	1	102	2	1	103
Total	**2,755**	**100**	**51**	**5,004**	**100**	**43**	**5,444**

[a] End-of-Mine waste rock volumes provided for context, corresponds to future watershed map provided in Figure 3-2.

[b] Waste rock placed in the Swift and Cataract watersheds by both FRO and GHO are listed in this table as part of FRO.

[c] Clode Creek and Eagle six pit are combined to Clode Creek.

[d] South Tailing Pond and Eagle Pond are combined as Lower Fording 1.

3.3 Pit Water Management

The FRO mine plan includes a number of open pits. Upon completion of mining, the Turnbull Pit is planned to serve as a tailings storage facility, while other pits will be either completely or partially backfilled. Three of these pits were explicitly included in the model, as shown in Table 3-3. Other relatively small pits (e.g., Henretta and Eagle 2/3/4 pits) were excluded, as they will have limited effects on flow over the 20-year planning period (of the Plan), as further discussed in Section 3.3.1.2.

Water management activities that occur beyond the 20-year planning period, such as Swift Pit filling, were included to enable assessment of long-term effects (e.g., of waste rock covers). The long-term information use conceptual level estimates based on current mine plans.

Table 3-3 FRO Open Pits Incorporated in the Model

Pit	Pit Completion (End-of-Mining)[a]	Volumes at End-of-Mining (million m^3)			Pit Configuration at End-of-Mining
		Mined Out	Flooded pit	Flooded pit and Void Space	
Turnbull Pit	2014	26	-[b]	-[b]	Filled with tailings
Eagle 6 Pit	2023	92	17	39	Partially backfilled flooded pit
Swift Pit	2040	684	454	523	Partially backfilled flooded pit

[a] Conceptual level estimates based on current mine plans.

[b] The Turnbull Pit will serve as a closed-circuit tailings storage facility from 2015 to 2034.

3.3.1 Pit Filling and Spilling

Pit filling and spilling for the large open pits at FRO is summarized in Table 3-4 and discussed below. Swift Pit (with 454 million m^3 flooded pit volume) was explicitly modelled as a storage reservoir, and is discussed in Section 3.3.1.1. Flow modelling for other pits is discussed in Section 3.3.1.2.

Table 3-4 Pit Filling and Spilling at FRO as Incorporated in the Model

Pit	Pit Completion and Start of Pit Filling[a]	End of Pit Filling and Start of Pit Spilling[a]	Receiving Environment	2034 In-Pit Waste Rock (million BCM)	End of Mining In-Pit Waste Rock (million BCM)
Turnbull	2015	2034	Clode Creek at the mouth	-	-
Eagle 6	2024	2035	Clode Creek at the mouth	435	503
Swift	2041	>2100[b]	Fording River downstream of Clode Creek (FR2)	236	415

[a] Conceptual level estimates based on current mine plans.

[b] While Swift Pit is filling, water will be pumped from the pit to maintain flows in the Fording River. The filling period for Swift Pit depends on the pumping rate.

3.3.1.1 Swift Pit

After mining of the Swift Project (2041 onwards), the Swift Pit (Phases 1 to 4) will be allowed to fill. This pit was modelled as a storage reservoir (Teck 2014b), based on a storage volume curve for the partially-backfilled pit. The curve was derived using geographic information systems analyses of the mined-out

and surface pit contour information. The flooded pit area is characterized by an area-volume relationship to allow a more accurate calculation of rainfall inflow and evaporation losses.

Simulated pit water gains include:

- direct rainfall onto to the flooded pit area, calculated as the monthly average precipitation multiplied by the flooded pit area;
- runoff from pitwalls;
- flow from the Swift upper diversion (from 2041)
- groundwater inflows from the adjacent tributary watersheds of the Fording and Elk Rivers.

Simulated pit water losses include:

- evaporation losses, calculated as the monthly average evaporation multiplied by the flooded pit area
- pumping at 8,000 m^3/day (during pit filling) to the upper Fording River to mitigate potential stream flow reductions.

The spill location for the pit was determined from topographic analysis, and corresponds to the lowest point of the mined-out surface (i.e., without waste rock) along the eastern wall of the pit. The spill is buried by an historical waste rock dump. Therefore, the pit will fill to the spill elevation (about 1,640 masl) and discharge through the waste rock into Smith Ponds and then to the Fording River.

3.3.1.2 Other Pits

The flow model includes the effect of temporary, medium-term reductions of flow during filling periods for two other large pits at FRO:

- After mining, Turnbull Pit watershed will contribute zero flow during the tailings storage period (2015 to 2034). From 2035 onwards (i.e., pit full and spilling), the pit will spill to Clode Pond.
- After mining of the Eagle pushback, Eagle 6 Pit will be allowed to fill. In turn, Eagle 6 Pit watershed will contribute zero flow during the pit filling period (2024 to 2035). From 2036 onwards (i.e., pit full and spilling), the pit will spill to Clode Creek.

Short-term reductions in flow due to filling of relatively small pits (e.g., Henretta, Eagle 2/3/4) are excluded from the model. In the context of water quality planning over multiple decades, these events are too short in duration to affect the Plan.

3.3.2 Groundwater Considerations

The FRO mine plan includes the Turnbull and Swift pits, which will be mined down below the elevation of the Fording River and will become local groundwater sinks.

Groundwater modelling was undertaken as part of the FRO Swift Project Environmental Assessment Certificate Application (in progress). The results available at the time of developing the Plan were used as inputs to the flow model, based on the following:

- Turnbull Pit may influence groundwater starting in 2011, with maximum effect in 2015 and recovery to stable long-term conditions once the pit is filled with tailings (from 2035 onwards).
- Swift Pit will affect groundwater starting in 2022, with maximum effect in 2041 (end of mining) and recovery to a stable long-term condition at the end of pit filling, with the northern end of the pit remaining as a long-term groundwater sink.

Estimated total groundwater inflows to each pit were derived from the groundwater modelling results, and balanced by a corresponding reduction in baseflows in adjacent watersheds and in the Fording and Elk rivers. The distribution of baseflow reductions between watersheds was estimated from the drawdown curves for each pit. The flow model watersheds that contribute groundwater inflows to the Swift and Turnbull pits are shown on Figures 3-3 and 3-4. Groundwater contributions (i.e., baseflow reductions) are provided in Tables 3-5 and 3-6. Contributions from all other watersheds are assumed to be negligible, and were not modelled.

Figure 3-3 Groundwater Inflows to Swift Pit

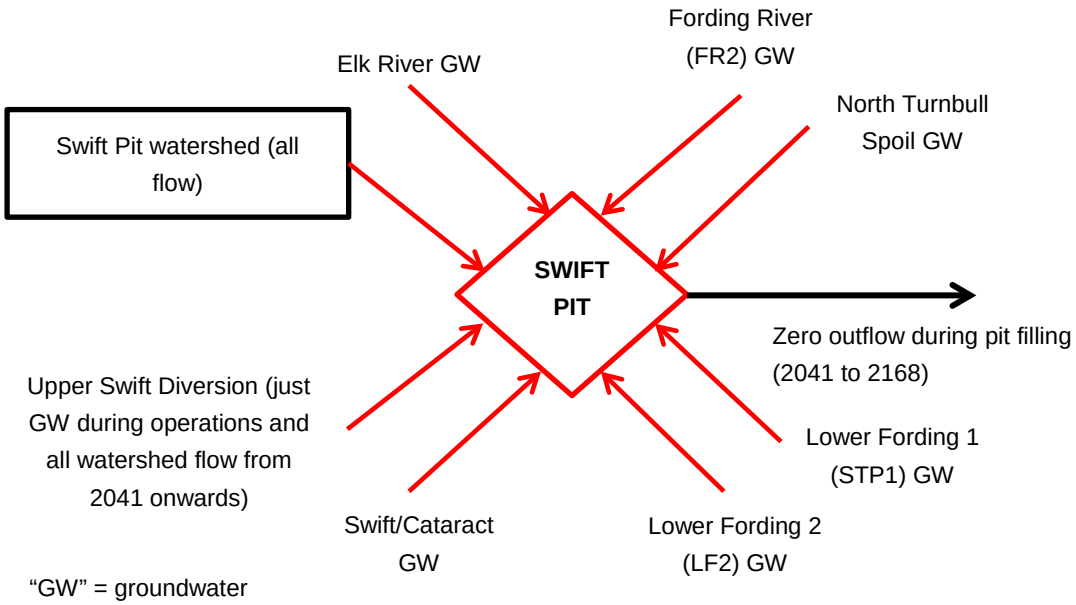
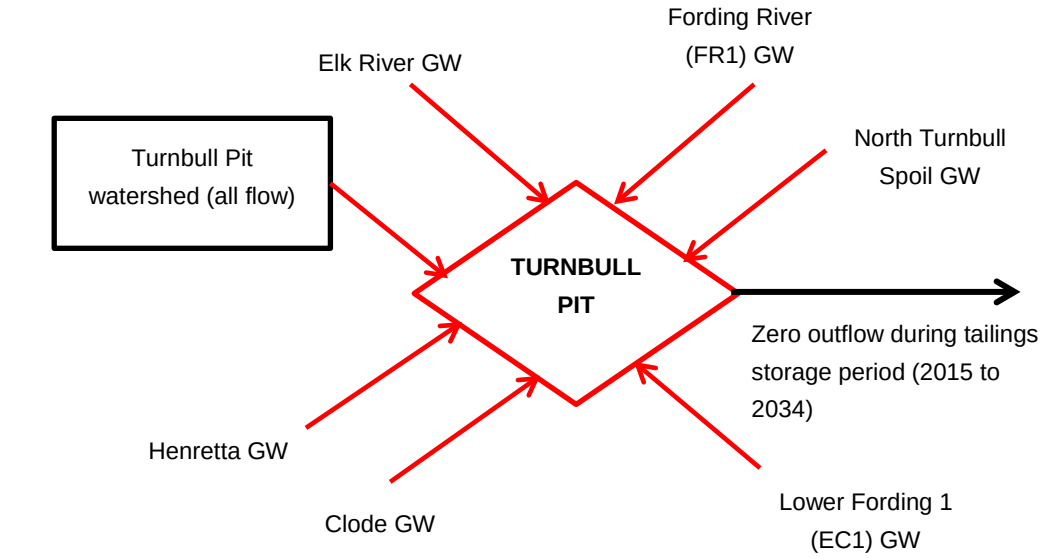


Figure 3-4 Groundwater Inflows to Turnbull Pit



Note: "GW" = groundwater

Table 3-5 Estimated Groundwater Baseflows from FRO Watersheds Reporting to Swift Pit

Date[a]	North Turnbull Spoil [m^3/day]	Lower Fording River 1 STP1 [m^3/day]	Lower Fording River 2 (LF2) [m^3/day]	Swift Creek Upper Diversion [m^3/day]	Cataract Creek[b] [m^3/day]	Fording River [m^3/day]	Elk River [m^3/day]	Total Groundwater Inflow to Swift Pit[c] [m^3/day]
1/01/2022	0	0	0	0	0	0	0	**0**
1/01/2041 (start of pit filling)	2,126	159	200	950	650	886	2,587	**7,558**
Long-term (pit full and spilling)	1,579	0	50	576	178	115	1,283	**3,781**

(a) Flow model interpolates linearly between snapshot dates.

(b) Combined watershed of Cataract and Swift creeks.

(c) Not including Swift Pit sub-watershed inflows.

Table 3-6 Estimated Groundwater Baseflows from FRO Watersheds Reporting to Turnbull Pit

Date[a]	Henretta Creek [m^3/day]	North Turnbull Spoil [m^3/day]	Clode Creek [m^3/day]	Lower Fording River 1 (EC1) [m^3/day]	Fording River [m^3/day]	Elk River [m^3/day]	Total Groundwater Inflow to Turnbull Pit[b] [m^3/day]
1/01/2011	0	0	0	0	0	0	**0**
1/01/2015	536	452	780	256	36	28	**2,088**
1/01/2035 onwards	536	0	780	256	36	28	**1,636**

(a) Flow model interpolates linearly between snapshot dates.

(b) Not including Turnbull Pit sub-watershed inflows.

3.4 Current and Future Flow Predictions

A conceptual flow diagram of the sub-watersheds and water management linkages is shown on Figure 3-5.

Flows were derived at various modelling nodes associated with FRO, as summarized in Table 3-7 and shown on Figures 3-1 and 3-2 above. Flows in the Fording River downstream of Henretta Creek (FR1), downstream of Clode Creek (FR2), between Swift and Cataract creeks (FR3) and downstream of Porter Creek (FR3b) were derived by summing simulated flows from contributing watersheds.

Table 3-7 FRO Modelling Nodes

Modelling Node ID	Modelling Node Description	Location	
		Easting	Northing
CA1	Cataract Creek at the mouth	652465	5557536
CL1	Clode Creek at the mouth	650871	5564287
HC1	Henretta Creek at the mouth	652219	5566469
PC1	Porter Creek at the mouth	653545	5555325
SC1	Swift Creek at the mouth	652027	5558254
KC1	Kilmarnock Creek at the mouth	652612	5559619
LM1	Lake Mountain Creek at the mouth	650858	5563301
FR1	Fording River downstream of Henretta Creek	651304	5565451
FR2	Fording River downstream of Clode Creek and upstream of Kilmarnock Creek	651781	5559984
FR3	Fording River between Swift and Cataract creeks	652503	5558088
FR3b	Fording River downstream of Porter Creek	653751	5555147

Location in UTM Zone 11 NAD83.

The results of the flow modelling for selected snapshot years are presented in Table 3-8. The associated watershed area and elevation input data are presented in Appendix B.

Figure 3-5 FRO Conceptual Flow Diagram

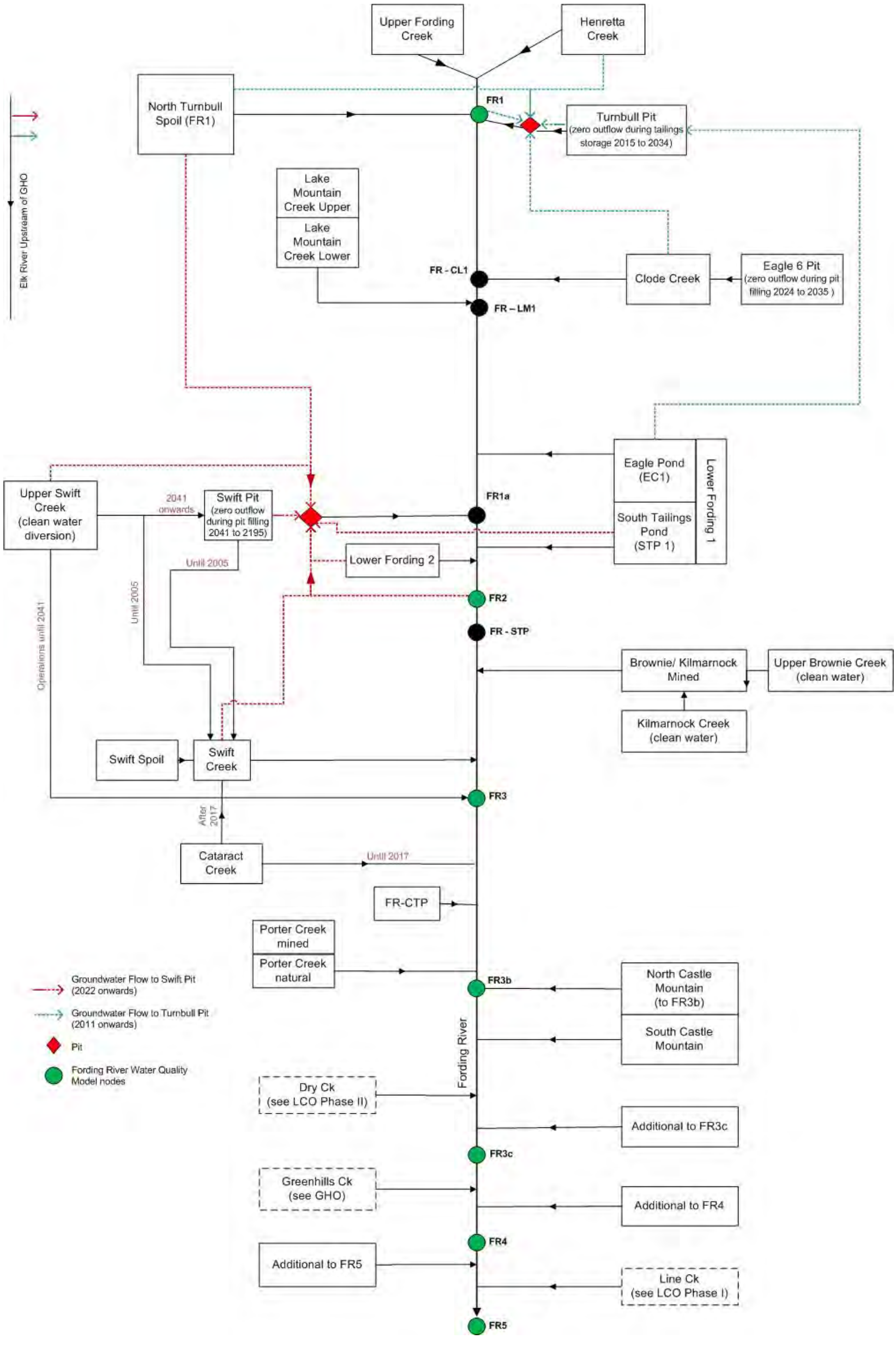


Table 3-8 Current and Future Flows for Watersheds at FRO

Watershed	Node ID	Flow Model Watershed Name	Current Year 2013 (m^3/d)		Year 2040 (m^3/d)	
			Annual	Winter	Annual	Winter
Upper Fording	UF	Upper Fording	42,460	13,572	42,460	13,572
	HC1	**Henretta Creek at the mouth**	**57,482**	**20,916**	**57,529**	**20,940**
	NTS	North/Turnbull Spoil	3,498	1,597	14,361	9,355
	E6P	Eagle 6 Pit	6,932	4,498	9,490	6,042
	CL1	Clode Creek	6,768	4,588	7,326	4,957
	TP	Turnbull Pit	1,499	1,060	1,323	955
Lake Mountain Creek	LMU	Lake Mountain Creek Upper	6,176	1,974	-[(a)]	-[(a)]
	LML	Lake Mountain Creek Lower	7,093	3,515	-[(a)]	-[(a)]
	LM1	**Lake Mountain Creek at the mouth**	**13,269**	**5,489**	**-[(a)]**	**-[(a)]**
Lower Fording	LF-EC1	Lower Fording Rv1 EC1	1,962	1,416	1,962	1,416
	LF-STP	Lower Fording Rv1 STP1	3,654	2,637	3,654	2,637
	LF-LF2	Lower Fording Rv2 LF2	7,383	5,211	1,702	1,228
Swift Cataract Creeks	SC-UD	Swift Creek upper diversion	2,498	799	4,353	1,392
	SP	Swift Pit	1,941	1,398	9,508	6,855
	SS	Swift Spoil	3,455	1,860	-[(a)]	-[(a)]
	CA1	**Cataract Creek at the mouth**	**4,246**	**3,064**	**-[(b)]**	**-[(b)]**
	SC1	**Swift Creek at the mouth**	**3,455**	**1,860**	**7,646**	**5,518**
Kilmarnock Brownie Creeks	BC-Cln	Brownie Clean	7,370	3,069	7,370	3,069
	KCBC-Mn	Kilmarnock Clean Diverted	30,008	16,664	28,930	16,382
	KC-Div	Kilmarnock Brownie Mined	22,878	9,525	22,878	9,525
	KC1	**Kilmarnock Creek at the mouth**	**60,256**	**29,258**	**59,177**	**28,976**
Fording River downstream of FRO	**PC1**	**Porter Creek at the mouth**	**3,256**	**1,900**	**2,085**	**1,054**
	CM-FR3b	Castle Mnt FR3b	6,865	2,194	6,887	2,202
	CM-FRD	Castle Mnt FRD	5,563	1,778	5,541	1,771
	FRCTP	FRCTP	1,123	359	696	222
	Add-FR3c	Additional to FR3c	147,047	47,002	147,047	47,002

(a) Watershed has been mined out or combined with another watershed.

(b) Watershed is combined with Swift Creek.

Note: Bold text indicates a water quality modelling node.

3.5 Water Quality Management

The selected water quality management measures at FRO for the initial implementation plan are:

- FRO South and FRO North (Phase 1 and Phase 2) active water treatment facilities, as described in Table 3-9
- Kilmarnock Creek and Brownie Creek clean water diversions, as described in Table 3-10.

Table 3-9 Active Water Treatment at Fording River Operations According to the Initial Implementation Plan

Potential Active Water Treatment Plant	Treatment Capacity and Commissioning Date	Treatment Sources (In Order of Priority)	Assumed Collection Efficiency	Treated Water Discharge Location	Bypass Water Discharge Location
FRO South AWTP	20,000 m^3/d by Q4 2017	Swift/Cataract creeks	80%	Fording River between Swift and Cataract creeks	Swift/Cataract creek
		Kilmarnock Creek	70%		
FRO North AWTP	15,000 m^3/d by Q4 2021 (Phase 1) Additional 15,000 m^3/d by Q4 2029 (Phase 2)	North Spoil	70%	Fording River downstream of Henretta Creek	North Spoil
		Clode Creek	95%		
		Swift Pit	80%		

Table 3-10 Clean Water Diversions at Fording River Operations According to the Initial Implementation Plan

Potential Clean Water Diversion	Description	Area of Watershed Targeted for Diversion [km^2]	Assumed Diversion Capacity[(a)] [m^3/d]	Commissioning Date	Discharge Location
Kilmarnock Creek	Collect clean water upstream of the Kilmarnock spoil and pump around the downstream side of the spoil.	14.9	45,000	by Q4 2017 (concurrent with FRO South AWTP)	Kilmarnock Creek at the mouth
Brownie Creek	Collect and pump clean water upstream of Brownie spoil to the downstream side into Kilmarnock watershed, which would subsequently be pumped to the downstream side of the Kilmarnock spoil.	4.2	14,000	by Q4 2017 (concurrent with FRO South AWTP)	Kilmarnock Creek at the mouth

[(a)] Diversion capacity was set to the maximum predicted May flow between 2020 and 2034 under average flow conditions.

The treatment sources in Table 3-9 are shown in order of priority. When multiple intake sources are identified for an active water treatment plant, it would draw sequentially following the order of priority: from the source with the highest selenium concentration to the source with the lowest, until either its treatment capacity was reached or all available sources were treated. This reflects the fact that elevated selenium concentrations are the most pressing water-quality issue in the Elk Valley. If the treatment capacity is reached before all available intake sources were treated, excess water will be bypassed and released at the bypass water discharge location shown in Table 3-9. Additional discussions on the collection efficiency (which accounts for leakage and losses) and other assumptions are provided in the technical report on *Water Quality Modelling for the Initial Implementation Plan* (Teck 2014d).

The clean water diversions, as shown in Table 3-10, are based on an assumed capacity to convey up to May monthly flow of an average flow year. Collection efficiencies for the clean water diversions are assumed to be 95%. In addition to the Kilmarnock and Brownie Creek diversions in the initial implementation plan, North Spoil and Upper Swift Creek diversions are currently planned at FRO as part of its operational water management plan.

Site-specific detailed design of the active water treatment plants and water management measures would be completed prior to implementation and may result in changes to the collection efficiencies and other parameters incorporated in the initial implementation plan.

4 Greenhills Operations

Greenhills Operations has been in operation since 1981. It is about six km northeast of the town of Elkford, and adjoins FRO at the northern end of the site. This section describes the site conditions at GHO, including the current and future watershed conditions, waste rock, pit water management, and predicted current and future flow conditions. The project description included in the Plan is subject to revision and reflects the plans for the project as of August 2013.

4.1 Current and Future Watershed Conditions

At GHO, mining and spoil placement resulted in historical disturbance to tributaries of the Fording River (Swift, Cataract, Porter and Greenhills Creeks) and tributaries of the Elk River (Leask, Wolfram and Thompson Creeks). Leask and Wolfram Creeks report to the Elk River mainstem through subsurface flow, while other tributaries are connected to the Fording or Elk river mainstem through surface flow. The current (i.e., 2010 Snapshot) and future watershed boundaries are shown on Figures 4-1 and 4-2. Swift, Cataract and Porter Creeks are included in the FRO model area (Table 3-1).

Table 4-1 summarizes the historical and planned future watershed changes at GHO that are included in the model. Future mining activities with the highest level of developed supporting information (i.e., detailed mine plan with some associated topography, water management and waste rock schedule) and associated watershed changes are included in the most detail. This includes completion of the Cougar South and Cougar North pits, and placement of associated waste rock. Slightly less information (i.e., incomplete topography) is developed for Cougar North Extension (also known as Greenhills Ridge Phase 1) and placement of associated waste rock. Therefore, the disturbance area for the pit was assumed to be the same as the disturbance area from the 2011 LOM. The model assumes that Cougar North Extension will drain to Cougar North during operations and at closure, with the objective of limiting the number of watercourses that receive mine-affected water, and of optimizing selenium mitigation.

As discussed in Section 2.1, detailed mine plans are unavailable for the GHO Greenhills Ridge Phase II Project, and so future mining activities in relation to this project are modelled based on a conceptual level of detail (i.e., production and waste rock only – with uncertainty regarding waste rock placement and mine sequencing). This approach considers consistent production levels, recognizing that the detail associated with each of the specific projects will continue to evolve. Greenhills Ridge Phase II waste rock information is developed from 2022 to 2046, with waste rock placed in spoils in Greenhills, Porter, Cataract and Swift Creeks, in the West Spoil, and as backfill in Cougar pit. No changes to watershed conditions associated with Greenhills Ridge Phase II are included in the flow model. Spoiling will occur on top of existing waste rock.

650000
655000
5560000
5555000
5550000
5545000

FORDING RIVER
KILMARNOCK CREEK
CASMO CREEK
CASCADE CREEK
BASHFUL CREEK
CAST CREEK
SHANDLEY CK
NORTH FORK
MIDDLE FORK
SWIFT CK
SOUTH FORK
CATARACT CK
ELK RIVER
BR. F CREEK
WOLF CREEK
WILLOW CR. NORTH
WILLOW CR. SOUTH
WILDE CR.
WILDE CR.
WADE CR.
COUGAR CR.
NONAME CR.
MICKELSON CR.
PORTER CR.
CHAUNCEY CREEK
LEASK CREEK
WOLFRAM CR. NORTH
WOLFRAM CR. SOUTH
NORTH THOMPSON CR.
GREENHILLS CR.
THOMPSON CR.
UPPER THOMPSON CREEK N
UPPER THOMPSON CR.
COUSINS CREEK
GARDINE CREEK
GREENHILLS CREEK

FR2
FR-STP
KC1
SC1
FR3
CA1
PC1
FR3b
LE1
WC1
TC1
ER1a
GH1
FR4
DC1

Cougar Pit North
Leask Creek
Wolfram Creek
Cougar Pit South
Greenhills Dump
Thompson Creek
Greenhills Other
Additional to FR4

Round Prairie

N

LEGEND

- CITY / TOWN / COMMUNITY
- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- WATER QUALITY NODE
- CANADIAN PACIFIC RAILWAY
- ROAD
- WATERCOURSE
- CURRENT GREENHILLS OPERATIONS PERMITTED AREA
- SUB-WATERSHED
- WATERBODY
- Cougar Pit North — SUB-WATERSHED NAME

2 0 2
SCALE 1:50,000 KILOMETRES

REFERENCE

Provincial boundaries and populated places obtained from The Atlas of Canada, Natural Resources Canada. Hydrography, Existing Development and transportation obtained from Teck Coal Limited. Imagery obtained from The Orthoshop.
Projection: UTM Zone 11 Datum: NAD 83

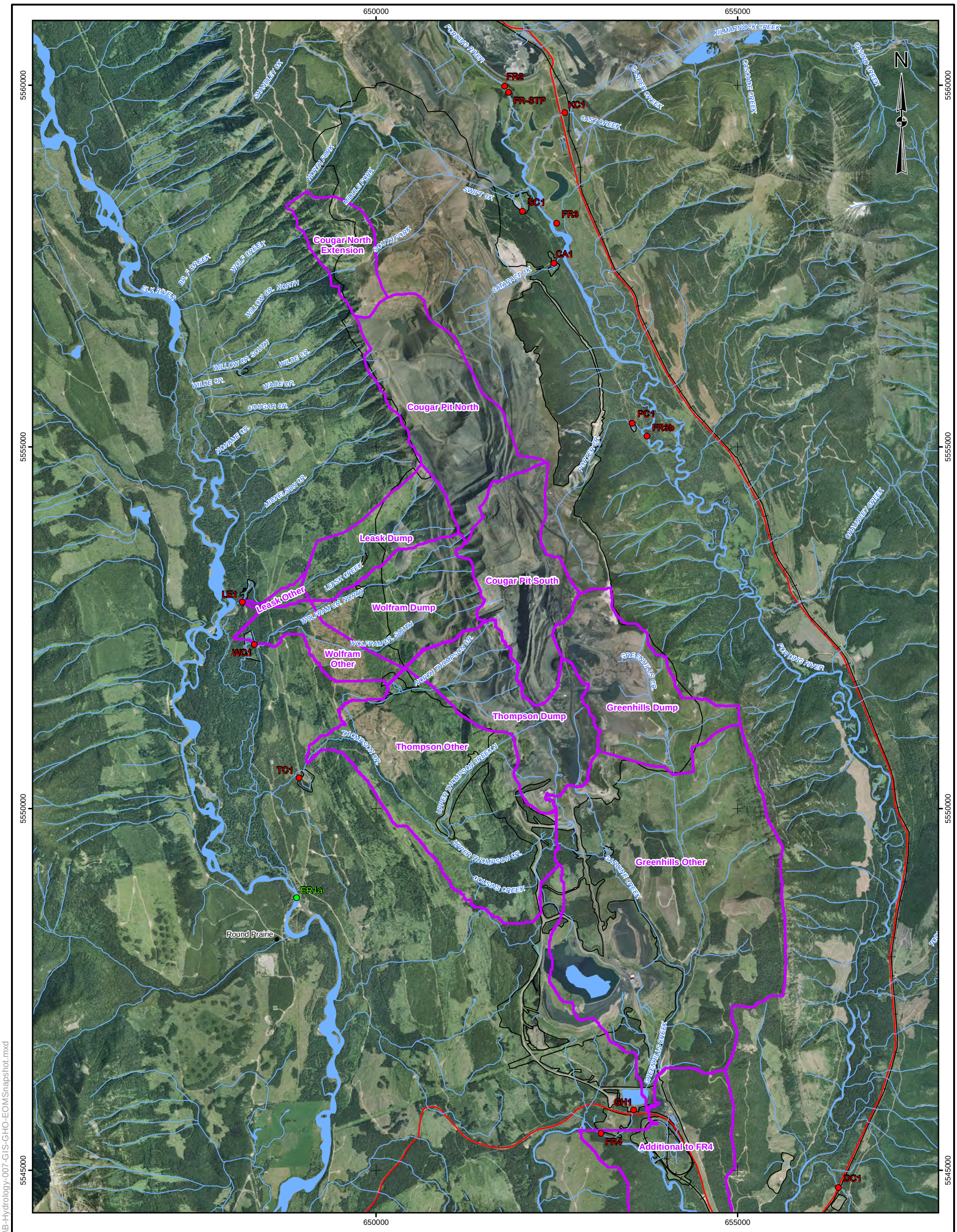
PROJECT
TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE
GREENHILLS OPERATIONS WATERSHEDS
(2010 SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 4-1	
GIS	DR	16 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

I:\CLIENT\TECK_COAL\13-1349-0006\Mapping\MXD\Hydrology\B-Hydrology-008-GIS-GHO-2010Snapshot.mxd



LEGEND

- CITY / TOWN / COMMUNITY
- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- WATER QUALITY NODE
- CANADIAN PACIFIC RAILWAY
- ROAD
- WATERCOURSE
- CURRENT GREENHILLS OPERATIONS PERMITTED AREA
- SUB-WATERSHED
- WATERBODY
- Cougar Pit North — SUB-WATERSHED NAME

2 0 2

SCALE 1:50,000 KILOMETRES

REFERENCE

Provincial boundaries and populated places obtained from The Atlas of Canada, Natural Resources Canada. Hydrography, Existing Development and transportation obtained from Teck Coal Limited. Imagery obtained from The Orthoshop.
Projection: UTM Zone 11 Datum: NAD 83

PROJECT

TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE

GREENHILLS OPERATIONS WATERSHEDS
(END OF MINE SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 4-2	
GIS	DR	16 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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Table 4-1 GHO Watershed Summary

Flow Model Watershed Name	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Leask Creek WR Dump	• waste rock in upper watershed • flows into Leask Creek Other sub-watershed	• pit expansion reduces watershed area • more waste rock • revegetation of dump[(a)] • see note[(b)]
Leask Creek Other	• natural watershed in lower Leask Creek (below the final toe of the dump) • discharges to sediment pond	• no planned changes
Wolfram WR Dump	• waste rock in upper watershed • flows into Wolfram Creek Other sub-watershed	• pit expansion reduces watershed area • more waste rock • revegetation of dump[(a)] • see note[(b)]
Wolfram Creek Other	• natural watershed in lower Wolfram Creek (below the final toe of the dump) • discharges to sediment pond	• no planned changes
Thompson WR Dump	• waste rock in upper watershed • flows into Thompson Creek Other sub-watershed	• more waste rock • revegetation of dump[(a)] • see note[(b)]
Thompson Creek other	• natural watershed in lower Thompson Creek (below the final toe of the dump)	• no planned changes
Greenhills WR Dump	• waste rock in upper watershed • flows into Greenhills Creek Other sub-watershed	• more waste rock • revegetation of dump[(a)] • see note[(b)]
Greenhills Other	• remaining natural and mining area in the Greenhills watershed (no waste rock) • includes CCR area and tailings facility • discharges to sediment pond	• no planned changes
Cougar Pit North	• historically Cougar Pit North was included in Cataract Creek watershed (FRO) until 2009 when it started filling (i.e., zero outflow)	• more mining and waste rock • operational pumping to Leask Creek • North and South Pits are contiguous from 2016 onwards (i.e., one pit for the purposes of pit water management) • revegetation of dump[(a)] • see note[(b)]
Cougar Pit South	• historically Cougar South Pit discharged mainly to Wolfram Creek watershed	• more mining and waste rock • operational pumping to Wolfram Creek until 2016 • North and South Pits are contiguous from 2016 onwards (i.e., one pit for the purposes of pit water management) • pit filling from 2031 to 2055 • pit spills to Leask Creek • revegetation of dump[(a)] • see note[(b)]
Cougar Pit North Ext	• no sub-watershed specified for the historical period	• mining • no backfill • assumed pit water discharges to Cougar North Pit • see note[(b)]
FR4 Additional	• additional area reporting to the Fording River between FR3c and FR4 nodes • predominantly natural with a small area of mining disturbance	• no planned changes

(a) Revegetation of waste rock spoils and tailings facilities is not included in the final water quality model used for the initial implementation plan. As these facilities are not available for revegetation/rehabilitation until the placement of waste rock or tailings is completed, the potential benefits of revegetation over the 20-year planning timeframe (of the Plan) are very limited and not modelled.

(b) Waste rock from Greenhills Ridge Phase II (2022 to 2046) is included in the water quality model. No changes to watershed conditions were included in the flow model. The spoiling was assumed to occur on top of existing waste rock in Leask/Wolfram/Thompson (i.e., West Spoil), Greenhills, Porter, Cataract and Swift watersheds, and backfill in Cougar pits.

4.2 Waste Rock Volumes

Table 4-2 summarizes current and future waste rock at GHO with consideration for the mine development projects described in Sections 2.1 and 4.1. Cumulative waste rock in each watershed in 2013 and 2034 are shown in BCM, and as percentages of the total waste rock at GHO and in the context of the Elk Valley. The cumulative waste rock in each watershed at the end of mining is also provided as reference.

Waste rock placed in the Swift, Cataract and Porter watersheds by GHO is considered as part of FRO and listed in Table 3-2. As mentioned in Section 3.2, Swift, Cataract and Porter watersheds drain to the Fording River and the Swift and Cataract watersheds are planned for waste rock placement for the proposed FRO Swift Project. Based on this allocation, GHO currently accounts for approximately 7% of the total waste rock in the Elk Valley. By 2034, GHO will account for approximately 12% of the waste rock in the Elk Valley.

Table 4-2 Cumulative Waste Rock Placement at GHO

Watershed	2013			2034			End-of-Mine for the Plan[a]
	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)
Greenhills Creek (East Spoil)	121	33	2	214	15	2	214
Leask Creek (West Spoil)	14	4	0.3	116	8	1	123
Wolfram Creek (West Spoil)	52	14	1	258	18	2	274
Thompson Creek (West Spoil)	97	27	2	130	9	1	135
Cougar North Pit	73	20	1	73	5	1	230
Cougar South Pit	4	1	0.1	615	44	5	655
Total	**361**	**100**	**7**	**1405**	**100**	**12**	**1632**

[a] End-of-Mine waste rock volumes provided for context, corresponds to future watershed map provided in Figure 4-2.

4.3 Pit Water Management

The mine plan for GHO includes two open pits. Upon completion of mining, these pits will be partially backfilled as shown in Table 4-3.

Table 4-3 GHO Open Pits Incorporated in the Model

Pit	Pit Completion (End-of-Mining)	Volumes at End-of-Mining [million m^3]			Pit Configuration at End-of-Mining
		Mined Out	Flooded pit	Flooded pit and Void Space	
Cougar North Extension Pit	-[(a)]	--	--	--	No backfill
Cougar North/South Pit	2031	148	66	90	Partial backfill

(a) No pit completion date or volume assumed, given that mining associated with Greenhills Ridge is ongoing.

Groundwater inflows into the Cougar Pits were not considered in the model, because these are not scheduled to reach depths below the elevation of adjacent surface waters; thus, it is unlikely that they will act as local groundwater sinks to the extent that they could appreciably affect surface flows.

The flow model includes the effect of a temporary, medium-term reduction during the pit filling period for the Cougar North/South pit. Cougar North and South are contiguous from 2016 onwards. The watershed is assumed to contribute zero flow during the pit filling period (2031 to 2055). From 2056 onwards (i.e., pit full and spilling), the pit will spill to Leask Creek. Cougar North Extension will not store water, because of ongoing mining associated with Greenhills Ridge. A summary of pit filling and spilling at GHO is provided in Table 4-4.

Table 4-4 Pit Filling and Spilling at GHO Incorporated in the Model

Pit	Pit Completion and Start of Pit Filling	End of Pit Filling and Start of Pit Spilling	Receiving Environment	2034 In-Pit Waste Rock (million BCM)	End of Mining In-Pit Waste Rock (million BCM)
Cougar North Extension	-[(a)]	-	Cougar Pit	0	0
Cougar North	2031	2056	Leask Creek at the mouth	73	230
Cougar South			Leask Creek at the mouth	613	655

(a) No pit filling period was assumed, because the storage volume of the pit is small.

4.4 Current and Future Flow Predictions

A conceptual flow diagram of the sub-watersheds and water management linkages is shown on Figure 4-3.

Flows were derived at various modelling nodes, as summarized in Table 4-5 and shown on Figures 4-1 and 4-2. Flows in the Fording River downstream of Greenhills Creek (FR4) were derived by summing simulated flows from contributing watersheds.

Table 4-5 GHO Modelling Nodes

Modelling Node ID	Modelling Node Description	Location	
		Easting	Northing
LE1	Leask Creek at the mouth	648156	5552849
TC1	Thompson Creek at the mouth	648938	5550421
WC1	Wolfram Creek at the mouth	648321	5552267
GH1	Greenhills Creek at the mouth	653566	5545829
FR4	Fording River downstream of Greenhills Creek	653114	5545507
ER1a	Elk River downstream of Thompson Creek	648904	5548763
ER1b	Elk River near Elkford	649304	5543373

Note: Location in UTM Zone 11 NAD83.

The results of the flow modelling for selected snapshot years are presented in Table 4-6. The associated watershed area and elevation input data are presented in Appendix B.

Figure 4-3 GHO Conceptual Flow Diagram

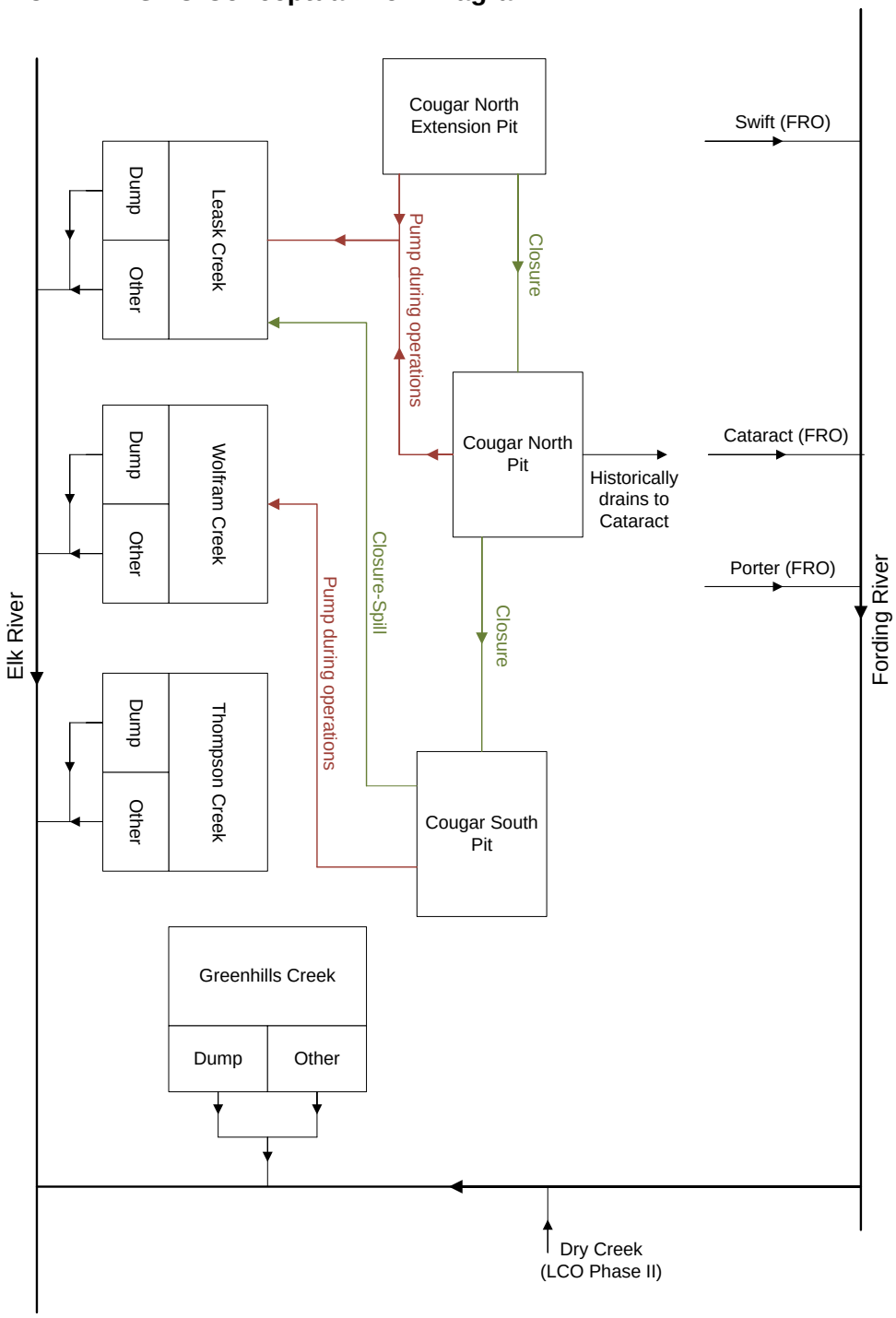


Table 4-6 Current and Future Flows for Watersheds at GHO

Watershed	Node ID	Flow Model Watershed Name	Current Year 2013 (m^3/d)		Year 2040 (m^3/d)	
			Annual	Winter	Annual	Winter
Leask Creek	LC-WR	Leask Creek WR Dump	1,890	1,168	1,918	1,385
	LC-Oth	Leask Creek Other	83	36	83	36
	LE1	**Leask Creek at the mouth**	**1,973**	**1,204**	**2,001**	**1,420**
Wolfram Creek	WC-WR	Wolfram WR Dump	2,787	1,864	3,007	2,171
	WC-Oth	Wolfram Creek Other	597	257	597	257
	WC1	**Wolfram Creek at the mouth**	**3,384**	**2,121**	**3,604**	**2,427**
Thompson Creek	TC-WR	Thompson WR Dump	3,987	2,864	3,884	2,803
	TC-Oth	Thompson Creek other	3,873	1,664	3,873	1,664
	TC1	**Thompson Creek at the mouth**	**7,860**	**4,529**	**7,757**	**4,467**
Greenhills Creek	GH-WR	Greenhills WR Dump	3,541	2,037	3,979	2,572
	GH-Oth	Greenhills Other	10,450	4,646	10,450	4,646
	GH1	**Greenhills Creek at the mouth**	**13,991**	**6,684**	**14,430**	**7,219**
Pit Area	CPN	Cougar Pit North	3,854	2,883	0[(a)]	0[(a)]
	CPS	Cougar Pit South	2,730	2,130	0[(a)]	0[(a)]
	CPNX	Cougar Pit North Ext	1,120	340	0[(a)]	0[(a)]
Fording River	Add-FR4	FR4 Additional	5,246	1,919	5,246	1,919

[(a)] Zero outflow during pit filling period (see Table 4-4).

Note: Bold text indicates a water quality modelling node.

4.5 Water Quality Management

The water quality management measure at GHO for the initial implementation plan is the GHO active water treatment facility, as described in Table 4-9. No clean water diversion is selected for GHO.

Table 4-9 Active Water Treatment at Greenhills Operations According to the Initial Implementation Plan

Potential Active Water Treatment Plant	Treatment Capacity and Commissioning Date	Treatment Sources (In Order of Priority)	Assumed Collection Efficiency	Treated Water Discharge Location	Bypass Water Discharge Location
GHO AWTP	7,500 m^3/day by Q4 2025	West Spoil (mixed flow from Leask, Thompson and Wolfram creeks)	95%	Thompson Creek	Leask Creek
		Upper Greenhills Creek	70%		

The discussion of treatment sources, treatment capacity and bypass water discharge that was provided for FRO (in Section 3.5) is consistent with the associated considerations for GHO. Additional discussions on the collection efficiency (which accounts for leakage and losses) and other assumptions are provided in the technical report on *Water Quality Modelling for the Initial Implementation Plan* (Teck 2014d).

Site-specific detailed design of the active water treatment plants would be completed prior to implementation and may result in changes to the collection efficiencies and other parameters incorporated in the initial implementation plan.

5 Line Creek Operations

Line Creek Operations is located about 20 km north of Sparwood, in the Line Creek watershed. LCO Phase I has been operational since 1981. LCO Phase II is an expansion into the adjacent LCO Dry Creek watershed, north of LCO Phase I. LCO Dry Creek is currently undisturbed by mining activities. Both Line Creek and LCO Dry Creek are tributaries of the Fording River.

This section describes the site conditions at LCO, including the current and future watershed conditions, waste rock, pit water management, and predicted current and future flows. The project description included in the Plan is subject to revision and reflects the plans for the project as of August 2013.

5.1 Current and Future Watershed Conditions

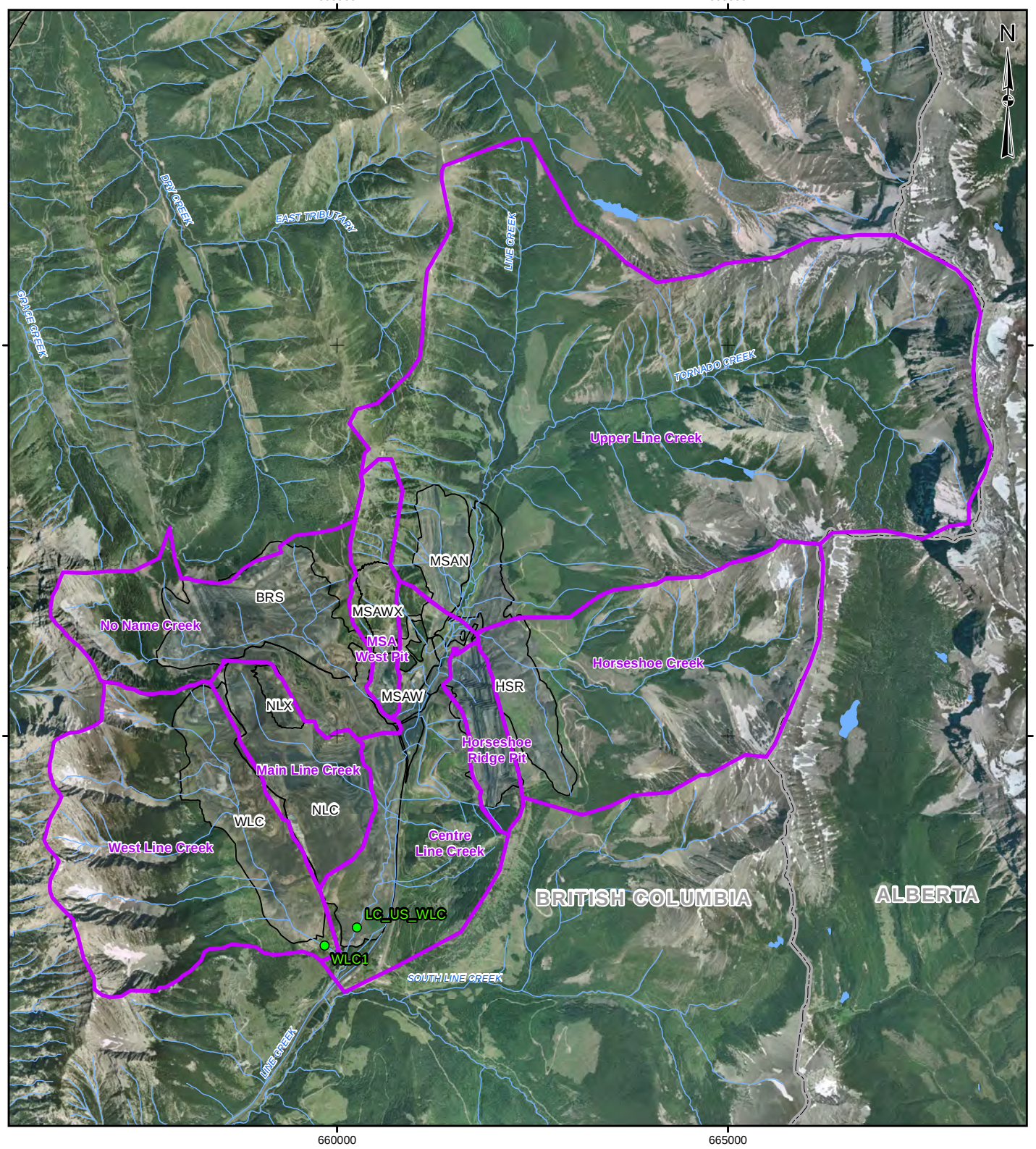
The LCO Phase I mining area is in the centre of the Line Creek watershed, between the tributaries of Tornado Creek and South Line Creek. The disturbed area due to mining activities is currently about 25% of the total Line Creek watershed area. Large volumes of waste rock have been placed in West Line Creek, No Name Creek, Horseshoe Creek and the Line Creek Rock Drain. Planned future mining will not noticeably increase the disturbed area. The current (i.e., 2010 Snapshot) and future watershed boundaries are shown on Figures 5-1 and 5-2.

The current and future watershed boundaries for the LCO Phase II Project are shown on Figures 5-3 and 5-4.

A summary of historical and planned future watershed changes at LCO included in the model is presented in Table 5-1.

The following mining activities are included in the model:

- Completion of the MSAX, BRS, NLX and BRX pits, and placement of associated waste rock in existing disturbed areas.
- Operation of the West Line Creek Active Water Treatment Plant (AWTP) from 2014 onwards.
- Completion of the LCO Phase II Project, in the LCO Dry Creek watershed, which involves new mining areas on Burnt Ridge North and Mount Michael. Waste rock will be placed in a new spoil in upper LCO Dry Creek, as backfill in the new pits and in Phase I.



LEGEND

- WATER QUALITY NODE
- CANADIAN PACIFIC RAILWAY
- WATERCOURSE
- BRITISH COLUMBIA - ALBERTA BORDER
- EXISTING LINE CREEK OPERATIONS DEVELOPMENT AREA
- SUB-WATERSHED
- WATERBODY

BRS	BURNT RIDGE SOUTH
HSR	HORSESHOE RIDGE
MSAN	MINE SERVICES AREA NORTH
MSAW	MINE SERVICES AREA WEST
MSAWX	MINE SERVICES AREA WEST EXTENSION
NLC	NORTH LINE CREEK
NLX	NORTH LINE CREEK EXPANSION
WLC	WEST LINE CREEK

West Line Creek SUB-WATERSHED NAME

2 0 2

SCALE 1:70,000 KILOMETRES

REFERENCE

Transportation data obtained from GeoGratis. Hydrography and existing development obtained from Teck Coal Limited. Imagery obtained from The Orthoshop. Projection: UTM Zone 11 Datum: NAD 83

PROJECT

TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE

LINE CREEK OPERATIONS PHASE I WATERSHEDS
(2010 SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 5-1	
GIS	DR	10 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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660000
665000
5545000
5540000
5535000
5530000
N
DRY CREEK
EAST TRIBUTARY
LINE CREEK
TORNADO CREEK
SPAGE CREEK
LCO Phase II Project Area
Upper Line Creek Diversion
Upper Line Creek
MSA West Pit
MSAN
MSAWX
BRS
No Name Creek
Horsehoe Creek Diversion
HSR
MSAW
NLX
Horseshoe Ridge Pit
Horseshoe Creek
Main Line Creek
WLC
Line Creek Operations
NLC
WEST LINE CREEK
Centre Line Creek
West Line Creek
BRITISH COLUMBIA
ALBERTA
LC_US_WLC
WLC1
LINE CREEK
SOUTH LINE CREEK

LEGEND

- WATER QUALITY NODE
- CANADIAN PACIFIC RAILWAY
- LCO PHASE II CONTOUR (5m INTERVAL)
- POTENTIAL HORSESHOE CREEK CLEAN WATER DIVERSION CHANNEL
- PROPOSED UPPER LINE CREEK CLEAN WATER DIVERSION PIPELINE
- WATERCOURSE
- BRITISH COLUMBIA - ALBERTA BORDER
- EXISTING LINE CREEK OPERATIONS DEVELOPMENT AREA
- SUB-WATERSHED
- WATERBODY

BRS	BURNT RIDGE SOUTH
HSR	HORSESHOE RIDGE
MSAN	MINE SERVICES AREA NORTH
MSAW	MINE SERVICES AREA WEST
MSAWX	MINE SERVICES AREA WEST EXTENSION
NLC	NORTH LINE CREEK
NLX	NORTH LINE CREEK EXPANSION
WLC	WEST LINE CREEK

West Line Creek SUB-WATERSHED NAME

2 0 2
SCALE 1:50,000 KILOMETRES

REFERENCE

1: 50,000 scale hydrography and transportation obtained from GeoGratis. Imagery obtained from The Orthoshop.
Projection: UTM Zone 11 Datum: NAD 83

PROJECT
TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE
LINE CREEK OPERATIONS PHASE I WATERSHEDS
(END OF MINE SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 5-2	
GIS	DR	10 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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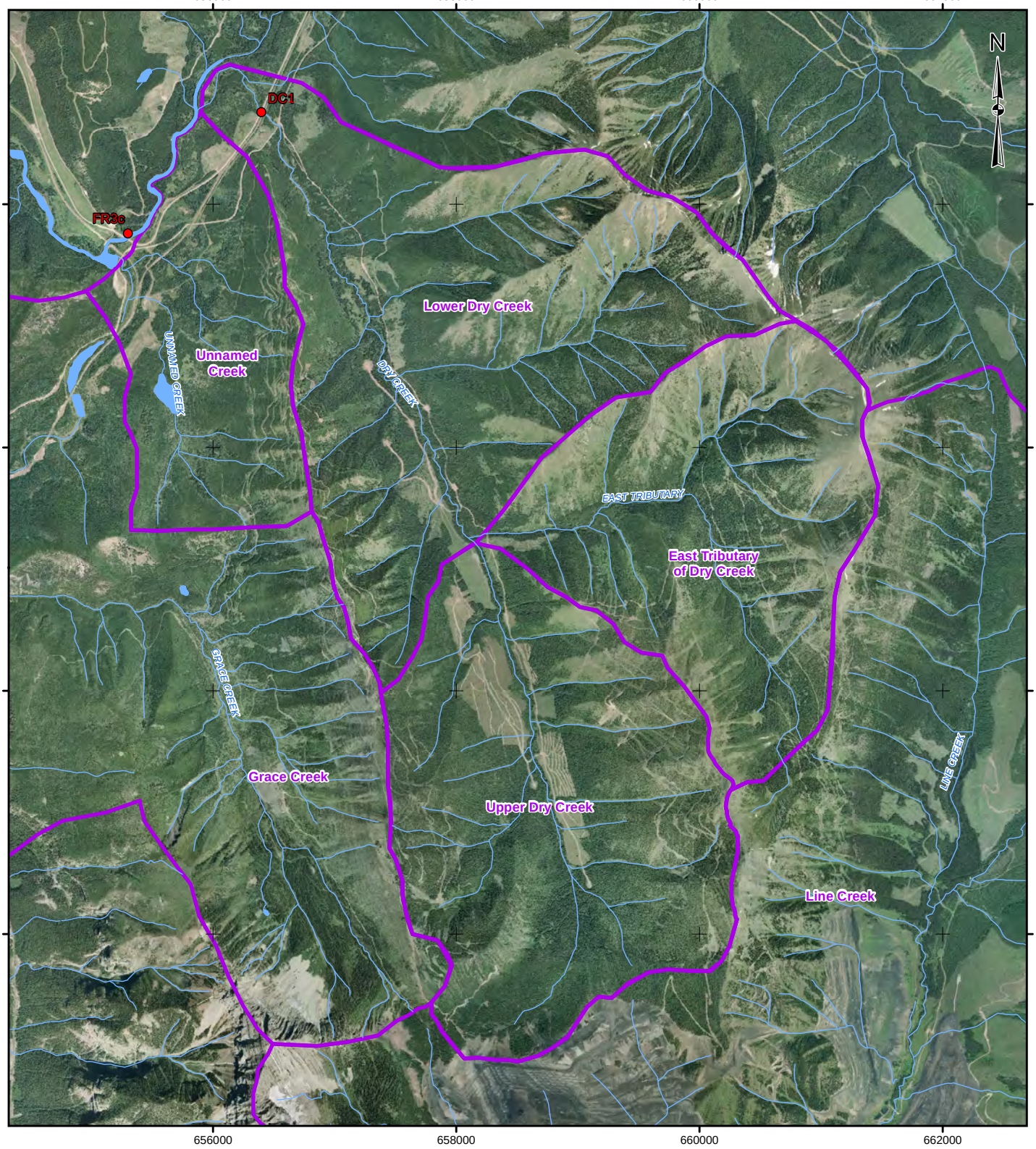

LEGEND

- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- WATERCOURSE
- SUB-WATERSHED
- WATERBODY

Line Creek SUB-WATERSHED NAME

1 0 1

SCALE 1:45,000 KILOMETRES

REFERENCE

1: 50,000 scale hydrography data obtained from GeoGratis.
Imagery obtained from The Orthoshop. Projection: UTM Zone 11 Datum: NAD 83

PROJECT

TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE

LINE CREEK OPERATIONS PHASE II WATERSHEDS
(2010 SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 5-3	
GIS	DR	10 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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655000
660000
5545000
5540000
N
DC1
FR3C
FORDING RIVER
Conveyance Pipeline
Dry Creek
DRY CREEK
Unnamed Creek
UNNAMED CREEK
Proposed Active Water Treatment Facility
Sediment Ponds
East Tributary of Dry Creek
EAST TRIBUTARY
Diversion Structure
BRN 2
MM1
MM2
Grace Creek
GRACE CREEK
Upper Dry Creek
BRN 3
MM3
MM4
BRN 4
Line Creek
LINE CREEK
MSAWX
BRS

LEGEND

- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- PIT WALL
- WASTE ROCK SPOIL
- PIT OUTFLOW CHANNEL
- ROAD
- WATERCOURSE
- DRY CREEK WATER MANAGEMENT STRUCTURES
- PIT LAKE WATER SURFACE
- SUB-WATERSHED
- WATERBODY

BRN	BURNT RIDGE NORTH
BRS	BURNT RIDGE SOUTH
MM	MOUNT MICHAEL
MSAWX	MINE SERVICES AREA WEST EXTENSION

Line Creek SUB-WATERSHED NAME

REFERENCE

1: 50,000 scale hydrography data obtained from GeoGratis. Other data obtained from Teck Coal Limited.
Imagery obtained from The Orthoshop. Projection: UTM Zone 11 Datum: NAD 83

1 0 1
SCALE 1:30,000 KILOMETRES

PROJECT
TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE
LINE CREEK OPERATIONS PHASE II WATERSHEDS
(END OF MINE SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 5-4	
GIS	DR	10 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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Table 5-1 LCO Watershed Summary

Watershed	Sub-Watershed Name	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
LCO Dry Creek[a]	Upper Dry Creek	• natural upper watershed of LCO Dry Creek, above east tributary confluence	• watershed area reduced because of pit expansion • placement of waste rock over a large area • collection system for mine affected water below toe of dump • mine affected water is conveyed to a sediment pond and then conveyed to the Fording River (from 2015 onwards) • revegetation of dump[b]
	Lower Dry Creek	• natural lower watershed of LCO Dry Creek, below east tributary confluence	• watershed area reduced because of pit expansion
	East Tributary Dry Creek	• natural east tributary watershed of LCO Dry Creek	• watershed area reduced because of pit expansion • MM1 flooded pit discharges to the east tributary after 2033
	BRN 2 Pit	• no historical area (part of other watersheds)	• mining of pit, operational discharge to Upper Dry Creek • some backfill with waste rock • pit filling 2032 to 2057 • flooded pit discharge to Upper Dry Creek after 2057 • revegetation of dump[b]
	BRN 3 Pit	• no historical area (part of other watersheds)	• mining of pit, operational discharge to Upper Dry Creek • backfill with waste rock • discharges to BRN2 Pit from 2032 onwards • revegetation of dump[b]
	BRN 4 Pit	• no historical area (part of other watersheds)	• mining of pit, operational discharge to Upper Dry Creek • backfill with waste rock • discharges to BRN3 Pit from 2032 onwards • revegetation of dump[b]
	MM1 Pit	• no historical area (part of other watersheds)	• mining of pit, operational discharge to Upper Dry Creek • no backfill • flooded pit discharges to east tributary of Dry Creek after 2033
	MM2/3 Pit	• no historical area (part of other watersheds)	• mining of pit, operational discharge to Upper Dry Creek • backfill with waste rock • closure discharge to Upper Dry Creek • revegetation of dump[b]

Table 5-1 Line Creek Operations Watershed Summary (continued)

Watershed	Sub-Watershed Name	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Line Creek[c]	Upper Line Creek	• predominantly natural upper watershed of Line Creek, above the Horseshoe Creek confluence	• potential clean water diversion, conveying clean water flows and discharging to Line Creek downstream of the intake for the West Line Creek AWTP
	West Line Creek	• large historical waste rock spoil, including rock drain • natural watershed area on the western side discharging to the rock drain	• more waste rock • mine-affected flow is collected and conveyed to the West Line Creek AWTP from 2014 onwards
	Centre Line Creek (upstream of West Line Creek confluence)	• predominantly mine disturbed sub-watershed area with most of the Phase I waste rock and pits (includes No Name and Horseshoe creeks) • large dump and rock drain on the main channel of Line Creek	• more mining and waste rock • mine-affected flow is collected in Line Creek downstream of the rock drain and conveyed to the West Line Creek AWTP from 2018 onwards
Fording River[a]	Additional to FR5	• additional natural watershed area between FR4 and FR5 which reports to the Fording River	• no planned changes

(a) Flows simulated using the representative hydrograph method (see Hydrology Report for details).

(b) Revegetation of waste rock spoils and tailings facilities is not included in the final water quality model used for the initial implementation plan. As these facilities are not available for revegetation/rehabilitation until the placement of waste rock or tailings is completed, the potential benefits of revegetation over the 20-year planning timeframe (of the Plan) are very limited and not modelled.

(c) Flows derived using other methods (see *Hydrology* report for details).

5.2 Waste Rock Volumes

Table 5-2 summarizes current and future waste rock volumes at LCO with consideration for the mine development projects described in Sections 2.1 and 5.1. The table shows the cumulative waste rock in each watershed in 2013 and 2034 in BCM and as percentage of the total waste rock at LCO and at Teck operations in the Elk Valley. The cumulative waste rock in each watershed at the end of mining is also provided as reference. Waste rock from BRX is assumed to be placed in existing waste rock spoils.

LCO currently accounts for approximately 11% of the total waste rock in the Elk Valley and, by 2034, will account for approximately 12% of the waste rock in the Elk Valley.

Table 5-2 Cumulative Waste Rock Placement at LCO

Watershed	2013			2034			End-of-Mine for the Plan[a]
	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)
Upper Line Creek (includes Tornado Creek)	20	3	0.4	20	1	0.2	20
Horseshoe Creek (North Backside Creek)	62	10	1	62	4	1	62
No Name Creek	124	21	2	328	23	3	328
Main Line Creek	84	14	1	158	11	1	158
Center Line Creek u/s West Line Creek	101	17	2	101	7	1	101
West Line Creek	210	35	4	210	15	2	210
Dry Creek Rock Drain	0	0	0	504	36	4	529
Burnt Ridge North 2 Pit	0	0	0	6	0.4	0	6
Burnt Ridge North 3 Pit	0	0	0	13	1	0.1	13
Burnt Ridge North 4 Pit	0	0	0	3	0.2	0	3
Mount Michael2/3 Pit	0	0	0	6	0.4	0	6
Total	**601**	**100%**	**11%**	**1,411**	**100%**	**12%**	**1,435**

[a] End-of-Mine waste rock volumes provided for context, corresponds to future watershed map provided in Figure 5-2.

5.3 Pit Water Management

The mine plan for LCO includes in a number of open pits. Upon completion of mining, these open pits will be partially or completely backfilled, or remain without backfill, and then filled with water to create flooded pits. Five of these pits were explicitly included in the model, as shown in Table 5-3. Other relatively small pits (e.g., Mount Michael 3/4 pits and pits at LCO Phase I) were not included as they will have limited effects on flow over the 20-year planning period.

Table 5-3 LCO Open Pits Incorporated in the Model

Pit	Pit Completion (End-of-Mining)	Volumes at End-of-Mining (million m^3)			Pit Configuration at End-of-Mining
		Mined Out	Flooded pit	Flooded pit and Void Space	
Mount Michael 1	2028	0.6	0.6	0.6	No Backfill
Mount Michael 2/3	2030	0.2	0	0.1	Complete Backfill
Burnt Ridge North 4	2034	0.6	0	0.2	Complete Backfill
Burnt Ridge North 3	2034	0.4	0	0.1	Complete Backfill
Burnt Ridge North 2	2034	32	32	32	Partial Backfill

Groundwater inflows into the Mount Michael and Burnt Ridge North pits were not considered in the model, because these pits are not scheduled to reach depths below the elevation of LCO Dry Creek. As a result, it is unlikely that these pits will act as local groundwater sinks to the extent that they could appreciably affect surface flows.

The model includes the effect of temporary, medium-term reductions of flow during pit filling for the Burnt Ridge North 2 Pit (BRN2 Pit) at LCO Phase II. After mining, the BRN2 Pit watershed will contribute zero flow during the pit filling period (2033 to 2057). Water management activities that occur beyond the 20-year planning period, such as BRN2 Pit filling, were included to enable assessment of long-term effects (e.g., of waste rock covers). The long-term information use conceptual level estimates based on current mine plans.

Short-term reductions in flow due to filling of relatively small pits (e.g., Mount Michael pits, BRN 3/4 pits) are not included in the model. In the context of water quality planning over the mine life (multiple decades), these events are too short in duration to affect the planning process of the Plan.

A summary of the pit filling and spilling at LCO is provided in Table 5-4.

Table 5-4 Pit Filling and Spilling at LCO Incorporated in the Model

Pit	Pit Completion and Start of Pit Filling	End of Pit Filling and Start of Pit Spilling	Receiving Environment	2034 In-Pit Waste Rock (million BCM)	End of Mining In-Pit Waste Rock (million BCM)
Mount Michael 1	-[(a)]	-	East Tributary	0	0
Mount Michael 2/3	-[(a)]	-	Upper Dry Creek	46	46
Burnt Ridge North 4	-[(a)]	-	Burnt Ridge North 3 Pit	7	7
Burnt Ridge North 3	-[(a)]	-	Burnt Ridge North 2 Pit	24	24
Burnt Ridge North 2	2033	2055	Upper Dry Creek	11	11

[(a)] No pit filling period was assumed, because the storage volume of the pit is small.

5.4 Current and Future Flow Predictions

A process flow diagram of the sub-watersheds and water management linkages for LCO Phase II is shown on Figure 5-5.

Flows were derived at various modelling nodes, as summarized in Table 5-5 and shown on Figures 5-1 through 5-4. Flows in the Fording River downstream of LCO Dry Creek (FR3c) and at the river mouth (FR5) were derived by summing simulated flows from contributing watersheds.

Table 5-5 LCO Assessment Nodes

Modelling Node ID	Modelling Node Description	Location	
		Easting	Northing
DC1	Dry Creek at the mouth	656399	5544757
FR3c	Fording River downstream of Dry Creek	655302	5543759
WLC1	West Line Creek at the mouth	660004	5532209
LC_US_WLC	Line Creek upstream of WLC	660125	5532281
LC1	Line Creek at the mouth	655604	5528824
FR5	Fording River at the mouth	652977	5528919

Note: Location in UTM Zone 11 NAD83.

Results of the flow modelling for selected snapshot years are presented in Table 5-6. Watershed area and elevation input data are presented in Appendix B.

Figure 5-5 LCO Phase II Conceptual Flow Diagram

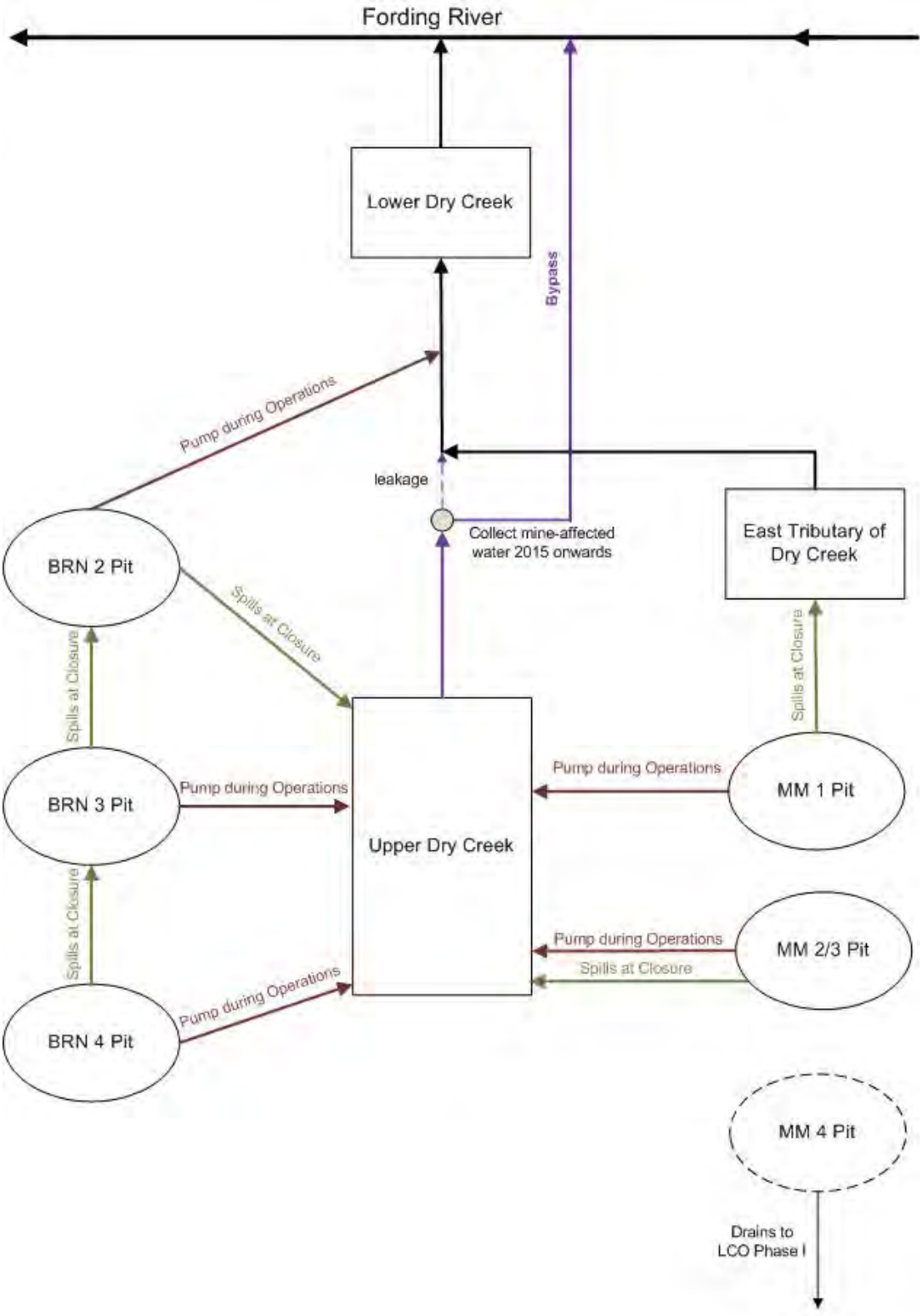


Table 5-6 Current and Future Flows for Watersheds at LCO

Watershed	Node ID	Flow Model Watershed Name	Current Year 2013 (m^3/d)		Year 2040 (m^3/d)	
			Annual	Winter	Annual	Winter
LCO Dry Creek[a]	UDrC	Upper Dry Creek	8,305	2,680	8,201	5,092
	LDrC	Lower Dry Creek	8,698	2,779	8,035	2,568
	ETDrC	East Tributary Dry Creek	6,985	2,232	6,454	2,063
	BRN2	BRN 2 Pit	0[a]	0[a]	0[c]	0[c]
	BRN3	BRN 3 Pit	0[a]	0[a]	0[c]	0[c]
	BRN4	BRN 4 Pit	0[a]	0[a]	0[c]	0[c]
	MM1	MM1 Pit	0[a]	0[a]	552	399
	MM23	MM2/3 Pit	0[a]	0[a]	1,941[d]	1,401[d]
	DC1	**Dry Creek at the mouth**	**23,988**	**7,740**	**15,041**	**5,030**
Line Creek[b]	ULC	Upper Line Creek	36,102	14,356	36,102	14,356
	ULCD	Upper Line Creek diversion	-[b]	-[b]	21,405	14,189
	WLC	**West Line Creek**	**6,396**	**3,096**	**6,396**	**3,096**
	LC_US_WLC	**Line Creek upstream of WLC**	**78,288**	**31,129**	**78,288**	**31,129**
	LC1	**Line Creek at the mouth**	**177,926**	**70,747**	**177,926**	**70,747**
Fording River[a]	Add-FR5	Additional to FR5	44,364	14,180	43,767	13,990

(a) Currently there are no pits in the Dry Creek watershed.

(b) Upper Line Creek Diversion discharges downstream of the LC_US_WLC node.

(c) Zero outflow during pit filling period (2032 to 2057).

(d) Mine affected flow does not contribute to Dry Creek at the Mouth (i.e., mine affected flow is collected, treated and discharged to the Fording River).

Note: Bold text indicates a water quality modelling node.

5.5 Water Quality Management

The selected water quality management measures at LCO for the initial implementation plan are:

- West Line Creek (Phase 1 and Phase 2) and LCO Dry Creek active water treatment facilities, as described in Table 5-9
- Upper Line Creek, No Name Creek and Upper Horseshoe Creek diversions, as described in Table 5-10.

Table 5-9 Active Water Treatment at Line Creek Operations According to the Initial Implementation Plan

Potential Active Water Treatment Plant	Treatment Capacity and Commissioning Date	Treatment Sources (In Order of Priority)	Assumed Collection Efficiency	Treated Water Discharge Location	Bypass Water Discharge Location
West Line Creek AWTP	7,500 m^3/day in Q2 2014 (Phase 1) Additional 7,500 m^3/day by Q4 2031 (Phase 2)	West Line Creek	95%	Line Creek Fording River downstream of LCO Dry Creek	Line Creek Fording River downstream of LCO Dry Creek
		Line Creek	95%		
LCO Dry Creek AWTP	7,500 m^3/day by Q4 2027	LCO Dry Creek	>95%	Line Creek	Line Creek

Table 5-10 Clean Water Diversions at Line Creek Operations According to the Initial Implementation Plan

Potential Clean Water Diversion	Description	Area of Watershed Targeted for Diversion [km^2]	Assumed Diversion Capacity[(a)] [m^3/d]	Commissioning Date	Discharge Location
No Name Creek	Collect clean water in the upper No Name Creek drainage and discharge downstream of the Line Creek spoils and mine-affected water intake system.	1.8	7,000	by Q4 2031 (concurrent with West Line Creek Phase 2 AWTP)	Line Creek at the mouth
Upper Line Creek	Collect and pump clean water in the upper Line Creek watershed and discharge into Line Creek, according to the commitments made in the LCO Phase II Environmental Assessment Certificate Application.	28	35,000	In Q2 2014 (concurrent with West Line Creek Phase 1 AWTP)	Line Creek at the mouth
Upper Horseshoe Creek	Extend Upper Line Creek diversion to the upper Horseshoe Creek watershed.	9	35,000 combined with Upper Line Creek	by Q4 2031 (concurrent with West Line Creek Phase 2 AWTP)	Line Creek at the mouth

[(a)] Diversion capacity for No Name Creek was set to the maximum predicted May flow between 2020 and 2034 under average flow conditions. Diversion capacity for Upper Line Creek is consistent with the LCO Phase II Environmental Assessment Certificate Application.

The discussion of treatment sources, treatment capacity and bypass water discharge that was provided for FRO (in Section 3.5) is consistent with the associated considerations for LCO.

The clean water diversions, as shown in Table 5-10, are based on an assumed capacity to convey up to May monthly flow of an average flow year. Collection efficiencies for the clean water diversions are assumed to be 95%.

Site-specific detailed design of the active water treatment plants and water management measures would be completed prior to implementation and may result in changes to the collection efficiencies and other parameters incorporated in the initial implementation plan.

6 Elkview Operations

Elkview Operations has been in operation since 1969 and is located near Sparwood, at the confluence of Michel Creek and the Elk River. This section describes the site conditions at EVO, including the current and future watershed conditions, waste rock, pit water management, and predicted current and future flows. The project description included in the Plan is subject to revision and reflects the plans for the project as of August 2013.

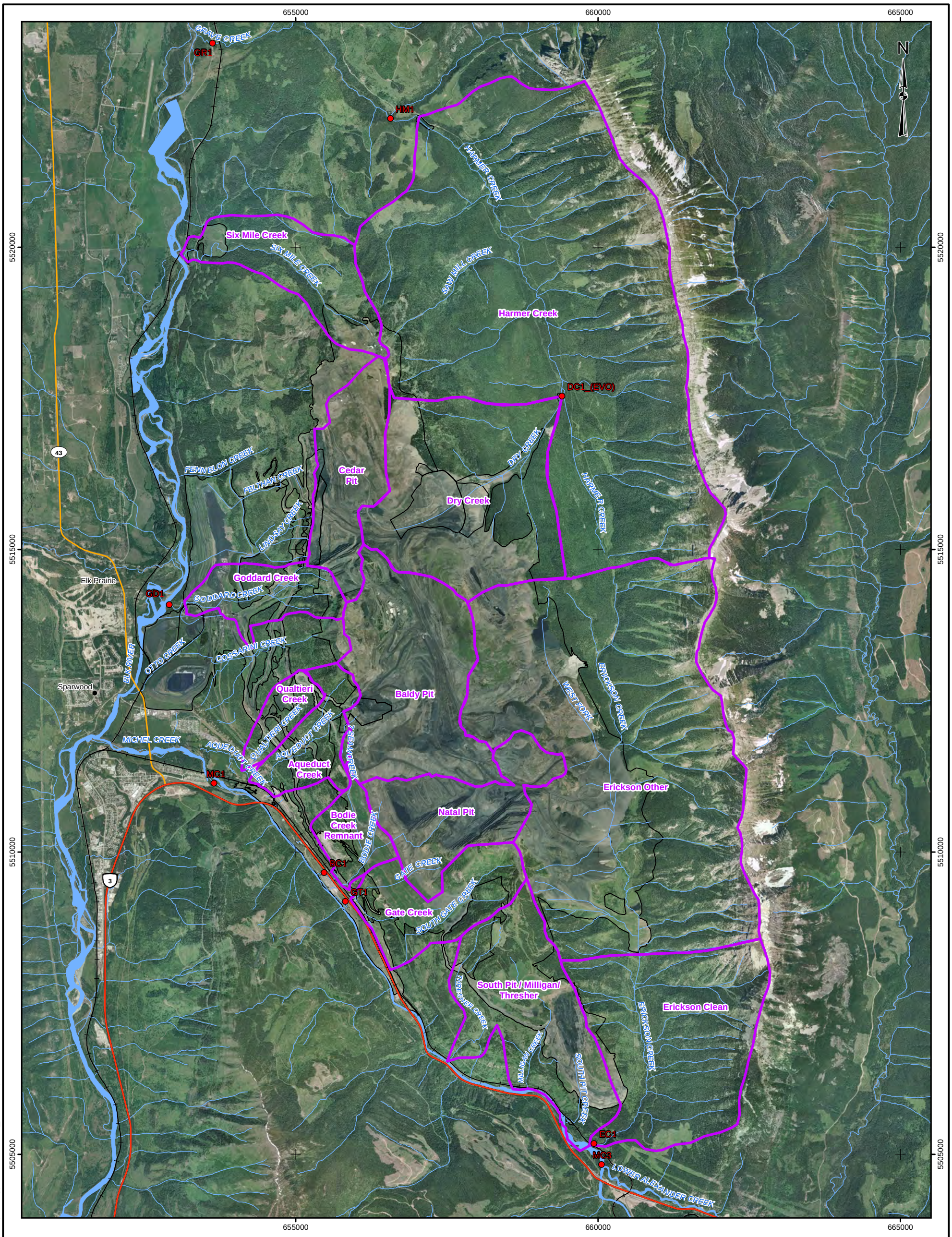
6.1 Current and Future Watershed Conditions

At EVO, the southern half of the mining area drains to various local tributaries of Michel Creek, the largest of which is Erickson Creek. The remainder of the mining area discharges into local tributaries of the Elk River, the largest of which is Grave Creek. Historical waste rock is present in the watersheds of at least eight local tributaries: Bodie, Gate, Dry, Erickson, Goddard, Harmer, South Pit and Six Mile creeks. The pit area historically discharges to Bodie Creek. Current and future watershed delineations are shown on Figures 6-1 and 6-2.

Table 6-1 summarizes the historical and planned future watershed changes at EVO included in the model.

The following mining activities are included in the model:

- Completion of South, Natal and Baldy Ridge pits, and placement of associated waste rock in the EVO Dry and Erickson creek watersheds and as backfill in the pits.
- Completion of Adit Ridge pit and placement of associated waste rock in the EVO Dry Creek watershed and as backfill in Natal and Baldy Ridge pits .
- Continuation of fine tailings disposal in the West Fork Tailings Storage Facility (WFTF) in the Erickson Creek watershed.



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LEGEND

- CITY / TOWN / COMMUNITY
- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- CANADIAN PACIFIC RAILWAY
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- WATERCOURSE
- CURRENT ELKVIEW OPERATIONS PERMITTED AREA
- SUB-WATERSHED
- WATERBODY
- Dry Creek SUB-WATERSHED NAME

2 0 2

SCALE 1:60,000 KILOMETRES

REFERENCE

Populated places obtained from The Atlas of Canada, Natural Resources Canada. Roads obtained from Geobase. Imagery obtained from The Orthoshop. All other data provided by Teck Coal Limited. Projection: UTM Zone 11 Datum: NAD 83

PROJECT

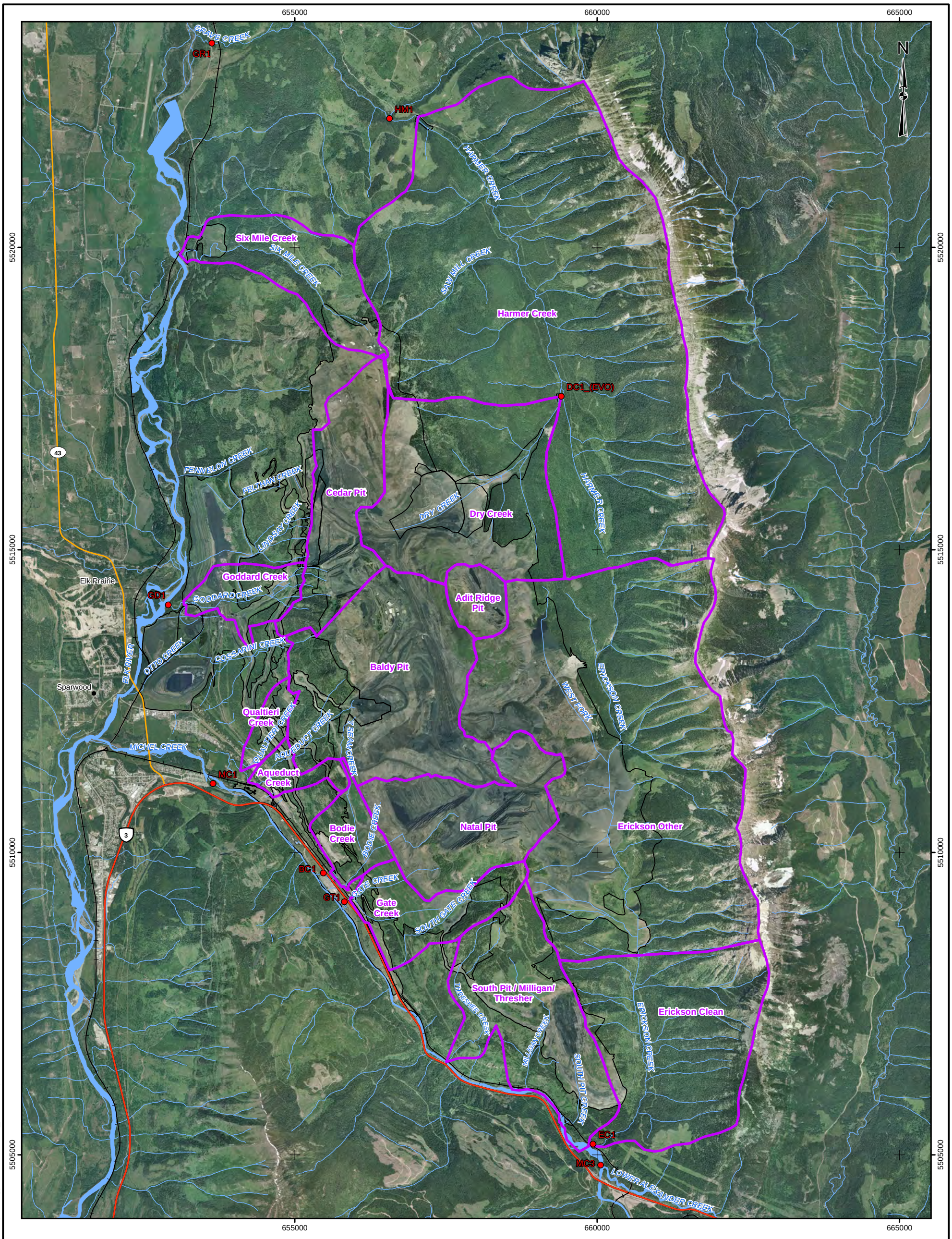
TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE

ELKVIEW OPERATIONS WATERSHEDS
(2010 SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 6-1	
GIS	DR	10 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		



LEGEND

- CITY / TOWN / COMMUNITY
- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- CANADIAN PACIFIC RAILWAY
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- WATERCOURSE
- CURRENT ELKVIEW OPERATIONS PERMITTED AREA
- SUB-WATERSHED
- WATERBODY
- Dry Creek SUB-WATERSHED NAME

2 0 2

SCALE 1:60,000 KILOMETRES

PROJECT

TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE

ELKVIEW OPERATIONS WATERSHEDS (END OF MINE SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	09 Oct. 2013	FIGURE 6-2	
GIS	DR	10 Oct. 2013		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

REFERENCE

Populated places obtained from The Atlas of Canada, Natural Resources Canada. Roads obtained from Geobase. All other data provided by Teck Coal Limited. Imagery obtained from The Orthoshop. Projection: UTM Zone 11 Datum: NAD 83

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Table 6-1 EVO Watershed Summary

Watershed	Sub-watershed	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Elk River	Six Mile Creek	• Small area of historical waste rock	• Revegetation of dump[(a)]
	EVO Dry Creek	• EVO Dry Creek is a tributary of Harmer Creek. • Historical mining and waste rock	• Reduction in area due to mining • More mining and waste rock • Revegetation of dump[(a)]
	Harmer Creek unit watershed (not including EVO Dry Creek)	• Harmer Creek is a tributary of Grave Creek • Predominantly natural watershed with a very small amount of waste rock	• Revegetation of dump[(a)]
	Grave Creek unit watershed (not including Harmer Creek and EVO Dry Creek)	• Grave Creek is a tributary of the Elk River • Natural watershed area	• No planned changes
	Goddard Creek	• Historical mining disturbance	• Reduction in area due to mining • Revegetation of dump[(a)]
Michel Creek	Qaultieri Creek	• Historical mining disturbance	• Reduction in area due to mining
	Aqueduct Creek	• Historical mining disturbance	• Reduction in area due to mining
	Cedar Pit (north)	• Pit area and backfill (historically pit water was directed to Baldy/Natal pits and then discharged to Bodie Creek)	• More mining and backfill • Increase in area due to mining • Operational discharge to EVO Dry Creek (2013 to 2036) • Closure discharge to Baldy Pit (2037 onwards) • Revegetation of dump[(a)]
	Baldy Ridge Pit (middle)	• Pit area and backfill (historically pit water was directed to Natal pits and then discharged to Bodie Creek) • Temporary storage in Natal pit started in April 2012 (zero outflow)	• More mining and backfill • Increase in area due to mining • Operational discharge to Natal pit (April 2012 to 2021) • Operational and closure discharge to Bodie Creek (2022 onwards) • Closure discharge from Natal pit • Revegetation of dump[(a)]
	Natal Pit (south)	• Pit area and backfill • Historically received inflow from Cedar and Baldy pits and discharged to Bodie Creek • Temporary storage in Natal pit started in April 2012	• More mining and backfill • Increase in area due to mining • Temporary storage of Baldy and Natal watershed flows from April 2012 to 2015 (zero outflow) • Pit dewatering: - 2016 to 2021 (see Appendix C for the planned pumping rates) to Bodie Creek (i.e., dewatering temporary storage) - 2022 to 2031 (inflow = outflow) to Bodie Creek - 2032 to 2046 (inflow = outflow) to Gate Creek • Pit filling from 2047 to 2070 (zero outflow) • Closure discharge to Baldy Ridge Pit (i.e., pit spill) • Revegetation of dump[(a)]

Table 6-1 EVO Watershed Summary (continued)

Watershed	Sub-watershed	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Michel Creek (continued)	Bodie Creek remnant (not including pit area)	• Predominately mine disturbed watershed with historical waste rock	• Reduction in area due to mining • Operational pumping from pit area: - 2016 to 2021 from Natal pit (i.e., dewatering temporary storage see Appendix C for pumping rates) - 2022 to 2031 all flow from Natal and Baldy pits - 2032 to 2046 all flow from Baldy pit • Closure discharge from Baldy pit (includes Natal) • Revegetation of dump[(a)]
	Gate Creek	• Historical mining disturbance due to waste rock	• Reduction in area due to mining • Operational pumping from Natal pit area (2032 to 2046)
	South Pit, Milligan, Thresher	• Watersheds combined for simplification • Historical mining disturbance due to pit area and waste rock	• Revegetation of dump[(a)]
	Erickson Clean	• Natural watershed area, discharges to Erickson Other	• No planned changes (identified as potential clean diversion)
	Erickson Other	• Remaining area in the Erickson creek watershed, made up of mine disturbed and natural area • Large area of historical waste rock • Tailings storage since 2008	• Reduction in area due to mining • More waste rock and mining • More tailings storage • Adit Ridge Pit spills to Erickson Other after 2088 • Revegetation of dump[(a)]
	Adit Ridge Pit	• Sub-watershed is not defined for the historical period (area is included as part of EVO Dry Creek and Erickson Other watersheds)	• More mining (2024 to 2046) • Pit filling from 2047 to 2088 (zero outflow) • Operational and closure discharge to Erickson Other watershed
	Alexander Creek	• Natural sub-watershed that reports to Lower Alexander Creek	• No planned changes
	Unnamed sub watershed of Lower Alexander	• Natural sub-watershed that reports to Lower Alexander	• No planned changes
	Lower Alexander Creek	• Natural watershed is a tributary of Michel Creek	• No planned changes
	Additional to MC3	• Additional natural area reporting to the MC3 node	• No planned changes
	Additional to MC1	• Additional area reporting to the MC1 node • Predominantly natural with a small area of mining disturbance	• No planned changes

[(a)] Revegetation of waste rock spoils and tailings facilities is not included in the final water quality model used for the initial implementation plan. As these facilities are not available for revegetation/rehabilitation until the placement of waste rock or tailings is completed, the potential benefits of revegetation over the 20-year planning timeframe (of the Plan) are very limited and not modelled.

6.2 Waste Rock Volumes

Table 6-2 summarizes current and future waste rock volumes at EVO with consideration for the mine development projects described in Sections 2.1 and 6.1. The table shows cumulative waste rock in each watershed in 2013 and 2034 in BCM, and as percentages of the total waste rock at EVO and at Teck operations in the Elk Valley. Cumulative waste rock in each watershed at the end of mining is also provided as reference.

EVO currently accounts for approximately 27% of the total waste rock in the Elk Valley and, by 2034, will account for approximately 25% of the waste rock in the Elk Valley.

Table 6-2 Cumulative Waste Rock at EVO

Watershed	2013			2034			End-of-Mine for the Plan[(a)]
	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley (%)	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)
Erickson Creek	487	34	9	1,068	38	9	1,129
Gate Creek	50	3	1	50	2	0.4	50
Bodie Creek	68	5	1	68	2	1	68
South Pit/Milligan/Thresher Creeks	28	2	1	28	1	0.2	28
EVO Dry Creek	417	29	8	771	27	7	796
Harmer Creek	142	10	3	142	5	1	142
Goddard Creek	1	0.1	0.02	1	0.04	0	1
Six Mile Creek	7	1	0.1	7	0.3	0.1	7
Cedar Pit	12	1	0.2	51	2	0.4	51
Natal Pit	62	4	1	284	10	2	294
Baldy Ridge Pit	170	12	3	377	13	3	617
Total	**1,444**	**100**	**27**	**2,847**	**100**	**25**	**3,183**

(a) End-of-Mine waste rock volumes provided for context, corresponds to future watershed map provided in Figure 6-2.

6.3 Pit Water Management

The mine plan for EVO includes a number of open pits. Upon completion of mining, these pits will be partially or completely backfilled, or remain without backfill, and then filled with water to create flooded pits. Four of these pits were explicitly included in the model, as shown in Table 6-3. Other relatively small pits (e.g., the F2 pit) are not included in the model as they will have limited effects on flow over the 20-year planning period.

Table 6-3 EVO Open Pits Incorporated in the Model

Pit	Pit Completion (End-of-Mining)	Volumes at End-of-Mining (million m^3)			Pit Configuration at End-of-Mining
		Mined Out	Flooded pit	Flooded pit and Void Space	
Cedar	2036	0	0	0	No/ little storage
Baldy Ridge	2022	9.0	0	2.7	Complete Backfill
Natal	2047	66	39	47	Partial Backfill
Adit	2047	17	17	17	No Backfill

Groundwater inflows into the Cedar, Baldy Ridge, Natal and Adit pits were not considered in the model, because these are not scheduled to reach depths below the elevation of Michel Creek. As such, it is unlikely that they will act as local groundwater sinks to the extent that they could appreciably affect surface flows.

The model includes the effect of temporary, medium-term reductions of flow during pit filling periods for two large pits at EVO:

- After mining, Adit Ridge Pit watershed was assumed to contribute zero flow during the pit filling period (starting in 2047). The pit was assumed to spill to Erickson Creek.
- Flow reductions due to storage in Natal Pit were included for two periods:
  - Temporary storage during operations: Natal Pit was assumed to contribute zero flow from April 2012 to 2015. Dewatering of the stored water in Natal Pit was assumed to occur from 2016 to 2019 at the pumping rates outlined in Appendix C. The stored water was discharged to Bodie Creek.
  - Pit filling at end of mining: Natal Pit was assumed to contribute zero flow during the pit filling period (starting in 2047). The pit was assumed to spill to the Baldy Ridge Pit.

Short-term reductions in flow due to filling of relatively small pits (e.g., Cedar and Baldy Ridge) are excluded from the model. In the context of water quality planning over multiple decades, these events are too short in duration to have an effect on the planning process.

Pit dewatering at Natal Pit is summarized in Table 6-4, and pit filling and spilling at EVO is summarized in Table 6-5.

Table 6-4 Pit Dewatering at EVO Incorporated in the Model

Pit	Start of Pit Dewatering	End of Pit Dewatering	Receiving Environment	In-Pit Waste Rock (million BCM)
Natal	2016	2019	Bodie Creek	109

Table 6-5 Pit Filling and Spilling at EVO Incorporated in the Model

Pit	Pit Completion and Start of Pit Filling	End of Pit Filling and Start of Pit Spilling	Receiving Environment	2034 In-Pit Waste Rock (million BCM)	End of Mining In-Pit Waste Rock (million BCM)
Cedar	-[(a)]	-	Baldy Ridge Pit	51	51
Baldy Ridge	-[(a)]	-	Bodie Creek	375	617
Natal	2047	2071	Baldy Ridge Pit	283	294
Adit	2047	2088	Erickson Creek	0	0

[(a)] No pit filling period was assumed, because the storage volume of the pit is small.

6.4 Current and Future Flow Predictions

A conceptual flow diagram of the sub-watersheds and water management linkages is shown in Figure 6-3.

Flows were derived at various modelling nodes, as summarized in Table 6-6, and shown on Figures 6-1 and 6-2 above.

Table 6-6 EVO Modelling Nodes

Modelling Node ID	Modelling Node Description	Location	
		Easting	Northing
BC1	Bodie Creek at the mouth	655750	5509360
DC1_(EVO)	EVO Dry Creek at the mouth	659409	5517536
EC1	Erickson Creek at the mouth	659970	5504950
GC1	Gate Creek at the mouth	655740	5509040
GD1	Goddard Creek at the mouth	652890	5513760
MC1	Michel Creek at the mouth	653590	5511060
MC3	Michel Creek upstream of EVO	659950	5504890
ER3	Elk River downstream of Michel Creek	651245	5503416
HM1	Harmer Creek at the mouth	656571	5522125
GR1	Grave Creek at the mouth	653633	5523371

Note: Location in UTM Zone 11 NAD83.

Results of the flow modelling for selected snapshot years are presented in Table 6-7. Watershed area and elevation input data are presented in Appendix B.

Figure 6-3 EVO Conceptual Flow Diagram

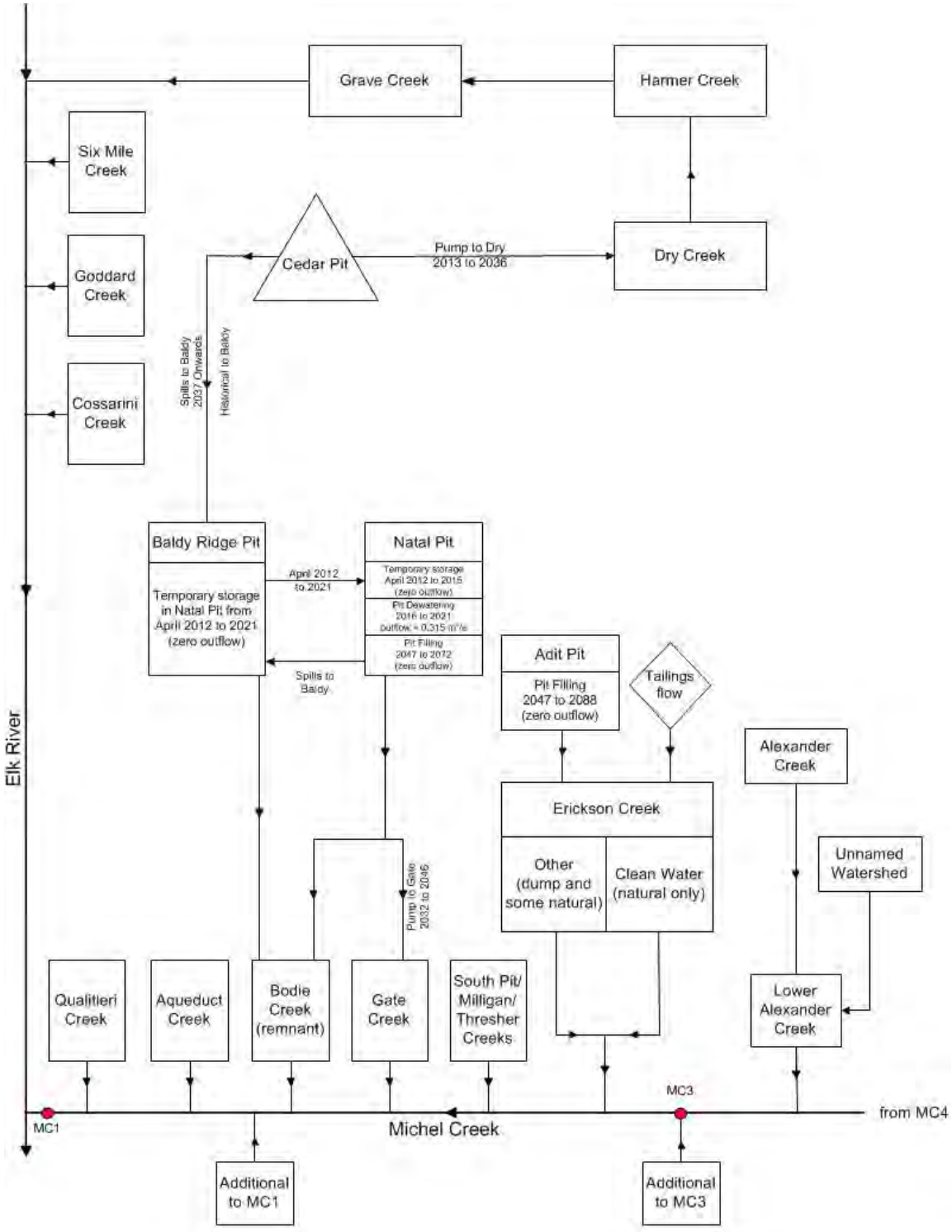


Table 6-7 Current and Future Flows for Watersheds at EVO

Watershed	Node ID	Flow Model Watershed Name	Current Year 2013 (m^3/d)		Year 2040 (m^3/d)	
			Annual	Winter	Annual	Winter
Elk River Tributaries	6MC	Six Mile Creek	3,142	1,584	3,145	1,586
	GD1	**Goddard Creek at the mouth**	**1,758**	**1,081**	**1,304**	**859**
Grave Creek	DC1_EVO	EVO Dry Creek	9,674	5,949	9,694	6,568
	HaC	Harmer Creek unit watershed (not including EVO Dry Creek)	34,344	16,786	34,344	16,786
	GrC	Grave Creek unit watershed (not including Harmer Creek and EVO Dry Creek)	43,120	21,039	43,120	21,039
	HM1	**Harmer Creek at the mouth**	**48,271[(a)]**	**25,805[(a)]**	**44,037**	**23,353**
	GR1	**Grave Creek at the mouth**	**95,645[(a)]**	**49,914[(a)]**	**87,157**	**44,392**
Michel Creek Tributaries	QC	Qaultieri Creek	800	453	599	345
	AC	Aqueduct Creek	1,821	1,026	668	376
Bodie Creek[(a)]	CePN	Cedar Pit (north)	4,254	3,070	5,197	3,768
	BRP	Baldy Ridge Pit (middle)	7,605	5,504	9,290	6,786
	NaP	Natal Pit (south)	4,419	3,210	5,104	3,684
	BoC	Bodie Creek remnant (not including pit area)	1,091	705	1,034	679
	BC1	**Bodie Creek at the mouth**	**1,091[(b)]**	**705[(b)]**	**15,521**	**11,233**
Michel Creek Tributaries	**GC1**	**Gate Creek at the mouth**	**2,783**	**1,657**	**7,465[(d)]**	**5,140[(d)]**
	SPMT	South Pit, Milligan, Thresher Creeks	6,277	3,565	6,277	3,565
Erickson Creek	EC-Div	Erickson Clean Diverted	7,360	3,591	7,360	3,591
	EC-Oth	Erickson Other	26,244	15,349	24,300	14,590
	ARP	Adit Ridge Pit	-[(c)]	-[(c)]	1,142	824
	EC1	**Erickson Creek at the mouth**	**33,604**	**18,940**	**32,802**	**19,005**
Alexander Creek	AxC	Alexander Creek	234,587	114,460	234,587	114,460
	UnLaxC	Unnamed sub watershed of Lower Alexander	41,053	20,031	41,053	20,031
	LAxC	Lower Alexander Creek	6,735	3,286	6,735	3,286
Michel Creek Other	Add-MC3	Additional to MC3	50,213	24,500	50,213	24,500
	Add-MC1	Additional to MC1	33,327	16,443	33,327	16,443

(a) Harmer/Grave creeks total flow includes pumping from Cedar Pit (2013 to 2036).

(b) Natal Pit temporary storage (i.e., zero outflow from Natal Pit and Baldy Ridge Pit watersheds).

(c) Pit is inactive and watershed area is included elsewhere.

(d) Gate creeks total flow includes pumping from Natal Pit (2032 to 2046).

Note: Bold text indicates a water quality modelling node.

6.5 Water Quality Management

The selected water quality management measures at EVO for the initial implementation plan are:

- EVO (Phase 1 and Phase 2) active water treatment facility, as described in Table 6-9
- Upper Erickson Creek and South Gate Creek diversions, as described in Table 6-10.

Table 6-9 Active Water Treatment at Elkview Operations According to the Initial Implementation Plan

Potential Active Water Treatment Plant	Treatment Capacity and Commissioning Date	Treatment Sources (In Order of Priority)	Assumed Collection Efficiency	Treated Water Discharge Location	Bypass Water Discharge Location
EVO AWTP	30,000 m^3/day by Q2 2019 (Phase 1) Additional 20,000 m^3/day by Q4 2023 (Phase 2)	Bodie Creek	95%	Erickson Creek	Bodie Creek
		Gate Creek	95%		
		Erickson Creek	90%		

Table 6-10 Clean Water Diversions at Elkview Operations According to the Initial Implementation Plan

Potential Clean Water Diversion	Description	Area of Watershed Targeted for Diversion [km^2]	Assumed Diversion Capacity[(a)] [m^3/d]	Commissioning Date	Discharge Location
Upper Erickson Creek	Collect and pump clean water upstream of the spoil and discharge downstream of the mine-affected water intake system.	4.0	14,000	by Q4 2019 (concurrent with EVO Phase 1 AWTP)	Erickson Creek at the mouth
South Gate Creek	Collect and pump clean water in the upper Line Creek watershed and discharge into Line Creek, according to the commitments made in the LCO Phase II Environmental Assessment Certificate Application.	0.9 to 1.3	3,500	by Q4 2019 (concurrent with EVO Phase 1 AWTP)	Gate Creek at the mouth

[(a)] Diversion capacity was set to the maximum predicted May flow between 2020 and 2034 under average flow conditions.

The discussion of treatment sources, treatment capacity and bypass water discharge that was provided for FRO (in Section 3.5) is consistent with the associated considerations for EVO.

The clean water diversions, as shown in Table 6-10, are based on an assumed capacity to convey up to May monthly flow of an average flow year. Collection efficiencies for the clean water diversions are assumed to be 95%.

Site-specific detailed design of the active water treatment plants and water management measures would be completed prior to implementation and may result in changes to the collection efficiencies and other parameters incorporated in the initial implementation plan.

7 Coal Mountain Operations

Coal Mountain Operations Phase I is on the upper reaches of Michel Creek. Teck is considering a mining development in the Michel Creek watershed (CMO Phase II), approximately 20 km northwest of the CMO Phase I mining area. CMO Phase II will provide continuity of production and employment, with a planned LOM from 2017 to 2042.

Teck continues to evaluate alternative mine plans and associated water management plans for CMO Phase II. The project description included in the Plan is subject to revision and reflects the plans for the project as of August 2013.

This section describes the site conditions at CMO, including the current and future watershed conditions, waste rock, pit water management, and the predicted current and future flows.

7.1 Current and Future Watershed Conditions

7.1.1 CMO Phase I

Local watershed flows were not defined for the CMO Phase I mining area, since further spatial definition of this site is not expected to be required to support the development of the Plan. Active mining is expected to be completed by 2018.

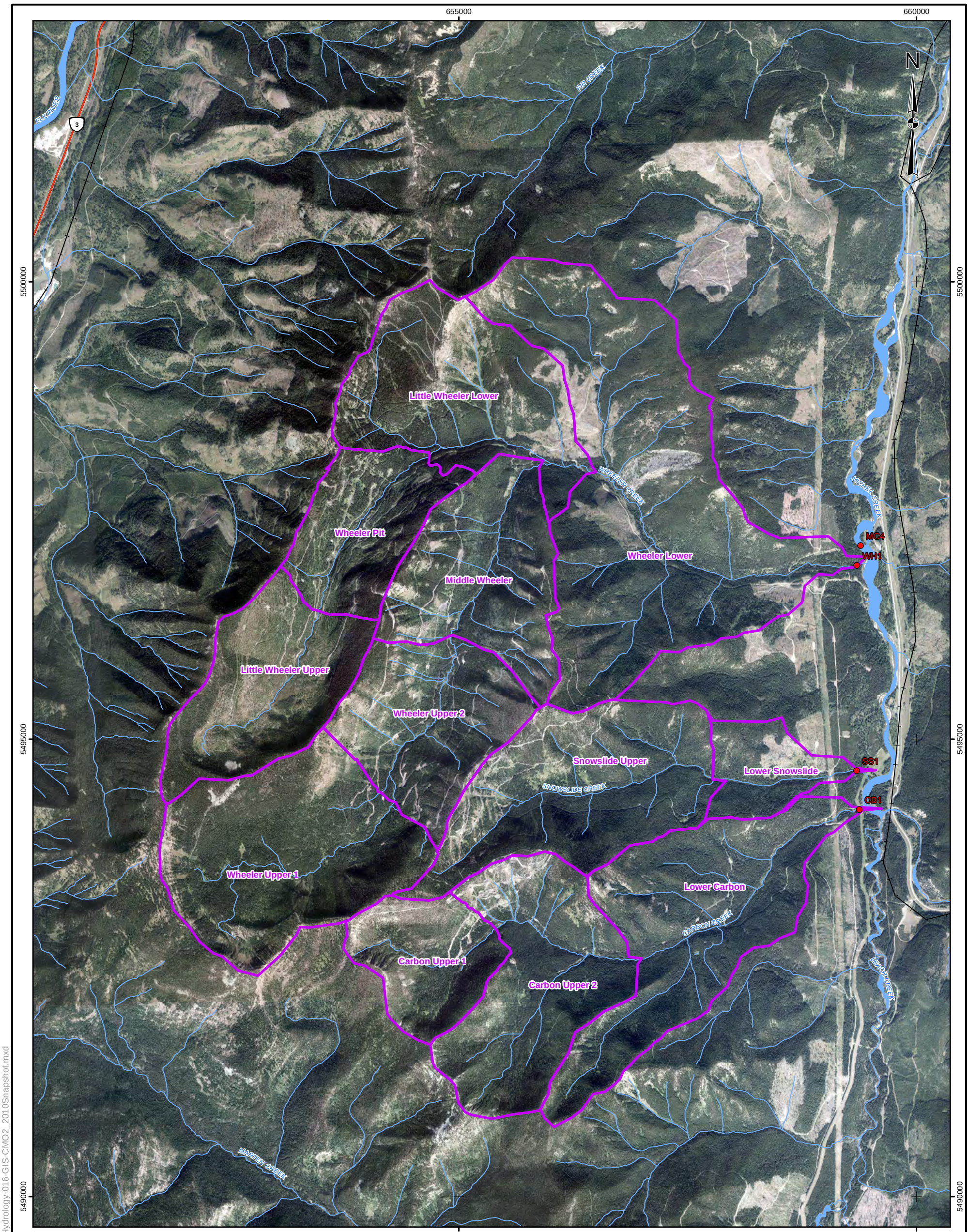
7.1.2 CMO Phase II

CMO Phase II is mainly located within the Wheeler Creek watershed, with small disturbances proposed in the Carbon and Snowslide Creek watersheds. All three creeks are tributaries of Michel Creek and are currently undisturbed by mining activities. The current watershed boundaries are shown on Figure 7-1.

CMO Phase II watershed boundaries for the End-of-Mine Snapshot are shown in Figure 7-2. These delineations are based on the information for the mine plan summary report that was included in the model (Section 2-1).

A summary of historical watershed conditions and planned future watershed changes at CMO included in the model is presented in Table 7-1.

Some supporting information (i.e., mine plan with associated topography and waste rock schedule) was developed for the potential mine plan and the water management concepts were prepared to support the analyses herein, as required. The model includes watershed changes associated with completion of Marten, Wheeler and Marten Ridge pits, and placement of associated waste rock in the Wheeler Creek watershed.



LEGEND

- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- CANADIAN PACIFIC RAILWAY
- CORBIN HIGHWAY
- PRIMARY HIGHWAY
- WATERCOURSE
- SUB-WATERSHED
- WATERBODY

Wheeler Pit SUB-WATERSHED NAME

1 0 1

SCALE 1:40,000 KILOMETRES

REFERENCE

Primary Highway obtained from Geobase. Railway data obtained from GeoGratis. Elevation data, hydrography and other project data obtained from Teck Coal Limited. Projection: UTM Zone 11 Datum: NAD 83

PROJECT

TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE

COAL MOUNTAIN OPERATIONS PHASE II
WATERSHEDS (2010 SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	10 Oct. 2013	FIGURE 7-1	
GIS	DC	15 May 2014		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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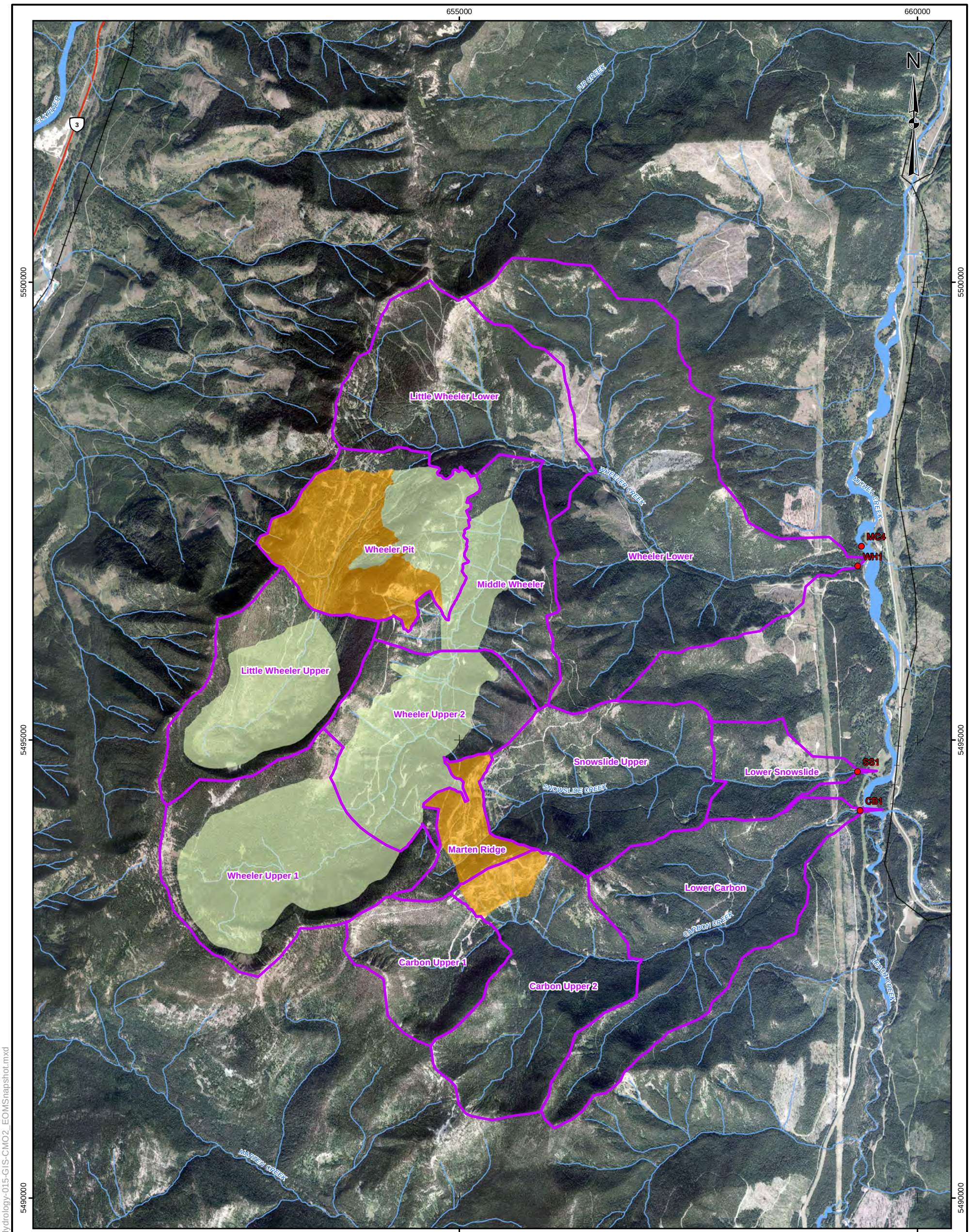

LEGEND

- FLOWS AT WATER QUALITY NODE SIMULATED USING REPRESENTATIVE HYDROGRAPH METHOD
- CANADIAN PACIFIC RAILWAY
- CORBIN HIGHWAY
- PRIMARY HIGHWAY
- WATERCOURSE
- MINE DUMP
- MINE PIT
- SUB-WATERSHED
- WATERBODY
- Wheeler Pit SUB-WATERSHED NAME

1 0 1

SCALE 1:40,000 KILOMETRES

REFERENCE

Primary Highway obtained from Geobase. Railway data obtained from GeoGratis. Elevation data, hydrography and other project data obtained from Teck Coal Limited. Projection: UTM Zone 11 Datum: NAD 83

PROJECT

TECK COAL ELK VALLEY
WATER QUALITY PLAN

TITLE

COAL MOUNTAIN OPERATIONS PHASE II
WATERSHEDS (END OF MINE SNAPSHOT)

Teck

PROJECT No. 13-1349-0006			SCALE AS SHOWN	REV. 0
DESIGN	AC	10 Oct. 2013	FIGURE 7-2	
GIS	DC	16 May 2014		
CHECK	JC	27 Jun. 2014		
REVIEW	AF	27 Jun. 2014		

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Table 7-1 CMO Watershed Summary

Watershed	Sub-Watershed Name	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Michel Creek	MC5	• historical mining and waste rock at CMO Phase I and natural watershed area	• no changes (CMO Phase I is almost finished production with end of mining in 2018)
Wheeler Creek	Upper Little Wheeler	• natural upper watershed of Little Wheeler Creek, upstream of proposed Wheeler Pit • discharges to Wheeler Pit watershed	• no changes to watershed area • placement of waste rock over a large area (2017-22) • collection system for mine affected water below toe of dump; mine-affected water is conveyed to Middle Wheeler during active mining of Wheeler Pit • revegetation of dump (2023-62)[(a)] • discharges to Wheeler Pit at end of mining (2039 onwards)
	Wheeler Pit	• natural middle watershed of Little Wheeler Creek (proposed Wheeler pit footprint) • discharges to Lower Little Wheeler	• watershed area increases because of mining of Hosmer Ridge and Wheeler Ridge • active mining activity (2017-39) • partial backfilling with waste rock (2036-29) • pit dewatering collection system assumes pumping of mine-affected water to Middle Wheeler during active mining • pit fills and spills to Middle Wheeler at end-of mining (zero outflow from 2040 to 2090) • revegetation of backfill dump above spill elevation (2040-79)[(a)]
	Lower Little Wheeler	• natural lower watershed of Little Wheeler Creek • discharges to Lower Wheeler watershed	• no changes in watershed area • no planned mining activity in the watershed • discharges to Lower Wheeler watershed
	Upper Wheeler 1	• natural upper watershed of Wheeler Creek, above proposed Marten Pit footprint • discharges to Upper Wheeler 2	• watershed area reduces because of partially re-assigning dump area to Upper Wheeler 2 (2027-36) • placement of waste rock over a large area (2017-31) • collection system for mine affected water below toe of dump during active mining of Marten Pit (2017-22); conveyance to Middle Wheeler • discharges to Upper Wheeler 2 into back-filled Marten Pit (2023 onwards) • revegetation of dump (2032-71)[(a)]
	Upper Wheeler 2 (Marten Pit)	• natural upper watershed of Wheeler Creek (Marten Pit footprint) • discharges to Middle Wheeler	• watershed area marginally decreases (2021-22) (re-assigned to Upper Wheeler 1) and then increases because of mining at Marten Ridge Pit (2023-31) • active mining of Marten Pit (2017-22) • pit dewatering collection system assumes pumping to Middle Wheeler during active mining • complete backfill of Marten Pit (2023-26) and placement of waste rock in Wheeler valley (2023-36) • revegetation of dump (2037-76)[(a)]

Table 7-1 CMO Watershed Summary (continued)

Watershed	Sub-Watershed Name	Historical Watershed Conditions	Summary of Planned Future Watershed Changes
Wheeler Creek (continued)	Middle Wheeler	• natural middle watershed of Wheeler Creek, upstream of confluence with Little Wheeler Creek • discharges to Lower Wheeler	• watershed area reduces because of Wheeler pit mining of Wheeler Ridge (2022-31) • placement of waste rock (2031-36) • revegetation of dump (2037-76)[(a)] • discharges to Lower Wheeler
	Lower Wheeler	• natural lower watershed of Wheeler Creek, downstream of confluence with Little Wheeler Creek • discharges to Michel Creek	• no changes in watershed area • no planned mining activity in the watershed • discharges to Michel Creek
Snowslide Creek	Marten Ridge Pit	• no watershed during the historical period	• watershed gets created due to Marten Ridge Pit mining (2022-31) • pit dewatering collection system for mine affected water to be pumped to Upper Wheeler 2 (Marten Pit) • pit fills and spills at closure to Upper Wheeler 2 (Marten Pit)
	Upper Snowslide	• natural upper watershed of Snowslide Creek (downstream of the proposed Marten Ridge Pit) • discharges to Lower Snowslide	• watershed area reduces because of Marten Ridge Pit mining (2022-31) • no planned mining activity in the watershed • discharges to Lower Snowslide
	Lower Snowslide	• natural lower watershed of Snowslide Creek • discharges to Michel Creek	• no changes in watershed area • no planned mining activity in the watershed • discharges to Michel Creek
Carbon Creek	Upper Carbon 1	• natural upper watershed of Carbon Creek (upstream of the proposed Marten Ridge Pit) • discharges to Upper Carbon 2	• no changes in watershed area • no planned mining activity in the watershed • discharges to Upper Carbon 2
	Upper Carbon 2	• natural middle watershed of Carbon Creek • discharges to Lower Carbon	• no changes in watershed area • Marten Ridge Pit mining affects a small portion of this watershed (2027-2031) • discharges to Lower Carbon
	Lower Carbon	• natural lower watershed of Carbon Creek • discharges to Michel Creek	• no changes in watershed area • no planned mining activity in the watershed • discharges to Michel Creek
Michel Creek	Additional to MC4	• additional natural area reporting to the MC4 node	• no planned changes

(a) Revegetation of waste rock spoils and tailings facilities is not included in the final water quality model used for the initial implementation plan. As these facilities are not available for revegetation/rehabilitation until the placement of waste rock or tailings is completed, the potential benefits of revegetation over the 20-year planning timeframe (of the Plan) are very limited and not modelled.

7.2 Waste Rock Volume

Tables 7-2 and 7-3 summarize current and future waste rock volumes at CMO, considering the mine development projects described in Sections 2.1 and 7.1. The tables show cumulative waste rock in each watershed in 2013 and 2034 in BCM, and as percentages of the total waste rock at each site and at Teck operations in the Elk Valley. Cumulative waste rock in each watershed at the end of mining is also provided as reference.

CMO currently accounts for approximately 5% of the total waste rock in the Elk Valley. By 2034, CMO will account for approximately 8% of the waste rock in the Elk Valley.

Table 7-2 Waste Rock at CMO Phase I

Watershed	2013			2034			End of Mining
	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)
Michel Creek	272	100	5	310	100%	3	310

Table 7-3 Cumulative Waste Rock at CMO Phase II

Watershed	2013			2034			End-of-Mine for the Plan[(a)]
	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)	Percent of Site Total (%)	Percent of Elk Valley Total (%)	Waste Rock (MBCM)
Upper Wheeler Creek	0	0	0	231	40	2	228
Marten Pit	0	0	0	219	38	2	264
Middle Wheeler Creek	0	0	0	25	4	0.2	42
Upper Little Wheeler Creek	0	0	0	108	18	1	108
Wheeler Pit	0	0	0	0	0	0	37
Total	**0**	**0**	**0**	**583**	**100**	**5**	**679**

(a) End-of-Mine waste rock volumes provided for context, corresponds to future watershed map provided in Figure 7-2.

7.3 Pit Water Management

The mine plan for CMO will result in three open pits. The pits at CMO Phase I were not explicitly included in the model. CMO Phase II includes three pits, which were explicitly included in the model as shown in Table 7-4. Upon completion of mining, these pits will be partially or completely backfilled, or remain without backfill, and then filled with water to create flooded pits. A summary of the pit filling and spilling at CMO is provided in Table 7-5.

Table 7-4 CMO Phase II Open Pits Incorporated in the Model

Pit	Pit Completion (End-of-Mining)	Volumes at End-of-Mining (million m^3)			Pit Configuration at End-of-Mining
		Mined Out	Flooded pit	Flooded pit and Void Space	
Wheeler	2040	160	148	152	Minimal Backfill
Marten	2023	8.0	0	2.4	Complete Backfill
Marten Ridge	2040	2.4	2.0	2.0	No Backfill

Table 7-5 Pit Filling and Spilling at CMO Phase II Incorporated in the Model

Pit	Pit Completion and Start of Pit Filling	End of Pit Filling and Start of Pit Spilling	Receiving Environment	2034 In-Pit Waste Rock (million BCM)	End of Mining In-Pit Waste Rock (million BCM)
Wheeler	2040	2095	Wheeler Creek	0	37
Marten	2023	2024	Wheeler Creek	218	264
Marten Ridge	- [(a)]	-	Marten Pit	0	0

[(a)] No pit filling period was assumed, because the storage volume of the pit is small.

Groundwater inflows into the Wheeler and Marten pits were not available at the time of writing. The Marten Ridge Pit is not scheduled to reach depths below the elevation of Michel Creek; thus, it is unlikely that it will act as a local groundwater sink to the extent that it could appreciably affect surface flows.

The model includes the effect of temporary, medium-term reductions of flow during the pit filling period for the Wheeler Pit at CMO Phase II. After mining, Wheeler Pit was assumed to contribute zero flow during the pit filling period (starting in 2040).The pit was assumed to spill to the Middle Wheeler Creek sub-watershed.

Short-term reductions in flow due to filling of relatively small pits (e.g., Marten Ridge Pit, and the CMO Phase I pits) were not included in the model. In the context of water quality planning over the mine life (multiple decades), these events are too short in duration to affect the planning process.

7.4 Current and Future Flow Predictions

As discussed in Section 7.1.1, further spatial definition of CMO Phase I is not expected to be required to support the development of the Plan. Therefore, a single watershed (i.e., Michel Creek downstream of CMO and upstream of Leach Creek [MC5]) was used to derive flows in the upper watershed of Michel Creek, including CMO Phase I. The CMO Phase I mining area accounts for approximately 15% of the total watershed area at MC5 (Table 7-6). Watershed conditions are not expected to change in the future, as mining at CMO Phase I is nearly completed.

Figure 7-3 is a process flow diagram of the sub-watersheds and water management linkages for CMO Phase II. Flows were derived at various modelling nodes associated with CMO, as summarized in Table 7-6 and shown on Figures 7-1 and 7-2 above. Results of the flow modelling for selected snapshot years are presented in Table 7-7. Watershed area and elevation input data are presented in Appendix B.

Table 7-6 CMO Modelling Nodes

Modelling Node ID	Modelling Node Description	Location	
		Easting	Northing
MC5	Michel Creek downstream of CMO and upstream of Leach Creek	667186	5488211
CB1	Carbon Creek at the mouth	659375	5494229
SS1	Snowslide Creek at the mouth	659348	5494653
WH1	Wheeler Creek at the mouth	659350	5496898
MC4	Michel Creek downstream of Wheeler Creek	659391	5497114

Note: Location in UTM Zone 11 NAD83.

7.5 Water Quality Management

No water quality management measures are required at CMO for the initial implementation plan.

Figure 7-3 CMO Phase II Project Conceptual Flow Diagram

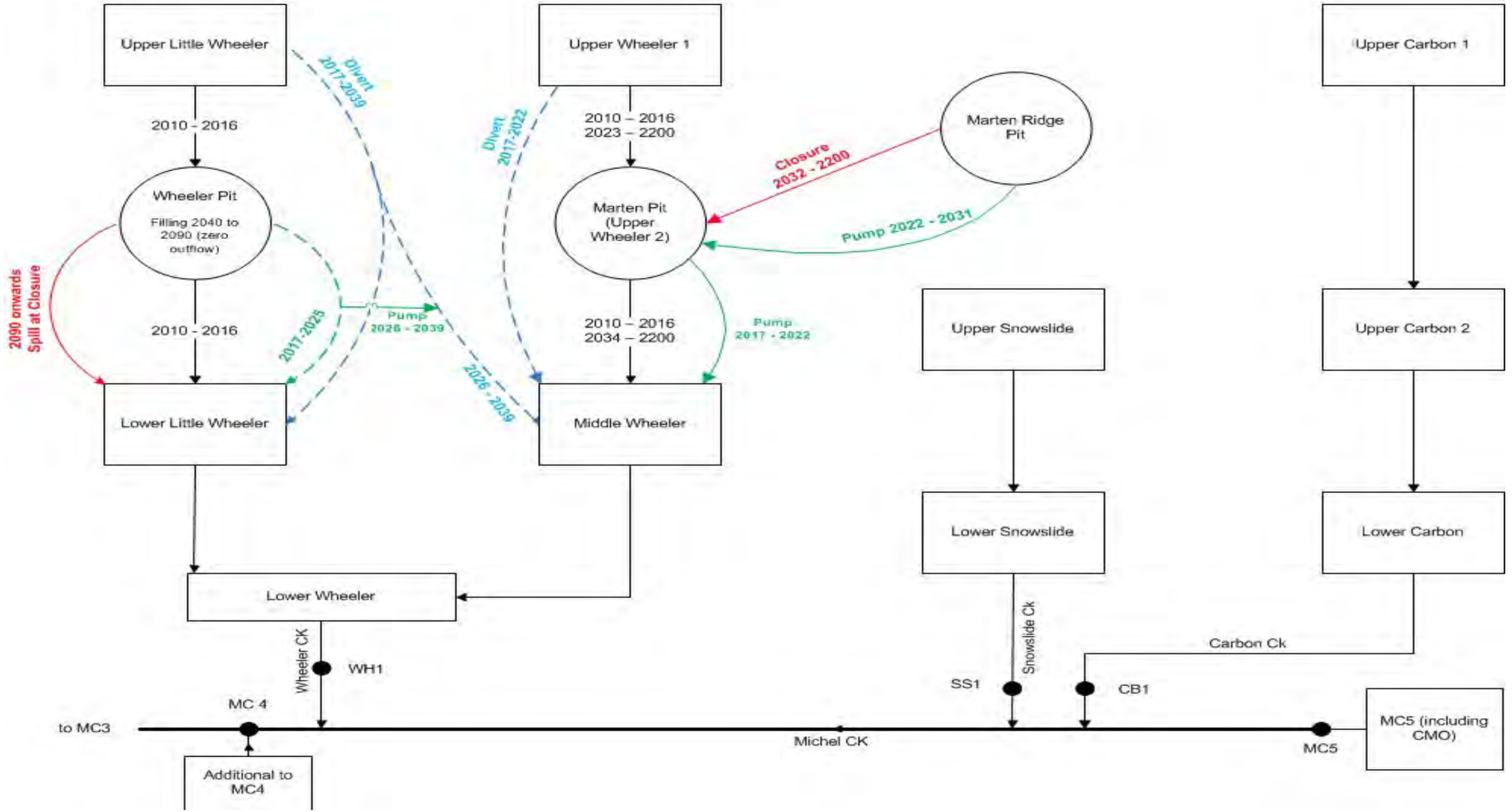

Table 7-7 Current and Future Flows for Watersheds at CMO

Watershed	Node ID	Flow Model Watershed Name	Current Year 2013 (m^3/d)		Year 2040 (m^3/d)	
			Annual	Winter	Annual	Winter
Wheeler Creek	ULW	Upper Little Wheeler	5,656	2,760	0[(b)]	0[(b)]
	WP	Wheeler Pit	3,947	1,926	0[(b)]	0[(b)]
	LLW	Lower Little Wheeler	6,290	3,069	6,317	3,082
	UW1	Upper Wheeler 1	8,887	4,336	7,078	4,391
	UW2	Marten Pit (Upper Wheeler 2)	4,788	2,336	4,273	2,686
	MW	Middle Wheeler	3,919	1,912	3,388	1,858
	LW	Lower Wheeler	11,603	5,661	11,603	5,661
	WH1	Wheeler Creek at the Mouth	45,089	22,000	33,877	18,477
Snowslide Creek	MRP	Marten Ridge Pit	-[(a)]	-[(a)]	1,217	798
	USS	Upper Snowslide	6,166	3,008	5,109	2,493
	LSS	Lower Snowslide	1,321	645	1,321	645
	SS1	Snowslide Creek at the Mouth	7,487	3,653	6,430	3,137
Carbon Creek	UCB1	Upper Carbon 1	3,186	1,554	3,182	1,553
	UCB2	Upper Carbon 2	5,818	2,839	5,536	2,804
	LCB	Lower Carbon	6,079	2,966	6,079	2,966
	CB1	Carbon Creek at the Mouth	15,083	7,359	14,797	7,323
Michel Creek	Add-MC4	Additional to MC4	327,562	159,825	327,562	159,825

(a) No watershed area for this snapshot.

(b) Zero outflow during filling period for Wheeler Pit (2040 to 2090).

8 Flow Predictions for Regional Waterbodies

Flows at regional nodes were derived using various methods as described in the *Hydrology* report (Teck 2014c), and are summarized as follows:

- Fording River and Michel Creek nodes were derived by summing simulated flows from contributing watersheds.
- Line Creek nodes were derived based primarily on gauged data, except for West Line Creek which was based on simulated and gauged data.
- Elk River nodes were derived based primarily on gauged data.

Current and future flows were simulated using the flow model for the regional waterbodies potentially affected by Teck's Elk Valley operations. The results of the flow modelling for selected snapshot years are presented in Table 8-1.

Table 8-1 Current and Future Flows for Regional Waterbodies

	RIVER NODES		Current (m^3/d)		Year 2040 (m^3/d)	
Watershed	**Sub-Watershed**	**Site Description**	**Annual**	**Winter**	**Annual**	**Winter**
Michel Creek	MC5	Michel Creek downstream of CMO and upstream of Leach Creek confluence	102,901	52,978	102,901	52,978
	MC4	Michel Creek downstream of MWO (Wheeler Ck)	498,121	245,815	494,276	247,346
	MC3	Michel Creek upstream of EVO	830,710	408,092	828,007	410,447
	MC1	Michel Creek at the mouth	931,691	467,665	928,524	470,731
Fording River	FR1	Fording River downstream of Henretta Creek	102,811	35,307	102,029	36,302
	FR2	Fording River downstream of Clode Creek and upstream of Kilmarnock Creek	145,582	60,816	144,600	61,680
	FR3	Fording River between Swift and Cataract creeks	211,791	92,733	214,828	95,831
	FR3b	Fording River downstream of Porter Creek	227,281	100,250	224,496	99,309
	FR3c	Fording River downstream of Dry Creek	403,879	156,770	406,168	162,420
	FR4	Fording River downstream of Greenhills	423,117	165,373	425,844	171,558
	FR5	Fording River at the mouth	645,407	250,300	647,538	256,295
Elk River	ER1A	Elk River upstream of Thompson Creek	1,042,920	323,856	1,042,920	323,856
	ER1B	Elk River downstream of GHO and upstream of Fording River confluence (near Elkford)	1,176,768	379,296	1,176,768	379,296
	ER2	Elk River downstream of Fording River confluence	2,126,232	714,384	2,126,232	714,384
	ER3	Elk River downstream of Michel Creek confluence	3,637,080	1,562,832	3,637,080	1,562,832
	ER3b	Elk River at Fernie	3,996,576	1,717,344	3,996,576	1,717,344
	ER4	Elk River at Elko Reservoir	4,562,136	1,960,416	4,562,136	1,960,416
	LK1	Elk River at the mouth	6,128,136	2,695,104	6,128,136	2,695,104
Lake Koocanusa		Bull River at Wardner	3,992,883	1,190,663	-	-
		Kootenay River at Fort Steele	20,237,482	4,687,745	-	-
		Elk River at Philips Bridge	8,735,385	2,897,657	-	-

9 References

Golder (Golder Associates Ltd.). 2010. *Elkview Operations (EVO) Baldy Ridge Extension Water Balance*. Prepared for Teck Coal Limited.

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Teck 2014b. *Elk Valley Water Quality Plan – Water Quality Modelling Methods*. Prepared for Teck Coal by Golder Associates Ltd, July 2014.

Teck 2014c. *Elk Valley Water Quality Plan - Hydrology*. Prepared for Teck Coal by Golder Associates Ltd, July 2014.

Teck 2014d. *Elk Valley Water Quality Plan - Water Quality Modelling for the Initial Implementation Plan*. Prepared for Teck Coal by Golder Associates Ltd, July 2014.

APPENDIX A

WASTE ROCK VOLUMES, PIT WALL AND COAL REJECTS AREAS AND BLASTING INFORMATION

July 2014

Teck

LIST OF TABLES

Table A-1 Cumulative Waste Rock Volumes by Drainage at Fording River Operations

Year	Cumulative Waste Rock Volume (million BCM)											
	Henretta Creek	Clode Creek	Eagle Pit	Eagle Creek	South Tailings Pond	Kilmarnock Creek	North Spoil	Lake Mountain Creek	Lower Fording 2	Swift Creek	Combined Swift & Cataract	Swift Pit
2004	96	127	-	64	31	812	-	30	152	58	-	-
2005	111	129	-	64	31	871	-	30	152	58	-	-
2006	122	146	-	64	31	915	-	30	152	58	-	-
2007	136	191	-	64	31	931	-	30	152	58	-	-
2008	147	213	-	64	31	970	-	30	152	58	-	-
2009	153	232	-	64	31	1,011	-	30	152	58	-	-
2010	157	242	-	64	31	1,056	16	30	152	58	-	-
2011	158	261	-	64	31	1,108	36	30	152	58	-	-
2012	159	289	-	64	31	1,146	55	30	152	58	-	-
2013	159	268	40	64	31	1,193	66	30	152	58	-	-
2014	159	296	40	64	31	1,254	71	30	152	58	-	-
2015	159	332	40	64	31	1,319	71	30	152	58	-	-
2016	159	371	40	64	31	1,377	78	-	6	-	58	176
2017	159	376	84	64	31	1,415	98	-	6	-	58	173
2018	159	377	136	64	31	1,443	115	-	6	-	66	170
2019	159	380	200	64	31	1,455	138	-	6	-	66	162
2020	159	380	255	64	31	1,455	180	-	6	-	69	141
2021	159	380	293	64	31	1,455	210	-	6	-	110	121
2022	159	380	309	64	31	1,455	247	-	6	-	165	108
2023	159	380	318	64	31	1,455	312	-	6	-	197	97
2024	159	380	318	64	31	1,455	328	-	6	-	254	113

Table A-1 Cumulative Waste Rock Volumes by Drainage at Fording River Operations (continued)

Year	Cumulative Waste Rock Volume (million BCM)											
	Henretta Creek	Clode Creek	Eagle Pit	Eagle Creek	South Tailings Pond	Kilmarnock Creek	North Spoil	Lake Mountain Creek	Lower Fording 2	Swift Creek	Combined Swift & Cataract	Swift Pit
2025	159	380	318	64	31	1,478	381	-	6	-	254	140
2026	159	380	318	64	31	1,517	449	-	6	-	254	137
2027	159	380	318	64	31	1,555	514	-	6	-	254	134
2028	159	380	318	64	31	1,586	589	-	6	-	254	132
2029	159	380	318	64	31	1,626	605	-	6	-	254	180
2030	159	380	350	64	31	1,635	637	-	6	-	254	209
2031	159	380	382	64	31	1,643	691	-	6	-	254	211
2032	159	380	390	64	31	1,675	754	-	6	-	254	210
2033	159	380	411	64	31	1,689	808	-	6	-	254	226
2034	159	380	436	64	31	1,706	863	-	6	-	254	236

- = no waste rock.

Table A-2 Cumulative Waste Rock Volumes by Drainage at Greenhills Operations

Year	Cumulative Waste Rock Volume (million BCM)									
	Swift Creek	Cataract Creek	Combined Swift & Cataract	Porter Creek	Greenhills Creek	Leask Creek	Wolfram Creek	Thompson Creek	Cougar North Pit	Cougar South Pit
2004	141	299	-	70	96	-	2	31	-	-
2005	153	302	-	75	110	0.02	2	43	-	-
2006	155	320	-	76	113	0.02	2	57	-	-
2007	155	343	-	77	117	0.02	4	66	-	-
2008	155	364	-	79	117	0.40	5	80	-	-
2009	155	380	-	79	117	4	10	85	8	-
2010	155	387	-	79	117	7	13	88	35	-
2011	155	408	-	79	117	9	16	89	59	-
2012	161	432	-	81	121	12	28	94	73	-
2013	161	451	-	81	121	14	52	97	73	4
2014	161	451	-	81	121	22	69	116	73	13
2015	161	451	-	81	124	39	93	123	73	13
2016	-	-	614	81	124	53	122	127	73	16
2017	-	-	625	81	124	59	158	127	73	16
2018	-	-	645	81	129	71	177	127	73	16
2019	-	-	654	81	131	85	196	127	73	16
2020	-	-	660	81	136	92	204	127	73	28
2021	-	-	660	81	138	96	214	127	73	81
2022	-	-	674	81	145	101	225	127	73	110
2023	-	-	690	81	156	104	233	127	73	135
2024	-	-	704	81	166	107	240	127	73	159
2025	-	-	710	83	172	109	245	127	73	197
2026	-	-	716	85	179	110	246	127	73	215
2027	-	-	729	89	194	111	250	127	73	236
2028	-	-	732	94	202	111	252	127	73	254
2029	-	-	762	101	209	111	253	128	73	307
2030	-	-	766	102	214	111	253	128	73	363
2031	-	-	766	102	214	112	253	128	73	444
2032	-	-	766	102	214	112	254	128	73	513
2033	-	-	766	102	214	113	255	128	73	557
2034	-	-	766	102	214	116	258	130	73	615

- = no waste rock.

Table A-3 Cumulative Waste Rock Volumes by Drainage at Line Creek Operations

Year	Cumulative Waste Rock Volume (million BCM)										
	Upper Line Creek	Horseshoe Creek	No Name Creek	Main Line Creek	Center Line Creek	West Line Creek	Dry Creek	Mount Michael 2/3 Pit	Burnt Ridge North 2 Pit	Burnt Ridge North 3 Pit	Burnt Ridge North 4 Pit
2004	11	32	48	33	52	187	-	-	-	-	-
2005	12	37	55	38	60	187	-	-	-	-	-
2006	13	40	60	42	66	187	-	-	-	-	-
2007	15	44	66	46	72	187	-	-	-	-	-
2008	16	49	73	51	80	187	-	-	-	-	-
2009	18	53	80	55	87	187	-	-	-	-	-
2010	19	58	87	60	95	192	-	-	-	-	-
2011	20	62	93	64	101	203	-	-	-	-	-
2012	20	62	115	64	101	210	-	-	-	-	-
2013	20	62	124	84	101	210	-	-	-	-	-
2014	20	62	133	108	101	210	1	-	-	-	-
2015	20	62	142	138	101	210	7	-	-	-	-
2016	20	62	150	155	101	210	23	-	-	-	-
2017	20	62	159	158	101	210	54	-	-	-	-
2018	20	62	172	158	101	210	86	-	-	-	-
2019	20	62	196	158	101	210	107	-	-	-	-
2020	20	62	214	158	101	210	138	-	-	-	-
2021	20	62	223	158	101	210	172	-	-	-	-
2022	20	62	243	158	101	210	192	-	-	-	-
2023	20	62	258	158	101	210	217	-	-	-	-
2024	20	62	295	158	101	210	224	-	-	-	-
2025	20	62	307	158	101	210	251	-	-	-	-
2026	20	62	314	158	101	210	284	-	-	-	-
2027	20	62	314	158	101	210	321	-	-	-	-
2028	20	62	314	158	101	210	362	-	-	-	-
2029	20	62	314	158	101	210	398	4	-	-	-
2030	20	62	314	158	101	210	439	6	-	-	-
2031	20	62	322	158	101	210	462	6	-	-	-
2032	20	62	328	158	101	210	479	6	-	-	-
2033	20	62	328	158	101	210	502	6	-	-	-
2034	20	62	328	158	101	210	504	6	6	13	3
2035	20	62	328	158	101	210	521	6	6	13	3
2036	20	62	328	158	101	210	529	6	6	13	3

- = no waste rock.

Table A-4 Cumulative Waste Rock Volumes by Drainage at Elkview Operations

Year	Cumulative Waste Rock Volume (million BCM)										
	Goddard Creek	Six Mile Creek	Dry Creek	Harmer Creek	Erickson Creek	South Pit, Milligan and Thresher Creeks	Gate Creek	Bodie Creek	Cedar Pit	Baldy Ridge Pit	Natal Pit
2004	1.1	7.3	333	142	302	21	45	165	-	-	-
2005	1.1	7.3	349	142	312	24	50	184	-	-	-
2006	1.1	7.3	369	142	320	26	50	196	-	-	-
2007	1.1	7.3	378	142	344	28	50	202	-	-	-
2008	1.1	7.3	390	142	365	28	50	213	-	-	-
2009	1.1	7.3	401	142	388	28	50	228	-	-	-
2010	1.1	7.3	415	142	400	28	50	242	-	-	-
2011	1.1	7.3	417	142	433	28	50	68	8	167	3
2012	1.1	7.3	417	142	472	28	50	68	12	170	16
2013	1.1	7.3	417	142	487	28	50	68	12	170	62
2014	1.1	7.3	417	142	513	28	50	68	16	170	97
2015	1.1	7.3	417	142	561	28	50	68	21	170	109
2016	1.1	7.3	417	142	628	28	50	68	22	170	109
2017	1.1	7.3	417	142	674	28	50	68	51	170	109
2018	1.1	7.3	442	142	725	28	50	68	51	170	109
2019	1.1	7.3	460	142	776	28	50	68	51	170	109
2020	1.1	7.3	471	142	828	28	50	68	51	170	109
2021	1.1	7.3	489	142	855	28	50	68	51	170	136
2022	1.1	7.3	509	142	882	28	50	68	51	170	160
2023	1.1	7.3	534	142	913	28	50	68	51	183	162
2024	1.1	7.3	554	142	951	28	50	68	51	191	164
2025	1.1	7.3	577	142	986	28	50	68	51	196	167

Table A-4 Cumulative Waste Rock Volumes by Drainage at Elkview Operations (continued)

Year	Cumulative Waste Rock Volume (million BCM)										
	Goddard Creek	Six Mile Creek	Dry Creek	Harmer Creek	Erickson Creek	South Pit, Milligan and Thresher Creeks	Gate Creek	Bodie Creek	Cedar Pit	Baldy Ridge Pit	Natal Pit
2026	1.1	7.3	614	142	1,005	28	50	68	51	204	176
2027	1.1	7.3	636	142	1,027	28	50	68	51	207	196
2028	1.1	7.3	659	142	1,048	28	50	68	51	232	196
2029	1.1	7.3	674	142	1,065	28	50	68	51	258	196
2030	1.1	7.3	708	142	1,068	28	50	68	51	287	196
2031	1.1	7.3	732	142	1,068	28	50	68	51	306	208
2032	1.1	7.3	764	142	1,068	28	50	68	51	319	228
2033	1.1	7.3	771	142	1,068	28	50	68	51	330	272
2034	1.1	7.3	771	142	1,068	28	50	68	51	377	284

- = no waste rock.

Table A-5 Cumulative Waste Rock Volumes at Coal Mountain Operations

Year	Cumulative Waste Rock Volume [million BCM]
2004	155
2005	167
2006	177
2007	188
2008	199
2009	211
2010	224
2011	240
2012	257
2013	272
2014	285
2015	297
2016	306
2017	309
2018	310

Table A-6 Cumulative Waste Rock Volumes by Drainage at Coal Mountain Phase 2[(a)]

Year	Cumulative Waste Rock Volume (million BCM)				
	Upper Wheeler sub-watershed	Marten Pit sub-watershed	Middle Wheeler sub-watershed	Upper Little Wheeler sub-watershed	Wheeler Pit sub-watershed
2016	-	-	-	-	-
2017	14	-	-	18	-
2018	28	-	-	36	-
2019	41	-	-	54	-
2020	55	-	-	72	-
2021	69	-	-	90	-
2022	83	-	-	108	-
2023	62	56	-	108	-
2024	84	71	-	108	-
2025	106	85	-	108	-
2026	128	100	-	108	-
2027	151	112	-	108	-
2028	175	125	-	108	-
2029	194	135	-	108	-
2030	215	144	-	108	-
2031	235	153	-	108	-
2032	234	175	8	108	-
2033	232	197	17	108	-
2034	231	219	25	108	-

- = no waste rock.

[(a)] Formerly known as the Marten Wheeler Project.

Table A-7 Cumulative Pit Wall Areas by Drainage at Fording River Operations

Year	Pit Wall Areas [km^2]										
	Henretta Creek	Clode Creek	Eagle Pit	Turnbull Pit	Eagle Creek	South Tailings Pond	Kilmarnock Creek	Lake Mountain Creek	Lower Fording 2	Swift Pit	Cataract Creek
2004	1.54	1.73	-	0.72	0.11	2.01	0.76	0.05	0.00	1.67	2.51
2005	1.78	1.76	-	0.73	0.11	2.01	0.82	0.05	0.00	1.76	2.51
2006	1.96	1.97	-	0.82	0.11	2.01	0.86	0.05	0.00	1.79	2.51
2007	2.19	2.55	-	1.06	0.11	2.01	0.88	0.05	0.00	1.79	2.51
2008	2.37	2.89	-	1.20	0.11	2.01	0.92	0.05	0.00	1.79	-
2009	2.38	3.14	-	1.30	0.11	2.01	0.95	0.05	0.00	1.79	-
2010	2.40	3.29	-	1.37	0.11	2.01	1.00	0.05	0.00	1.79	-
2011	2.35	3.28	-	1.34	0.03	2.01	0.76	0.05	0.00	1.79	-
2012	2.27	3.28	-	1.30	0.03	2.01	0.55	0.05	0.00	1.79	-
2013	2.2	0.6	3.10	1.3	0.03	2.0	0.37	0.05	0.00	1.79	-
2014	2.1	0.5	3.49	1.2	0.03	2.0	0.20	0.05	0.00	1.79	-
2015	2.0	0.3	3.88	1.2	0.03	2.0	0.03	0.05	0.00	1.79	-
2016	2.0	0.2	4.27	1.2	0.03	2.0	-	0.01	0.57	1.51	-
2017	2.0	-	4.66	1.2	0.03	2.0	-	-	0.62	1.69	-
2018	2.0	-	4.31	1.2	0.03	2.0	-	-	0.62	1.91	-
2019	2.0	-	3.89	1.2	0.03	2.0	-	-	0.62	2.14	-
2020	2.0	-	3.47	1.2	0.03	2.0	-	-	0.62	2.37	-
2021	2.0	-	3.04	1.2	0.03	2.0	-	-	0.62	2.59	-
2022	2.0	-	2.62	1.2	0.02	2.0	-	-	0.62	2.82	-
2023	2.0	-	2.20	1.2	0.02	2.0	-	-	0.62	3.50	-
2024	2.0	-	2.17	1.2	0.02	2.0	-	-	0.62	4.23	-
2025	2.0	-	2.17	1.2	0.02	2.0	-	-	0.62	4.95	-
2026	2.0	-	2.17	1.2	0.02	2.0	-	-	0.62	5.68	-
2027	2.0	-	2.17	1.2	0.02	2.0	-	-	0.62	5.64	-
2028	2.0	-	2.17	1.2	0.02	2.0	-	-	0.62	5.53	-
2029	2.0	-	2.17	1.2	0.02	2.0	-	-	0.62	5.42	-
2030	2.0	-	2.17	1.2	0.02	2.0	-	-	0.62	5.31	-
2031	2.0	-	2.17	1.2	0.02	2.1	-	-	0.62	5.20	-
2032	2.0	-	2.17	1.2	0.02	2.1	-	-	0.62	5.19	-
2033	2.0	-	2.17	1.2	0.02	2.1	-	-	0.62	5.19	-
2034	2.0	-	2.17	1.2	0.02	2.1	-	-	0.62	5.19	-

- = no pit wall area.

Table A-8 Cumulative Pit Wall Areas by Drainage at Greenhills Operations

Year	Pit Wall Areas [km^2]						
	Greenhils Creek	Leask Creek	Wolfram Creek	Thompson Creek	Cougar North Extension Pit	Cougar North Pit	Cougar South Pit
2004	1.46	-	0.11	0.09	-	-	0.30
2005	1.67	-	0.11	0.13	-	-	0.30
2006	1.73	-	0.11	0.17	-	-	0.30
2007	1.78	-	0.18	0.19	-	-	0.48
2008	1.79	0.02	0.26	0.24	-	-	0.70
2009	1.79	0.16	0.51	0.25	-	0.40	1.37
2010	1.79	0.30	0.67	0.26	-	1.71	1.79
2011	1.79	0.31	0.60	0.22	-	1.82	1.83
2012	1.79	0.31	0.52	0.18	-	1.82	1.83
2013	1.8	0.24	0.47	0.14	-	2.0	2.0
2014	1.8	0.16	0.42	0.09	-	2.1	2.2
2015	1.8	0.09	0.37	0.05	-	2.3	2.3
2016	1.8	0.01	0.32	-	-	2.5	2.5
2017	1.8	-	0.29	-	0.09	2.5	2.3
2018	1.8	-	0.27	-	0.18	2.5	2.2
2019	1.8	-	0.25	-	0.27	2.5	2.0
2020	1.8	-	0.22	-	0.36	2.5	1.8
2021	1.8	-	0.20	-	0.46	2.5	1.6
2022	1.8	-	0.17	-	0.55	2.5	1.4
2023	1.8	-	0.15	-	0.64	2.5	1.3
2024	1.8	-	0.12	-	0.74	2.5	1.1
2025	1.8	-	0.10	-	0.83	2.5	0.9
2026	1.8	-	0.08	-	0.92	2.5	0.7
2027	1.8	-	0.05	-	1.01	2.5	0.6
2028	1.8	-	0.03	-	1.11	2.5	0.4
2029	1.8	-	-	-	1.20	2.5	0.2
2030	1.8	-	-	-	1.29	2.5	-
2031	1.8	-	-	-	1.30	2.5	-
2032	1.8	-	-	-	1.30	2.5	-
2033	1.8	-	-	-	1.30	2.5	-
2034	1.8	-	-	-	1.30	2.5	-

- = no pit wall area.

Table A-9 Cumulative Pit Wall Areas by Drainage at Line Creek Operations

Year	Pit Wall Areas [km^2]				
	Mount Michael 1 Pit	Mount Michael 2/3 Pit	Burnt Ridge North 2 Pit	Burnt Ridge North 3 Pit	Burnt Ridge North 4 Pit
2004	-	-	-	-	-
2005	-	-	-	-	-
2006	-	-	-	-	-
2007	-	-	-	-	-
2008	-	-	-	-	-
2009	-	-	-	-	-
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
2013	-	-	-	-	-
2014	-	0.17	-	0.14	0.08
2015	-	0.35	-	0.30	0.17
2016	-	0.53	0.08	0.45	0.26
2017	-	0.72	0.16	0.61	0.35
2018	-	0.78	0.24	0.65	0.37
2019	0.06	0.84	0.32	0.69	0.38
2020	0.13	0.90	0.41	0.72	0.40
2021	0.20	0.96	0.49	0.76	0.41
2022	0.26	1.02	0.57	0.79	0.42
2023	0.28	1.03	0.65	0.83	0.36
2024	0.29	1.05	0.78	0.62	0.29
2025	0.30	1.06	0.92	0.48	0.23
2026	0.31	0.93	1.05	0.36	0.22
2027	0.32	0.78	1.06	0.23	0.22
2028	0.33	0.63	1.18	0.22	0.22
2029	0.34	0.48	1.32	0.22	0.22
2030	0.35	0.48	1.45	0.22	0.22
2031	0.36	0.49	1.58	0.22	0.22
2032	0.37	0.50	1.72	0.22	0.22
2033	0.37	0.50	1.73	0.22	0.22
2034	0.37	0.50	1.73	0.22	0.22

- = no pit wall area.

Table A-10 Cumulative Pit Wall Areas by Drainage at Elkview Operations

Year	Pit Wall Areas [km^2]									
	Goddard Creek	Dry Creek	Erickson Creek	South Pit, Milligan and Thresher Creeks	Gate Creek	Bodie Creek	Cedar Pit	Natal Pit	Baldy Ridge Pit	Adit Pit
2004	0.90	0.24	0.68	0.44	0.46	6.60	-	-	-	-
2005	0.90	0.25	0.70	0.50	0.52	7.38	-	-	-	-
2006	0.90	0.27	0.72	0.54	0.52	7.89	-	-	-	-
2007	0.90	0.27	0.77	0.57	0.52	8.14	-	-	-	-
2008	0.90	0.28	0.82	0.59	0.52	8.60	-	-	-	-
2009	0.90	0.29	0.87	0.59	0.52	9.19	-	-	-	-
2010	0.90	0.30	0.90	0.59	0.52	9.76	-	-	-	-
2011	0.90	0.30	0.90	0.59	0.52	0.41	1.58	3.27	4.50	-
2012	0.90	0.30	0.90	0.59	0.52	0.41	1.58	3.24	4.50	-
2013	0.90	0.30	0.90	0.59	0.52	0.41	1.58	3.21	4.33	-
2014	0.90	0.30	0.90	0.59	0.52	0.41	1.58	3.19	4.15	-
2015	0.90	0.30	0.90	0.59	0.51	0.41	1.58	3.16	3.97	-
2016	0.90	0.17	0.90	0.59	0.51	0.41	1.54	3.13	3.79	-
2017	0.90	0.01	0.90	0.59	0.51	0.41	1.49	3.10	3.61	-
2018	0.90	-	0.90	0.59	0.51	0.41	1.45	3.07	3.43	-
2019	0.90	-	0.90	0.59	0.51	0.41	1.40	3.04	3.25	-
2020	0.90	-	0.90	0.59	0.51	0.41	1.36	3.01	3.07	-
2021	0.90	-	0.90	0.59	0.51	0.41	1.31	2.98	2.88	-
2022	0.90	-	0.90	0.59	0.51	0.41	1.26	2.95	2.70	-
2023	0.90	-	0.90	0.59	0.51	0.41	1.22	2.92	2.52	-
2024	0.90	-	0.69	0.59	0.50	0.41	1.17	2.89	2.34	0.17
2025	0.90	-	0.47	0.59	0.50	0.41	1.13	2.86	2.16	0.35
2026	0.90	-	0.24	0.59	0.50	0.41	1.08	2.83	1.98	0.53
2027	0.90	-	0.02	0.59	0.50	0.41	1.04	2.80	1.80	0.71
2028	0.90	-	-	0.59	0.50	0.41	0.99	2.80	1.75	0.77
2029	0.90	-	-	0.59	0.50	0.41	0.94	2.80	1.72	0.82
2030	0.90	-	-	0.59	0.50	0.41	0.90	2.80	1.68	0.88
2031	0.90	-	-	0.59	0.50	0.41	0.85	2.80	1.65	0.93
2032	0.90	-	-	0.59	0.50	0.41	0.81	2.80	1.61	0.99
2033	0.90	-	-	0.59	0.50	0.41	0.76	2.80	1.77	0.99
2034	0.90	-	-	0.59	0.50	0.41	0.71	2.80	1.93	0.99

- = no pit wall area.

Table A-11 Cumulative Pit Wall Areas at Coal Mountain Operations

Year	Pit Wall Areas [km^2]
2004	4.61
2005	4.95
2006	5.27
2007	5.59
2008	5.93
2009	6.27
2010	6.66
2011	6.42
2012	6.42
2013	6.42
2014	6.42
2015	6.42
2016	6.42
2017	6.42
2018	6.42
2019	6.42
2020	6.42
2021	6.42
2022	6.42
2023	6.42
2024	6.42
2025	6.42
2026	6.42
2027	6.42
2028	6.42
2029	6.42
2030	6.42
2031	6.42
2032	6.42
2033	6.42
2034	6.42

Table A-12 Cumulative Pit Wall Areas by Drainage at Coal Mountain Phase 2[(a)]

Year	Pit Wall Areas [km^2]		
	Marten Pit sub-watershed	Upper Carbon Creek	Wheeler Pit sub-watershed
2004	-	-	-
2005	-	-	-
2006	-	-	-
2007	-	-	-
2008	-	-	-
2009	-	-	-
2010	-	-	-
2011	-	-	-
2012	-	-	-
2013	-	-	-
2014	-	-	-
2015	-	-	-
2016	-	-	-
2017	-	-	0.17
2018	-	-	0.35
2019	-	-	0.53
2020	-	-	0.71
2021	-	-	0.89
2022	0.13	-	1.19
2023	0.26	-	1.49
2024	0.40	-	1.80
2025	0.53	-	2.10
2026	0.67	-	2.41
2027	0.64	0.06	2.52
2028	0.60	0.14	2.62
2029	0.56	0.21	2.73
2030	0.52	0.28	2.83
2031	0.47	0.35	2.93
2032	0.51	0.35	2.91
2033	0.54	0.35	2.87
2034	0.58	0.35	2.84

- = no pit wall area.

[(a)] Formerly known as the Marten Wheeler Project.

Table A-13 Cumulative Coal Rejects Areas

Year	Areas [km^2]							
	Lake Mountain Creek	South Tailings Pond	Lower Fording 2	Kilmarnock Creek	EVO Elk Other	Goddard Creek	Greenhills Creek	Coal Mountain Operations
2004	0.09	0.59	0.30	0.23	0.78	0.22	0.74	0.57
2005	0.09	0.59	0.30	0.25	0.78	0.22	0.85	0.62
2006	0.09	0.59	0.30	0.26	0.78	0.22	0.88	0.66
2007	0.09	0.59	0.30	0.26	0.78	0.22	0.91	0.70
2008	0.09	0.59	0.30	0.27	0.78	0.22	0.91	0.74
2009	0.09	0.59	0.30	0.29	0.78	0.22	0.91	0.78
2010	0.09	0.59	0.30	0.30	0.78	0.22	0.91	0.83
2011	0.09	0.58	0.30	0.30	0.78	0.22	0.91	0.80
2012	0.09	0.56	0.30	0.30	0.78	0.22	0.91	0.80
2013	0.09	0.55	0.30	0.30	0.78	0.22	0.91	0.80
2014	0.09	0.53	0.30	0.30	0.78	0.22	0.91	0.80
2015	0.09	0.52	0.30	0.30	0.78	0.22	0.91	0.80
2016	0.01	0.50	0.30	0.30	0.78	0.22	0.91	0.80
2017	-	0.49	0.29	0.30	0.78	0.22	0.91	0.80
2018	-	0.47	0.29	0.30	0.78	0.22	0.91	0.80
2019	-	0.46	0.28	0.30	0.78	0.22	0.91	0.80
2020	-	0.44	0.27	0.29	0.78	0.22	0.91	0.80
2021	-	0.43	0.26	0.29	0.78	0.22	0.91	0.80
2022	-	0.41	0.26	0.28	0.78	0.22	0.91	0.80
2023	-	0.40	0.25	0.27	0.78	0.22	0.91	0.80
2024	-	0.38	0.24	0.26	0.78	0.22	0.91	0.80
2025	-	0.37	0.23	0.26	0.78	0.22	0.91	0.80
2026	-	0.36	0.23	0.25	0.78	0.22	0.91	0.80
2027	-	0.34	0.22	0.24	0.78	0.22	0.91	0.80
2028	-	0.33	0.21	0.23	0.78	0.22	0.91	0.80
2029	-	0.31	0.20	0.23	0.78	0.22	0.91	0.80
2030	-	0.30	0.20	0.22	0.78	0.22	0.91	0.80
2031	-	0.28	0.19	0.21	0.78	0.22	0.89	0.80
2032	-	0.27	0.18	0.20	0.78	0.22	0.87	0.80
2033	-	0.25	0.17	0.20	0.78	0.22	0.84	0.80
2034	-	0.24	0.17	0.19	0.78	0.22	0.82	0.80

- = no coal rejects area.

Table A-14 Explosives Use Information at Teck Coal Operations in the Elk Valley

Year	Fording River Operations		Greenhills Operations		Line Creek Operations		Coal Mountain Operations		Elkview Operations		Generic Constants	
	Powder Factor [kg explosives/m^3]	ANFO Fraction	Powder Factor [kg explosives/m^3]	ANFO Fraction	Powder Factor [kg explosives/m^3]	ANFO Fraction	Powder Factor [kg explosives/m^3]	ANFO Fraction	Powder Factor [kg explosives/m^3]	ANFO Fraction	Nitrogen Concentration in ANFO	Nitrogen Concentration in Slurry
2006	0.72	0.53	0.79	0.51	0.7	0.6	0.72	0.97	0.62	0.56	0.31	0.28
2007	0.71	0.48	0.76	0.5	0.7	0.6	0.72	1.0	0.58	0.65	0.31	0.28
2008	0.74	0.46	0.79	0.51	0.7	0.6	0.74	1.0	0.58	0.65	0.31	0.28
2009	0.72	0.42	0.78	0.48	0.7	0.6	0.77	0.9	0.58	0.65	0.31	0.28
2010	0.74	0.26	0.83	0.53	0.7	0.6	0.8	0.93	0.58	0.69	0.31	0.28
2011	0.82	0.37	0.85	0.60	0.67	0.54	0.79	0.58	0.73	0.48	0.31	0.28
2012	0.76	0.30	0.76	0.39	0.72	0.51	0.86	0.54	0.78	0.31	0.31	0.28
2013	0.76	0.30	0.76	0.39	0.72	0.51	0.86	0.54	0.78	0.31	0.31	0.28
2034	0.76	0.30	0.76	0.39	0.72	0.51	0.86	0.54	0.78	0.31	0.31	0.28

Table A-15 Rehandle Waste Volumes by Drainage at Fording River Operations

Year	Rehandle Waste Volume (million BCM)				
	North Spoil		Combined Swift & Cataract		
	Waste Rock	Coal Rejects	Waste Rock	Burning Waste Rock	Tailings
2016	2	-	-	2	-
2017	3	-	-	2	-
2018	2	-	2	2	-
2019	8	0.2	-	-	6
2020	20	0.2	1	-	6
2021	1	0.2	19	-	6
2022	0.5	-	13	-	-
2023	2	-	9	-	-
2024	2	-	16	-	-
2025	4	-	-	-	-
2026	3	-	-	-	-
2027	3	-	-	-	-
2028	2	-	-	-	-
2029	5	-	-	-	-
2030	9	-	-	-	-
2031	14	-	-	-	-
2032	8	-	-	-	-

APPENDIX B

GOLDSIM FLOW MODEL INPUT

July 2014

Teck

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1 MODEL VERSION

The input data in this Appendix corresponds to Revision 6.0 of the EVWQP flow model.

2 Sub-watershed Area Inputs

2.1 Historical Area Inputs (1995-2010)

Table B-1 2010 Sub-watershed Areas - Fording River Operations (in km^2)

Sub-Watershed	Natural	Mined	Waste Rock	CCR	Reclaimed	Total
Upper_Fording	40.20	0	0	0	0	**40.20**
Henretta_Ck	44.52	5.3	2.90	0	0	**49.8**
North_Turnbull_Spoil	2.01	1.20	1.20	0	0	**3.21**
Clode_Ck	3.00	7.70	4.40	0	0	**10.60**
Turnbull_Pit	0	1.37	0	0	0	**1.37**
Lake_Mountain_Ck_Upper	7.50	0	0	0	0	**7.50**
Lake_Mountain_Ck_Lower	4.84	2.44	2.30	0.09	0	**7.28**
Lower_Fording_Rv1_EC1	0	1.81	1.70	0	0.08	**1.81**
Lower_Fording_Rv1_STP1	0	3.36	0.76	0.59	0.01	**3.36**
Lower_Fording_Rv2_LF2	0.42	6.54	6.24	0.30	0	**6.96**
Swift_Ck_upper_diversion	2.57	0	0	0	0	**2.57**
Swift_Pit	0	1.79	0	0	0	**1.79**
Cataract_Ck (up to 1/1/2008)	0	6.97	4.42	0	0	**6.97**
(2009 onwards)	0	4.19	4.42	0	0	**4.19**
Porter_Ck	1.36	1.59	1.59	0	0	**2.95**
Castle_Mnt_FR3b	9.06	0	0	0	0	**9.06**
Castle_Mnt_FRD	7.34	0	0	0	0	**7.34**
FRCTP	1.50	0	0	0	0	**1.50**
Brownie	4.23	0	0	0	0	**4.23**
Kilmarnock_Brownie_Mined	13.50	9.90	8.60	0.30	0	**23.40**
Kilmarnock_Clean_Diverted	14.90	0	0	0	0	**14.90**
Additional_FR3c	162.1	0	0	0	0	**162.1**
Swift Spoil	2.08	1.60	1.60	0	0	**3.68**
Eagle Pit	0	0	0	0	0	**0**

Table B-2 2010 Sub-watershed Areas - Greenhills Operations (in km^2)

Sub-Watershed	Natural	Mined	Waste Rock	CCR	Reclaimed	Total
LeaskCk_Other	0.15	0	0	0	0	**0.15**
Leask_WR_Dump	1.41	0.78	0.47	0	0	**2.20**
Thompson_ck_other	5.83	0	0	0	0	**5.83**
Thompson_WR_Dump	0	3.03	2.77	0	0	**3.03**
Wolfram_ck_Other	1.05	0	0	0	0	**1.05**
Wolfram_WR_Dump	1.32	1.48	0.80	0	0	**2.79**
Greenhills_Other	9.69	2.70	0	0.91	0	**12.39**
Green_Hills_WR_Dump	1.17	1.54	1.54	0	0	**2.71**
FR4_Additional	6.96	0.65	0	0	0	**7.61**
Cougar_Pit_North	0	2.96	1.14	0	0	**2.96**
Cougar_Pit_South	0	1.83	0	0	0	**1.83**
Cougar_Pit_North_Ext	1.30	0	0	0	0	**1.30**

Table B-3 2010 Sub-watershed Areas - Line Creek Operations (Phase II) (in km^2)

Sub-Watershed	Natural	Mined	Waste Rock	CCR	Reclaimed	Total
Upper_Dry_Creek	8.73	0	0	0	0	**8.73**
Lower_Dry_Creek	10.59	0	0	0	0	**10.59**
East_Tributary_Dry_Creek	7.02	0	0	0	0	**7.02**
BRN_2_Pit	0	0	0	0	0	**0**
BRN_3_Pit	0	0	0	0	0	**0**
BRN_4_Pit	0	0	0	0	0	**0**
MM1_Pit	0	0	0	0	0	**0**
MM2_3_Pit	0	0	0	0	0	**0**
Additional_to_FR5	69.11	0	0	0	0	**69.11**

Table B-4 2010 Sub-watershed Areas - Elkview Operations (in km^2)

Sub-Watershed	Natural	Mined	Waste Rock	CCR	Reclaimed	Total
Six_Mile_Creek	3.29	0.30	0.30	0	0	**3.59**
Dry_Creek	4.40	4.30	4.00	0	0	**8.70**
Harmer_Creek_ONLY	32.70	0.10	0.10	0	0	**32.80**
Grave_Creek_ONLY	42.70	0	0	0	0	**42.70**
Goddard_Creek	1.12	1.00	0.10	0	0	**2.00**
Qaultieri_Creek	0.71	0.29	0	0	0	**1.00**
Aqueduct_Creek	1.46	0.65	0	0	0	**2.11**
Bodie_Baldy_Ridge_Middle	0	0	0	0	0	**0**
Bodie_Remnant	0	0	0	0	0	**0**
Bodie_Cedar_Pit_North	0	0	0	0	0	**0**
Bodie_Natal_South	0	0	0	0	0	**0**
Gate_Creek	1.88	1.32	0.80	0	0	**3.20**
South_pit_milligan_thresher	4.30	1.89	1.30	0	0	**6.18**
Erickson_Clean_Diverted	8.20	0	0	0	0	**8.20**
Erickson_Mined	14.50	8.90	8.00	0	0	**23.40**
Alexander_Creek	145.72	0	0	0	0	**145.72**
Lower_Alexander_Creek	6.26	0	0	0	0	**6.26**
Unnamed_subwatershed_Lower_Alexander	32.01	0	0	0	0	**32.01**
Additional_to_MC3	41.74	0	0	0	0	**41.74**
Additional_to_MC1	28.25	1.10	0	0	0	**29.35**
Bodie_ck_Total	0.53	15.36	5.55	0	0	**15.89**
Adit_Ridge_Pit	0	0	0	0	0	**0**

Table B-5 2010 Sub-watershed Areas - Coal Mountain Operations and Coal Mountain Phase 2 Project (in km^2)

Sub-Watershed	Natural	Mined	Waste Rock	CCR	Reclaimed	Total
Michel_Creek_5	56.7	10.5	3.28	0.8	0	**0**
Upper_Wheeler_1	4.85	0	0	0	0	**4.85**
Upper_Wheeler_2	3.06	0	0	0	0	**3.06**
Middle_Wheeler	2.82	0	0	0	0	**2.82**
Lower_Wheeler	8.69	0	0	0	0	**8.69**
Upper_Little_Wheeler	3.12	0	0	0	0	**3.12**
Wheeler_Pit	2.7	0	0	0	0	**2.7**
Lower_Little_Wheeler	3.99	0	0	0	0	**3.99**
Marten_Ridge_Pit	0	0	0	0	0	**0**
Upper_Carbon_1	1.88	0	0	0	0	**1.88**
Upper_Carbon_2	3.78	0	0	0	0	**3.78**
Lower_Carbon	4.71	0	0	0	0	**4.71**
Upper_Snowslide	4.28	0	0	0	0	**4.28**
Lower_Snowslide	1.14	0	0	0	0	**1.14**
Additional_to_MC4	222	0	0	0	0	**222**

2.2 Future Area Inputs (2011-2200)

Table B-6 Future Sub-watershed Areas – Fording River Operations (in km^2)

FORDING RIVER OPERATIONS SUB-WATERSHED AREA INPUTS							
Sub-Watershed	**Date**	**Natural**	**Mined**	**Waste Rock**	**CCR**	**Reclaimed**	**Total**
Upper Fording	12/31/2010	40.20	0	0	0	0	40.20
	1/1/2200	40.20	0	0	0	0	40.20
Henretta Creek	12/31/2010	44.5	5.3	2.9	0	0	49.8
	1/1/2011	44.5	5.3	2.9	0	0	49.8
	1/1/2016	44.8	5.4	3.4	0	0	50.2
	1/1/2056	44.8	5.4	0	0	3.4	50.2
	1/1/2200	44.8	5.4	0	0	3.4	50.2
Turnbull Spoil	31/12/2010	2.0	1.2	1.2	0	0	3.2
	1/01/2011	2.0	1.2	1.2	0	0	3.2
	31/12/2015	2.0	1.2	1.2	0	0	3.2
	1/01/2017	4.03	3.5	3.5	0	0	7.5
	1/01/2023	1.8	10.5	10.5	0	0	12.3
	1/01/2027	3.42	11.23	11.23	0	0	14.7
	1/01/2032	3.2	11.45	11.45	0	0	14.7
	31/12/2040	2.8	11.8	11.8	0	0	14.7
	1/01/2081	2.8	11.8	0	0	11.8	14.7
	1/01/2200	2.8	11.8	0	0	11.8	14.7
Clode Creek	31/12/2010	3.0	7.7	4.4	0	0	10.6
	31/12/2012	3.0	7.7	4.4	0	0	10.6
	1/01/2013	0.9	4.6	3.9	0	0	5.5
	1/01/2017	0.9	4.9	4.9	0	0	5.8
	1/01/2019	0.9	4.9	4.9	0	0	5.8
	1/01/2059	0.9	4.9	0	0	4.9	5.8
	1/01/2200	0.9	4.9	0	0	4.9	5.8
Upper Lake Mountain Creek	31/12/2010	7.5	0	0	0	0	7.5
	1/01/2011	7.5	0	0	0	0	7.5
	31/12/2015	7.5	0	0	0	0	7.5
	1/01/2017	8.5	2.77	0	0	0	11.3
	1/01/2023	3.5	3.1	0	0	0	6.6
	1/01/2027	0	0	0	0	0	0
	1/01/2200	0	0	0	0	0	0
Lower Lake Mountain Creek	31/12/2010	4.8	2.44	2.3	0.09	0	7.3
	1/01/2011	4.8	2.44	2.3	0.09	0	7.3
	31/12/2015	4.8	2.44	2.3	0.09	0	7.3
	1/01/2017	0	0	0	0	0	0
	1/01/2023	0	0	0	0	0	0
	1/01/2200	0	0	0	0	0	0
Lower Fording River 1 (EC1)	31/12/2010	0	1.81	1.70	0	0.08	1.81
	1/01/2011	0	1.81	1.70	0	0.08	1.81
	1/01/2051	0	1.81	0	0	1.80	1.81
	1/01/2200	0	1.81	0	0	1.80	1.81
Lower Fording River 1 (STP1)	12/31/2010	31/12/2010	0	3.4	0.8	0.59	0
	1/1/2011	1/01/2011	0	3.4	0.8	0.59	0
	1/1/2051	1/01/2051	0	3.4	0	0	1.4
	1/1/2200	1/01/2200	0	3.4	0	0	1.4

Table B-6 Future Sub-watershed Areas – Fording River Operations (in km^2) (continued)

FORDING RIVER OPERATIONS SUB-WATERSHED AREA INPUTS							
Sub-Watershed	**Date**	**Natural**	**Mined**	**Waste Rock**	**CCR**	**Reclaimed**	**Total**
Swift Upper Diversion	31/12/2010	2.6	0	0	0	0	2.6
	1/01/2011	2.6	0	0	0	0	2.6
	31/12/2015	2.6	0	0	0	0	2.6
	1/01/2017	3.4	0	0	0	0	3.4
	1/01/2027	4.5	0	0	0	0	4.5
	1/01/2051	4.5	0	0	0	0	4.5
	1/01/2200	4.5	0	0	0	0	4.5
Swift Pit	31/12/2010	0	1.79	0	0	0	1.79
	31/12/2015	0	1.79	0	0	0	1.79
	1/01/2017	0.78	5.17	3.69	0	0	5.95
	1/01/2023	0	6.53	3.69	0	0	6.53
	1/01/2027	0	9.5	3.77	0	0	9.5
	1/01/2032	0	9.5	4.33	0	0	9.5
	1/01/2037	0	9.5	4.33	0	0	9.5
	31/12/2040	0	9.5	4.52	0	0	9.5
	1/01/2081	0	9.5	0	0	4.52	9.5
	1/01/2200	0	9.5	0	0	4.52	9.5
Cataract Creek	31/12/2010	0	4.2	4.19	0	0	4.2
	1/01/2011	0	3.6	3.6	0	0	3.6
	31/12/2015	0	3.6	3.6	0	0	3.6
	1/01/2017	0	7.18	2.96	0	0	7.2
	1/01/2023	0	6.51	3.44	0	0	6.5
	1/01/2063	0	6.51	0	0	3.44	6.5
	1/01/2071	0	6.51	0	0	3.44	6.5
	1/01/2091	0	6.51	0	0	3.44	6.5
	1/01/2200	0	6.51	0	0	3.44	6.5
Porter Creek	31/12/2010	1.36	1.55	1.55	0	0	2.91
	1/01/2017	1.36	1.55	1.55	0	0	2.91
	1/01/2018	1.36	0.70	0.70	0	0	2.06
	1/01/2057	1.36	0.70	0	0	0.70	2.06
	1/01/2091	1.36	0.70	0	0	0.70	2.06
	1/01/2200	1.36	0.70	0	0	0.70	2.06
Castle MNT reporting to FR3b	31/12/2010	9.1	0	0	0	0	9.1
	1/01/2011	9.1	0	0	0	0	9.1
	1/01/2051	9.1	0	0	0	0	9.1
	1/01/2200	9.1	0	0	0	0	9.1
Castle MNT FRD	31/12/2010	7.3	0	0	0	0	7.3
	1/01/2011	7.3	0	0	0	0	7.3
	1/01/2051	7.3	0	0	0	0	7.3
	1/01/2200	7.3	0	0	0	0	7.3
Lower Fording River 2 (LF2)	31/12/2010	0.4	6.54	6.2	0.30	0	7.0
	1/01/2011	0.4	6.54	6.2	0.30	0	6.96
	31/12/2015	0.4	6.54	6.2	0.30	0	6.96
	1/01/2017	0	1.57	0.65	0.30	0	1.6
	1/01/2057	0	1.57	0	0	0.95	1.6
	1/01/2200	0	1.57	0	0	0.95	1.6
Turnbull Pit[(a)]	31/12/2010	0	1.4	0	0	0	1.4
	1/01/2011	0	1.4	0	0	0	1.4
	31/12/2014	0	1.2	0	0	0	1.2

Table B-6 Future Sub-watershed Areas – Fording River Operations (in km^2) (continued)

FORDING RIVER OPERATIONS SUB-WATERSHED AREA INPUTS							
Sub-Watershed	**Date**	**Natural**	**Mined**	**Waste Rock**	**CCR**	**Reclaimed**	**Total**
	1/01/2015	0	1.2	0	0	0	1.2
	31/12/2034	0	1.2	0	0	0	1.2
	1/01/2035	0	1.2	0	0	0	1.2
	1/01/2051	0	1.2	0	0	0	1.2
	1/01/2200	0	1.2	0	0	0	1.2
FR-CTP	12/31/2010	1.50	0	0	0	0	1.50
	1/1/2200	1.50	0	0	0	0	1.50
Brownie Creek Clean	31/12/2010	4.23	0	0	0	0	4.23
	1/01/2011	4.23	0	0	0	0	4.23
	1/01/2051	4.23	0	0	0	0	4.23
	1/01/2200	4.23	0	0	0	0	4.23
Kilmarnock and Brownie Mined	31/12/2010	13.5	9.9	8.6	0.3	0	23.4
	1/01/2013	13.5	9.9	8.6	0.3	0	23.4
	1/01/2017	11.1	9.6	9.6	0.3	0	20.6
	1/01/2020	11.1	9.6	9.6	0.3	0	20.6
	1/01/2060	11.1	9.6	0	0	9.9	20.6
	1/01/2200	11.1	9.6	0	0	9.9	20.6
Kilmarnock Natural Diverted	12/31/2010	14.9	0	0	0	0	14.9
	1/1/2200	14.9	0	0	0	0	14.9
Additional to FR3c	12/31/2010	162.14	0	0	0	0	162.14
	1/1/2200	162.14	0	0	0	0	162.14
Swift Spoil	31/12/2010	2.1	1.6	1.6	0	0	3.7
	1/01/2011	2.1	1.6	1.6	0	0	3.7
	31/12/2015	2.1	1.6	1.6	0	0	3.7
	1/01/2017	0	0	0	0	0	0
	2/01/2051	0	0	0	0	0	0
	1/01/2200	0	0	0	0	0	0
Eagle Pit	31/12/2010	0	0	0	0	0	0
	31/12/2012	0	0	0	0	0	0
	1/01/2013	1.8	3.2	0.5	0	0	5.1
	1/01/2017	1.8	5.7	1	0	0	7.5
	1/01/2024	1.8	5.7	3.5	0	0	7.5
	1/01/2064	1.8	5.7	0	0	3.5	7.5
	1/01/2200	1.8	5.7	0	0	3.5	7.5

Table B-7 Future Sub-watershed Areas – Greenhills Operations (in km^2)

GREENHILLS OPERATIONS SUB-WATERSHED AREA INPUTS							
Sub-Watershed	**Date**	**Natural**	**Mined**	**Waste Rock**	**CCR**	**Reclaimed**	**Total**
Leask Ck Other	12/31/2010	0.15	0	0	0	0	0.15
	1/1/2200	0.15	0	0	0	0	0.15
Leask Ck WR	31/12/2010	1.41	0.78	0.47	0	0	2.20
	1/01/2013	1.41	0.78	0.47	0	0	2.20
	1/01/2017	0	1.70	1.70	0	0	1.70
	1/01/2028	0	1.70	1.70	0	0	1.70
	1/01/2068	0	1.70	0	0	1.70	1.70
	1/01/2200	0	1.70	0	0	1.70	1.70
Thompson Ck Other	12/31/2010	5.83	0	0	0	0	5.83
	1/1/2200	5.83	0	0	0	0	5.83
Thompson Ck WR	31/12/2010	0	3.03	2.77	0	0	3.03
	1/01/2017	0	3.03	3.03	0	0	3.03
	1/01/2057	0	3.03	0	0	3.03	3.03
	1/01/2200	0	3.03	0	0	3.03	3.03
Wolfram Ck Other	12/31/2010	1.06	0	0	0	0	1.06
	1/1/2200	1.06	0	0	0	0	1.06
Wolfram Ck WR	31/12/2010	1.32	1.48	0.80	0	0	2.79
	1/01/2013	1.18	1.61	1.10	0	0	2.79
	1/01/2017	0	2.52	2.20	0	0	2.52
	1/01/2030	0	2.52	2.52	0	0	2.52
	1/01/2070	0	2.52	0	0	2.52	2.52
	1/01/2200	0	2.52	0	0	2.52	2.52
Greenhills Other	31/12/2010	9.69	2.70	0	0.91	0	12.39
	1/01/2031	9.69	2.70	0	0.91	0	12.39
	1/01/2071	9.69	2.70	0	0	0.91	12.39
	1/01/2200	9.69	2.70	0	0	0.91	12.39
Greenhills WR	31/12/2010	1.17	1.54	1.54	0	0	2.71
	1/01/2018	1.17	1.54	1.54	0	0	2.71
	1/01/2025	0.50	2.21	2.21	0	0	2.71
	1/01/2031	0.50	2.21	2.21	0	0	2.71
	1/01/2071	0.50	2.21	0	0	2.21	2.71
	1/01/2200	0.50	2.21	0	0	2.21	2.71
FR4 Additional	12/31/2010	6.96	0.65	0	0	0	7.61
	1/1/2200	6.96	0.65	0	0	0	7.61
Cougar Pit North	31/01/2010	0	2.96	1.14	0	0	2.96
	1/01/2013	0	2.96	1.14	0	0	2.96
	1/01/2017	0	3.62	1.14	0	0	3.62
	1/01/2031	0	3.62	1.14	0	0	3.62
	1/01/2071	0	3.62	0	0	1.14	3.62
	1/01/2200	0	3.62	0	0	1.14	3.62
Cougar Pit South	31/12/2010	0	1.83	0	0	0	1.83
	1/01/2013	0	1.83	0	0	0	1.83
	1/01/2017	0	2.90	0.4	0	0	2.90
	1/01/2031	0	2.90	2.90	0	0	2.90
	1/01/2071	0	2.90	0	0	2.90	2.90
	1/01/2200	0	2.90	0	0	2.90	2.90
Cougar Pit North Extension	31/12/2010	1.30	0	0	0	0	1.30
	1/01/2017	1.30	0	0	0	0	1.30
	1/01/2031	0	1.30	0	0	0	1.30
	1/01/2200	0	1.30	0	0	0	1.30

Table B-8 Future Sub-watershed Areas – Line Creek Operations (Phase II) (in km^2)

LINE CREEK OPERATIONS PHASE II SUB-WATERSHED AREA INPUTS							
Sub-Watershed	**Date**	**Natural**	**Mined**	**Waste Rock**	**CCR**	**Reclaimed**	**Total**
Upper Dry Creek	12/31/2010	8.73	0	0	0	0	8.73
	1/1/2014	8.73	0	0	0	0	8.73
	1/1/2019	5.52	1.73	1.73	0	0	7.25
	1/1/2024	4.14	2.36	2.36	0	0	6.50
	1/1/2033	2.35	4.01	4.01	0	0	6.36
	1/1/2051	2.35	4.01	2.21	0	1.80	6.36
	1/1/2058	2.35	4.01	1.50	0	2.51	6.36
	1/1/2073	2.35	4.01	0	0	4.01	6.36
	1/1/2200	2.35	4.01	0	0	4.01	6.36
East Tributary of Dry Creek	12/31/2010	7.02	0	0	0	0	7.02
	1/1/2014	7.02	0	0	0	0	7.02
	1/1/2033	6.53	0	0	0	0	6.53
	1/1/2200	6.53	0	0	0	0	6.53
Lower Dry Creek	12/31/2010	10.59	0	0	0	0	10.59
	1/1/2014	10.59	0	0	0	0	10.59
	1/1/2033	9.88	0	0	0	0	9.88
	1/1/2200	9.88	0	0	0	0	9.88
BRN4 Pit	12/31/2010	0	0	0	0	0	0
	1/31/2013	0	0	0	0	0	0
	1/1/2018	0	0.36	0	0	0	0.36
	1/1/2023	0	0.42	0	0	0	0.42
	1/1/2026	0	0.42	0.20	0	0	0.42
	12/31/2032	0	0.42	0.20	0	0	0.42
	1/1/2058	0	0.42	0.07	0	0.13	0.42
	1/1/2073	0	0.42	0	0	0.20	0.42
	1/1/2200	0	0.42	0	0	0.20	0.42
BRN3 Pit	12/31/2010	0	0	0	0	0	0
	12/31/2013	0	0	0	0	0	0
	1/1/2018	0	0.62	0	0	0	0.62
	1/1/2024	0	0.83	0	0	0	0.83
	1/1/2025	0	0.60	0	0	0	0.60
	1/1/2028	0	0.60	0.38	0	0	0.60
	12/31/2032	0	0.60	0.38	0	0	0.60
	1/1/2058	0	0.60	0.10	0	0.29	0.60
	1/1/2073	0	0.60	0	0	0.38	0.60
	1/1/2200	0	0.60	0	0	0.38	0.60

Table B-8 Future Sub-watershed Areas – Line Creek Operations (Phase II) (in km^2) (continued)

LINE CREEK OPERATIONS PHASE II SUB-WATERSHED AREA INPUTS							
Sub-Watershed	Date	Natural	Mined	Waste Rock	CCR	Reclaimed	Total
BRN2 Pit	12/31/2010	0	0	0	0	0	0
	1/1/2016	0	0	0	0	0	0
	1/1/2024	0	0.66	0	0	0	0.66
	12/31/2026	0	1.06	0	0	0	1.06
	1/1/2028	0	1.20	0.14	0	0	1.20
	1/1/2033	0	1.87	0.14	0	0	1.87
	1/1/2058	0	1.87	0.05	0	0.09	1.87
	1/1/2073	0	1.87	0	0	0.14	1.87
	1/1/2200	0	1.87	0	0	0.14	1.87
MM2/3 Pit	12/31/2010	0	0	0	0	0	0
	1/1/2014	0	0	0	0	0	0
	1/1/2018	0	0.73	0	0	0	0.73
	1/1/2023	0	1.02	0	0	0	1.02
	1/1/2026	0	1.06	0	0	0	1.06
	1/1/2030	0	1.17	0.70	0	0	1.17
	1/1/2033	0	1.20	0.70	0	0	1.20
	1/1/2051	0	1.20	0.39	0	0.32	1.20
	1/1/2073	0	1.20	0	0	0.70	1.20
	1/1/2200	0	1.20	0	0	0.70	1.20
MM1 Pit	12/31/2010	0	0	0	0	0	0
	1/1/2019	0	0	0	0	0	0
	1/1/2023	0	0.27	0	0	0	0.27
	1/1/2033	0	0.37	0	0	0	0.37
	1/1/2051	0	0.37	0	0	0	0.37
	1/1/2200	0	0.37	0	0	0	0.37
Additional to FR5	12/31/2010	69.11	0	0	0	0	69.11
	1/1/2014	69.11	0	0	0	0	69.11
	1/1/2032	68.18	0	0	0	0	68.18
	1/1/2200	68.18	0	0	0	0	68.18

Table B-9 Future Sub-watershed Areas – Elkview Operations (in km^2)

ELKVIEW OPERATIONS SUB-WATERSHED AREA INPUTS							
Sub-Watershed	**Date**	**Natural**	**Mined**	**Waste Rock**	**CCR**	**Reclaimed**	**Total**
Six Mile Creek	12/31/2010	3.29	0.30	0.30	0	0	3.59
	1/1/2051	3.29	0.30	0	0	0.30	3.59
	1/1/2200	3.29	0.30	0	0	0.30	3.59
Dry Creek	31/12/2010	4.4	4.3	4.0	0	0	8.7
	31/01/2016	4.4	4.3	4.0	0	0	8.7
	1/01/2018	2.9	5.5	5.5	0	0	8.4
	1/01/2023	2.9	5.5	5.5	0	0	8.4
	1/01/2028	2.1	6.2	6.2	0	0	8.4
	1/01/2033	2.0	6.4	6.4	0	0	8.4
	1/01/2048	2.0	6.4	6.4	0	0	8.4
	1/01/2088	2.0	6.4	0	0	6.4	8.4
	1/01/2200	2.0	6.4	0	0	6.4	8.4
Harmer Creek Only	31/12/2010	32.7	0.1	0.1	0	0	32.8
	1/01/2013	32.7	0.1	0.1	0	0	32.8
	1/01/2053	32.7	0.1	0	0	0.1	32.8
	1/01/2200	32.7	0.1	0	0	0.1	32.8
Grave Creek Only	12/31/2010	42.70	0	0	0	0	42.70
	1/1/2200	42.70	0	0	0	0	42.70
Goddard Creek	31/12/2010	1.00	1.00	0.10	0	0	2.00
	1/01/2016	1.00	1.00	0.09	0	0.02	2.00
	1/01/2038	0.46	1.00	0.03	0	0.07	1.46
	1/01/2051	0.46	1.00	0	0	0.10	1.46
	1/01/2200	0.46	1.00	0	0	0.10	1.46
Qualtieri Creek	31/12/2010	0.7	0.3	0	0	0	1.0
	1/01/2033	0.7	0.3	0	0	0	1.0
	1/01/2043	0.4	0.3	0	0	0	0.7
	1/01/2200	0.4	0.3	0	0	0	0.7
Aquaduct Creek	31/12/2010	1.5	0.7	0	0	0	2.1
	1/01/2013	1.5	0.7	0	0	0	2.1
	1/01/2033	0.6	0.2	0	0	0	0.8
	1/01/2200	0.6	0.2	0	0	0	0.8
Bodie Creek Remnant	31/12/2010	0.53	0.91	0.50	0	0	1.44
	1/01/2027	0.43	0.91	0.29	0	0.21	1.34
	1/01/2050	0.43	0.91	0	0	0.50	1.34
	1/01/2200	0.43	0.91	0	0	0.50	1.34
Cedar Pit (North)	31/12/2010	0	3.5	1.9	0	0	3.5
	1/01/2016	0	3.5	1.9	0	0	3.5
	1/01/2042	0	4.3	3.9	0	0	4.3
	1/01/2082	0	4.3	0	0	3.9	4.3
	1/01/2200	0	4.3	0	0	3.9	4.3
Baldy Ridge Pit (Middle)	31/12/2010	0	7.0	2.5	0	0	7.0
	1/01/2013	0	7.0	2.5	0	0	7.0
	1/01/2028	0	7.5	5.7	0	0	7.5
	1/01/2033	0	7.3	5.7	0	0	7.3
	1/01/2043	0	9.0	5.7	0	0	9.0
	1/01/2048	0	9.0	7.0	0	0	9.0
	1/01/2088	0	9.0	0	0	7.0	9.0
	1/01/2200	0	9.0	0	0	7.0	9.0

Table B-9 Future Sub-watershed Areas – Elkview Operations (in km^2) (continued)

ELKVIEW OPERATIONS SUB-WATERSHED AREA INPUTS							
Sub-Watershed	**Date**	**Natural**	**Mined**	**Waste Rock**	**CCR**	**Reclaimed**	**Total**
Natal Pit (South)[(b)]	31/12/2010	0	4.3	1.0	0	0	4.3
	1/01/2028	0	5.1	2.3	0	0	5.1
	1/01/2036	0	5.1	2.3	0	0	5.1
	1/01/2076	0	5.1	0	0	2.3	5.1
	1/01/2200	0	5.1	0	0	2.3	5.1
Gate Creek	31/12/2010	1.9	1.3	0.8	0	0	3.2
	1/01/2028	1.3	1.3	0.4	0	0.4	2.6
	1/01/2051	1.3	1.3	0	0	0.8	2.6
	1/01/2200	1.3	1.3	0	0	0.8	2.6
South Pit Milligan Thresher	12/31/2010	4.30	1.89	1.30	0	0	6.18
	1/1/2051	4.30	1.89	0	0	1.30	6.18
	1/1/2200	4.30	1.89	0	0	1.30	6.18
Erickson Creek Total	31/12/2010	22.7	8.9	8.0	0	0	31.6
	1/01/2024	22.7	8.9	8.0	0	0	31.6
	1/01/2028	22.7	8.0	8.0	0	0	30.7
	1/01/2033	20.1	10.4	10.4	0	0	30.5
	1/01/2047	20.1	10.4	10.4	0	0	30.5
	1/01/2087	20.1	10.4	0	0	10.4	30.5
	1/01/2200	20.1	10.4	0	0	10.4	30.5
Erickson Creek Clean Diversion	31/12/2010	8.2	0	0	0	0	8.2
	1/01/2043	8.2	0	0	0	0	8.2
	1/01/2200	8.2	0	0	0	0	8.2
Erickson Creek Other	31/12/2010	14.5	8.90	8.00	0	0	23.4
	1/01/2024	14.5	8.90	8.00	0	0	23.4
	1/01/2028	14.5	8.00	8.00	0	0	22.5
	1/01/2033	11.9	10.4	10.4	0	0	22.3
	1/01/2047	11.9	10.4	10.4	0	0	22.3
	1/01/2087	11.9	10.4	0	0	10.4	22.3
	1/01/2200	11.9	10.4	0	0	10.4	22.3
Alexander Creek	12/31/2010	145.72	0	0	0	0	145.72
	1/1/2200	145.72	0	0	0	0	145.72
Lower Alexander Creek	12/31/2010	6.26	0	0	0	0	6.26
	1/1/2200	6.26	0	0	0	0	6.26
Unnamed (Lower Alexander)	12/31/2010	32.01	0	0	0	0	32.01
	1/1/2200	32.01	0	0	0	0	32.01
Additional to MC3	12/31/2010	41.7	0	0	0	0	41.7
	1/1/2200	41.7	0	0	0	0	41.7
Additional to MC1	12/31/2010	28.25	1.10	0	0	0	29.35
	1/1/2200	28.25	1.10	0	0	0	29.35
Adit Ridge Pit	31/12/2010	0	0	0	0	0	0
	1/01/2024	0	0	0	0	0	0
	1/01/2028	0	0.7	0	0	0	0.7
	1/01/2033	0	1.0	0	0	0	1.0
	31/12/2046	0	1.0	0	0	0	1.0
	1/01/2200	0	1.0	0	0	0	1.0

Table B-10 Future Sub-watershed Areas – Coal Mountain Phase 2 Project (in km^2)

MARTEN WHEELER PROJECT SUB-WATERSHED AREA INPUTS							
Sub-Watershed	Date	Natural	Mined	Waste Rock	CCR	Reclaimed	Total
Upper Wheeler 1	1/01/2017	4.85	0	0	0	0	4.85
	31/12/2021	2.89	1.96	1.96	0	0	4.85
	31/12/2026	2.32	2.50	2.50	0	0	4.82
	31/12/2031	1.68	3.07	3.07	0	0	4.75
	31/12/2036	1.62	2.77	2.43	0	0.35	4.40
	31/12/2039	1.62	2.77	2.22	0	0.55	4.40
	31/12/2071	1.62	2.77	0	0	2.77	4.40
	1/01/2200	1.62	2.77	0	0	2.77	4.40
Upper Wheeler 2 (Marten Pit)	1/01/2017	3.06	0	0	0	0	3.06
	31/12/2021	2.01	1.05	0	0	0	3.06
	31/12/2022	1.59	1.20	0	0	0	2.79
	31/12/2026	1.59	1.41	1.13	0	0	3.00
	31/12/2031	1.26	1.85	1.67	0	0	3.11
	31/12/2036	1.03	2.17	2.17	0	0	3.20
	31/12/2039	1.02	2.17	2.01	0	0.16	3.19
	31/12/2076	1.02	2.17	0	0	2.17	3.19
	1/01/2200	1.02	2.17	0	0	2.17	3.19
Middle Wheeler	1/01/2017	2.82	0	0	0	0	2.82
	31/12/2021	2.82	0	0	0	0	2.82
	31/12/2026	2.60	0	0	0	0	2.60
	31/12/2031	2.44	0	0	0	0	2.44
	31/12/2036	1.72	0.81	0.81	0	0	2.53
	31/12/2039	1.72	0.82	0.75	0	0.06	2.53
	31/12/2076	1.72	0.82	0	0	0.82	2.53
	1/01/2200	1.72	0.82	0	0	0.82	2.53
Lower Wheeler	1/01/2017	8.69	0	0	0	0	8.69
	1/01/2200	8.69	0	0	0	0	8.69
Upper Little Wheeler	1/01/2017	3.12	0	0	0	0	3.12
	31/12/2021	1.55	1.56	1.56	0	0	3.12
	31/12/2022	1.43	1.71	1.71	0	0	3.13
	31/12/2026	1.43	1.71	1.54	0	0.17	3.13
	31/12/2031	1.42	1.71	1.33	0	0.38	3.13
	31/12/2036	1.42	1.71	1.11	0	0.60	3.13
	31/12/2039	1.42	1.71	0.98	0	0.73	3.13
	31/12/2062	1.42	1.71	0	0	1.71	3.13
	1/01/2200	1.42	1.71	0	0	1.71	3.13
Wheeler Pit Subwatershed	1/01/2017	2.70	0	0	0	0	2.70
	31/12/2021	1.79	0.91	0	0	0	2.70
	31/12/2026	0.69	2.43	0	0	0	3.12
	31/12/2031	0.34	2.94	0	0	0	3.28
	31/12/2036	0.22	3.05	0.28	0	0	3.27
	31/12/2039	0.22	3.05	1.09	0	0	3.27
	31/12/2079	0.22	3.05	0	0	1.09	3.27
	1/01/2200	0.22	3.05	0	0	1.09	3.27
Lower Little Wheeler	31/12/2021	3.99	0	0	0	0	3.99
	31/12/2039	4.01	0	0	0	0	4.01
	1/01/2200	4.01	0	0	0	0	4.01

Table B-10 Future Sub-watershed Areas – Marten Wheeler Project (in km^2) (continued)

MARTEN WHEELER PROJECT SUB-WATERSHED AREA INPUTS							
Sub-Watershed	**Date**	**Natural**	**Mined**	**Waste Rock**	**CCR**	**Reclaimed**	**Total**
Marten Ridge Pit Subwatershed	1/01/2017	0	0	0	0	0	0
	31/12/2021	0	0	0	0	0	0
	31/12/2026	0.22	0.68	0	0	0	0.90
	31/12/2031	0.22	0.47	0	0	0	0.69
	31/12/2036	0.22	0.66	0	0	0	0.88
	31/12/2039	0.19	0.69	0	0	0	0.88
	31/12/2076	0.19	0.69	0	0	0	0.88
	1/01/2200	0.19	0.69	0	0	0	0.88
Upper Carbon 1	31/12/2021	1.88	0	0	0	0	1.88
	31/12/2039	1.87	0	0	0	0	1.87
	1/01/2200	1.87	0	0	0	0	1.87
Upper Carbon 2	1/01/2017	3.78	0	0	0	0	3.78
	31/12/2021	3.78	0	0	0	0	3.78
	31/12/2026	3.54	0	0	0	0	3.54
	31/12/2031	3.43	0.35	0	0	0	3.78
	31/12/2036	3.43	0.35	0	0	0	3.79
	31/12/2039	3.42	0.36	0	0	0	3.79
	1/01/2200	3.42	0.36	0	0	0	3.79
Lower Carbon	1/01/2017	4.71	0	0	0	0	4.71
	1/01/2200	4.71	0	0	0	0	4.71
Upper Snowslide	1/01/2017	4.28	0	0	0	0	4.28
	31/12/2021	4.28	0	0	0	0	4.28
	31/12/2026	3.73	0	0	0	0	3.73
	31/12/2031	3.64	0	0	0	0	3.64
	31/12/2036	3.64	0	0	0	0	3.64
	31/12/2039	3.64	0	0	0	0	3.64
	1/01/2200	3.64	0	0	0	0	3.64
Lower Snowslide	1/01/2017	1.14	0	0	0	0	1.14
	1/01/2200	1.14	0	0	0	0	1.14
Additional to MC4	1/01/2016	222	0	0	0	0	222
	1/01/2200	222	0	0	0	0	222

3 Sub-watershed Elevation Inputs

3.1 Natural Areas

Table B-11 Average Sub-watershed Elevations (in m) - Fording River Operations Natural Areas

Date	Upper_Fording	Henretta_Ck	North_Turnbull_Spoil	Clode_Ck	Turnbull_Pit	Lake_Mountain_Ck_Upper	Lake_Mountain_Ck_Lower	Lower_Fording_Rv1_EC1	Lower_Fording_Rv1_STP1	Lower_Fording_Rv2_LF2	Swift_Ck_upper_diversion	Swift_Pit	Cataract_Ck	Porter_Ck	Castle_Mnt_FR3b	Castle_Mnt_FRD	FRCTP	Brownie	Kilmarnock_Brownie_Mined	Kilmarnock_Clean_Diverted	Additional_FR3c	Swift Spoil	Eagle Pit
1/01/1995	2,200	2,300	1,800	2,100	2,100	1,900	1,900	1,700	1,700	1,600	2,300	2,300	1,900	1,900	1,853	1,800	1,785	2,400	2,030	2,250	2,016	1,800	2,250
31/12/2012	2,200	2,300	1,800	2,100	2,100	1,900	1,900	1,700	1,700	1,600	2,300	2,300	1,900	1,900	1,853	1,800	1,785	2,400	2,030	2,250	2,016	1,800	2,250
1/01/2013	2,200	2,300	1,800	2,060	2,100	1,900	1,900	1,700	1,700	1,600	2,300	2,300	1,900	1,900	1,853	1,800	1,785	2,400	2,030	2,250	2,016	1,800	2,250
1/01/2040	2,200	2,300	1,800	2,060	2,100	1,900	1,900	1,700	1,700	1,600	2,300	2,300	1,900	1,900	1,853	1,800	1,785	2,400	2,075	2,250	2,016	1,800	2,250
1/01/2200	2,200	2,300	1,800	2,060	2,100	1,900	1,900	1,700	1,700	1,600	2,300	2,300	1,900	1,900	1,853	1,800	1,785	2,400	2,075	2,250	2,016	1,800	2,250

Table B-12 Average Sub-watershed Elevations (in m) - Greenhills Operations Natural Areas

Date	LeaskCk_ Other	Leask_WR_ Dump	Thompson_ ck_other	Thompson_ WR_Dump	Wolfram_ ck_Other	Wolfram_ WR_Dump	Greenhills_ Other	Green_Hills_WR_ Dump	FR4_ Additional	Cougar_ Pit_North	Cougar_ Pit_South	Cougar_ Pit_North_Ext
1/1/1995	1,425	1,631	1,646	1,945	1,450	1,660	1,830	1,880	1,647	1,895	2,022	2,006
12/31/2010	1,425	1,631	1,646	1,945	1,450	1,660	1,830	1,880	1,647	1,895	2,022	2,006
1/1/2031	1,425	1,631	1,646	-	1,450	1,660	1,830	1,880	1,647	-	-	-
1/1/2200	1,425	1,631	1,646	-	1,450	1,660	1,830	1,880	1,647	-	-	-

Table B-13 Average Sub-watershed Elevations (in m) - Line Creek Operations (Phase II) Natural Areas

Date	Upper_Dry_ Creek	Lower_Dry_ Creek	East_Tributary_ Dry_Creek	BRN_2_Pit	BRN_3_Pit	BRN_4_Pit	MM1_Pit	MM2_3_Pit	Additional_to_ FR5
1/1/1995	2,074	1,897	2,128	-	-	-	-	-	1,600
1/1/2013	2,074	1,897	2,128	-	-	-	-	-	1,600
1/1/2023	1,974	1,885	2,120	-	-	-	-	-	1,600
1/1/2026	1,974	1,885	2,120	-	-	-	-	-	1,600
1/1/2200	1,974	1,885	2,120	-	-	-	-	-	1,600

Table B-14 Average Sub-watershed Elevations (in m) - Elkview Operations Natural Areas

Date	Six_Mile_Creek	Dry_Creek	Harmer_Creek_ONLY	Grave_Creek_ONLY	Goddard_Creek	Qaultieri_Creek	Aqueduct_Creek	Bodie_Baldy_Ridge_Middle	Bodie_Remnant	Bodie_Cedar_Pit_North	Bodie_Natal_South	Gate_Creek	South_pit_milligan_thresher	Erickson_Clean_Diverted	Erickson_Mined	Alexander_Creek	Lower_Alexander_Creek	Unnamed_subwatershed_Lower_Alexander	Additional_to_MC3	Additional_to_MC1	Bodie_ck_Total	Adit_Ridge_Pit
1/01/1995	1,590	1,735	1,785	1,742	1,466.5	1,391	1,445	-	1,250	-	-	1,483	1,682	1,900	1,615	1,91,5	1,429	1,641	1,564	1,512	1,680	-
31/12/2010	1,590	1,735	1,785	1,742	1,466.5	1,391	1,445	-	1,250	-	-	1,483	1,682	1,900	1,615	1,91,5	1,429	1,641	1,564	1,512	1,680	-
1/01/2011	1,590	1,735	1,785	1,742	1,466.5	1,391	1,445	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2016	1,590	1,735	1,785	1,742	1,466.5	1,391	1,445	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2033	1,590	1,650	1,785	1,742	1,400	1,391	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2038	1,590	1,650	1,785	1,742	1,400	1,391	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2043	1,590	1,650	1,785	1,742	1,400	1,350	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2046	1,590	1,650	1,785	1,742	1,400	1,350	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2051	1,590	1,650	1,785	1,742	1,400	1,350	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2062	1,590	1,650	1,785	1,742	1,400	1,350	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2075	1,590	1,650	1,785	1,742	1,400	1,350	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2077	1,590	1,650	1,785	1,742	1,400	1,350	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2086	1,590	1,650	1,785	1,742	1,400	1,350	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-
1/01/2200	1,590	1,650	1,785	1,742	1,400	1,350	1,400	-	1,250	-	-	1,483	1,682	1,600	1,800	1,91,5	1,429	1,641	1,564	1,512	-	-

Table B-15 Average Sub-watershed Elevation (in m) – Coal Mountain Operations and Coal Mountain Phase 2 Project Natural Areas

Date	MC5 (including CMO)	Upper_Wheeler_1	Upper_Wheeler_2	Middle_Wheeler	Lower_Wheeler	Upper_Little_Wheeler	Wheeler_Pit_Subwatershed	Lower_Little_Wheeler	Marten_Ridge_Pit_Subwatershed	Upper_Carbon_1	Upper_Carbon_2	Lower_Carbon	Upper_Snowslide	Lower_Snowslide	Additional_to_MC4
1/01/1995	1,912	2,070	1,880	1,740	1,690	2,060	1,800	1,890	2,050	1,980	1,860	1,650	1,780	1,520	1,810
1/01/2010	1,912	2,070	1,880	1,740	1,690	2,060	1,800	1,890	2,050	1,980	1,860	1,650	1,780	1,520	1,810
31/12/2016	1,912	2,070	1,880	1,740	1,690	2,060	1,800	1,890	2,050	1,980	1,860	1,650	1,780	1,520	1,810
31/12/2021	1,912	2,070	1,880	1,740	1,690	2,060	1,800	1,890	2,050	1,980	1,860	1,650	1,780	1,520	1,810
31/12/2026	1,912	2,090	1,910	1,740	1,690	2,060	1,750	1,890	2,050	1,980	1,830	1,650	1,750	1,520	1,810
31/12/2031	1,912	2,110	1,950	1,740	1,690	2,060	1,780	1,890	2,050	1,980	1,830	1,650	1,750	1,520	1,810
31/12/2036	1,912	2,110	1,960	1,800	1,690	2,060	1,830	1,890	2,050	1,980	1,830	1,650	1,750	1,520	1,810
31/12/2039	1,912	2,110	1,960	1,800	1,690	2,060	1,830	1,890	2,060	1,980	1,820	1,650	1,750	1,520	1,810
31/12/2199	1,912	2,110	1,960	1,800	1,690	2,060	1,830	1,890	2,060	1,980	1,820	1,650	1,750	1,520	1,810

3.2 Mined Areas

Table B-16 Average Sub-watershed Elevations (in m) - Fording River Operations Mined Areas

Date	Upper_Fording	Henretta_Ck	North_Turnbull_Spoil	Clode_Ck	Turnbull_Pit	Lake_Mountain_Ck_Upper	Lake_Mountain_Ck_Lower	Lower_Fording_Rv1_EC1	Lower_Fording_Rv1_STP1	Lower_Fording_Rv2_LF2	Swift_Ck_upper_diversion	Swift_Pit	Cataract_Ck	Porter_Ck	Castle_Mnt_FR3b	Castle_Mnt_FRD	FRCTP	Brownie	Kilmarnock_Brownie_Mined	Kilmarnock_Clean_Diverted	Additional_FR3c	Swift Spoil	Eagle Pit
1/01/1995	2,000	1,800	1,600	1,900	1,900	1,700	1,700	1,700	1,700	1,700	1,800	1,800	1,800	2,000	1,853	1,800	1,950	21,00	2,040	1,800	2,016	1,800	2,040
31/12/2012	2,000	1,800	1,600	1,900	1,900	1,700	1,700	1,700	1,700	1,700	1,800	1,800	1,800	2,000	1,853	1,800	1,950	21,00	2,040	1,800	2,016	1,800	2,040
1/01/2013	2,000	1,800	1,600	1,880	1,900	1,700	1,700	1,700	1,700	1,700	1,800	1,800	1,800	2,000	1,853	1,800	1,950	21,00	2,040	1,800	2,016	1,800	2,040
1/01/2040	2,000	1,800	1,600	1,950	1,900	1,700	1,700	1,700	1,700	1,700	1,800	1,800	1,800	2,000	1,853	1,800	1,950	21,00	2,050	1,800	2,016	1,800	1,940
1/01/2200	2,000	1,800	1,600	1,950	1,900	1,700	1,700	1,700	1,700	1,700	1,800	1,800	1,800	2,000	1,853	1,800	1,950	21,00	2,050	1,800	2,016	1,800	1,940

Table B-17 Average Sub-watershed Elevations (in m) - Greenhills Operations Mined Areas

Date	LeaskCk_Other	Leask_WR_Dump	Thompson_ck_other	Thompson_WR_Dump	Wolfram_ck_Other	Wolfram_WR_Dump	Greenhills_Other	Green_Hills_WR_Dump	FR4_Additional	Cougar_Pit_North	Cougar_Pit_South	Cougar_Pit_North_Ext
1/01/1995	-	1,833	-	1,945	-	1,840	1,830	2,075	1,500	1,895	2,022	-
31/12/2010	-	1,833	-	1,945	-	1,840	1,830	2,075	1,500	1,895	2,022	-
1/01/2017	-	1,750	-	1,908	-	1,822	1,830	2,075	1,500	1,920	2,000	1,874
1/01/2031	-	1,750	-	1,908	-	1,822	1,830	2,075	1,500	1,920	2,000	1,874
1/01/2200	-	1,750	-	1,908	-	1,822	1,830	2,075	1,500	1,920	2,000	1,874

Table B-18 Average Sub-watershed Elevations (in m) - Line Creek Operations (Phase II) Mined Areas

Date	Upper_Dry_Creek	Lower_Dry_Creek	East_Tributary_Dry_Creek	BRN_2_Pit	BRN_3_Pit	BRN_4_Pit	MM1_Pit	MM2_3_Pit	Additional_to_FR5
1/1/1995	-	-	-	-	-	-	-	-	-
1/1/2013	2,132	-	-	1,900	2,100	2,100	2,200	2,200	-
1/1/2200	2,132	-	-	1,900	2,100	2,100	2,100	2,200	-

Table B-19 Average Sub-watershed Elevations (in m) - Elkview Operations Mined Areas

Date	Six_Mile_Creek	Dry_Creek	Harmer_Creek_ONLY	Grave_Creek_ONLY	Goddard_Creek	Qaultieri_Creek	Aqueduct_Creek	Bodie_Baldy_Ridge_Middle	Bodie_Remnant	Bodie_Cedar_Pit_North	Bodie_Natal_South	Gate_Creek	South_pit_milligan_thresher	Erickson_Clean_Diverted	Erickson_Mined	Alexander_Creek	Lower_Alexander_Creek	Unnamed_subwatershed_Lower_Alexander	Additional_to_MC3	Additional_to_MC1	Bodie_ck_Total	Adit_Ridge_Pit
1/1/1995	1,21,6	1,850	1,850	-	1,540	1,478	1,672	1,700	1,350	1,850	1,600	1,601	1,761	-	1,850	-	-	-	-	1,171	1,489	-
1/1/2011	1,21,6	1,850	1,850	-	1,540	1,478	1,672	1,700	1,350	1,850	1,600	1,601	1,761	-	1,850	-	-	-	-	1,171	1,489	1,775
1/1/2028	1,21,6	1,850	1,850	-	1,540	1,478	1,672	1,700	1,350	1,850	1,600	1,601	1,761	-	1,850	-	-	-	-	1,171	-	1,775
1/1/2033	1,21,6	1,850	1,850	-	1,540	1,478	1,672	1,700	1,350	1,850	1,600	1,601	1,761	-	1,750	-	-	-	-	1,171	-	1,775
1/1/2200	1,21,6	1,850	1,850	-	1,540	1,478	1,672	1,700	1,350	1,850	1,600	1,601	1,761	-	1,750	-	-	-	-	1,171	-	1,775

Table B-20 Average Sub-watershed Elevation (in m) – Coal Mountain Operations and Coal Mountain Phase 2 Project Mined Areas

Date	MC5 (including CMO)	Upper_Wheeler_1	Upper_Wheeler_2	Middle_Wheeler	Lower_Wheeler	Upper_Little_Wheeler	Wheeler_Pit_Subwatershed	Lower_Little_Wheeler	Marten_Ridge_Pit_Sub watershed	Upper_Carbon_1	Upper_Carbon_2	Lower_Carbon	Upper_Snowslide	Lower_Snowslide	Additional_to_MC4
1/01/1995	1,750	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/01/2010	1,750	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31/12/2016	1,750	2,070	1,880	-	-	2,040	1,850	-	-	-	-	-	-	-	-
31/12/2021	1,750	2,550	1,760	-	-	2,040	1,850	-	1,880	-	-	-	-	-	-
31/12/2026	1,750	1,990	1,800	-	-	2,060	1,780	-	1,880	-	1,840	-	-	-	-
31/12/2031	1,750	2,050	1,840	1,740	-	2,060	1,720	-	1,870	-	1,840	-	-	-	-
31/12/2036	1,750	2,060	1,880	1,690	-	2,060	1,670	-	1,880	-	1,840	-	-	-	-
31/12/2039	1,750	2,060	1,810	1,690	-	2,060	1,710	-	1,890	-	1,840	-	-	-	-
31/12/2199	1,750	2,060	1,810	1,690	-	2,060	1,710	-	1,890	-	1,840	-	-	-	-

4 Other Inputs

- FRO Swift Pit Capacity = 525.7 million m^3
- GHO Cougar North/South Pit Capacity = 90.5 million m^3
- Water management to maintain flows in the Fording River at FRO is included as follows:
  - 2019 onwards (i.e. during operation of the North AWTF); pumping 2,000 m^3/day of treated water to the Fording River at the outlet of the North Spoil sediment pond and pumping up to 18,000 m^3/day of treated water to the Fording River at the confluence of Clode Creek.
  - 2041 to 2168 (i.e. during the Swift Pit filling period); pumping 8,000 m^3/day of water from the Swift Pit to the Fording River (through the North AWTF if capacity is available).
- EVO Tailings Flow to Erickson Creek watershed = 5000 m^3/day from October 2005 to December 2046.
- A number of selectors are included in the model to control watershed changes such as pit filling and water management, as shown in Table B-21.

Table B-21 Selectors in the Flow Model

	Selectors	Notes
	Swift_Upper_Diversion	Period that Swift Upper clean diversion is active
Start	1/01/2005	
Finish	1/01/2041	
	Swift_Pit_to_Fording	Period that the Swift Pit discharges to the Fording River
Start	1/01/2005	
Finish	1/01/2200	
	Cataract_to_Swift_Creek	Period that Swift and Cataract Creeks are combined
Start	1/01/2017	
Finish	1/01/2200	
	Swift_Pit_Mining	Mining period for Swift Pit
Start	1/01/2016	
Finish	1/01/2041	
	Eagle_Pit_Filling	Filling period for Eagle Pit (zero discharge)
Start	1/01/2024	
Finish	1/08/2036	
	Cedar_Pit_Pumping	Operational pumping of Cedar Pit flow to Dry Creek (inflow = outflow)
Start	1/01/2013	
Finish	31/12/2036	
	Baldy_Pit_to_Natal	Baldy Pit water draining to Natal Pit
Start	1/04/2012	
Finish	31/12/2021	
	Natal_Temp_Storage	Temporary storage in Natal Pit during operations (zero discharge)
Start	1/04/2012	
Finish	31/12/2015	
	Natal_Dewatering	Dewatering of temporary storage in Natal Pit
Start	1/01/2016	(pumping maximum rate of 0.315 m^3/s)
Finish	31/12/2021	
	Natal_to_Gate	Operational pumping from Natal Pit to Gate (inflow = outflow)
Start	1/01/2032	
Finish	31/12/2046	
	Natal_Filling	Filling period for Natal Pit (zero discharge)
Start	1/01/2047	
Finish	1/09/2070	
	Adit_Pit_Filling	Filling period for Adit Pit (zero discharge)
Start	1/01/2047	
Finish	31/12/2088	
	Natal_to_Baldy_to_Bodie	Natal Pit spills to Baldy Pit (which spills to Bodie Creek)
Start	1/10/2070	
Finish	1/01/2200	

APPENDIX C

NATAL PIT DEWATERING RATES

July 2014

LIST OF TABLES

Table C-1: Natal Pit Dewatering Rates under Different Flow Conditions (m^3/d)

Month	Average Flow	High Flow	Low Flow
Jun-2014	-	20,000	-
Jul-2014	-	39,000	-
Aug-2014	10,000	10,000	3,000
Sep-2014	10,000	10,000	1,000
Oct-2014	10,000	35,000	2,000
Nov-2014	10,000	35,000	1,000
Dec-2014	10,000	35,000	500
Jan-2015	5,000	20,000	1,000
Feb-2015	7,000	20,000	1,000
Mar-2015	20,000	39,000	3,000
Apr-2015	39,000	39,000	25,000
May-2015	39,000	39,000	39,000
Jun-2015	39,000	39,000	39,000
Jul-2015	39,000	39,000	30,000
Aug-2015	7,000	10,000	3,000
Sep-2015	7,000	7,000	1,000
Oct-2015	10,000	39,000	3,000
Nov-2015	10,000	35,000	5,000
Dec-2015	7,500	35,000	-
Jan-2016	5,000	15,000	-
Feb-2016	7,500	20,000	-
Mar-2016	20,000	39,000	3,000
Apr-2016	39,000	39,000	25,000
May-2016	39,000	39,000	39,000
Jun-2016	39,000	39,000	39,000
Jul-2016	35,000	39,000	30,000
Aug-2016	5,000	10,000	3,000
Sep-2016	7,500	10,000	1,000
Oct-2016	10,000	35,000	3,000
Nov-2016	10,000	39,000	-
Dec-2016	5,000	20,000	-
Jan-2017	5,000	15,000	-
Feb-2017	5,000	15,000	-
Mar-2017	20,000	39,000	3,000
Apr-2017	39,000	39,000	25,000
May-2017	39,000	39,000	39,000
Jun-2017	39,000	39,000	39,000
Jul-2017	30,000	39,000	30,000
Aug-2017	5,000	7,000	3,000
Sep-2017	5,000	10,000	1,000
Oct-2017	10,000	25,000	3,000
Nov-2017	10,000	39,000	-
Dec-2017	5,000	20,000	-
Jan-2018	-	10,000	-
Feb-2018	-	15,000	-
Mar-2018	15,000	39,000	1,000
Apr-2018	39,000	39,000	15,000
May-2018	39,000	39,000	39,000

Table C-1: Natal Pit Dewatering Rates under Different Flow Conditions (m^3/d) (continued)

Month	Average Flow	High Flow	Low Flow
Jun-2018	39,000	39,000	39,000
Jul-2018	25,000	39,000	25,000
Aug-2018	2,000	7,000	3,000
Sep-2018	4,000	10,000	-
Oct-2018	10,000	25,000	-
Nov-2018	10,000	39,000	-
Dec-2018	5,000	20,000	-
Jan-2019	-	10,000	-
Feb-2019	-	10,000	-
Mar-2019	15,000	25,000	3,000
Apr-2019	20,000	39,000	15,000
May-2019	35,000	39,000	39,000
Jun-2019	39,000	39,000	39,000
Jul-2019	35,000	25,000	25,000
Aug-2019	-	3,000	1,000
Sep-2019	-	1,000	-
Oct-2019	10,000	20,000	-
Nov-2019	10,000	39,000	-
Dec-2019	3,000	15,000	-

- = no dewatering pumping.