

Prepared for:

**Surat Basin Rail Joint Venture
c/o AECOM Australia Pty Ltd
12 Cribb Street
Milton Qld 4064**

Groundwater Impact Assessment

Surat Basin Rail Joint Venture

Final

AECOM

16 December 2009

Document No.: B1015902_RPTFinal_16Dec09.doc

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Groundwater Impact Assessment Surat Basin Rail Joint Venture

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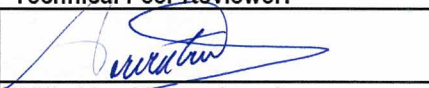
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Glossary of Terms

BGS	Below Ground Surface
CSG	Coal Seam Gas
DVWSS	Dawson Valley Water Supply Scheme
DERM	Department of Environment and Resource Management
DO	Dissolved Oxygen
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
ESA	Environmental Site Assessment
GAB	Great Artesian Basin
IPA	Integrated Planning Act
km	kilometres
km ²	square kilometres
ML	megalitres
ML/yr	megalitres per year
m	metres
m/day	metres per day
m ² /day	square metres per day
m ³ /day	cubic metres per day
µg/L	micrograms per litre
µS/cm	MicroSiemens per centimetre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
ppm	parts per million
ROP	Resource Operations Plan
SWL	Standing Water Level
SBRJV	Surat Basin Rail Joint Venture
TIA	Theodore Irrigation Area
TDS	Total Dissolved Solids
WRP	Water Resources Plan

Artesian Bore – includes a shaft, well, gallery, spear or excavation, and any works constructed in connection with the shaft, well, gallery, spear or excavation, that taps an aquifer and the water flows, or has flowed, naturally to the surface

Subartesian Bore – includes a shaft, well, gallery, spear or excavation, and any works constructed in connection with the shaft, well, gallery, spear or excavation, that taps an aquifer and the water does not flow and never has flowed naturally to the surface

Unallocated General Reserve Water – water reserved by the state available for those eligible to be granted a water license

Unallocated State Reserve Water – unallocated water reserved by the state for projects of state significance, regional significance or for town water supply purposes

Water Allocations – an entitlement to be supplied with a volumetric share of water by the operator of a water supply scheme

Water Entitlement – means a water allocation, interim water allocation or water license

Water Licence – authority of owner of a parcel of land to take and use water on that land and to interfere with the flow of water on, under or adjoining any of the land

Water Permit – authority to take water for an activity, including, for example, the construction of a road and must have a foreseeable conclusion date

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1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has undertaken a groundwater impact assessment as part of a supplementary environmental impact statement (EIS) for the Surat Basin Rail Joint Venture (SBRJV). The purpose of the joint venture is to construct a 210-km railway that connects the existing western railway system at Wandoan, Queensland and the Moura railway system at Banana, Queensland.

The SEIS, and in particular, the groundwater impact assessment, were designed to supplement the EIS that was completed in February 2009. Since the initial submittal, additional information was made available to provide a more detailed assessment of the water supply options as well as an assessment of the potential impacts to groundwater.

The objective of the groundwater impact assessment is to:

- Assess the availability and potential yield of existing groundwater resources in the project area for water supply.
- Evaluate the potential impacts of the project on the existing groundwater resources and environment.
- Identify management and mitigation measure to address such potential impact.

1.1 Scope of Works

In order to meet the objectives of this assessment, AECOM undertook the following:

- Desktop review of the hydrogeological environment, including:
 - The occurrence, characteristics and interconnectivity of aquifers in the project area.
 - Groundwater levels and water quality characteristics.
 - Recharge / discharge mechanisms.
 - Groundwater usage.
 - Environmental values associated with the aquifers.
- Assessment of different water supply options, using a combination of surface water and groundwater supply sources, including, but not limited to Great Artesian Basin (GAB) groundwater, coal seam gas (CSG) production water and surface water.
- Assessment of current water licences to identify potential groundwater resources available to the project.
- Development of water demand schedule for the project in terms of potential water sources, water demand, water quality, location and timeframe along the railway line.
- Analytical modelling to assess the impacts of the groundwater demand on the aquifers, in terms of extent and level of drawdown on current groundwater users. The results of the model assisted in evaluating potential groundwater sources for the project.
- Evaluation of the potential groundwater sources, with respect to viability, impact assessment and identification of management / mitigation measures of identified impacts. In addition, the regulatory requirements for obtaining groundwater were identified.

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2.0 Construction Water

A detailed water supply study was undertaken as part of the EIS and SEIS (Aurecon Hatch, 2009a). Three potential water supply sources to meet the water demand of the project have been identified, i.e. surface water, groundwater and Coal Seam Gas produced water. Aurecon Hatch (2009a) provides a detailed description and assessment of the surface water and CSG water supplies in the construction water supply portion of the EIS.

Table 1 provides a summary of the proposed water use and volume required to complete the project based on an analysis by Aurecon Hatch (2009a). The construction phase of the project is expected to last for 33 months.

Table 1: Estimated Water Volume Requirements for Construction

Description	Minimum Water Required (ML)	Maximum Water Required (ML)
Bulk Earthworks	1,420	1,662
Concrete	18	18
Pavement	246	246
Dust Suppression	810	910
Miscellaneous	130	465
Construction Camps	80	80
Contingency	650	800
Total	3,300	4,200

2.1 Water Supply Options

A summary of the water supply options available to the project is provided below.

2.1.1 Surface Water

Surface water is managed by DERM and SunWater. DERM is responsible for authorising works, water licences, unsupplemented water allocations and water permits, while SunWater manages the water allocations in the Dawson Valley Water Supply Scheme (DVWSS) in the Fitzroy Basin Resource Operations Plan (ROP).

The primary source of surface water within the project area is the Dawson River, managed under the DVWSS. The Dawson River is a major tributary of the Fitzroy River and originates in the Carnarvon Gorges, north of Injune, approximately 640 km in length. The catchment area of the Dawson River is approximately 50,800 km², and is bounded to the west by the Lynd and Exhibition Ranges, the Great Dividing Range to the south, and the Auburn, Calliope, Ulam and Dee Ranges to the east. The Dawson River combines with the Mackenzie River to form the Fitzroy River, which discharges into Keppel Bay near Rockhampton.

The project is reasonably close to the Dawson River from Cracow to Banana, so surface water could potentially be collected from a number of weirs, including Glebe, Gyranda and Isla Delusion along the river. Although there is no unallocated water in the DVWSS, water is available through short term water permits or trading of existing water allocations. This water source is not as reliable as other options because its availability is dependent on precipitation and catchment runoff.

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According to the Construction Water Supply Report (Aurecon Hatch, 2009a), approximately 1,500 ML of water would be required for the northern portion of the project. Given the absence of viable groundwater resources in this area, this water demand is proposed to be primarily obtained from the Dawson River. The Construction Water Supply Report and Surface Water Impact Assessment reports (Aurecon Hatch, 2009a) provide more detail on the surface water supply option and impacts.

2.1.2 Groundwater

The major source of groundwater for this project is the Great Artesian Basin (GAB) in the southern portion of the project area. The GAB is managed under the Water Resource (Great Artesian Basin) Plan and the Great Artesian Basin ROP. The legislative framework permits groundwater within the GAB to be extracted through a number of options (discussed in more detail in **Section 1.1**). Groundwater is the preferred water source in the southern portion of the project due to its reliability as a water source and its quality.

Another potential groundwater source in the project area is the Dawson River Alluvium, located in the southern and northern portions of the project. Although the sub-artesian aquifers can locally have high yields and groundwater is shallow, this water supply source is not considered reliable for the project because it is dependent on rainfall, and the water quality is significantly less than groundwater in the GAB.

Based on the estimated surface water demand (1,500 ML), approximately 1,800 ML to 2,700 ML of groundwater would be required to meet the project's water demands.

2.1.3 Coal Seam Gas

A potential water supply source for the project is the produced water from existing CSG operations. The major gas fields in the vicinity of the project area are in the Bowen Basin (northern portion of the project) and in the Surat Basin (southern portion of the project). These fields include the Dawson Valley near Banana, and the Peat and Scotia fields near Wandoan.

The Dawson Valley field produced 29.1 ML of water in 2007-2008 whilst the Peat field produced 20.1 ML. The Scotia field did not produce any water in 2007/08 according to DME reports. The low water production from these bores is due to the age and location of the fields. All fields have been established for some time and therefore water production has decreased substantially.

CSG fields outside the Project such as the Fairview and Spring Gully fields near Injune and the Berwyndale South located south of Miles produce higher quantities of water, with production of 2,007 ML/a, 1,976 ML/a and 1,955 ML/a respectively (DME, 2008). Fairview and Spring Gully are located over 85 km to the west of the Project whilst Berwyndale South is 80 km to the south of the Project.

CSG-derived water is a minor source of water compared to surface water and groundwater, and the water quality is poor with respect to the project requirements. Electrical conductivity values for water in coal seams can range from 2,000 – 5,000 $\mu\text{S}/\text{m}$, with pH values ranging from 8 – 9. Use of typical water from SCG field could require treatment prior to construction use, so it is unlikely that this is a viable source for water.

Aurecon Hatch (2009b) provides more detail in the surface water impact assessment portion of the EIS.

3.0 Legislative Framework

As part of this groundwater impact assessment, a brief review of applicable legislation has been undertaken, with the purpose to identify any regulatory constraints/requirements or approval processes. The relevant legislation with respect to the groundwater resources for the project includes:

- The Queensland Water Act 2000
- Water Resources (Great Artesian Basin) Plan 2006
- The Great Artesian Basin Resource Operations Plan 2006
- The Water Resources (Fitzroy Basin) Plan 1999
- The Fitzroy Basin Resource Operation Plan 1999

3.1 Queensland Water Act 2000

The *Queensland Water Act (2000)* was drafted to govern all surface water and groundwater in the state. The state is divided into 22 catchments that are individually managed. This project falls within two catchments: the Great Artesian Basin in the southern part of the project, and the Fitzroy Basin in the northern part of the project. A Water Resources Plan (WRP) has been developed for each of these catchments to define the government's goals for achieving a balance between the allocation and sustainable use of water to meet human needs and meeting the needs of the environment. A Resource Operations Plan (ROP) has also been developed for these catchments to detail how the government will achieve the goals specified in the WRP.

Under the water act, there are a number of options for accessing surface water and groundwater within the GAB. The legislative means of access to this water are:

- Unallocated state reserve water.
- Unallocated general reserve water.
- Water allocations.
- Water licence.
- Water permit.

These options are discussed in more detail in **Section 3.5**.

3.2 Water Resources (Great Artesian Basin) Plan 2006

The Water Resources (Great Artesian Basin) Plan was released in 2006 under the Queensland Water Act (2000). The plan states that its purpose is to define the availability of water in the GAB, provide a framework for sustainably managing water and the taking of water and to identify priorities and mechanisms for dealing with future water requirements.

The WRP subdivides the GAB into 25 management area, and are further subdivided into management units. The southern portion of the project falls within management units Surat North 2 and Surat North 3 of the Surat North management area, and management unit Mimosa 1 of the Mimosa management area. For the purposes of this project, only the Surat North management area is considered to have groundwater accessible to meet the demands of the project.

3.3 Great Artesian Basin Resource Operations Plan 2006

The Surat North management area is governed under the GAB ROP, and implements the goals outlined in the WRP. The GAB ROP applies to the following water within their respective management areas:

- Artesian water.
- Subartesian water connected to artesian water.
- Water springs connected to artesian water or subartesian water connected to artesian water.

This plan provides a sustainable management of water by protecting environmentally and culturally significant springs and waterways and ensuring that water resources are properly allocated.

3.4 Water Resources (Fitzroy Basin) Plan and Fitzroy Basin Resource Operation Plan

The purpose of the WRP and ROP for the Fitzroy Basin is similar to the GAB WRP, but it applies to:

- Water in a watercourse or lake.
- Water in springs not connected to artesian water or subartesian water connected to artesian water.
- Overland flow water, other than water in springs connected to artesian water or subartesian water connected to artesian water.

For the purposes of this groundwater impact assessment, groundwater in the Fitzroy Basin is not considered a viable option to meet the water demands of the project because of unreliable yields and decreasing water quality.

Water legislation, with respect to groundwater, is only considered for the GAB in this assessment because only surface water resources in the northern part of the project can sustain the construction activities within the Fitzroy Basin. Groundwater can be accessed in the GAB through water permitting and private agreements with local property owners.

3.5 Water Access Options

3.5.1 State Water Reserve

According to the Water Act 2000, there is approximately 10,000 ML of groundwater that is unallocated at any given time within the GAB. This groundwater is declared to be reserved for:

- A project of state significance.
- A project of regional significance.
- For water granted to a local government – town water supply purposes.

Although this project is classified as a project of state significance, the state is not releasing unallocated water at this time, according to DERM. Therefore, unallocated state reserved water is not considered a viable source for groundwater for this project.

3.5.2 Water Allocations

Water allocations are assigned to land, much like a title is assigned to land, and grant that land a volumetric limit of water per water year (1 July – 30 June). Water not utilised during the water year can be traded between two parties. DERM has defined water allocations as being associated with surface water, so groundwater cannot be obtained or traded through water allocations.

3.5.3 Water Licenses

According to DERM, water licenses are the equivalent to water allocations for groundwater within the GAB. Therefore, under the GAB ROP, the groundwater could be traded between parties within the water year. This can be done through a seasonal water assignment, which is defined as:

“A temporary assignment of all or part of the volumetric limit, under a water licence, from the licensee to another person (the assignee) within a water year.”

The license from which the assignment can be obtained from must state a volumetric limit or have a ‘metered entitlement’. Under rules set forth by the GAB ROP:

- The assigned water cannot be taken outside the groundwater management area or management unit from which it is drawn.
- The maximum water volume that can be taken under the assignment during a water year is 100 ML.
- More water can be assigned if it is shown that the impact to the aquifer can be managed.
- A hydrogeological assessment may be required to demonstrate the impacts on the aquifer by increasing the assignment.

Results of correspondence and license data obtained from DERM indicate that water licenses designated for stock purposes (approximately 75% of wells in search area) do not state a volumetric limit. Wells in the GAB with volumetric limits stated on the licenses are not yet ‘metered entitlements’. Therefore, groundwater through water licenses cannot be traded at this time.

3.5.4 Water Permits

A party may apply for a water permit for taking water for an activity (e.g. construction, mineral exploration, petroleum exploration). In order to qualify for a water permit, the activity must have a reasonably foreseeable conclusion date. In order to obtain a water permit, the proposed use must be in compliance with the applicable WRP and ROP and consideration must be given to the impact on existing water entitlements and natural ecosystems.

A water permit may be granted on new and existing groundwater bores, regardless of the license or allocation attached to that bore and/or land. DERM has indicated that this is the most suitable option for acquiring groundwater within the GAB.

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4.0 Description of the Existing Groundwater Environment

4.1 Regional Geology and Stratigraphy

The following is a summary of the regional geologic setting at and in the vicinity of the project area as described by Anulka N.L. (1996). A generalised stratigraphic column is provided as **Figure 1**. A geology map of the southern portion of the project area is provided in **Figure F1**.

The basement rocks are composed of the Palaeozoic Kuttung Formation consisting of metasediments and metavolcanics. The basement units are unconformably overlain by formations within the Bowen Basin. These include the Early Permian Back Creek Group in the basal part, and consist of marine to paralic clastic and volcanoclastic sediments. This formation is known as a good source for oil. The Late Permian Kianga Formation conformably overlies the Back Creek Group. The Kianga formation is composed of a sequence of coal, siltstone, shale and sandstone. Many regard this formation as being the major oil source in the region.

The Early Triassic Rewan Group unconformably overlies the Kianga Formation. The Rewan Group is a volcanogenically-derived conglomerate, sandstone and siltstone. The Mid-Triassic Showgrounds Sandstone conformably overlies the Rewan Group consisting of a quartzose sandstone sequence. The Showgrounds Sandstone is considered equivalent to the Clematis Sandstone, located north and west of the project area. The Moolayember Formation, including the Snake Creek Member, conformably overlies the Showgrounds and Clematis Sandstone. The Snake Creek Member of the Moolayember is a dark grey-black shale, providing a good seal for the underlying sandstone formations. The remaining sequences of the Moolayember Formation consist of progradational deltaic deposits of shales through to siltstones and sandstones overlain by a siltstone / sandstone sequence.

A major unconformity exists between the Bowen Basin and overlying Surat Basin, where much of the Triassic sediments were eroded. The basal formation of the Surat Basin is the Early to Mid-Jurassic Bundamba Group, including the Precipice Sandstone, Evergreen Formation and Hutton Sandstone. The Precipice Sandstone is a thick quartzose braided stream sandstone sequence. Most parts of the basin have an upper sandstone sequence separated by a tight siltstone / shale unit, which acts as a seal of the lower sandstone sequence. The Precipice is known as a major reservoir for groundwater. The Evergreen Formation acts as a seal for the upper sandstone sequence of the Precipice Sandstone. Within the Evergreen Formation is the Boxvale Sandstone, which consists of reservoir quality sandstone. The Mid-Jurassic Hutton Sandstone conformably overlies the Evergreen Formation, and consists of a thick sequence of quartzose braided stream sandstones. This formation can include siltstone and shale in the basal sequences. The formations within the Bundamba Group are part of the GAB, and are the focus of this assessment. The overlying Walloon Coal Measures provides a good seal over the Hutton Sandstone, which is considered a reliable source groundwater in the region.

The Bundamba Group is conformably overlain by the Mid to Late Jurassic Injune Creek Group, including the Walloon Coal Measures, Springbok Sandstone, Birkhead Formation and Westbourne Formation. The Walloon Coal Measures is comprised of a sequence of coal, shale, siltstone and generally tight sandstone. Conformably overlying the Walloon Coal Measures is the Springbok Formation, consisting of quartzose sandstone. This is overlain by siltstone, mudstone and minor sandstone of the Westbourne Formation.

The Late Jurassic to Early Cretaceous Blythesdale Group conformably overlies the Injune Creek Group, and includes the Gubberamunda Sandstone, the Orallo Formation, the Mooga Sandstone and Bungil Formation. The Gubberamunda Sandstone and Orallo Formation consist of lacustrine to fluvial depositional environments, while the Mooga Sandstone and Bungil Formation consist of fluvial and paralic deposits, respectively.

Conformably overlying the Blythesdale Group is the Early Cretaceous Rolling Downs Group, including the Doncaster Member, Coreena Member, Surat Siltstone and Griman Creek Formation. These sequences consist of fluctuating marine and coastal / alluvial depositional environments. The Rolling Downs Group completes the stratigraphic sequence within the Surat Basin.

Figure 1: Generalised Stratigraphy of the Bowen and Surat Basins (Adapted from Geobyte, 1997)

Basin	Age		Unit	Environment	
Surat Basin	Cretaceous	Early	Rolling Downs Group	Griman Creek Formation	Shallow marine coastal plain
				Surat Siltstone	
			Coreena Member	Shallow marine coastal plain	
			Doncaster Member		
		Blythesdale Group	Bungil Formation	Coastal plain, deltaic shoreline, shallow marine	
			Mooga Sandstone	Fluvial	
	Orallo Formation		Fluvial, lacustrine, possibly brackish coastal environments		
	Jurassic	Late	Gubberamunda Sandstone	Fluvial	
			Injune Creek Group	Westbourne Formation	Shallow marine shoreline and coastal plain
		Springbok Sandstone		Fluvial, paludal, deltaic	
		Walloon Coal Measures & Birkhead Formation		Paludal, lacustrine, fluvial	
		Early	Bundamba Group	Hutton Sandstone	Fluvial
				Evergreen Formation	Fluvial, deltaic, minor marine
Precipice Sandstone				Fluvial	
Bowen Basin	Triassic	Middle	Moolayember Formation	Fluvial, deltaic	
			Snake Creek Mudstone	Lacustrine	
			Showgrounds Sandstone	Fluvial	
	Permian	Early	Rewan Group	Terrestrial, fluvial	
		Late	Kianga Formation	Mainly fluvial, lacustrine, paludal	
		Early	Back Creek Group	Shallow marine coastal plain	
Tasman Geosyncline	Carboniferous - Devonian		Kuttung Formation Timburry Hills Formation Roma Granite	Shallow marine, intrusive, terrestrial	

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4.2 Regional Hydrogeology

As stated in **Section 2.0**, there are two primary groundwater supply aquifer in the vicinity of the project. These are the GAB aquifer in the southern portion of the project (i.e. the “southern water supply area”), and the unconfined aquifers that are located within the GAB catchment and the Fitzroy Basin (i.e. the “northern water supply area”).

4.2.1 Great Artesian Basin Aquifers

The southern water supply area encompasses approximately 90 km of the proposed railway, and is within the GAB catchment. The GAB covers an area of approximately 1.7 square kilometres, extending from Cape York to the north to Dubbo in the south. It is estimated that the GAB stores approximately 64,900 million megalitres (Department of Natural Resource and Water, 2006). It is estimated that there is approximately 1 million ML of recharge in the GAB per year. Confined aquifers within the GAB are the primary source for groundwater in the region. The confined aquifers in the GAB produce either artesian or subartesian groundwater.

Historical groundwater measurements show that groundwater within the eastern part of the GAB flows in a southerly direction, while groundwater within the northern part of the GAB flows north towards the Gulf of Carpentaria. The groundwater velocity is considered slow, ranging from 1 to 5 m per year based on available regional hydraulic parameter data (Great Artesian Basin Consultative Council, 1998). The youngest water is found near the recharge zones and has been dated to thousands of years old. The oldest groundwater in the GAB has been dated close to two million years old.

The majority of groundwater in the southern portion of the GAB discharges through mound springs to the southwest. There are mound springs local to the project area that discharge water as a result of geological structures such as folds, faults, monoclines and intersecting lineaments, or because the confining layers are thin. The majority of springs in the vicinity of the project area are classified as recharge springs, where groundwater flows to the surface because the rate of precipitation exceeds the rate at which the aquifer can accept water.

The GAB catchment is divided into 25 management areas in order to better govern groundwater resources. The project specifically falls within the Surat North management area and the Mimosa management area.

Within the Surat North management area, there are four management units:

- Surat North 1 (Westbourne Formation, Springbok Sandstone, Walloon Coal Measures, Eurombah Formation).
- Surat North 2 (Hutton Sandstone, Evergreen Formation).
- Surat North 3 (Precipice Formation).
- Surat North 4 (Moolayember Formation, Clemantis Sandstone).

According to the GAB ROP, only groundwater within the Hutton Sandstone, Evergreen Formation and Precipice Sandstone is accessible. Therefore, groundwater from management units Surat North 1 and Surat North 4, as well as the Mimosa management area is not available.

Groundwater within the Precipice Formation is generally preferred because of its high yields, while the Hutton Sandstone is heavily utilised because of its shallowness compared to other aquifers.

4.2.2 Unconfined Aquifer

The principal unconfined aquifer in the project area is the Dawson River alluvium, which is present in the southern and northern water supply areas. Bores screened within the unconfined aquifers produce subartesian water. The Dawson River alluvium is typically composed of soils ranging from unconsolidated clays, silts, sands and gravels. Until 1985, Theodore obtained town water supplies from bores screened in the Dawson River alluvium at a rate of approximately 150 ML/yr, but due to deteriorating water quality over time, the town has become reliant on the Dawson River for its water source.

Although there are a number bores screened in the unconfined aquifers, they are not considered a feasible source for water due to unreliable yields and deteriorating water quality.

4.3 Groundwater Bore Searches

AECOM obtained two groundwater bore databases from DERM. The first database (herein referred to as the groundwater database) includes borehole registration information, borehole logs, well construction details and hydrogeologic data (e.g. water level, yield, water quality, etc.). The second database (herein referred to as the license database) includes a list of groundwater bores that have water license information (e.g. license status, management area, purpose, etc.). Correspondence with DERM confirmed that there is some conflict between some of the data in the databases with more bores listed in the groundwater database than in the license database. The wells in the groundwater database no longer exist, were unintentionally omitted from the license database or have not been licensed since the license database was constructed.

It must be recognised that the DERM groundwater database contains data that has not been validated or verified. However, the data is considered of sufficient quality for the purpose of this groundwater impact assessment study.

The groundwater database identified 1,888 bores in the Surat North management area, while the license database identified 552 existing, licensed groundwater bores (**Figure F2**). It is assumed that only the bores listed in the license database are accessible. Groundwater bores in the license database include:

- 272 groundwater bores are screened across the Hutton Sandstone.
- 165 bores are screened across the Precipice.
- 89 of these bores are screened in the Evergreen Formation.
- 11 are screened in Quaternary alluvial deposits.
- The formation from which water is drawn from is not known for 15 of the bores, but because the licenses state they are managed within Surat North 2 and Surat North 3, it is assumed that water can be drawn from these bores.

According to the databases, 440 of these bores are classified as subartesian, and 106 are considered artesian. The remaining six bores are not classified.

These wells are privately owned as their registered numbers are six digits or below. A list of the groundwater bores identified in the license database are provided in **Table T1** and a map showing which aquifers the well are screened across is provided in **Figure F3**.

The following sections summarise data obtained from the groundwater database. Although some of the data was taken from bores not included in the license database, the data are still useful for understanding the hydrogeological conditions of the project area.

4.4 Description of Environmental Values

The following provides a description of the environmental values associated with the groundwater resources. Groundwater resources in the project area, particularly the southern portion, are an integral part of the overall existing water resource system that are utilised by a number of existing users. Groundwater will be a significant resource for the construction and operation of the project, therefore, the protection and monitoring of this resource is relevant.

4.4.1 Groundwater Levels

There are very few recent groundwater level measurements (within the last six years) reported in the groundwater database. From available data, groundwater levels in the last six years has ranged from approximately 12 m below ground surface (BGS) to approximately 42 m BGS. Although the database states some of these groundwater bores are subartesian, borehole log data indicate they are screened in GAB artesian aquifers. A summary of the water levels for these wells are provided in **Table T2**.

The database included 125 historical water level records, dating from 1938 to 2007, for bores screened within the Hutton Sandstone. Depth to groundwater measured during this period of time has ranged from 0.1 m to 140.2 m below the measured reference point. Although groundwater levels vary depending on the bore location within the GAB, the levels appear to have remained stable over time. There were only 41 records for water levels in bores screened within the Precipice Sandstone, dating from 1954 to 1997. Groundwater levels ranged from 0.44 m to 61.6 m below the measured reference point.

Many of the wells identified in the groundwater bore search contain historical groundwater data. This data can be used to assess historical groundwater fluctuation due to seasonal variations and / or groundwater extraction. Unfortunately, much data is restricted to wells screened in the subartesian aquifers outside the study area. Groundwater level data within the study area are sparse and generally 30 to 40 years old. It can be assumed, however, that groundwater bores screened across the GAB will not exhibit the magnitude of variations that might be observed in subartesian groundwater bores.

4.4.2 Groundwater Quality

Numerous groundwater quality parameters were reported in the groundwater database for artesian and subartesian water. The parameters of interest to this project included the following:

- pH
- Total Dissolved Solids
- Sodium
- Sulphate
- Chloride.

The parameters were compared to the following:

- Drinking Water – 2004 Australian Drinking Water Guidelines (ADWG) from the National Health and Medical Research Council and Agriculture and Resource Management Council of Australia and New Zealand (NHMRC)
- Concrete – AS1379
- Dust Suppression / Earthworks – Queensland Environmental Protection Agency, Decision to approve a resource for beneficial use – Associated water.

Based on the data provided by DERM, groundwater in the unconfined aquifers (e.g. Dawson River alluvium) is considered to have poor water quality, and is generally not suitable for the purposes of this project.

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Table 2 provides a summary of the groundwater quality requirements for the project water uses, as well as the number of licensed bores in the Hutton Sandstone and Precipice Sandstone that meet the water quality requirements.

Table 2: Summary of Groundwater Quality (Hutton and Precipice Sandstone)

	Units	Use			
		Earthworks / Dust Suppression (EPA)	Concrete (AS1379)	Drinking Water (ADWG)	Not Suitable
pH	pH units	6.0 – 9.0	>5	6.5 – 8.5	-
Total Dissolved Solids	mg/L	<2,000	<1,000	<500	-
Sodium	mg/L	-	-	<180	-
Chloride	mg/L	-	<1,000	-	-
Sulphate	mg/L	-	-	<250	-
Hutton Sandstone	No. Suitable	89	89	83	0
Precipice Sandstone	No. Suitable	70	69	68	0

Notes:

Earthworks/Dust Suppression – Queensland Environmental Protection Agency, Decision to approve a resource for beneficial use – Associated water

Concrete – Australian Standard AS1379

Drinking Water – 2004 ADWG from the NHMRC

The majority of bores near the proposed railway that are screened in the Hutton Sandstone appear to only be suitable for construction activities because TDS concentrations are above 1,500 mg/L and sodium concentrations are above 180 mg/L. Groundwater within the Precipice Sandstone is considered suitable for most uses for the project.

Groundwater quality data for groundwater bores identified in the database search are provided in **Table T3**. A map showing the TDS concentrations of groundwater in bores is provided as **Figure F4**. A map showing the suitability of bores in the vicinity of the project area based on the water quality parameters discussed above is provided as **Figure F5**. **Figure F4** and **Figure F5**. In general, groundwater quality is poorest in the southern part of the project area and increases towards the 90 km chainage.

4.4.3 Springs

There are more than 600 spring complexes (Herczeg and Love, 2007) in 12 major spring groups (Fensham, 2006) around the margins of the GAB. Most of the springs located on the eastern margin of the GAB are considered surface expressions of recharged ‘overflow’, where the rate of recharge exceeds the hydraulic conductivity of the aquifers. Flora and fauna are diverse and plentiful in the vicinity of the springs, and are of cultural value to indigenous people.

A review of the spring register provided by DERM showed that there are recharge springs in the vicinity of the project. There are 64 recharge springs and two watercourse springs derived from the Hutton Sandstone, and 11 recharge springs and two watercourse springs derived from the Precipice Sandstone **Table T4: Recharge and Watercourse Springs Figure F3**.

According to the Australian Wetlands Database provided by Department of Environment, Water, Heritage and the Arts, Boggomoss springs are located near the project as well. (**Figure F3**). The springs are derived from the GAB, where the Dawson River has eroded overlying soil and rock, exposing the aquifers. Based on the geological map, the spring water appears to be derived from groundwater in the Precipice Sandstone. It has been documented that snail species, endemic to Boggomoss springs, exist in these springs.

The nearest springs are recharge springs derived from the Hutton Sandstone (**Figure F3**). It is considered unlikely that the project would adversely affect these springs because the wells in this area draw water from the Precipice Sandstone. The nearest springs that could be impacted by groundwater extraction are recharged springs derived from the Precipice Sandstone located approximately 10 km northwest of the proposed railway.

The Boggomoss Springs are located near the Dawson River, approximately 10 km from the nearest point of the proposed rail and approximately 7.5 km from the nearest groundwater bores screened in the Precipice Sandstone. Given the springs' location relative to the groundwater bores, and the likelihood that the springs are derived from the Precipice Sandstone, there is potential that the springs could be impacted by long-term extraction from the nearby groundwater bores.

According to DERM, there is no predefined acceptable impact threshold for a spring due to groundwater extraction when applying for a water permit. DERM still requires that those impacts be assessed as part of the application process, and the SBRJV would work with DERM to evaluate the impacts on a case by case basis.

4.4.4 Existing Groundwater Uses

Groundwater in the project area is primarily used for stock and domestic purposes. The source of groundwater is either the GAB aquifers or unconfined aquifers. The townships of Wandoan and Taroom depend on the GAB for their water resources, while townships between Cracow and Banana rely primarily on surface water (e.g. Dawson River) and, to a limited extent, groundwater from the Theodore Irrigation Area (TIA). Most of the groundwater derived from the TIA is used to irrigate crops, such as wheat and cotton.

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5.0 Analytical Groundwater Model

The section describes an analytical groundwater model that has been developed to quantify the potential adverse impacts from extraction of GAB groundwater for the project. The objectives of the model are:

- To estimate the drawdown of groundwater in a well over a given period of time.
- To define the region of influence from the groundwater extraction.
- To identify any impacts that the project may have on surrounding land uses and/or ecosystems.

At the request of DERM, the model intends to show that groundwater can be extracted from multiple locations along the project area in order to minimise adverse impacts to groundwater levels in the region while satisfying the demands of the project.

5.1 Analytical Model

According to the GAB ROP, groundwater can be extracted from a bore as long as surrounding bores are not drawn down more than 5 meters during the extraction period. The Theis equation is a tool that can conservatively estimate the impacts to aquifers within the project area, by estimating the drawdown of groundwater in a bore and the extent of the area of influence. The Theis equation is:

$$s = (QW(u)) / (4\pi T)$$

where:

s = drawdown (meters)

Q = extraction rate (m³/day)

W(u) = well function

u = (r²S) / (4Tt)

T = transmissivity (assumed to be 150 m²/day)

r = distance from bore to observation bore or spring (meters)

S = storage coefficient (assumed to be 5 x 10⁻⁴)

t = time (days).

The use of an analytical model such as the Theis equation is preferred over numerical models in this case because the available groundwater data are generally sparse or outdated. The GAB ROP recommends the use of the Theis equation to assess impacts to springs and groundwater bores. The developed analytical model has been used to assess the drawdown associated with potential increased water extraction, above current allocations.

5.2 Model Design

The model is based on groundwater data obtained from DERM and procedures outlined in the GAB ROP. AECOM used the water demand schedule provided by Aurecon Hatch (2009) as well as the proposed construction schedule provided by the SBRJV to derive the groundwater extraction estimates.

Three scenarios were chosen for the model. The first scenario was the minimum groundwater demand proposed in the water demand schedule and the second scenario was the maximum groundwater demand proposed in the water demand schedule. The third scenario was used as a conservative measure for groundwater demand to evaluate the sensitivity of the model. The water demand schedules for each scenario, including potential licensed bores that could be used for the project, are provided in **Appendix A. Charts A1 through A3** in **Appendix A** show the average daily water demand by chainage over the length of the project.

It must be noted that the existing wells used as extraction bores in the model, are only “hypothetical example bores”, and that no negotiations have been finalised with land/well owners and DEM regarding the accessibility and/or use of these wells for the project.

The model was used to model the impact in the GAB part of the project, being the southern 90-km section of the proposed railway. Based on the information discussed in the previous sections, groundwater is not considered a viable source of water outside the GAB. The proposed construction schedule nominates the following four major construction areas/chainages in the southern section:

- 0 – 9 km
- 9 – 19.28 km
- 19.28 – 63 km
- 63 – 90 km.

Construction within these chainages is expected to take approximately 33 months to complete. The following tables (**Table 3** and **Table 4**) show the groundwater demands for the three scenarios assessed with the model.

Table 3: Southern Project Area Water Demand

Chainage	Proposed Minimum Water Demand (ML)	Proposed Maximum Water Demand (ML)	Conservative Water Demand (ML)
0 – 9 km	117.63	177.03	235.26
9 – 19.28 km	140.26	211.08	280.52
19.28 – 63 km	613.19	922.83	1,226.38
63 – 90 km	520.26	835.17	1,109.89
Contingency (25%)	397.84	553.89	647.98
Total	1,800	2,700	3,500

Table 4: Water Demand by Use

Use	Minimum Water Demand (ML) (incl. contingency)	Maximum Water Demand (ML) (incl. contingency)	Conservative Water Demand (ML) (incl. contingency)
Bulk Earthworks	1,093.53	1,640.35	2,125.89
Concrete	16.45	24.62	31.95
Pavement	142.26	213.39	276.59
Dust Suppression	428.96	643.44	833.90
Construction Camps	118.80	178.20	230.95

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Groundwater bores were identified in each of these chainage groups based on databases provided by DERM. The bores in the databases were filtered to only include groundwater that had water quality (outlined in **Section 4.4.2**) suitable for the proposed construction activities. Once suitable bores were identified in each chainage group, the model calculated the drawdown for all licensed bores included in the databases.

According to the GAB ROP, existing groundwater bores in the vicinity of a proposed extraction bore cannot be drawn down more than five metres when applying for a new water license or changing the conditions of an existing license. This gives assurance to neighbouring water license holders that their groundwater is protected. Although it is anticipated that the SBRJV will not apply for new water licenses (or attempt to change existing licenses) for this project, the model utilises the 'five-metre threshold' to demonstrate that the proposed water demand will not adversely affect surrounding groundwater bores.

5.2.1 Hydrogeological Parameters

There are little hydrogeological data (e.g. hydraulic conductivity, transmissivity and storage coefficient) available for the GAB. Hennig (2005) reports these parameters in their desktop study of the GAB. Given the size and variability of the GAB, the values reported by Hennig should be considered indicative only of the aquifers in the project area.

Transmissivity

Transmissivity measurements have ranged from 1 to 2,000 m²/day based on systematic tests by the State Water Authorities (Hennig, 2005). Based on the GAB ROP, transmissivity in the GAB can be categorised into three groups:

- 1 TG-50 – median transmissivity less than 50 m²/day and taken to have a transmissivity of 50 m²/day.
- 2 TG-150 – median transmissivity between 50 and 150 m²/day, and taken to have a transmissivity of 150 m²/day.
- 3 TG-250 – median transmissivity greater than 150 m²/day and taken to have a transmissivity of 250 m²/day.

According to DERM, these median transmissivities are considered appropriate and are indicative of the regional scale aquifer properties.

As stated in **Section 4.2.1**, the southern portion of the Site is within the Surat North 2 and Surat North 3 management units, which are designated as TG-150 in the GAB ROP. Therefore, the transmissivity for the purposes of this report is assumed to be 150 m²/day.

Storativity

The storativity can range from 1×10^{-4} to 1×10^{-5} (Hennig 2005). For the purposes of this report, the GAB ROP states that the storativity coefficient for a confined aquifer is 5×10^{-4} .

Yield

Yield estimates for the Hutton Sandstone, Precipice Sandstone and Dawson River Alluvium have been provided by Connell Hatch et al. (2009) because yield data provided by DERM is scarce and considered outdated. The yields for the Hutton Sandstone are generally moderate and range from 6 to 13 L/s (200 to 400 ML/year) per bore. The deeper Precipice Sandstone has a higher permeability relative to the Hutton Sandstone and has yields from 20 to 30 L/s (630 to 945 ML/year) per bore. Groundwater bores screened in the Dawson River Alluvium can yield 10 to 60 L/s (315 to 1,900 ML/year) per bore.

5.2.2 Assumptions

The key assumptions for this model are as follows:

- The Hutton Sandstone and Precipice Sandstone are hydrogeologically separated units, where groundwater extracted from one aquifer would not impact the other aquifer. Additionally, recharge or watercourse springs associated with those aquifers are also hydrogeologically separated.
- The water demand used in the model is inclusive of the 25% contingency as a conservative measure.
- Individual bores are not identified in this model because arrangements with landowners have not been confirmed. However, individual bores are used as “hypothetical, example” extraction bores.
- The transmissivity value and storage coefficient provided in the GAB ROP is assumed to be constant throughout the GAB in the Hutton Sandstone and Precipice Sandstone.
- The wells used in this model will be accessible during the construction phase of the project.
- The potential impacts to groundwater for stock purposes is not considered because the model only evaluates the effect of additional drawdown on other bores as a result of the proposed construction activities.
- The model does not account for potential faults or other geological structures that could affect the predicted drawdown measurements.
- The model calculates the cumulative effects of drawdown in the bores, and does not take into account recharge if a bore is impacted for more than one time interval. This results in a conservative estimate for drawdown in that bore.
- The model does not take into account the effect on water quality due to groundwater extraction. It is therefore assumed that water quality would remain constant.
- The indicative zone of influence calculations developed from the model (**Table A1**) were compared against the look-up tables (**Tables A3 through A7**) to assess the number of bores that could be used within the chainage that would not result in greater than a 5 metre drawdown.

5.3 Model Results

The following sections provide results of the model for each chainage groups in the three scenarios shown in **Table 3**. The results for each scenario are summarised in **Appendix B** through **Appendix D**. **Figure F6** and **Figure F7** provide a hypothetical configuration of bores that could be used for the project.

5.3.1 0 – 9 km Construction Area

There are three bores screened in the Hutton Sandstone:

- RN 13856
- RN 22117
- RN 58409.

Although RN 58323 is located in the 9 – 19.28 km chainage group, it was included in the model due to its proximity to the 0 – 9 km chainage group. Two bores are screened in the Precipice Sandstone:

- RN 15793
- RN 58700.

It should be noted that these bores are currently licensed for town water supply and are not available for this project.

Scenario 1 – Groundwater Demand: 1,800 ML

One groundwater bore is required for groundwater extraction (**Table B1**). The maximum extraction rate in this chainage would be 1.109 ML/day for 150 days.

Given the water demand for this chainage group, 5 metre drawdown would be expected to occur at a distance of approximately 0.144 km from the extraction point. The minimum distance between bores screened in the Hutton Sandstone is approximately 4.9 km, so the proposed water demand would be unlikely to draw down groundwater more than 5 metres in the adjacent bores.

Scenario 2 – Groundwater Demand: 2,700 ML

One groundwater bore is required for groundwater extraction (**Table C1**). The maximum extraction rate in this chainage would be 1.669 ML/day for 150 days.

Given the water demand for this chainage group, 5 metre drawdown would be expected to occur at a distance of approximately 0.598 km from the extraction point. The proposed water demand would be unlikely to draw down groundwater more than 5 metres in the adjacent bores.

Scenario 3 – Groundwater Demand: 3,500 ML

One groundwater bore is required for groundwater extraction (**Table D1**). The maximum extraction rate in this chainage would be 2.580 ML/day for 150 days.

Given the water demand for this chainage group, 5 metre drawdown would be expected to occur at a distance of approximately 1.245 km from the extraction point. The proposed water demand would be unlikely to draw down groundwater more than 5 metres in the adjacent bores.

5.3.2 9 – 19.28 km Construction Area

There are two licensed bores screened in the Hutton Sandstone within the 9 – 19.28 km chainage group:

- RN 16312
- RN 58232.

RN 13856 is located within the 0 – 9 km chainage group. There are also two licensed bores screened in the Precipice Sandstone:

- RN 16752
- RN 30681.

Scenario 1 – Groundwater Demand: 1,800 ML

A total of three bores were used in the model to minimise the extraction rate per bore. The 5 metre drawdown would occur at a distance 0.027 km from the extraction bores in the Hutton Sandstone and 0.022 km in the Precipice Sandstone. The minimum distance between the licensed bores screened in the Hutton Sandstone is approximately 4.6 km, and approximately 11.5 km for the bores screened in the Precipice Sandstone, so the bores would not be significantly impacted by the project.

Scenario 2 – Groundwater Demand: 2,700 ML

A total of three bores were used in the model to minimise the extraction rate per bore. The 5 metre drawdown would occur at a distance 0.179 km from the extraction bores in the Hutton Sandstone and 0.175 km in the Precipice Sandstone. The minimum distance between the licensed bores screened in the Hutton Sandstone is approximately 4.6 km, and approximately 11.5 km for the bores screened in the Precipice Sandstone, so the bores would not be significantly impacted by the project.

Scenario 3 – Groundwater Demand: 3,500 ML

A total of three bores were used in the model to minimise the extraction rate per bore. The 5 metre drawdown would occur at a distance 0.377 km from the extraction bores in the Hutton Sandstone and 0.447 km in the Precipice Sandstone. The minimum distance between the licensed bores screened in the Hutton Sandstone is approximately 4.6 km, and approximately 11.5 km for the bores screened in the Precipice Sandstone, so the bores would not be significantly impacted by the project.

5.3.3 19.28 – 63 km Construction Area

The 19.28 – 63 km chainage group is much larger than the preceding chainage groups, and as a consequence requires more water over a longer period of time. This chainage group was broken into four sub groups to more easily manage groundwater:

- 19.28 – 30 km
- 30 – 41 km
- 41 – 52 km
- 52 – 63 km.

By taking into consideration costs and logistics associated with water transportation, a minimum of one bore was included for each sub group.

There are 23 bores screened in the Hutton Sandstone and 24 bores screened in the Precipice Sandstone that could be considered for water supply in this chainage group.

Scenario 1 – Groundwater Demand: 1,800ML

A total of five bores were chosen to meet the water demands in this chainage. Two bores were chosen in the 19.28 – 30 km sub group (one bore screened in the Hutton Sandstone and one in the Precipice Sandstone) to minimise drawdown.

The five metre drawdown in the Hutton Sandstone would occur at a maximum distance of approximately 0.411 km in the 52 – 63 km sub group. There are two bores (RN 14538 and RN 23147) that are 0.349 km apart in the Hutton Sandstone (**Table B5**). Therefore, these wells could be impacted by the groundwater extraction from the Hutton Sandstone; however, further, detailed studies could be undertaken as part of the approvals process to better determine the potential impacts.

The maximum distance to five metre drawdown in the Precipice would be approximately 0.022 km. The minimum distance between bores screened in the Precipice Sandstone is approximately 0.221 km, so the bores would not be significantly impacted by the project.

Scenario 2 – Groundwater Demand: 2,700 ML

A total of five bores were chosen in this scenario to meet the water demands in this chainage. The five metre drawdown in the Hutton Sandstone would occur at a maximum distance of approximately 1.160 km in the 52 – 63 km sub group. There are still two bores (RN 14538 and RN 23147) that would be adversely impacted like the 1,800 ML scenario (**Table C5**). Therefore, these wells could be impacted by the groundwater extraction from the Hutton Sandstone; however, further, detailed studies could be undertaken as part of the approvals process to better determine the potential impacts.

The maximum distance to five metre drawdown in the Precipice would be approximately 0.215 km. The minimum distance between bores screened in the Precipice Sandstone is approximately 0.221 km, so the bores would not be unacceptably impacted by the project.

Scenario 3 – Groundwater Demand: 3,500 ML

A total of seven bores were chosen to meet the water demands in this chainage. Three bores were chosen in the 19.28 – 30 km sub group and two bores were chosen in the 52 – 63 km sub group to minimise drawdown.

The five metre drawdown in the Hutton Sandstone would occur at a maximum distance of approximately 0.410 km in the 52 – 63 km sub group. Two bores are 0.349 km apart in the Hutton Sandstone in this chainage (**Table D5**). Therefore, these wells could be impacted by the groundwater extraction from the Hutton Sandstone; however, further, detailed studies could be undertaken as part of the approvals process to better determine the potential impacts.

The maximum distance to five metre drawdown in the Precipice would be approximately 1.540 km. There are six bores that are separated by a distance less than 1.540 km:

- RN 16065
- RN 18207
- RN 38658
- RN 62077
- RN 67229
- RN 123167.

Due to their vicinity to one another, these bores were not used in the proposed water demand schedule in **Table A11**.

5.3.4 63 – 90 km Construction Area

The 63 – 90 km chainage group is also larger than preceding groups. There are 37 bores screened within the Precipice Sandstone and are situated in a larger density relative to bores in other chainage groups. This chainage group was also broken into four sub groups:

- 63 – 70 km
- 70 – 77 km
- 77 – 83 km
- 83 – 90 km.

A minimum of one bore was selected in each sub group except from 83 – 90 km due to the length of the chainage.

Scenario 1 – Groundwater Demand: 1,800 ML

A total of five bores were chosen to meet the water demands in this section of the project. Due to the high density of bores in the vicinity of the 83 – 90 km sub group (**Table B7**), two bores were used in the model for this sub group to limit drawdown.

Based on the water demands, the five metre drawdown would occur at a maximum of approximately 0.496 km in the 63 – 70 sub group. Five bores in the chainage group are separated by a distance less than 0.496 km:

- RN 14583
- RN 89504
- RN 89510
- RN 89540
- RN 89763.

Although these wells are located near the 90 km chainage, the proposed water demand schedule avoids these bores (**Table A4**).

Scenario 2 – Groundwater Demand: 2,700 ML

Five bores were chosen for this chainage. Based on the water demands, the five metre drawdown would occur at a maximum of approximately 1.262 km in the 83 – 90 sub group. Seven bores in the chainage group are separated by a distance less than 0.1.262 km:

- RN 14582
- RN 14583
- RN 89504
- RN 89510
- RN 89540
- RN 89763
- RN 89855.

RN 14582 was included in the proposed water demand schedule. Although RN 14582 is approximately 0.962 km from RN 89855, the proposed groundwater to be extracted from this bore in **Table A8** would be significantly less than the rate required to result in 5-meter drawdown. Additional bores proposed in the 1,800 ML scenario could be used to assist in limiting drawdown.

Scenario 3 – Groundwater Demand: 3,500 ML

A total of 10 bores were chosen to meet the water demands in this section of the project. Due to the high density of bores in this chainage, three bores were chosen for the 63 – 70 km sub group and 8 bores were chosen for the 83 – 90 km sub group.

Based on the water demands, the five metre drawdown would occur at a maximum of approximately 0.127 km in the 63 – 70 sub group (**Table D1**). There are no bores in this sub group that are within this distance (**Table D7**). It should be noted, however, given the close proximity of these bores, there is a cumulative effect to drawdown that should be taken into consideration when groundwater is extracted from multiple points.

5.4 Summary of Results

The following provides a summary of the results of this model.

- The 0 – 90 km chainage/portion of the railway was broken down into four construction areas.
- The 0 – 9 km construction chainage would only require one bore for each scenario to meet the demands of the project and would not significantly impact adjacent bores.
- Three bores could be used in each scenario to meet the project demands in the 9 – 19.28 km construction chainage to maintain drawdown within acceptable limits.
- Given the length of the 19 – 63 km construction chainage, it was further divided into four subgroups to manage drawdown and minimise transportation costs. Five bores were used in the 1,800 ML and 2,700 ML scenarios, while seven bores were required in the 3,500 ML scenario.
- The 63 – 90 km construction chainage was also broken down into four sub groups. Five bores could be used to reduce the impact to adjacent bores in the 1,800 ML and 2,700 ML scenarios. Ten bores would be required in the 3,500 ML scenario.
- The 0 – 63 km construction chainage would rely primarily on water from the Hutton Sandstone, while the remaining chainages could utilise water primarily from the Precipice Sandstone.
- The model shows that drawdown can be managed appropriately if a minimum of 14 bores were used across the 0 -90 km construction area for the 1,800 ML and 2,700 ML scenarios. **Figure F6** shows a hypothetical extraction bore configuration for these scenarios. A total of 22 bores would be required for the 3,500 ML scenario. **Figure F6** and **Figure F7** do not show the radius of influence for the hypothetical extraction bores because the
- **Table T5** has been included in this report as a reference tool to show the radius of influence for the 5-metre drawdown threshold, assuming different extraction rates over various times.
- There are wells that could be drawn down by marginally more than 5 meters as a result of a cumulative effect of pumping from multiple wells.

- Impacts to recharge springs and the Boggomoss Springs in the proximity of the project area should be at a minimum, although a more detailed hydrogeological assessment should be performed once bores have been chosen for extraction.

6.0 Impact Assessment

6.1 Potential Groundwater Impacts

6.1.1 Construction Phase

Potential impacts to groundwater during the construction phase include:

- Decreased water levels or pressure due to groundwater extraction.
- Decreased water quality.
- Groundwater contamination as a result of:
 - Chemical or petroleum hydrocarbon use and storage
 - Surface spills and leaks from equipment used during construction
 - Infiltration of impacts in stockpiled soil in the project area.

Water Levels and Pressure

The greatest potential groundwater impacts associated with the project is a decrease in groundwater levels in subartesian bores and in pressure in artesian bores in the Hutton Sandstone and Precipice Sandstone during groundwater extraction. Excessive pumping from a single bore could potentially decrease the performance of neighbouring bores and threaten the natural recharge and watercourse springs located in the vicinity of the project area.

The analytical modelling has indicated that it is possible to minimise the drawdown associated with groundwater extraction to less than 5 metres, by spreading the water demand over different bores where necessary.

Although the model shows that there would be minimal impact to bores surrounding potential extraction bores, additional detailed hydrogeological assessments should be performed when specific bores are selected for pumping. The detailed assessment would include pump tests to calculate the hydraulic conductivity (used to calculate transmissivity) for the extraction bores and monitoring of surrounding bores and/or springs to evaluate the region of influence. These additional data would allow for bore-specific groundwater modelling.

Upon commencement of groundwater extraction, the groundwater level or pressure should be continuously monitored in the bore, and surrounding bores and / or springs should be monitored daily to assess the impact of the groundwater extraction.

Water Quality

Groundwater quality can decrease over time as a result of excessive groundwater pumping. Evidence of this can be observed in subartesian aquifers located near Theodore in the Dawson River alluvium. Although the proposed pumping durations are relatively short and it is unlikely that groundwater quality will be impacted from the proposed activities, groundwater quality should be monitored.

Baseline groundwater quality data should be collected as part of the hydrogeological assessment discussed above. The monitoring program should consist of a minimum of three monitoring events of selected wells prior to construction and include the following analytes: pH, EC, temperature, major ions and TPH for shallow wells. During the construction activities, groundwater quality should be regularly monitored in the extraction bore.

Groundwater Contamination

Contamination (e.g. petroleum hydrocarbon) could potentially impact groundwater during the construction activities. The likelihood of surface spills from construction vehicles or storage areas directly impacting the Hutton Sandstone and Precipice Sandstone is considered low since these aquifers are greater than 100 m below the ground surface and are capped by low permeable aquitards. Nonetheless, samples should be collected from bores in the vicinity of the project before, during and after construction activities to confirm groundwater is not impacted, as described in the previous section.

6.1.2 Operational Phase

Potential impacts to groundwater during the operational phase include:

- Groundwater contamination as a result of:
 - Surface spills and leaks from the railway during operation.
 - Groundwater contamination from chemicals used for land maintenance.
 - Groundwater contamination from chemicals used to clean the railway or trains.

Upon completion of the construction phase of the project, it is assumed that groundwater would no longer be required. Therefore, the primary potential impacts to groundwater during the operational phase would be contamination (e.g. petroleum hydrocarbon, pesticides) as part of normal railway operations. As discussed in **Section 6.1.1**, it is considered unlikely that contamination would migrate directly to the Hutton Sandstone or Precipice Sandstone although an annual monitoring program should be implemented to verify that contamination is not occurring.

6.2 Management and Mitigation

6.2.1 Construction Phase

Table 5: Construction Phase Management/Mitigation Measures

Potential Impact	Management/Mitigation Measure
Chemicals and Petroleum Hydrocarbons	<ul style="list-style-type: none"> • All fuels and chemicals used during the construction phase of the project would be stored in bunded facilities that prevent spills, leakage, or over topping of the facility. The facility should prevent any migration of fuels or chemicals to surface water bodies or the underlying groundwater. • Construction vehicles would be maintained in accordance with the manufacturer’s specifications and would be checked daily for leaks prior to the start of work. • Construction areas would be regularly checked to confirm that construction equipment is not leaking fluids onto the ground surface. If there is evidence of a spill in the construction zone, the impacts would be contained and the impacted soil would be removed.
Impacted Stockpile Infiltration	<ul style="list-style-type: none"> • Sample surface water and groundwater in the vicinity of the project area to confirm these receptors are not adversely impacted by leachate from stockpiles.

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Potential Impact	Management/Mitigation Measure
Decreased Water Levels	<ul style="list-style-type: none"> • The flow rate of groundwater bores used for water extraction would be monitored, and controlled in a manner that will minimise drawdown. • Additional wells in the vicinity of the extraction bores would be monitored weekly to ensure that extraction activities are not impacting other groundwater users. • If the extraction activities are shown to drawdown groundwater greater than 5 m in neighbouring wells then DERM would be notified, the cause would be investigated and an appropriate course of action would be agreed.
Decreased Groundwater Quality	<ul style="list-style-type: none"> • Groundwater within the extraction bores would be sampled weekly for physico-chemical indicators (e.g. pH, EC, temperature) to confirm water quality is stable. • Bores in the vicinity of the extraction wells will be sampled at the commencement and completion of water extraction to confirm construction activities have not affected groundwater quality. The analysis would include pH, EC, temperature and major ions. • Water extraction will cease if results show that the groundwater quality is degrading DERM would be notified, the cause would be investigated and an appropriate course of action would be agreed.

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6.2.2 Operational Phase

Table 6: Operation Phase Management/Mitigation Measures

Potential Impact	Management/Mitigation Measures
Spills/Leaks	Monitor groundwater bores in the vicinity of the project area on an annual basis to ensure operations are not impacting groundwater.
Pesticides/Herbicides	Adopt weed management strategies which have a minimal impact on groundwater.

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7.0 Conclusions and Recommendations

Based on the results of a review of the available water sources and groundwater impact assessment, the following conclusions and recommendations can be made:

- Water for construction activities in the southern water supply area (0 – 90 km chainage) could be obtained from groundwater in the GAB.
- Based on the construction water supply study by Aurecon Hatch (2009a), water in the northern water supply area (90 – 210 km chainage) can be obtained from numerous surface water sources, including the Dawson River, ephemeral watercourses, overland flow and water collected in old mining voids.
- The northern project area would require approximately 1,500 ML of water from surface water sources, primarily the Dawson River.
- Based on a reliability analysis by Aurecon Hatch (2009a), groundwater from the GAB and surface water from the Dawson River are considered the most reliable sources of water for the project both in yield and in water quality. Alternative sources of water, such as CSG water, either do not yield as much water or have poor water quality.
- CSG water in the northern project area may be obtained from the Dawson Valley field, located near Moura.
- If groundwater is not accessible in the southern portion of the southern water supply area, the SBRJV may consider CSG water from the Scotia and / or Peat fields. This water would likely only be appropriate for dust suppression, earthworks and concrete because CSG water typically has high TDS concentrations.
- The Water Act (2000), GAB WRP and GAB ROP indicate that groundwater is available through numerous options. According to DERM, the most viable options are temporary water permits to extract additional water from existing, licensed bores.
- Water from the 0 – 63 km chainages would be obtained primarily from groundwater in the Hutton Sandstone, while groundwater would be obtained from the Precipice Sandstone in the 63 – 90 km chainage.
- Historical groundwater quality analytical results provided by DERM indicate there are 375 licensed groundwater bores screened in the Hutton Sandstone and Precipice Sandstone with historical water quality data. In general, groundwater in the Hutton Sandstone has poorer water quality than groundwater derived from the Precipice Sandstone. There are, however, no bores, that reported groundwater quality above the nominated guidelines. Baseline data should be collected from specific bores prior to commencement of construction activities to confirm groundwater quality.
- The density of bores is considered low from the 0 – 19.28 km chainages relative to bores in the other chainages, which reduces the likelihood of unacceptable impacts to neighbouring bores. The groundwater quality ranges from potable to suitable for dust suppression and earthworks only, which could reduce the number of potential extraction bores.
- While the groundwater quality is higher in the 19.28 – 90 km chainages relative to the bores to the south, the densities of the bores also increase. Therefore, more wells are available for groundwater extraction, but the potential for impacts to neighbouring bores increase.

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- Based on the model results for the 1800 ML and 2,700 ML scenarios, utilising numerous bores (i.e. 14 bores), screened across the Hutton Sandstone and Precipice Sandstone, can provide the required volume of water whilst limiting potential drawdown in neighbouring bores and reducing water transportation costs. Additional wells could be considered for extraction wells, which would likely further reduce groundwater drawdown across the project area.
- A total of 22 bores would be required to meet the demands of the conservative third scenario (3,500 ML).
- Although it appears there could be cumulative effects of drawdown from extraction from multiple bores, the model results are considered conservative, and given the short span of the project, draw down in the bores are not considered permanent.
- A groundwater monitoring program could be used to ensure that neighbouring groundwater bores and springs would not be impacted at an unacceptable level.

8.0 Limitation Statement

AECOM has chosen an appropriate level of effort for delivering this Groundwater Impact Assessment. The activities performed, constitute all activities, appropriate and necessary under the circumstances, to produce the report. Based on available historical records of the project area and groundwater bore data, it is AECOM's opinion that the potential environmental impacts associated with the project are discussed in this report.

We do not assume any liability for misrepresentation of facts that were provided in historical records. We also do not assume any liability for updates to historical records or groundwater databases undertaken following the assessment.

Furthermore, to completely understand the conclusions and recommendations outlined in the report, the document must be read in its entirety. This is because this report is site-specific with relevant information contained in the body of the reports as well as supporting tables and documentation.

Opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions. Conclusions contained in this report are based upon information, data and reports provided by others. Where assessments of the works conducted to reduce or mitigate any environmental liability identified in this report are made, such assessments are based upon the information available at the time.

AECOM has prepared this report solely for the benefit of the Surat Basin Rail Joint Venture in accordance with generally accepted consulting practices and for the intended purposes. This report may not be relied upon by any other party, except the Queensland Environmental Protection Agency, without the explicit written agreement of AECOM. No other warranty, expressed or implied, is made as to the professional advice included in this report.

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Environment

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
8356	Installed	08356N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Artesian-Ceased Flow		Stock
8357	Installed	08357N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
8440	Installed	48816S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
8445	Installed	08445S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
8449	Installed	26388N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10463	Installed	58213N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10475	Installed	14188S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10578	Installed	58456N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10583	Installed	57304S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
10584	Installed	10584S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10592	Installed	10592S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
10594	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
10690	Installed	10690N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10875	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock, Domestic Supply
10876	Installed	89695S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
10886	Installed	10886N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10918	Installed	67274S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
10929	Installed	89772S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10930	Installed	10930N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
10980	Installed	15669S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
10981	Installed	15669S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
10989	Installed	10989S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
10990	Installed	47466S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
10992	Installed	47467S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
11007	Installed	89728S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11009	Installed	406752	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
11104	Installed	11104S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
11140	Installed	37781S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
11175	Installed	11176N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11176	Installed	11176N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11306	Installed	57790S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
11501	Installed	11501N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
11558	Installed	11558S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
11560	Installed	11560N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
11647	Installed	11647S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
11648	Installed	14206S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11692	Installed	11692S	Licence to Take Water	Issued	The Not Assigned	Evergreen Formation	Subartesian		Stock
11694	Installed	11694N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11739	Installed	11739N	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock
11758	Installed	26062S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
11764	Installed	11764S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11765	Installed	11765S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11766	Installed	11766S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11850	Installed	11850S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
11878	Installed	17197S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
11882	Installed	11882N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
11892	Installed	68097S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
12118	Installed	12118N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
12221	Installed	12221N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
12236	Installed	89604S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
12238	Installed	12238S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Artesian-Controlled Flow		Stock
12372	Installed	12372N	Licence to Take Water	Issued	Surat North 1 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
12627	Installed	12627N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
12651	Installed	12651N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
12753	Installed	12753N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
12838	Installed	12838N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
12882	Installed	12882S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
13060	Installed	13060N	Licence to Take Water	Issued	Surat North 1 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
13073	Installed	13073S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Uncontrolled Flow		Stock
13180	Installed	48816S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
13521	Installed	89565S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
13791	Installed	13791S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
13856	Installed	13856N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
13881	Installed	13881S	Licence to Take Water	Issued	Surat North 4 Management Unit	Precipice Sandstone	Artesian-Ceased Flow		Domestic Supply, Stock
13882	Installed	13881S	Licence to Take Water	Issued	Surat North 4 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
13945	Installed	48973N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
14133	Installed	47214S	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
14179	Installed	14179S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14180	Installed	30587S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
14184	Installed	16836S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
14185	Installed	16836S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
14187	Installed	89670S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14188	Installed	14188S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14189	Installed	31194S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14190	Installed	31194S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14191	Installed	14191S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14204	Installed	14204S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
14205	Installed	14205S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
14206	Installed	14206S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Uncontrolled Flow		Stock
14228	Installed	89604S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
14229	Installed	89604S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
14231	Installed	14231S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
14247	Installed	14249N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14248	Installed	14249N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14249	Installed	14249N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14250	Installed	14249N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14270	Installed	47214S	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock, Domestic Supply
14273	Installed	14277S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
14276	Installed	14277S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14277	Installed	14277S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
14344	Installed	58456N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14350	Installed	14350S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14352	Installed	14352S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14358	Installed	14358N	Licence to Take Water	Issued	Surat 6 Management Unit	Hutton Sandstone	Subartesian	3	Stock, Stock Intensive
14388	Installed	47214S	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
14453	Installed	14453S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14459	Installed	14459S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14460	Installed	16229S	Licence to Take Water	Issued	Surat North 2 Management Unit	Precipice Sandstone	Subartesian		Stock
14461	Installed	14461N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14461	Installed	32502N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14535	Installed	15744N	Licence to Take Water	Issued	Surat North 1 Management Unit	Hutton Sandstone	Subartesian		Stock
14538	Installed	58608N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14561	Installed	14561S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
14562	Installed	14562S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian	20	Group Domestic, Stock
14562	Installed	14562S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian	20	Group Domestic, Stock
14573	Installed	14573N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14574	Installed	14576N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14575	Installed	14575N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
14577	Installed	14575N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
14578	Installed	14576N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14582	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
14583	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
14584	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
14590	Installed	57733S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14591	Installed	57733S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14593	Installed	102157	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14597	Installed	14597S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian	74	Domestic Supply, Irrigation, Stock
14609	Installed	14609S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
14610	Installed	15580S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14616	Installed	14616S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14617	Installed	14617N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
14654	Installed	14654N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
14680	Installed	14680N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14697	Installed	58443N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14861	Installed	15386N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14871	Installed	14871S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
14872	Installed	17247S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14883	Installed	89609S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
14887	Installed	14887S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
14888	Installed	14888N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
14970	Installed	14970S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
15053	Installed	15580S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15170	Installed	15170S	Licence to Take Water	Issued	Surat North 2 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
15171	Installed	15171N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
15386	Installed	15386N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15417	Installed	15417S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
15487	Installed	171099	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock
15508	Installed	15508N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15508	Proposed	15508N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15525	Installed	30478S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
15538	Installed	26006S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
15556	Installed	15556N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15557	Installed	15557N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Artesian-Ceased Flow		Stock
15565	Installed	15568N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15568	Installed	15568N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15579	Installed	17197S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
15580	Installed	15580S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15590	Installed	15590S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
15669	Installed	15669S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
15672	Installed	57492S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
15673	Installed	57492S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
15709	Installed	17248S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15710	Installed	17248S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15729	Installed	36395S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15744	Installed	15744N	Licence to Take Water	Issued	Surat North 1 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
15785	Installed	15785N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15792	Installed	48816S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
15793	Installed	15793N	Licence to Take Water	Under Renewal	Surat North 3 Management Unit	Precipice Sandstone	Subartesian	200	Urban
15862	Installed	58443N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
15960	Installed	31184N	Licence to Take Water	Under Renewal	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
16000	Installed	16000N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
16028	Installed	48816S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
16044	Installed	16044N	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock
16065	Installed	16065N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
16067	Installed	57733S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
16082	Installed	31560S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
16144	Installed	30478S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
16217	Installed	16217N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow	24	Stock Intensive, Stock
16218	Installed	16218N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
16225	Installed	16225N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
16229	Installed	16229S	Licence to Take Water	Issued	Surat North 2 Management Unit	Precipice Sandstone	Subartesian		Stock
16270	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock, Domestic Supply
16307	Installed	58871N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
16312	Installed	16312N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
16320	Abandoned	89505S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
16385	Installed	58296N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
16405	Installed	89670S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
16598	Installed	16598N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
16605	Installed	16605S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
16607	Installed	16607N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
16661	Installed	16661N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
16686	Installed	16686S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
16752	Installed	16752N	Licence to Take Water	Under Renewal	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
16758	Installed	58456N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
16836	Installed	16836S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
17070	Installed	17070S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
17110	Installed	17110N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
17147	Installed	26390N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
17196	Installed	17197S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
17197	Installed	17197S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock, Domestic Supply
17247	Installed	17247S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
17248	Installed	17248S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
17306	Installed	17306N	Licence to Take Water	Under Renewal	Surat North 2 Management Unit	Formation Name not Specified	Subartesian		Domestic Supply, Stock
17448	Installed	17448N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
17535	Installed	15556N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
17620	Installed	17620N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
17655	Installed	17655N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
17690	Installed	17690S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
17776	Installed	17776S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
17796	Installed	17796S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
17849	Installed	62877S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
17866	Installed	17866S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian	74	Irrigation
17866	Installed	14188S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
17945	Installed	17945S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
17984	Installed	17984S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
18096	Installed	08357N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
18109	Installed	18178N	Licence to Take Water	Under Renewal	Surat North 4 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
18120	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
18135	Installed	26390N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
18171	Installed	89565S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Unknown		Stock, Domestic Supply
18173	Installed	36120S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
18178	Installed	18178N	Licence to Take Water	Under Renewal	Surat North 4 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
18195	Installed	62877S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
18207	Installed	18207S	Licence to Take Water	Issued	Surat North 2 Management Unit	Precipice Sandstone	Subartesian		Stock
18223	Installed	58456N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
18224	Installed	18224N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
18279	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
18929	Installed	48953N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
19048	Installed	19048N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
22117	Installed	22117N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
22371	Installed	22371N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
23149	Installed	189456	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
26006	Installed	26006S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
26062	Installed	26062S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
26074	Installed	26074S	Licence to Take Water	Issued	Surat North 1 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
26119	Approval Lapsed	26120S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
26119	Installed	26120S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
26120	Installed	26120S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
26125	Installed	57733S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
26373	Installed	14459S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
26387	Installed	26388N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
26388	Installed	26388N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
26390	Installed	26390N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
30053	Installed	30990N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
30054	Installed	12651N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
30055	Installed	12651N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
30232	Installed	58310N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
30318	Installed	67281S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
30344	Installed	30345S	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock
30345	Installed	30345S	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock
30421	Installed	67284S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
30422	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
30423	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
30424	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
30484	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock, Domestic Supply
30506	Installed	67281S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
30507	Installed	67281S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
30535	Installed	35458N	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock
30555	Installed	43193S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
30576	Installed	89793S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
30587	Installed	30587S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
30655	Installed	62881S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
30681	Installed	30681N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
30709	Installed	30709S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
30756	Installed	62881S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
30784	Installed	48921N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
30788	Installed	30852S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
30852	Installed	30852S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
30990	Installed	30990N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
31184	Installed	31184N	Licence to Take Water	Under Renewal	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
31194	Installed	31194S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
31401	Installed	89609S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
31409	Installed	67281S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
31417	Installed	31417N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
31432	Installed	31432S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
31544	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
31560	Installed	31560S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
31687	Installed	48973N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
31791	Installed	31184N	Licence to Take Water	Under Renewal	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
31894	Installed	31894N	Licence to Take Water	Under Renewal	Surat North 3 Management Unit	Formation Name not Specified	Subartesian		Domestic Supply, Stock
32219	Installed	15669S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
32569	Installed	32713N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
32713	Installed	32713N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
32735	Installed	32735S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow	500	Town Water Supply
32939	Installed	32939N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
33283	Installed	33283S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
33547	Installed	57790S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
33771	Installed	33771N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
34227	Installed	34227N	Licence to Take Water	Issued	Surat EAST 3 Management Unit	Hutton Sandstone	Subartesian		Stock
34597	Installed	34597S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
34856	Installed	43394S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
35256	Installed	35256S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
35267	Installed	35267N	Licence to Take Water	Under Renewal	Surat North 2 Management Unit	Formation Name not Specified	Subartesian		Domestic Supply, Stock
35458	Installed	35458N	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Subartesian		Stock

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
35740	Installed	35740S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Amenities
35912	Installed	35912S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
36120	Installed	36120S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
36373	Installed	89793S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
36393	Installed	36393N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Subartesian		Stock
36394	Installed	15669S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
36395	Installed	36395S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
36396	Installed	17134I	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
36982	Installed	58289N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
37201	Installed	37201S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
37507	Installed	48816S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
37781	Installed	37781S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
37829	Installed	62880S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
37878	Installed	57790S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
38334	Installed	58289N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
38337	Installed	100582	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
38658	Installed	38658S	Licence to Take Water	Under Renewal	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow	444	Stock, Irrigation
43193	Installed	43193S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
43363	Installed	43363N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
43394	Installed	43394S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
43596	Installed	408797	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
43611	Installed	44700S	Licence to Take Water	Issued	Not Assigned - For WERD2000 Conversion Only	Robinson Creek Alluvium	Subartesian	200	Irrigation
43687	Installed	43687S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
43917	Installed	43917S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
43940	Installed	43940S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
44317	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
44404	Installed	44404S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
44541	Installed	44541S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
44700	Installed	44700S	Licence to Take Water	Issued	Not Assigned - For WERD2000 Conversion Only	Robinson Creek Alluvium	Subartesian	200	Irrigation
47214	Installed	47214S	Licence to Take Water	Issued	Surat North 3 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock, Domestic Supply
47325	Installed	62877S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
47329	Installed	47329S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
47360	Installed	15170S	Licence to Take Water	Issued	Surat North 2 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
47366	Installed	47366N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
47368	Installed	89728S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
47369	Installed	89728S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
47369	Installed	47369S	Licence to Take Water	Issued	The Not Assigned	Precipice Sandstone	Subartesian		Stock
47466	Installed	47466S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
47467	Installed	47467S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
47550	Installed	16229S	Licence to Take Water	Issued	Surat North 2 Management Unit	Precipice Sandstone	Subartesian		Stock
47768	Installed	31417N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
47959	Installed	89609S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
48816	Installed	48816S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
48829	Installed	11882N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
48831	Installed	48831N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
48863	Installed	48863N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
48911	Installed	48911N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
48911	Installed	176902	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
48914	Installed	48914N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
48921	Installed	48921N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
48949	Installed	58608N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
48950	Installed	48950N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Unknown		Stock
48973	Installed	48973N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
48983	Installed	14575N	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
57304	Installed	57304S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
57492	Installed	57492S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
57615	Installed	67281S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
57632	Installed	57632S	Licence to Take Water	Issued	The Not Assigned	Robinson Creek Alluvium	Subartesian	120	Domestic Supply, Irrigation, Stock
57700	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
57701	Installed	67284S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
57733	Installed	57733S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
57781	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
57790	Installed	57790S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
57843	Installed	57843S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow	100	Aquaculture, Irrigation
57843	Installed	57844S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
57844	Installed	57844S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
57872	Installed	67334N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Ceased Flow		Stock
58017	Installed	58017N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Artesian-Controlled Flow		Domestic Supply, Stock
58022	Installed	16000N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58031	Installed	58031N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Artesian-Controlled Flow		Domestic Supply, Stock
58036	Installed	17655N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
58037	Installed	17655N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
58045	Installed	58045N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Subartesian		Stock
58055	Installed	58456N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
58086	Installed	58086N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58087	Installed	58086N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
58093	Installed	58093N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Artesian-Controlled Flow		Stock
58097	Installed	58097N	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Subartesian		Stock
58133	Installed	58133N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian	75	Stock, Stock Intensive
58141	Installed	58086N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58213	Installed	58213N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58232	Installed	58232N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58242	Installed	17620N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
58269	Installed	15386N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58282	Installed	17862I	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58282	Installed	17659I	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58289	Installed	58289N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58294	Proposed	58294N	Licence to Take Water	Issued	Surat 6 Management Unit	Hutton Sandstone	Subartesian		Stock
58294	Installed	58294N	Licence to Take Water	Issued	Surat 6 Management Unit	Hutton Sandstone	Subartesian		Stock
58296	Installed	58296N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
58306	Installed	58306N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58310	Installed	58310N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58313	Installed	58313N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian	25	Stock, Stock Intensive
58319	Installed	58928N	Licence to Take Water	Issued	GAB - Taroom Shire	Hutton Sandstone	Subartesian		Stock
58335	Installed	58335N	Licence to Take Water	Issued	Surat EAST 3 Management Unit	Hutton Sandstone	Subartesian	15	Stock Intensive, Stock
58346	Installed	58500N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58409	Installed	58409N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
58430	Installed	58500N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58434	Installed	58500N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58435	Installed	58500N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58443	Installed	58443N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58456	Installed	58456N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
58462	Installed	58462N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
58475	Installed	33771N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
58500	Installed	58500N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58571	Installed	58571N	Licence to Take Water	Issued	Surat North 1 Management Unit	Hutton Sandstone	Subartesian		Stock
58580	Installed	177756	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58608	Installed	58608N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58623	Installed	177428	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
58623	Installed	177428	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
58624	Installed	58624N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58658	Installed	177756	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
58700	Installed	58700N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian	200	Town Water Supply
58726	Installed	58726N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
58773	Installed	100235	Licence to Take Water	Issued	Surat North 2 Management Unit	Formation Name not Specified	Subartesian		Domestic Supply, Stock
58827	Installed	101984	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58834	Installed	102157	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58850	Installed	58850N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58867	Installed	58867N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58871	Installed	58871N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58907	Installed	176861	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58907	Installed	176863	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58907	Installed	176865	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58907	Installed	176869	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58907	Installed	176902	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
58918	Installed	58918N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
58968	Installed	173375	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
58968	Installed	400405	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
62005	Installed	89589S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
62006	Installed	89517S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
62007	Installed	89589S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
62015	Installed	62015N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
62043	Installed	62043S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
62077	Installed	38658S	Licence to Take Water	Under Renewal	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow	444	Stock, Irrigation
62213	Installed	62213S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
62284	Installed	62284S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
62308	Installed	62308S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
62664	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
62665	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
62666	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
62746	Installed	17197S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
62877	Installed	62877S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
62880	Installed	62880S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
62881	Installed	62881S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
67229	Installed	38658S	Licence to Take Water	Under Renewal	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow	444	Stock, Irrigation
67231	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
67232	Installed	67284S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
67233	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
67234	Installed	67234S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
67236	Installed	15556N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
67260	Installed	67260S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
67273	Installed	14871S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
67274	Installed	67274S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
67280	Installed	67281S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
67281	Installed	67281S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
67284	Installed	67284S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
67334	Installed	67334N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
67382	Installed	89565S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Unknown		Stock, Domestic Supply
67384	Installed	84413S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
67385	Installed	67385S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
67386	Installed	67386S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
67410	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
67624	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
67625	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock, Domestic Supply
68097	Installed	68097S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
68210	Installed	68211D	Licence to Take Water	Issued	BIL Not Assigned	Quaternary - Undefined	Unknown		Stock
68211	Installed	68211D	Licence to Take Water	Issued	BIL Not Assigned	Quaternary - Undefined	Subartesian		Stock
84032	Installed	62877S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
84358	Installed	89777S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
84360	Installed	84360S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
84361	Installed	84362S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
84362	Installed	84362S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
84373	Installed	84373S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
84374	Installed	84374S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
84375	Installed	84375S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
84376	Installed	84377S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
84377	Installed	84377S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
84411	Installed	84413S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
84412	Installed	84413S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
84413	Installed	84413S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
84633	Installed	34597S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
84634	Installed	34597S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
84635	Installed	34597S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
88445	Installed	88445S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
88449	Installed	88449S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
88466	Installed	88466S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
88538	Installed	88538S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
89502	Installed	89502S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Artesian-Controlled Flow		Stock
89504	Installed	89510S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
89505	Installed	89505S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
89510	Installed	89510S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
89517	Installed	89517S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89540	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89551	Installed	17134I	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
89561	Installed	89627S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89565	Installed	89565S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
89572	Installed	89572S	Licence to Take Water	Issued	The Not Assigned	Precipice Sandstone	Subartesian		Stock
89589	Installed	89589S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock
89599	Installed	89599S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
89604	Installed	89604S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
89605	Installed	89605S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89608	Installed	89608S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
89609	Installed	89609S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Stock, Domestic Supply
89612	Installed	89612S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
89622	Installed	89622S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
89624	Installed	89565S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Unknown		Stock, Domestic Supply
89627	Installed	89627S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89639	Installed	89639S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian	60	Stock Intensive
89640	Installed	182400	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89643	Installed	89643S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89644	Installed	89644S	Licence to Take Water	Issued	The Not Assigned	Robinson Creek Alluvium	Subartesian	300	Irrigation
89647	Installed	89622S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
89650	Installed	57632S	Licence to Take Water	Issued	The Not Assigned	Robinson Creek Alluvium	Subartesian	120	Domestic Supply, Irrigation, Stock
89654	Installed	26062S	Licence to Take Water	Issued	Surat North 2 Management Unit	Evergreen Formation	Subartesian		Domestic Supply, Stock
89670	Installed	89670S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89671	Installed	14459S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89681	Installed	10584S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89688	Installed	89622S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
89694	Installed	89695S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
89695	Installed	89695S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Stock
89724	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89728	Installed	89728S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89742	Installed	89742S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Domestic Supply, Stock
89762	Installed	182400	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89763	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89764	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89772	Installed	89772S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89775	Installed	89775S	Licence to Take Water	Issued	Surat North 3 Management Unit	Formation Name not Specified	Subartesian		Stock

Table T1: Groundwater Bore Water Licences

RN	Works Status	Authorisation Number	Authorisation Type	Authorisation Status	Management Unit	Aquifer	Aquifer Type	Nominal Allocation (ML/water year)	Purpose
89777	Installed	89777S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89793	Installed	89793S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
89808	Installed	89808S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89829	Installed	171339	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89830	Installed	171341	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock, Domestic Supply
89853	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89854	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89855	Installed	16270S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
89865	Proposed	173558	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89867	Installed	10592S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89872	Proposed	89622S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
89876	Proposed	89808S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89876	Installed	89808S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
89877	Proposed	36395S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89905	Installed	89670S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89920	Installed	177021	Licence to Take Water	Issued	The Not Assigned	Hutton Sandstone	Subartesian		Stock, Domestic Supply
89931	Installed	88449S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Domestic Supply, Stock
89932	Installed	178602	Licence to Take Water	Issued	The Not Assigned	Precipice Sandstone	Artesian-Controlled Flow		Stock
89937	Installed	32735S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian	500	Town Water Supply
89941	Installed	14352S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89972	Installed	15590S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
89991	Installed	14188S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
89992	Installed	14188S	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
123030	Installed	58868N	Licence to Take Water	Issued	Surat 7 Management Unit	Precipice Sandstone	Subartesian		Stock
123104	Installed	105212	Licence to Take Water	Under Amendment	Surat North 2 Management Unit	Formation Name not Specified	Subartesian	24	Domestic Supply, Stock Intensive, Stock
123105	Installed	185670	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
123120	Installed	14680N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
123146	Installed	400541	Licence to Take Water	Issued	RMA Not Assigned	Eurombah Creek Alluvium	Subartesian	128	Stock Intensive
123150	Installed	190015	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
123158	Approval Lapsed	400541	Licence to Take Water	Issued	RMA Not Assigned	Eurombah Creek Alluvium	Subartesian	128	Stock Intensive
123167	Installed	16065N	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
123184	Approval Lapsed	407921	Licence to Take Water	Issued	RMA Not Assigned	Dawson River Alluvium	Subartesian	52	Irrigation, Stock Intensive
123201	Installed	100585	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock
123208	Installed	58571N	Licence to Take Water	Issued	Surat North 1 Management Unit	Hutton Sandstone	Subartesian		Stock
123231	Installed	409177	Licence to Take Water	Under Amendment	Upper Dawson River and Tributaries Alluvium	Dawson River Alluvium	Subartesian	72	Stock Intensive
123233	Installed	14461N	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
128004	Installed	173558	Licence to Take Water	Issued	Surat North 2 Management Unit	Hutton Sandstone	Subartesian		Stock
128008	Installed	89562S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Artesian-Controlled Flow		Domestic Supply, Stock
128186	Installed	48816S	Licence to Take Water	Issued	Surat North 3 Management Unit	Precipice Sandstone	Subartesian		Stock, Domestic Supply
128304	Installed	189839	Licence to Take Water	Issued	ROC Not Assigned	Precipice Sandstone	Subartesian		Domestic Supply, Stock

Notes:
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 Nominal allocation not specified in permits for bores licenses for stock purposes.

Table T2: Regional Groundwater Levels

RN	Date	Depth to Water (m BGS)	Aquifer	General Location
38975	2/07/2009	11.08	Alluvium	Theodore
89532	17/07/2008	15.36	Alluvium	8 km NE of Theodore
13030385	2/07/2009	13.21	Alluvium	10 km W of Theodore
13030389	2/07/2009	8.14	Alluvium	Theodore
13030390	2/07/2009	10.45	Alluvium	Theodore
13030392	2/07/2009	14.16	Alluvium	Theodore
13030393	2/07/2009	9.21	Alluvium	Theodore
13030394	2/07/2009	9.77	Alluvium	Theodore
13030395	2/07/2009	9.96	Alluvium	Theodore
13030397	2/07/2009	9.05	Alluvium	Theodore
13030399	2/07/2009	9.45	Alluvium	Theodore
13030401	2/07/2009	9.56	Alluvium	Theodore
13030402	2/07/2009	9.97	Alluvium	Theodore
13030404	2/07/2009	9.17	Alluvium	Theodore
13030406	2/07/2009	9.44	Alluvium	Theodore
13030407	2/07/2009	9.77	Alluvium	Theodore
13030412	2/07/2009	8.92	Alluvium	Theodore
13030420	2/07/2009	9.91	Alluvium	Theodore
13030423	2/07/2009	9.63	Alluvium	Theodore
13030426	2/07/2009	8.49	Alluvium	Theodore
13030427	2/07/2009	9.37	Alluvium	Theodore
13030428	2/07/2009	11.15	Alluvium	Theodore
13030430	2/07/2009	12.50	Alluvium	Theodore
13030434	21/01/2009	8.56	Alluvium	7 km S of Theodore
13030573	2/07/2009	14.43	Alluvium	Theodore
13030576	2/07/2009	10.03	Alluvium	Theodore
13030582	2/07/2009	9.40	Alluvium	Theodore
13030583	2/07/2009	9.61	Alluvium	Theodore
13030586	10/02/2005	11.78	Alluvium	Theodore
13030590	20/01/2009	9.09	Alluvium	Theodore
13030683	21/01/2009	9.68	Alluvium	25 km S of Theodore
13030684	21/01/2009	9.29	Alluvium	15 km S of Theodore
13030685	21/01/2009	3.75	Alluvium	15 km SE of Theodore
13030688	2/07/2009	16.67	Alluvium	20 km NE of Theodore
13030689	21/01/2005	8.19	Alluvium	16 km NE of Theodore
13030735	2/07/2009	9.21	Alluvium	Theodore
13030736	2/07/2009	8.23	Alluvium	Theodore
13030737	2/07/2009	8.60	Alluvium	Theodore
13030738	2/07/2009	10.39	Alluvium	Theodore
13030739	2/07/2009	8.82	Alluvium	Theodore
13030740	2/07/2009	9.74	Alluvium	Theodore
13030796	15/01/2003	6.34	Precipice	40 km NE of Taroom
13030797	15/01/2003	36.35	Precipice	40 km NE of Taroom
13030799	15/01/2003	41.98	Precipice	40 km NE of Taroom
13030808	13/07/2006	2.30	Gubberamunda	20 km SW of Wandoan
13030809	13/07/2006	8.92	Gubberamunda	18 km SW of Wandoan
13030810	13/07/2006	-9.53	Alluvium	18 km SW of Wandoan
13030811	13/07/2006	-16.44	Birkhead	30 km NW of Wandoan
13030818	21/01/2009	-0.88	Flat Top	8 km SE of Theodore
13030819	21/01/2009	-0.99	Alluvium	8 km SE of Theodore
13030820	21/01/2009	-5.30	Flat Top	8 km SE of Theodore
13030821	21/01/2009	-9.87	Flat Top	8 km SE of Theodore
13030822	2/07/2009	-3.92	Barfield	20 km N of Theodore
13030823	2/07/2009	-15.90	Rewan	20 km S of Theodore
13030824	2/07/2009	-13.31	Alluvium	20 km S of Theodore
13030827	2/07/2009	-12.95	Barfield	Banana
13030828	21/01/2009	-2.87	Flat Top	8 km SE of Theodore
13030829	21/01/2009	-6.89	Flat Top	8 km SE of Theodore

Notes:

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Table T3: Groundwater Quality

RN	Date	Conductivity ($\mu\text{S}/\text{cm}$)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Total Dissolved Solids (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
8442	27/02/1981	2,900	8.20	136	313	1,618.90	578.0	676.0	100.0
10479	27/04/1980	3,000	8.10	28	465	1,665.48	652.0	695.0	6.0
10479	27/09/1995	2,830	8.30	18	456	1,585.10	624.7	656.4	0.0
10719	23/01/1964	0	7.40	6,007	33	11,730.80	2,003.4	7,313.0	18.6
10862	25/09/1968	223	8.10	14	110	142.19	55.0	16.0	0.0
10862	8/08/1972	225	7.70	9	116	152.22	61.0	18.0	0.0
10862	7/10/1975	280	7.70	37	135	158.13	49.0	12.0	0.0
10862	13/10/1978	245	7.70	6	100	151.30	51.0	12.0	12.0
10862	16/12/1986	240	8.00	5	112	144.82	52.0	9.5	0.0
10863	8/08/1972	350	7.70	13	205	256.32	104.0	25.0	0.0
10863	7/10/1975	370	7.90	15	193	218.05	85.0	10.0	0.0
10863	8/01/1986	225	8.00	8	112	146.38	52.0	10.0	0.0
11017	14/03/1989	255	7.50	5	115	145.36	60.0	9.0	2.0
11064	30/12/1958	0	0.00	712	392	0.00	2,601.2	4,225.7	18.6
11104	1/10/1975	168	7.20	4	75	89.78	34.0	7.0	0.0
11104	8/01/1986	175	8.00	6	77	112.13	38.0	12.0	0.0
12221	20/03/1953	0	0.00	524	138	3,703.70	1,249.8	2,183.6	22.9
12221	28/04/1953	0	0.00	36	241	0.00	407.6	420.4	82.9
12221	28/04/1953	0	0.00	20	236	0.00	377.5	380.4	67.2
12238	15/11/1954	0	8.00	11	393	358.67	97.8	11.4	10.0
12238	1/10/1975	337	7.70	14	174	189.36	72.0	6.0	0.0
12238	16/07/1988	330	8.50	12	175	208.85	74.0	8.6	2.0
12238	28/05/1991	349	8.50	15	183	218.07	80.1	7.7	0.0
12382	23/02/1954	0	0.00	55	217	1,454.40	553.4	700.7	52.9
12627	18/05/1954	0	0.00	40	217	1,907.60	742.2	1,021.0	0.0
12763	14/03/1955	0	0.00	37	320	6,062.60	2,382.4	3,470.6	4.3
13041	13/01/1956	0	0.00	55	162	2,417.20	929.5	1,327.0	42.9
13060	17/05/1956	0	7.20	49	279	1,888.15	735.0	966.7	0.0
13180	18/09/1957	0	6.90	138	141	319.10	62.9	14.3	105.8
13831	30/12/1958	0	0.00	565	310	9,566.90	3,540.7	5,645.6	0.0
13856	17/11/1965	2,650	8.00	20	440	1,526.79	610.0	640.0	4.0
13881	31/10/1975	277	7.60	16	130	170.28	56.0	14.0	0.0
13882	24/04/1974	270	7.80	7	110	155.20	62.0	17.5	0.0
14582	7/10/1975	350	7.70	33	131	186.67	64.0	30.0	0.0

Table T3: Groundwater Quality

RN	Date	Conductivity (μ S/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Total Dissolved Solids (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
14598	25/06/1974	430	8.80	31	144	187.82	66.0	20.0	0.0
14697	1/01/1961	0	0.00	424	70	1,815.49	529.1	922.4	194.5
14697	30/07/1983	830	7.60	379	412	471.76	41.0	25.0	16.0
14872	18/10/1961	0	7.50	215	472	655.57	176.0	103.2	16.1
14872	18/10/1961	0	8.00	127	310	546.32	175.0	111.9	33.3
14943	1/01/1967	35,000	5.90	5,978	60	22,691.59	6,400.0	14,080.0	20.0
14943	1/01/1967	10,750	7.50	489	90	6,319.39	2,280.0	3,790.0	18.0
14943	1/01/1967	5,670	7.80	49	240	3,197.47	1,240.0	1,740.0	58.0
14943	1/01/1967	2,250	8.40	21	1,077	1,523.69	628.0	158.0	84.0
14986	17/09/1962	0	7.30	206	62	4,491.70	1,676.0	2,646.9	55.8
15417	7/04/1976	250	7.40	6	116	158.53	59.0	12.0	0.0
15495	25/03/1964	4,250	7.50	218	308	0.00	898.0	1,232.7	121.6
15538	19/03/1964	0	6.70	687	356	2,323.80	623.5	1,096.8	138.7
15672	26/02/1964	0	6.70	392	353	2,468.10	796.5	1,116.8	187.3
15673	26/02/1964	0	6.70	427	220	2,571.20	816.5	1,265.6	193.1
15862	4/08/1964	0	7.40	951	509	3,074.70	818.0	1,441.4	184.5
15862	4/08/1964	0	7.80	296	353	0.00	626.3	843.7	110.1
16028	12/03/1965	0	7.60	34	131	399.60	147.3	160.2	0.0
16082	1/01/1964	0	7.70	219	93	646.40	163.0	303.2	54.3
16270	9/09/1964	0	6.20	9	23	80.53	46.8	13.8	3.0
16270	9/09/1964	0	6.20	221	97	1,881.47	625.5	1,102.7	9.0
16270	17/08/1966	275	7.90	55	116	137.27	35.0	10.0	1.0
16270	7/10/1975	180	7.60	9	86	102.73	38.0	8.0	0.0
16270	6/06/1978	195	7.40	5	85	116.75	41.0	8.0	1.0
16270	24/11/1986	190	8.00	4	87	115.46	40.0	7.5	0.0
16270	28/10/1987	185	7.60	4	87	121.18	42.0	8.0	2.0
16270	15/02/1989	190	7.70	4	87	116.34	37.5	8.7	2.0
16270	7/09/1990	189	7.80	5	88	120.38	43.5	7.1	0.0
16270	18/01/1994	190	7.80	5	88	118.06	42.1	7.0	0.0
16270	18/01/1994	890	11.00	4	324	357.80	152.2	7.1	0.0
16270	22/08/2008	186	7.40	5	91	117.00	40.0	7.1	<1.0
16276	20/02/1976	530	8.50	76	168	288.66	78.0	68.0	0.0
16661	23/09/1966	2,200	8.60	19	210	1,256.42	485.0	540.0	98.0
16686	7/06/1966	230	6.70	9	108	146.15	59.0	15.0	4.0
16752	1/01/1966	3,360	8.90	16	364	1,908.37	759.0	924.0	0.0

Table T3: Groundwater Quality

RN	Date	Conductivity (μ S/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Total Dissolved Solids (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
16987	7/04/1976	265	7.10	9	122	165.36	59.0	16.0	0.0
17849	9/10/1975	238	7.50	6	112	149.03	52.0	14.0	0.0
17849	8/04/1976	255	7.50	5	110	149.49	54.0	12.0	0.0
17849	15/03/1989	245	7.60	7	111	142.99	59.0	9.5	2.0
17849	6/09/1990	240	8.00	7	111	153.88	55.2	10.2	0.0
17849	8/11/1995	230	8.20	6	112	145.67	53.7	8.4	0.0
17849	13/10/2008	231	7.50	5	112	145.00	51.0	9.2	<1.0
17849	8/07/1968	230	7.10	14	128	159.01	63.0	14.0	0.0
17849	25/07/1968	244	7.00	9	140	174.08	71.0	16.0	0.0
17849	17/11/1971	260	8.00	5	124	157.65	65.0	16.0	0.0
17945	2/05/1968	370	7.40	65	176	261.42	83.0	40.0	13.0
18173	18/11/1970	250	7.80	9	110	145.24	58.0	18.0	0.0
18173	19/02/1976	220	7.30	7	100	132.68	45.0	5.0	3.0
18173	21/03/1984	215	8.30	6	100	144.20	53.0	9.7	2.9
18173	9/01/1986	235	8.00	11	95	143.87	47.0	14.0	4.0
26080	7/04/1976	262	7.20	6	120	157.89	58.0	12.0	0.0
26080	15/09/1993	430	8.20	62	167	248.65	70.8	38.6	0.0
26081	7/04/1976	405	7.20	61	160	237.38	69.0	34.0	0.0
30318	21/10/1968	730	6.70	97	172	424.86	134.0	154.0	0.0
30506	19/11/1968	300	7.00	33	140	192.88	67.0	25.0	4.0
30507	4/12/1968	274	6.60	19	140	171.48	65.0	15.0	0.0
30884	11/10/1969	230	7.40	8	105	138.24	55.0	15.0	2.0
30884	7/10/1975	220	8.20	9	98	121.10	45.0	12.0	0.0
30884	13/10/1978	225	7.70	5	85	130.05	49.0	12.0	1.0
30884	20/03/1984	215	7.90	6	99	142.51	53.0	10.5	2.5
30884	29/03/1989	215	7.30	4	99	120.22	45.0	10.0	2.0
36120	17/11/1971	194	7.50	7	90	114.79	46.0	12.0	0.0
36120	7/10/1975	180	7.50	8	86	102.43	38.0	8.0	0.0
36120	10/02/1976	180	7.50	8	86	102.43	38.0	8.0	0.0
36120	8/06/1978	192	7.40	5	80	114.69	40.0	8.0	1.0
36120	17/12/1986	195	8.00	6	87	121.08	43.0	8.3	0.0
38156	28/08/1972	235	7.40	9	120	149.14	60.0	14.0	0.0
38156	7/10/1975	220	7.60	9	103	0.00	48.0	12.0	0.0
38156	10/02/1976	220	7.60	9	103	126.66	48.0	12.0	0.0
38658	22/06/1995	301	7.30	7	147	184.15	69.8	9.0	0.0

Table T3: Groundwater Quality

RN	Date	Conductivity ($\mu\text{S}/\text{cm}$)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Total Dissolved Solids (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
43687	2/11/1973	216	8.30	5	102	137.85	49.0	14.0	0.0
43687	23/07/1974	320	8.20	5	99	131.55	53.0	15.0	0.0
43687	17/12/1986	225	7.90	4	110	150.00	50.0	9.7	0.0
43687	29/10/1987	215	7.40	4	99	136.91	49.0	9.4	2.0
43687	14/03/1989	225	7.50	3	100	130.00	55.0	9.6	2.0
43687	4/09/1990	227	7.90	5	102	144.98	52.2	10.8	0.0
43687	27/09/1995	224	7.30	4	102	136.14	49.7	8.6	0.0
43687	21/08/2008	220	7.50	5	105	160.00	57.0	22.0	<1.0
44097	13/08/1974	13,400	8.00	141	400	7,836.97	3,000.0	4,440.0	6.0
44404	7/11/1973	270	8.30	7	112	139.02	53.0	14.0	0.0
44404	24/07/1974	240	7.70	5	105	136.89	55.0	15.0	0.0
44404	16/12/1986	240	8.10	5	110	140.00	52.0	9.3	2.0
44404	29/10/1987	225	7.30	5	111	147.44	52.0	9.3	2.0
44404	14/02/1989	235	7.40	4	110	150.00	52.0	9.4	2.2
44404	6/09/1990	243	8.00	4	110	154.05	55.2	11.6	0.0
44404	13/10/2008	227	7.50	5	110	144.00	51.0	9.1	<1.0
47259	21/03/1976	1,510	7.00	275	126	839.23	206.0	394.0	54.0
47328	7/04/1976	430	7.40	59	156	251.82	74.0	44.0	5.2
47329	7/04/1976	320	7.20	18	120	192.69	68.0	32.0	0.0
47330	7/04/1976	620	7.80	187	262	386.87	69.0	46.0	8.1
47502	20/07/1978	10,600	7.90	381	450	6,071.84	2,240.0	3,360.0	20.0
57904	7/05/1966	1,820	8.00	98	722	0.00	460.0	250.0	28.0
58232	21/04/1986	3,150	8.70	670	175	1,650.00	670.0	830.0	3.3
58266	11/11/1987	3,350	8.30	31	140	1,880.00	710.0	1,050.0	5.1
58377	6/06/1989	16,000	8.10	1,200	165	10,300.00	3,450.0	6,300.0	20.0
58393	7/07/1989	3,000	8.50	23	230	1,700.00	640.0	880.0	23.0
58393	14/08/1989	29,000	7.90	2,227	88	7,520.83	6,600.0	0.0	46.0
58393	8/09/1989	5,200	8.20	160	180	3,070.00	1,100.0	1,750.0	16.0
58409	15/02/1990	3,410	8.70	25	892	2,020.63	811.0	628.0	11.3
58608	2/02/1995	4,160	7.70	86	201	2,399.93	900.8	1,204.0	120.4
62077	19/06/1984	335	7.50	9	144	213.06	75.0	30.0	2.6
62077	2/03/1995	342	8.00	25	163	199.06	67.1	8.7	0.0
62289	5/10/1981	2,300	9.00	147	960	1,329.62	512.0	0.3	1.0
62289	11/01/1988	2,450	8.70	180	1,000	1,520.00	540.0	255.0	66.0
62289	4/03/1997	2,600	7.90	322	873	1,640.59	556.9	372.3	69.7

Table T3: Groundwater Quality

RN	Date	Conductivity ($\mu\text{S}/\text{cm}$)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Total Dissolved Solids (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
62290	5/10/1981	1,490	7.70	497	410	868.38	130.0	245.0	43.0
62290	16/07/1985	1,500	7.70	431	372	815.50	135.0	235.0	45.0
62290	11/01/1988	1,750	7.70	596	409	1,005.64	145.0	330.0	51.0
62323	26/10/1973	1,280	7.40	373	315	597.26	114.0	195.0	0.0
62323	7/03/1974	1,500	7.50	424	370	693.76	121.0	230.0	0.0
62323	7/03/1974	1,260	8.00	417	340	679.00	117.0	240.0	0.0
67229	21/06/1995	284	7.30	7	140	175.21	65.7	8.6	0.0
67280	11/11/1986	175	8.00	4	81	107.81	36.0	7.5	0.0
67280	30/03/1989	175	7.40	4	82	95.00	36.0	6.6	2.0
67280	13/08/1996	157	6.90	5	77	105.36	38.2	6.0	0.0
67281	11/11/1986	220	8.10	5	100	131.10	46.0	9.0	0.0
67281	26/10/1987	210	7.60	5	98	130.00	49.0	9.0	2.0
67281	15/02/1989	215	7.40	5	99	129.62	42.0	9.2	2.5
67281	16/10/1990	222	7.80	7	99	135.89	49.8	9.2	0.0
67300	12/11/1986	205	8.10	9	95	122.75	40.0	7.0	0.0
67300	30/03/1989	200	7.30	10	97	110.00	39.5	7.0	2.0
67624	23/07/1987	550	7.40	84	35	289.94	68.0	130.0	27.0
67625	11/08/1987	200	7.70	4	95	123.38	43.0	7.3	0.0
67625	30/03/1989	200	7.40	5	94	110.00	43.0	8.2	2.0
84032	19/05/1988	235	7.60	4	111	144.14	49.5	9.3	2.0
84032	10/04/1988	14,000	7.10	3,850	105	8,370.00	1,650.0	5,100.0	2.0
84678	4/02/1987	1,100	8.20	355	256	635.60	94.0	210.0	19.5
84679	3/02/1987	1,200	8.00	373	241	654.82	92.0	240.0	20.0
89532	16/03/1993	1,325	7.60	181	347	564.29	81.4	166.8	9.1
89590	21/10/1993	1,279	8.40	444	320	761.32	108.2	247.6	24.6

Notes:

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Table T4: Recharge and Watercourse Springs

NRS No.	Type	Aquifer
1	Recharge	Hutton Sandstone
2	Recharge	Hutton Sandstone
3	Recharge	Hutton Sandstone
4	Recharge	Hutton Sandstone
5	Recharge	Hutton Sandstone
6	Recharge	Hutton Sandstone
7	Recharge	Hutton Sandstone
8	Recharge	Hutton Sandstone
9	Recharge	Hutton Sandstone
10	Recharge	Hutton Sandstone
11	Recharge	Hutton Sandstone
12	Recharge	Hutton Sandstone
13	Recharge	Hutton Sandstone
14	Recharge	Hutton Sandstone
15	Recharge	Hutton Sandstone
16	Recharge	Precipice Sanstone
17	Recharge	Precipice Sanstone
18	Recharge	Precipice Sanstone
19	Recharge	Precipice Sanstone
20	Recharge	Precipice Sanstone
21	Recharge	Precipice Sanstone
22	Recharge	Hutton Sandstone
23	Recharge	Hutton Sandstone
24	Recharge	Hutton Sandstone
25	Recharge	Hutton Sandstone
26	Recharge	Hutton Sandstone
27	Recharge	Hutton Sandstone
28	Recharge	Hutton Sandstone
29	Recharge	Hutton Sandstone
30	Recharge	Hutton Sandstone
31	Recharge	Hutton Sandstone
32	Recharge	Hutton Sandstone
33	Recharge	Hutton Sandstone
34	Recharge	Precipice Sanstone
35	Recharge	Precipice Sanstone
36	Recharge	Precipice Sanstone
37	Recharge	Hutton Sandstone
39	Recharge	Hutton Sandstone
40	Recharge	Hutton Sandstone
41	Recharge	Hutton Sandstone
42	Recharge	Hutton Sandstone
43	Recharge	Hutton Sandstone
44	Recharge	Hutton Sandstone
45	Recharge	Hutton Sandstone
46	Recharge	Hutton Sandstone
47	Recharge	Hutton Sandstone
48	Recharge	Hutton Sandstone
49	Recharge	Hutton Sandstone
50	Recharge	Hutton Sandstone
51	Recharge	Hutton Sandstone
52	Recharge	Hutton Sandstone
53	Recharge	Hutton Sandstone
54	Recharge	Hutton Sandstone
55	Recharge	Hutton Sandstone
56	Recharge	Hutton Sandstone

Table T4: Recharge and Watercourse Springs

NRS No.	Type	Aquifer
57	Recharge	Hutton Sandstone
58	Recharge	Hutton Sandstone
59	Recharge	Hutton Sandstone
60	Recharge	Hutton Sandstone
61	Recharge	Hutton Sandstone
62	Recharge	Hutton Sandstone
63	Recharge	Hutton Sandstone
64	Recharge	Hutton Sandstone
65	Recharge	Hutton Sandstone
66	Recharge	Hutton Sandstone
67	Recharge	Hutton Sandstone
68	Recharge	Hutton Sandstone
69	Recharge	Precipice Sanstone
319	Recharge	Hutton Sandstone
319A	Recharge	Hutton Sandstone
320	Recharge	Hutton Sandstone
321	Recharge	Hutton Sandstone
nv346	Recharge	Hutton Sandstone
nv403	Recharge	Precipice Sanstone
r14	Watercourse	Hutton Sandstone
r15	Watercourse	Hutton Sandstone
r28	Watercourse	Precipice Sanstone
r29	Watercourse	Precipice Sanstone
r41	Watercourse	Precipice Sanstone

Notes:

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Table T5: Distances to 5-metre Drawdown

		Time (days)													
		30	60	90	120	150	200	300	400	500	600	700	800	900	1000
Extraction Rate (ML/day)	0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	0.010	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	0.025	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	0.050	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	0.100	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	0.200	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	0.300	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	0.400	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	0.500	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002
	0.600	0.002	0.002	0.003	0.003	0.004	0.005	0.006	0.006	0.007	0.008	0.008	0.009	0.010	0.010
	0.700	0.005	0.008	0.009	0.011	0.012	0.014	0.017	0.020	0.022	0.024	0.026	0.028	0.029	0.031
	0.800	0.013	0.018	0.022	0.025	0.028	0.032	0.039	0.045	0.051	0.056	0.060	0.064	0.068	0.072
	0.900	0.024	0.034	0.041	0.048	0.053	0.062	0.076	0.087	0.098	0.107	0.116	0.124	0.130	0.138
	1.000	0.040	0.057	0.070	0.080	0.090	0.104	0.128	0.147	0.165	0.181	0.195	0.209	0.220	0.233
	1.500	0.195	0.275	0.337	0.389	0.435	0.502	0.615	0.710	0.794	0.869	0.939	1.004	1.065	1.122
	2.000	0.428	0.604	0.740	0.854	0.955	1.103	1.351	1.560	1.744	1.910	2.064	2.206	2.340	2.466
	2.500	0.688	0.972	1.190	1.374	1.536	1.774	2.173	2.509	2.805	3.073	3.319	3.548	3.763	3.967
3.000	0.947	1.338	1.639	1.892	2.116	2.443	2.992	3.455	3.863	4.232	4.571	4.886	5.183	5.463	
4.000	1.424	2.012	2.465	2.846	3.182	3.674	4.500	5.196	5.810	6.364	6.874	7.349	7.794	8.216	
5.000	1.834	2.593	3.176	3.667	4.100	4.734	5.799	6.696	7.486	8.200	8.857	9.469	10.043	10.587	
6.000	2.186	3.090	3.786	4.372	4.888	5.644	6.912	7.981	8.923	9.775	10.558	11.287	11.972	12.620	
7.000	2.491	3.522	4.314	4.981	5.569	6.431	7.876	9.095	10.168	11.139	12.031	12.862	13.642	14.380	
8.000	2.758	3.900	4.777	5.515	6.166	7.120	8.721	10.070	11.258	12.333	13.321	14.241	15.105	15.922	
9.000	2.995	4.235	5.185	5.989	6.696	7.732	9.469	10.934	12.225	13.391	14.464	15.463	16.401	17.288	

Notes:
 Shading denotes distance is less than minimum distance between groundwater bores in database
 Distances in kilometers

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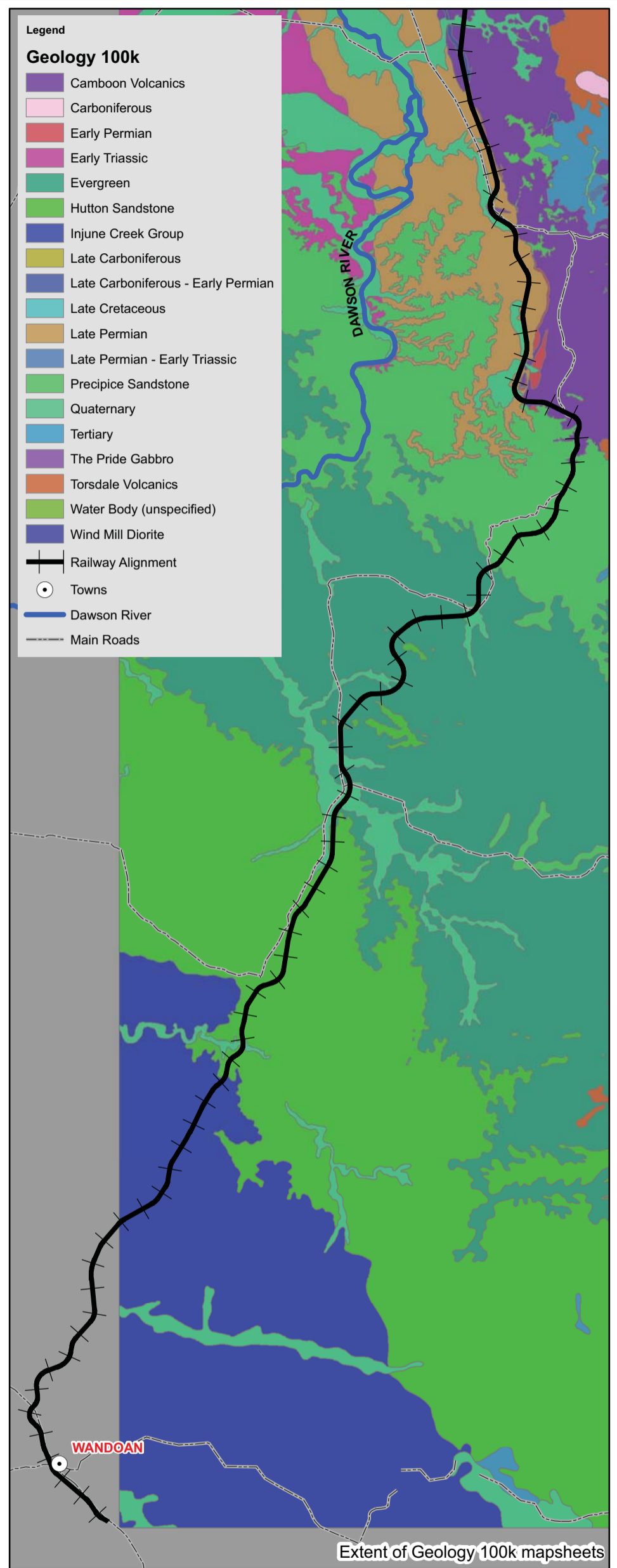
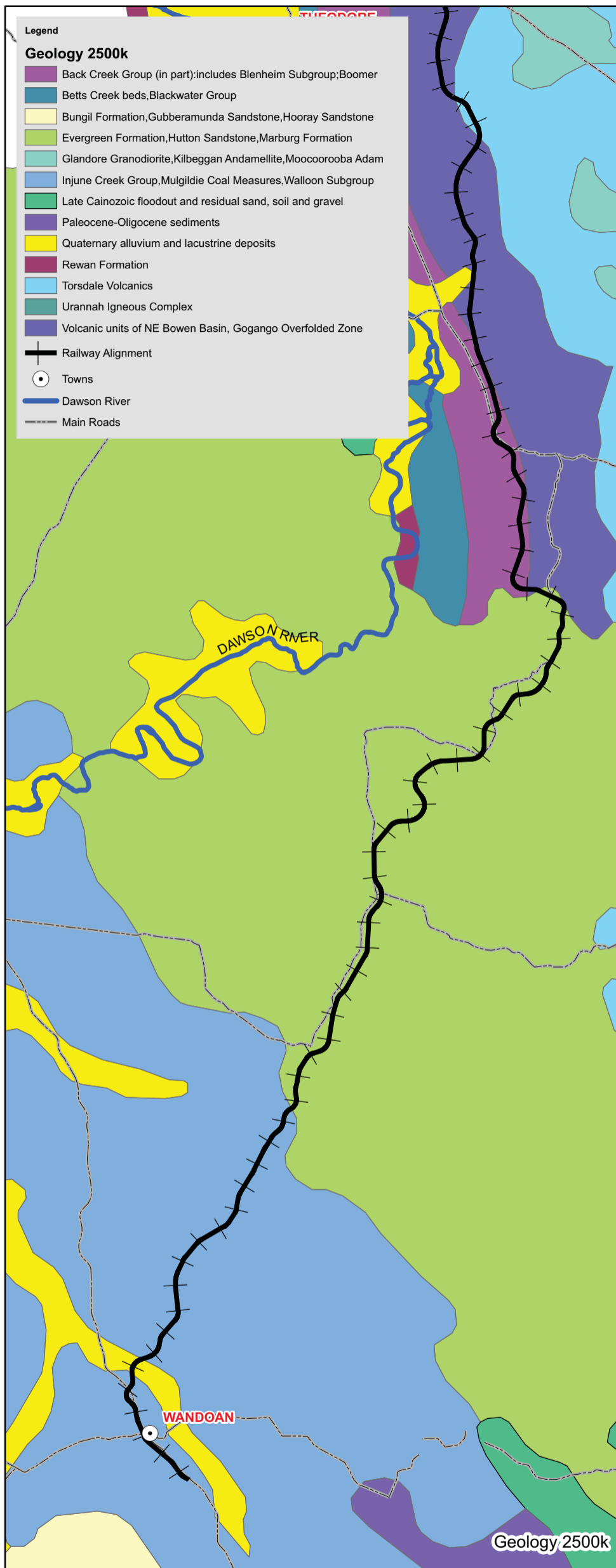
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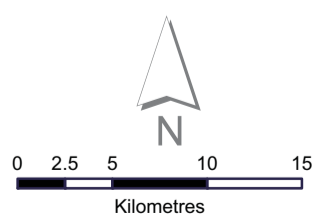
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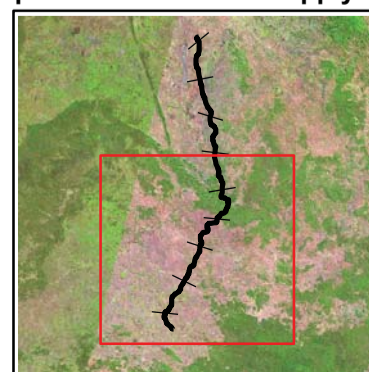
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Proposed South Water Supply Area



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Geology

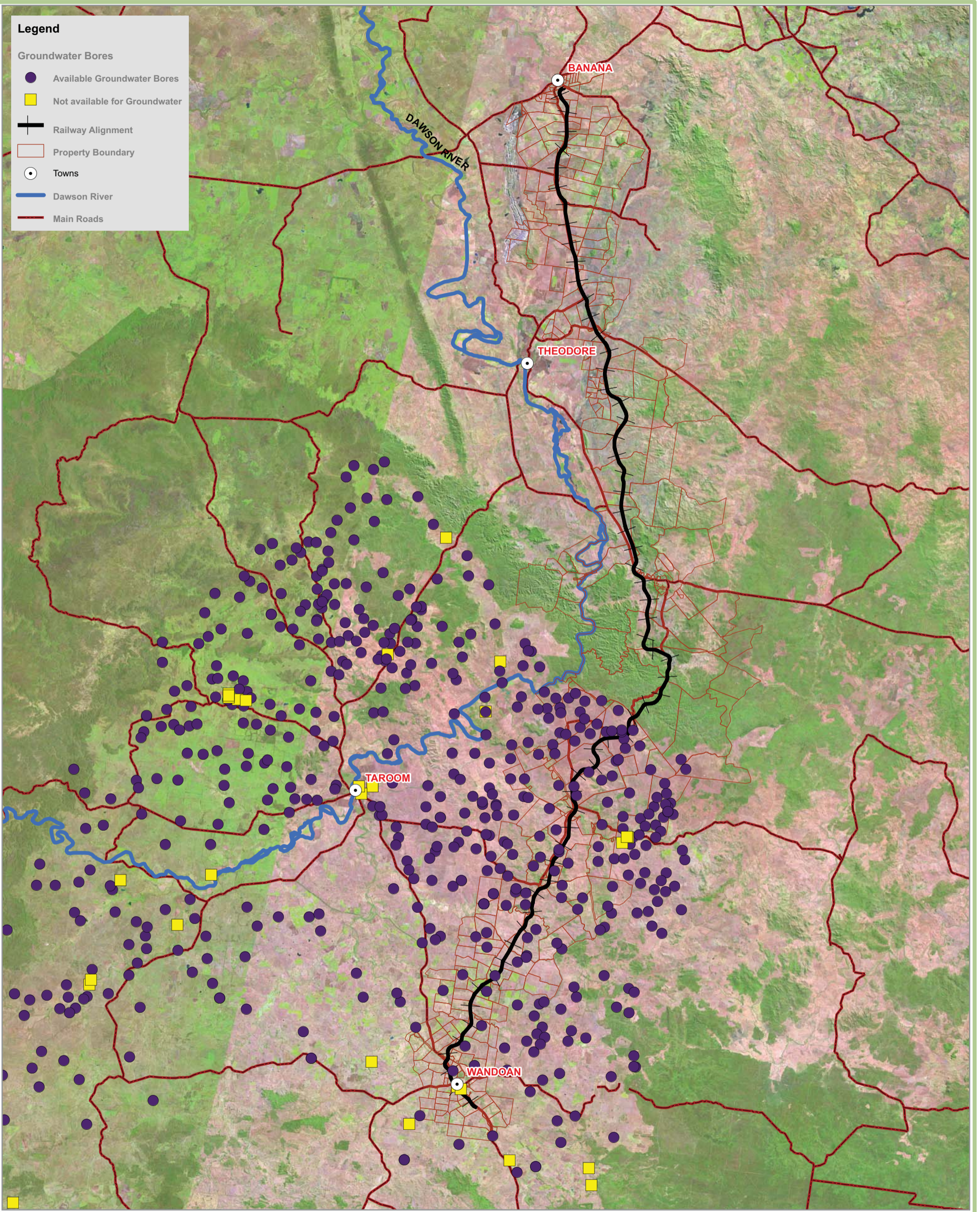
Map F1

August 2009

Legend

Groundwater Bores

- Available Groundwater Bores
- Not available for Groundwater
- Railway Alignment
- Property Boundary
- Towns
- Dawson River
- Main Roads



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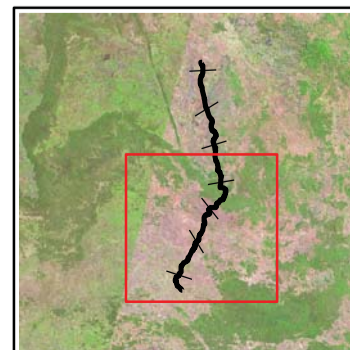
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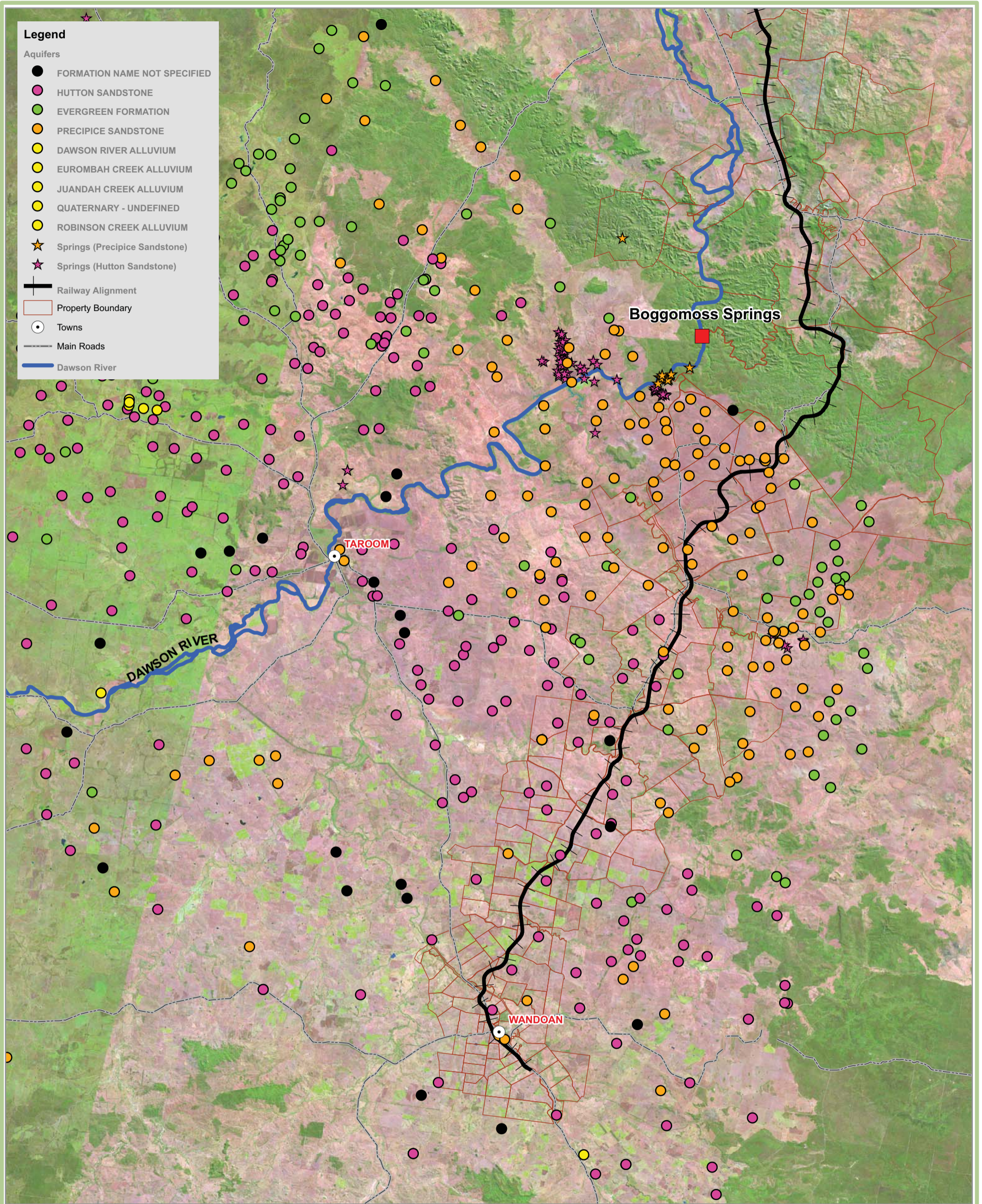
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Location of Groundwater Bores

Map F2
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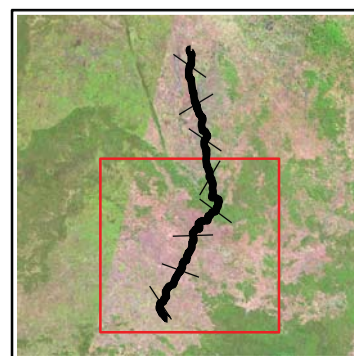
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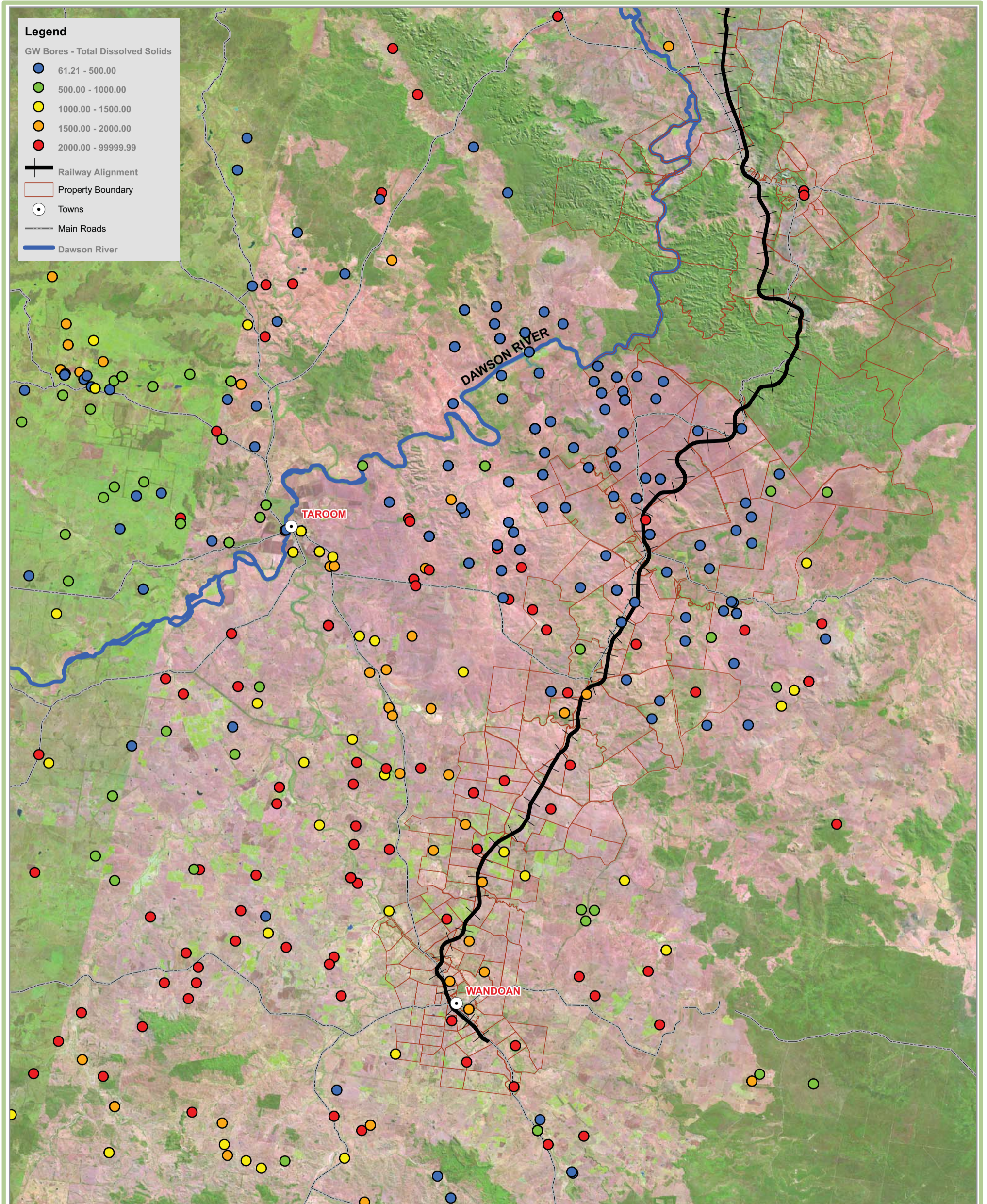


SURAT BASIN RAIL PROJECT EIS

Aquifers and Springs

Map F3

August 2009



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Legend

GW Bores - Total Dissolved Solids

- 61.21 - 500.00
- 500.00 - 1000.00
- 1000.00 - 1500.00
- 1500.00 - 2000.00
- 2000.00 - 99999.99

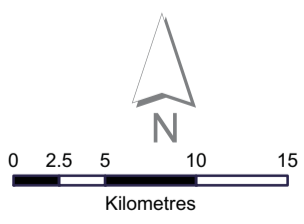
- Railway Alignment
- Property Boundary
- Towns
- Main Roads
- Dawson River

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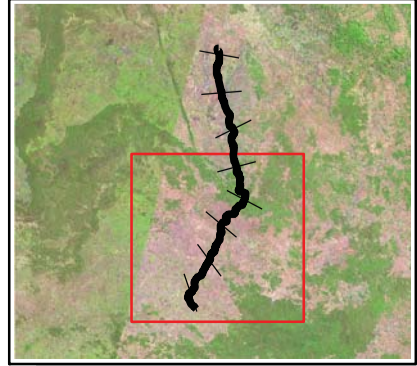
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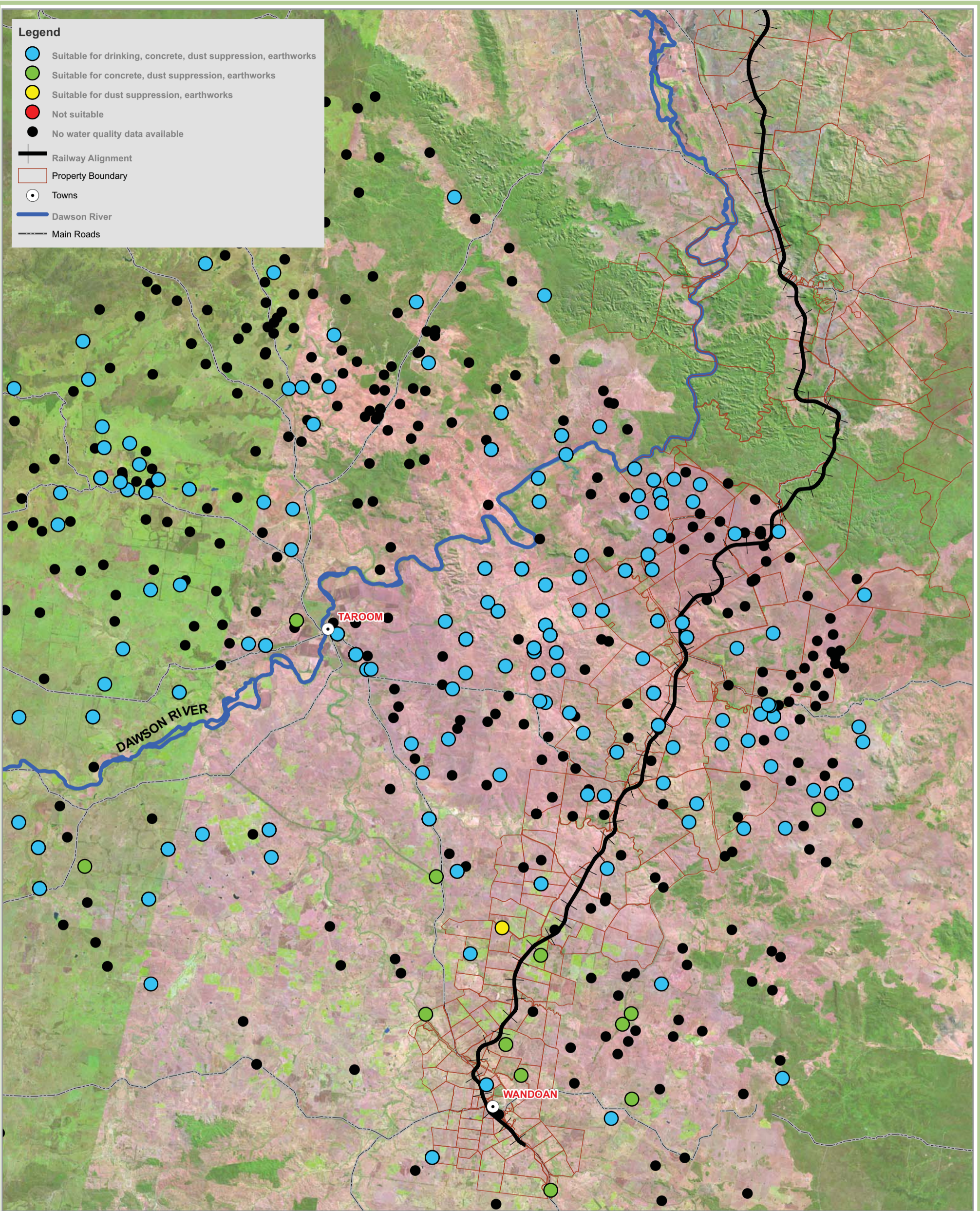
Proposed South Water Supply Area



SURAT BASIN RAIL PROJECT EIS

Groundwater - Total Dissolved Solids

Map F4
August 2009



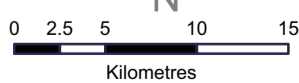
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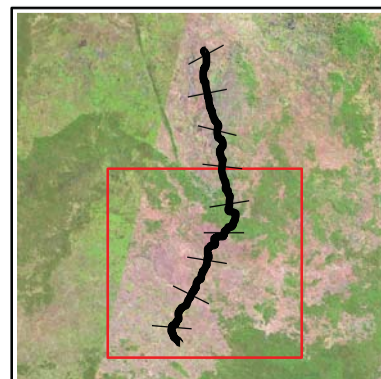
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Proposed South Water Supply Area

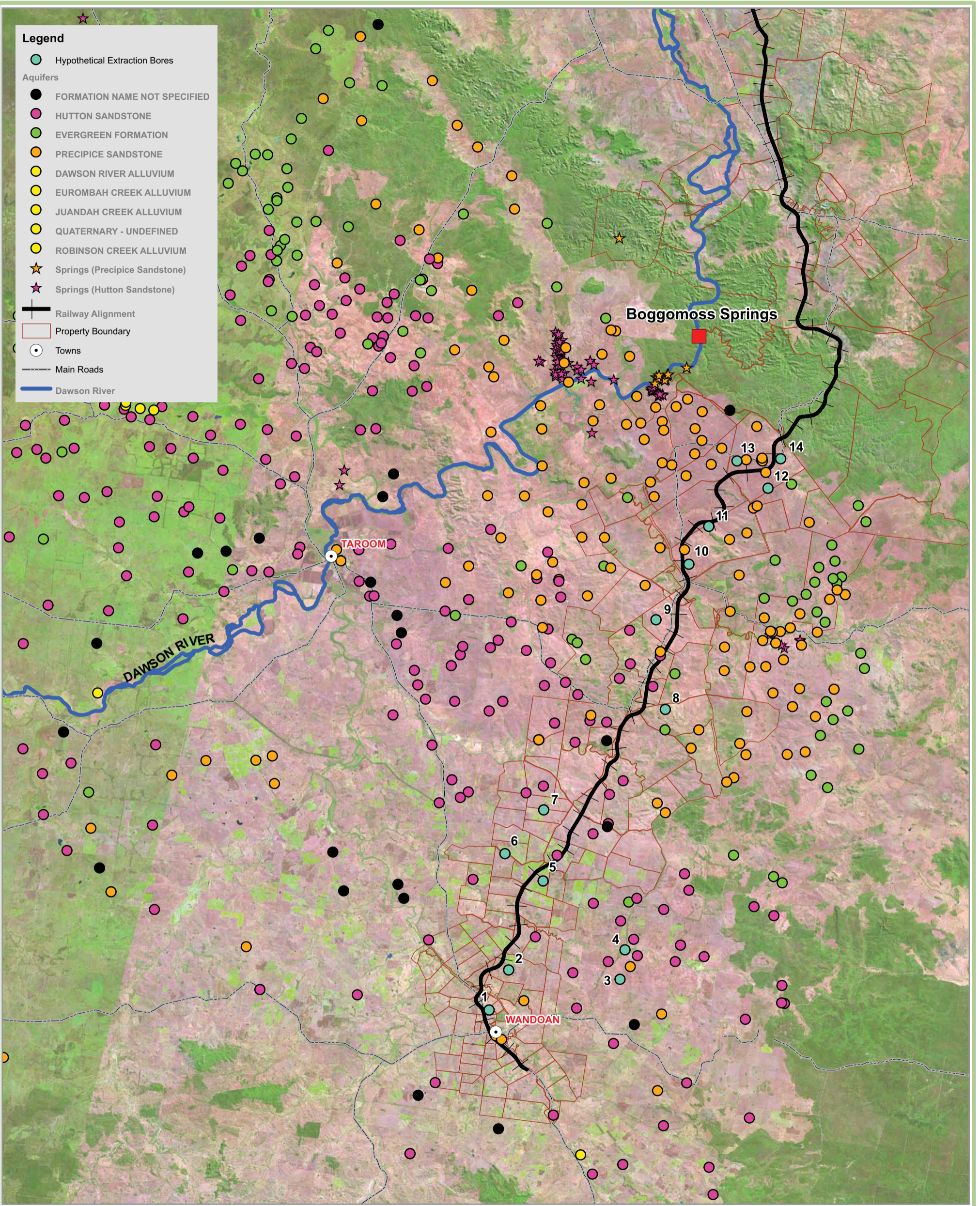


SURAT BASIN RAIL PROJECT EIS

Groundwater Suitability

Map F5

August 2009



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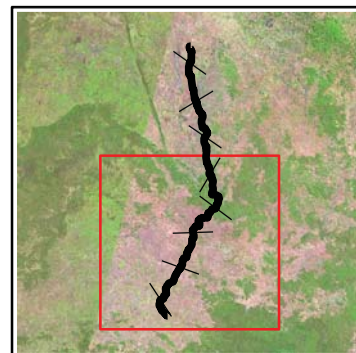
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Proposed South Water Supply Area



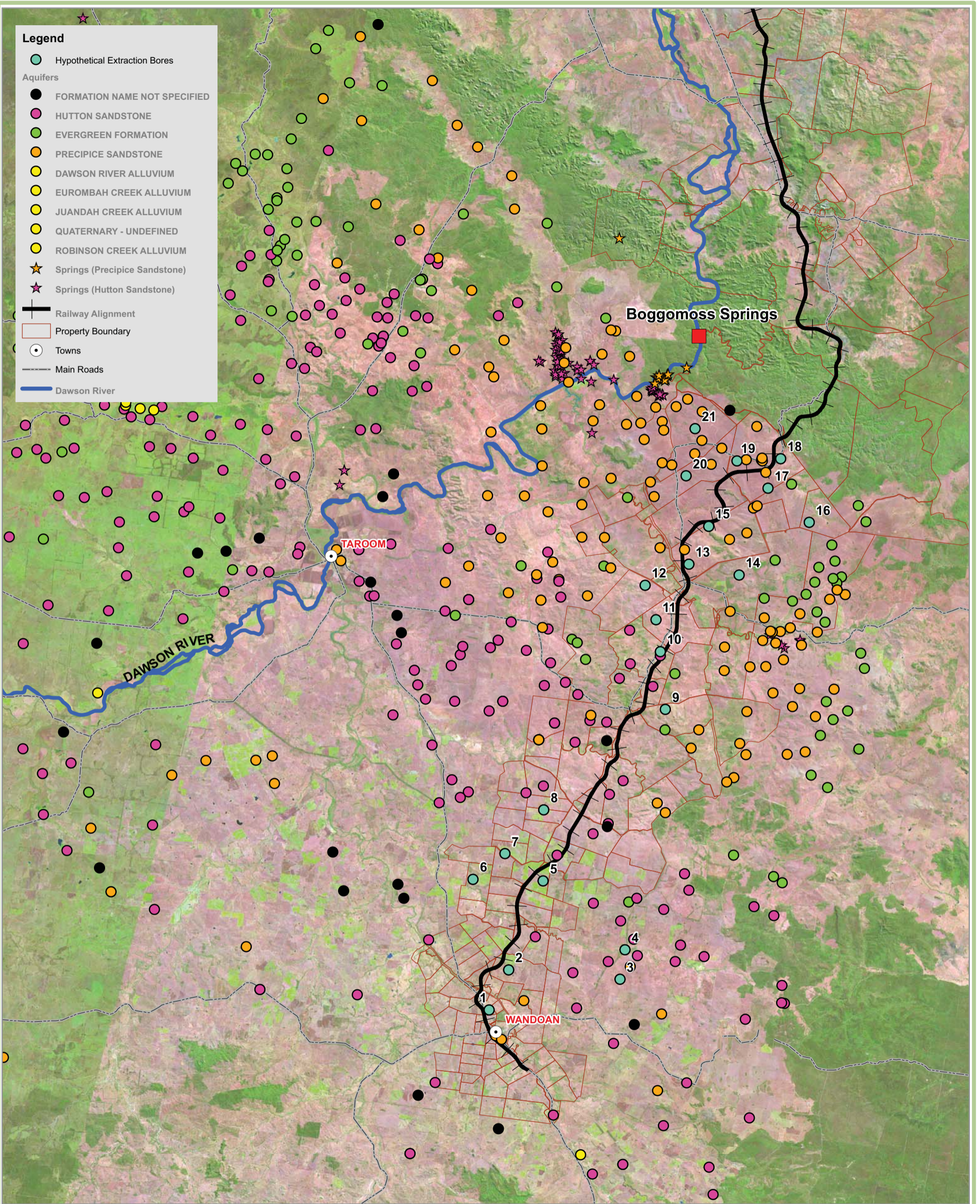
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SURAT BASIN RAIL PROJECT EIS

Model Results (1,800 ML & 2,700 ML)

Map F6

November 2009



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Legend

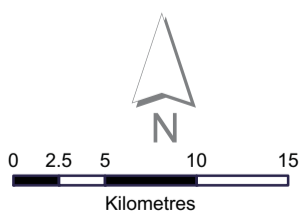
- Hypothetical Extraction Bores
- Aquifers**
- FORMATION NAME NOT SPECIFIED
- HUTTON SANDSTONE
- EVERGREEN FORMATION
- PRECIPICE SANDSTONE
- DAWSON RIVER ALLUVIUM
- EUROMBAH CREEK ALLUVIUM
- JUANDAH CREEK ALLUVIUM
- QUATERNARY - UNDEFINED
- ROBINSON CREEK ALLUVIUM
- ★ Springs (Precipice Sandstone)
- ★ Springs (Hutton Sandstone)
- Railway Alignment
- Property Boundary
- Towns
- Main Roads
- Dawson River

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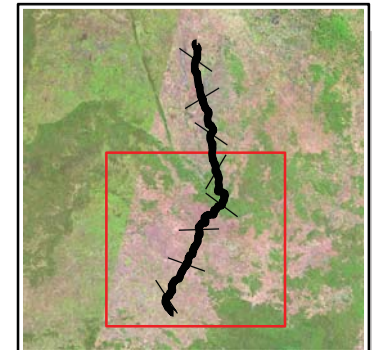
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Proposed South Water Supply Area



SURAT BASIN RAIL PROJECT EIS

Model Results (3,500 ML)
Map F7
 November 2009

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Environment

Appendix A

Groundwater Demand Schedules

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Environment

Table A1 - Groundwater Demand Schedule 0 - 9km (1,800 ML

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.
			1
			Extraction Rate (ML/day)
Jun-11	150	150	1.109
Jul-11			1.109
Aug-11			1.109
Sep-11			1.109
Oct-11			1.109
Nov-11	30	180	0.210
Aquifer			Hutton Sandstone

Table A2 - Groundwater Demand Schedule 9 - 19.28 km (1,800 ML)

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.			Total Extraction Rate (ML/day)
			2	3	4	
			Extraction Rate (ML/day)			
May-10	330	330	0.029	-	-	0.029
Jun-10			0.029	-	-	0.029
Jul-10			0.029	-	-	0.029
Aug-10			0.029	-	-	0.029
Sep-10			0.029	-	-	0.029
Oct-10			0.029	-	-	0.029
Nov-10			0.029	-	-	0.029
Dec-10			0.029	-	-	0.029
Jan-11			0.029	-	-	0.029
Feb-11			0.029	-	-	0.029
Mar-11			0.029	-	-	0.029
Apr-11			-	-	-	-
May-11	-	-	-	-	-	
Jun-11	-	-	-	-	-	
Jul-11	-	-	-	-	-	
Aug-11	-	-	-	-	-	
Sep-11	60	390	0.813	0.813	0.813	2.439
Oct-11			0.813	0.813	0.813	2.438
Nov-11			0.826	0.826	0.826	2.479
Dec-11			-	0.279	-	0.279
Aquifer			Hutton Sandstone	Hutton Sandstone	Precipice Sandstone	

Table A3 - Groundwater Demand Schedule 19.28 - 63 km (1,800 ML)

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.					Total Extraction Rate (ML/day)
			5	6	7	8	9	
			Extraction Rate (ML/day)					
Feb-10	120	120	-	-	0.096	-	-	0.096
Mar-10			-	-	0.096	-	-	0.096
Apr-10			-	-	0.096	-	-	0.096
May-10			-	-	0.096	-	-	0.096
Jun-10	120	240	-	-	0.108	-	-	0.108
Jul-10			-	-	0.108	-	-	0.108
Aug-10			-	-	0.108	-	-	0.108
Sep-10			-	-	0.108	-	-	0.108
Oct-10	120	360	-	-	0.258	-	1.526	1.783
Nov-10			-	-	0.258	-	1.526	1.783
Dec-10			-	-	0.258	-	1.526	1.783
Jan-11			-	-	0.258	-	1.526	1.783
Feb-11	120	480	0.838	-	0.096	0.838	-	1.771
Mar-11			0.838	-	0.096	0.838	-	1.771
Apr-11			0.838	-	0.096	0.838	-	1.771
May-11			0.838	-	0.096	0.838	-	1.771
Jun-11	30	510	0.532	-	0.096	0.532	0.150	1.308
Jul-11	120	630	0.532	-	0.096	0.532	0.725	1.883
Aug-11			0.532	-	0.096	0.532	0.725	1.883
Sep-11			0.532	0.575	0.096	0.532	0.150	1.883
Oct-11			0.532	0.575	0.096	0.532	0.150	1.883
Nov-11	30	660	-	0.575	0.096	-	0.150	0.821
Dec-11	150	810	-	-	0.096	-	-	0.096
Jan-12			-	-	0.096	-	-	0.096
Feb-12			-	-	0.096	-	-	0.096
Mar-12			-	-	0.096	-	-	0.096
Apr-12			-	-	0.096	-	-	0.096
Aquifer			Hutton Sandstone	Hutton Sandstone	Precipice Sandstone	Precipice Sandstone	Hutton Sandstone	

Table A4 - Groundwater Demand Schedule 63 - 90 km (1,800 ML)

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.					Total Extraction Rate (ML/day)
			10	11	12	13	14	
			Extraction Rate (ML/day)					
Feb-10	360	360	0.003	-	0.003	-	0.096	0.102
Mar-10			0.003	-	0.003	-	0.096	0.102
Apr-10			0.003	-	0.003	-	0.096	0.102
May-10			0.003	-	0.003	-	0.096	0.102
Jun-10			0.003	-	0.003	-	0.096	0.102
Jul-10			0.003	-	0.003	-	0.096	0.102
Aug-10			0.003	-	0.003	-	0.096	0.102
Sep-10			0.003	-	0.003	-	0.096	0.102
Oct-10			0.003	-	0.003	-	0.096	0.102
Nov-10			0.003	-	0.003	-	0.096	0.102
Dec-10			0.003	-	0.003	-	0.096	0.102
Jan-11			0.003	-	0.003	-	0.096	0.102
Feb-11	30	390	1.710	0.442	0.003	-	0.096	2.251
Mar-11	60	450	1.710	0.442	0.353	0.853	0.949	4.307
Apr-11			1.710	0.442	0.353	0.853	0.949	4.307
May-11	90	540	0.003	0.092	0.353	0.853	0.949	2.250
Jun-11			0.003	0.092	0.353	0.853	0.949	2.250
Jul-11			0.003	0.092	0.353	0.853	0.949	2.250
Aug-11	30	570	0.003	0.092	0.003	-	0.096	0.194
Sep-11	30	600	0.210	0.092	-	-	0.210	0.512
Aquifer			Precipice Sandstone	Precipice Sandstone	Precipice Sandstone	Precipice	Precipice Sandstone	

Table A5 - Groundwater Demand Schedule 0 - 9 km (2,700 ML

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.
			1
			Extraction Rate (ML/day)
Jun-11	150	150	1.669
Jul-11			1.669
Aug-11			1.669
Sep-11			1.669
Oct-11			1.669
Nov-11	30	180	0.316
Aquifer			Hutton Sandstone

Table A6 - Groundwater Demand Schedule 9 - 19.28 km (2,700 ML

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.			Total Extraction Rate (ML/day)
			2	3	4	
			Extraction Rate (ML/day)			
May-10	330	330	-	0.043	-	0.043
Jun-10			-	0.043	-	0.043
Jul-10			-	0.043	-	0.043
Aug-10			-	0.043	-	0.043
Sep-10			-	0.043	-	0.043
Oct-10			-	0.043	-	0.043
Nov-10			-	0.043	-	0.043
Dec-10			-	0.043	-	0.043
Jan-11			-	0.043	-	0.043
Feb-11			-	0.043	-	0.043
Mar-11			-	0.043	-	0.043
Apr-11			-	-	-	-
May-11	-	-	-	-	-	
Jun-11	-	-	-	-	-	
Jul-11	-	-	-	-	-	
Aug-11	-	-	-	-	-	
Sep-11	60	390	1.223	1.223	1.223	3.669
Oct-11			1.223	1.223	1.223	3.669
Nov-11	30	420	1.243	1.243	1.243	3.730
Dec-11	30	450	-	0.420	-	0.420
Aquifer			Hutton Sandstone	Hutton Sandstone	Precipice Sandstone	

Table A7 - Groundwater Demand Schedule 19.28 - 63 km (2,700 ML)

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.					Total Extraction Rate (ML/day)
			5	6	7	8	9	
			Extraction Rate (ML/day)					
Feb-10	120	120	-	-	0.144	-	-	0.144
Mar-10			-	-	0.144	-	-	0.144
Apr-10			-	-	0.144	-	-	0.144
May-10			-	-	0.144	-	-	0.144
Jun-10	120	240	-	-	0.163	-	-	0.163
Jul-10			-	-	0.163	-	-	0.163
Aug-10			-	-	0.163	-	-	0.163
Sep-10			-	-	0.163	-	-	0.163
Oct-10	120	360	-	-	0.389	-	2.295	2.684
Nov-10			-	-	0.389	-	2.295	2.684
Dec-10			-	-	0.389	-	2.295	2.684
Jan-11			-	-	0.389	-	2.295	2.684
Feb-11	120	480	1.261	-	0.144	1.261	-	2.665
Mar-11			1.261	-	0.144	1.261	-	2.665
Apr-11			1.261	-	0.144	1.261	-	2.665
May-11			1.261	-	0.144	1.261	-	2.665
Jun-11	30	510	0.800	-	0.144	0.800	0.226	1.969
Jul-11	120	630	0.800	-	0.144	0.800	1.091	2.834
Aug-11			0.800	-	0.144	0.800	1.091	2.834
Sep-11			0.800	0.865	0.144	0.800	0.226	2.834
Oct-11			0.800	0.865	0.144	0.800	0.226	2.834
Nov-11	30	660	-	0.865	0.144	-	0.226	1.235
Dec-11	150	810	-	-	0.144	-	-	0.144
Jan-12			-	-	0.144	-	-	0.144
Feb-12			-	-	0.144	-	-	0.144
Mar-12			-	-	0.144	-	-	0.144
Apr-12			-	-	0.144	-	-	0.144
Aquifer			Hutton Sandstone	Hutton Sandstone	Precipice Sandstone	Precipice Sandstone	Hutton Sandstone	

Table A8 - Groundwater Demand Schedule 63 - 90 km (2,700 ML)

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.					Total Extraction Rate (ML/day)
			10	11	12	13	14	
			Extraction Rate (ML/day)					
Feb-10	360	360	0.005	-	0.005	-	0.144	0.153
Mar-10			0.005	-	0.005	-	0.144	0.153
Apr-10			0.005	-	0.005	-	0.144	0.153
May-10			0.005	-	0.005	-	0.144	0.153
Jun-10			0.005	-	0.005	-	0.144	0.153
Jul-10			0.005	-	0.005	-	0.144	0.153
Aug-10			0.005	-	0.005	-	0.144	0.153
Sep-10			0.005	-	0.005	-	0.144	0.153
Oct-10			0.005	-	0.005	-	0.144	0.153
Nov-10			0.005	-	0.005	-	0.144	0.153
Dec-10			0.005	-	0.005	-	0.144	0.153
Jan-11			0.005	-	0.005	-	0.144	0.153
Feb-11	30	390	2.572	0.665	0.005	-	0.144	3.385
Mar-11	60	450	2.572	0.665	0.532	1.284	1.428	6.479
Apr-11			2.572	0.665	0.532	1.284	1.428	6.479
May-11	90	540	0.005	0.138	0.532	1.284	1.428	3.385
Jun-11			0.005	0.138	0.532	1.284	1.428	3.385
Jul-11			0.005	0.138	0.532	1.284	1.428	3.385
Aug-11	30	570	0.005	0.138	-	-	0.144	0.287
Sep-11	30	600	0.316	0.138	-	-	0.316	0.770
Aquifer			Precipice Sandstone	Precipice Sandstone	Precipice Sandstone	Precipice Sandstone	Precipice Sandstone	

Table A9 - Groundwater Demand Schedule 0 - 9 km (3,500 ML)

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No. 1
			Extraction Rate (ML/day)
Jun-11	150	150	2.225
Jul-11			2.225
Aug-11			2.225
Sep-11			2.225
Oct-11			2.225
Nov-11	30	180	0.420
Aquifer			Hutton Sandstone

Table A10 - Groundwater Demand Schedule 9 - 19.28 km (3,500 ML)

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.			Total Extraction Rate (ML/day)
			2	3	4	
			Extraction Rate (ML/day)			
May-10			0.058	-	-	0.058
Jun-10			0.058	-	-	0.058
Jul-10			0.058	-	-	0.058
Aug-10			0.058	-	-	0.058
Sep-10			0.058	-	-	0.058
Oct-10	330	330	0.058	-	-	0.058
Nov-10			0.058	-	-	0.058
Dec-10			0.058	-	-	0.058
Jan-11			0.058	-	-	0.058
Feb-11			0.058	-	-	0.058
Mar-11			0.058	-	-	0.058
Apr-11	-	-	-	-	-	-
May-11	-	-	-	-	-	-
Jun-11	-	-	-	-	-	-
Jul-11	-	-	-	-	-	-
Aug-11	-	-	-	-	-	-
Sep-11	60	390	1.625	1.625	1.625	4.875
Oct-11			1.625	1.625	1.625	4.875
Nov-11	30	420	1.653	1.653	1.653	4.959
Dec-11	30	450	-	0.558	-	0.558
Aquifer			Hutton Sandstone	Hutton Sandstone	Precipice Sandstone	

Table A11 - Groundwater Demand Schedule 19.28 - 63 km (3,500 ML)

	Time (Days)	Time Cumulative (Days)	Groundwater Bore No.						Total Extraction Rate (ML/day)	
			5	6	7	8	9	10		11
			Extraction Rate (ML/day)							
Feb-10			-	-	-	-	0.191	-	-	0.191
Mar-10	120	120	-	-	-	-	0.191	-	-	0.191
Apr-10			-	-	-	-	0.191	-	-	0.191
May-10			-	-	-	-	0.191	-	-	0.191
Jun-10			-	-	-	-	0.216	-	-	0.216
Jul-10	120	240	-	-	-	-	0.216	-	-	0.216
Aug-10			-	-	-	-	0.216	-	-	0.216
Sep-10			-	-	-	-	0.216	-	-	0.216
Oct-10			-	-	-	-	0.516	1.525	1.525	3.566
Nov-10	120	360	-	-	-	-	0.516	1.525	1.525	3.566
Dec-10			-	-	-	-	0.516	1.525	1.525	3.566
Jan-11			-	-	-	-	0.516	1.525	1.525	3.566
Feb-11			0.463	-	2.887	-	0.191	-	-	3.541
Mar-11	120	480	0.463	-	2.887	-	0.191	-	-	3.541
Apr-11			0.463	-	2.887	-	0.191	-	-	3.541
May-11			1.525	-	1.525	-	0.191	0.150	0.150	3.541
Jun-11	30	510	1.063	1.063	-	-	0.191	0.150	0.150	2.616
Jul-11			1.063	1.063	-	-	0.191	0.725	0.725	3.766
Aug-11	120	630	1.063	1.063	-	-	0.191	0.725	0.725	3.766
Sep-11			1.063	1.063	-	1.150	0.191	0.150	0.150	3.766
Oct-11			1.063	1.063	-	1.150	0.191	0.150	0.150	3.766
Nov-11	30	660	-	-	-	1.150	0.191	0.150	0.150	1.641
Dec-11			-	-	-	-	0.191	-	-	0.191
Jan-12			-	-	-	-	0.191	-	-	0.191
Feb-12	150	810	-	-	-	-	0.191	-	-	0.191
Mar-12			-	-	-	-	0.191	-	-	0.191
Apr-12			-	-	-	-	0.191	-	-	0.191
Aquifer			Hutton Sandstone	Hutton Sandstone	Precipice Sandstone	Hutton Sandstone	Precipice Sandstone	Hutton Sandstone	Precipice Sandstone	

Chart A1 - Water Demand per Chainage vs. Time (1,800 ML)

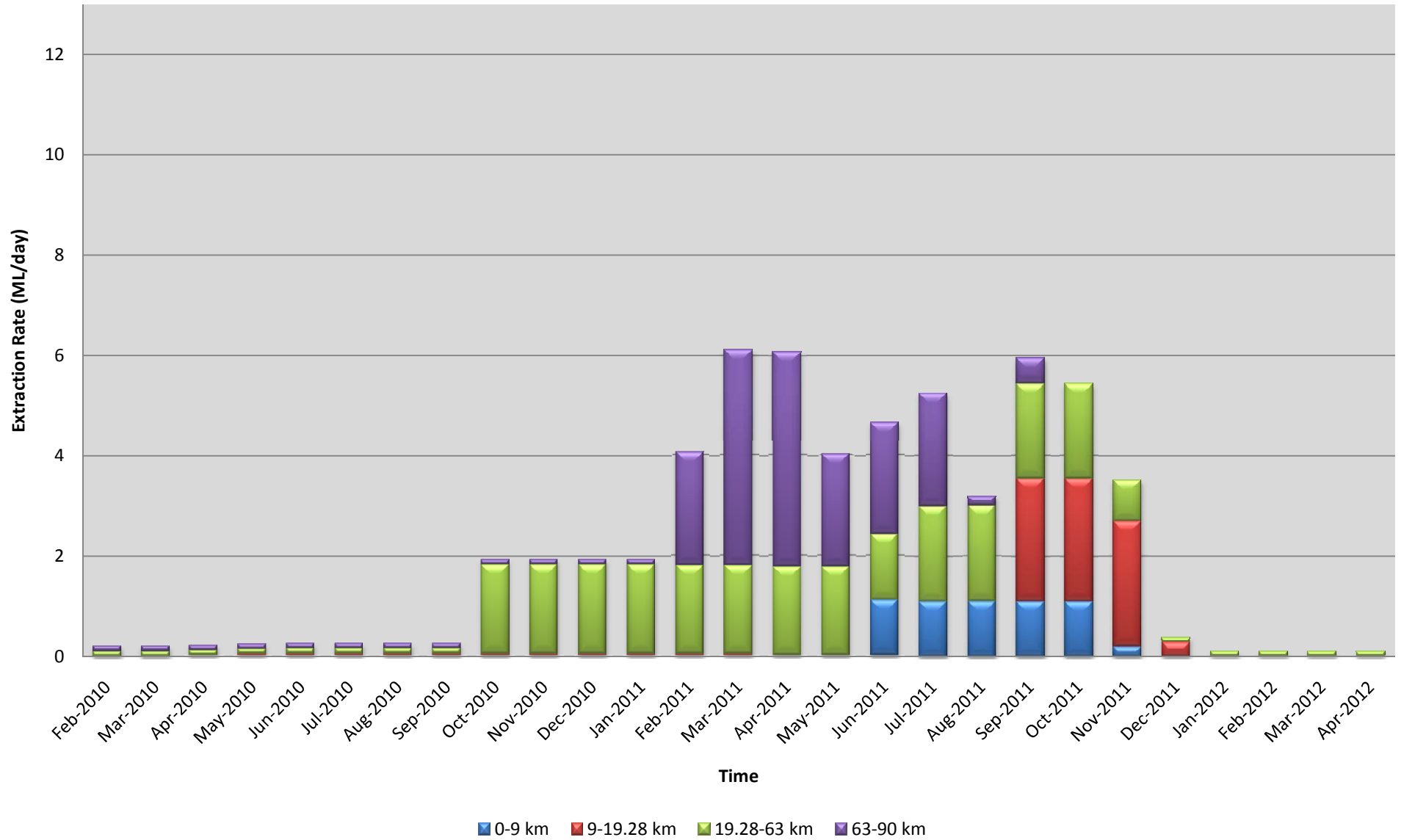


Chart A2 - Water Demand per Chainage vs. Time (2,700 ML)

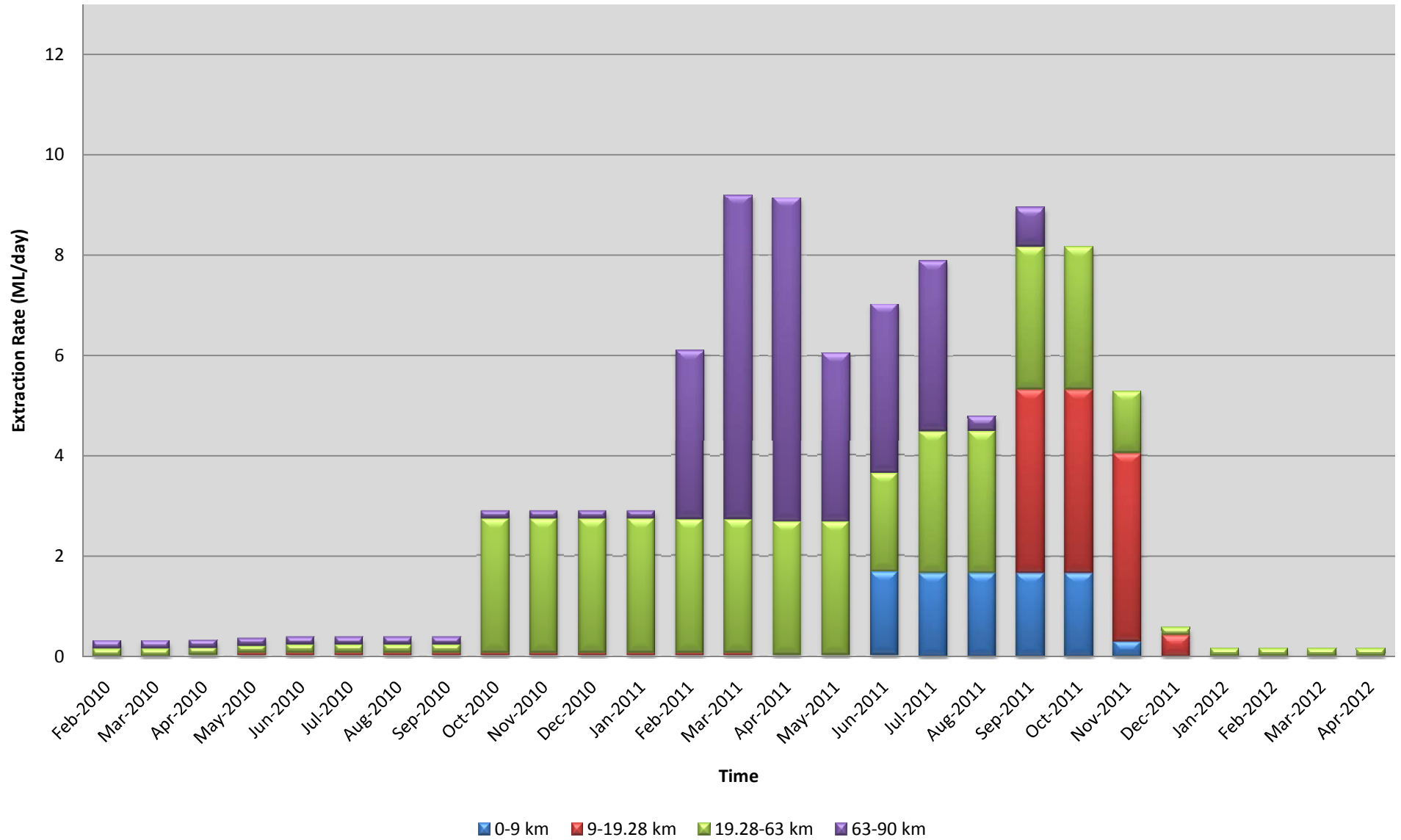
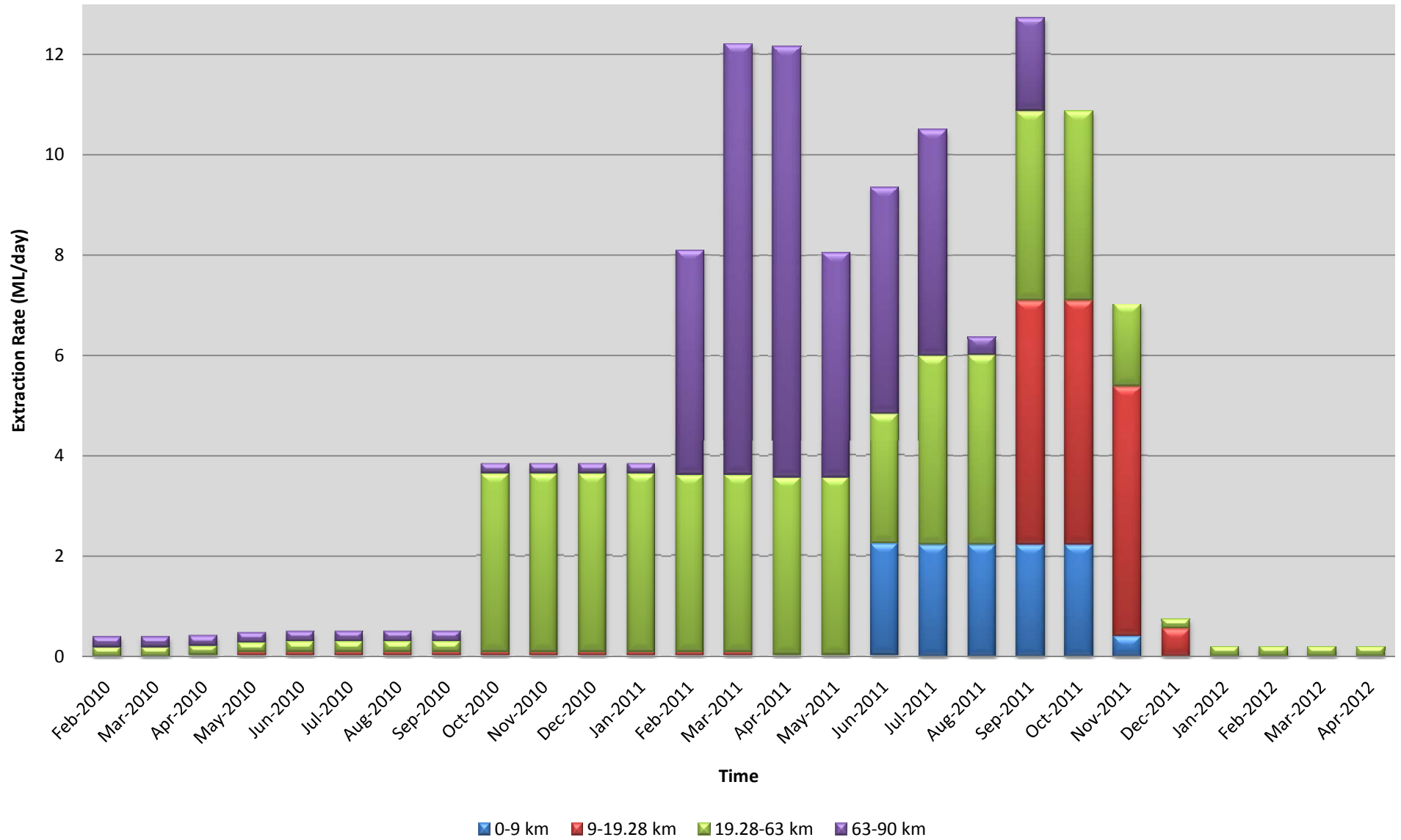


Chart A3 - Water Demand per Chainage vs. Time (3,500 ML)



Appendix B

Groundwater Model Results (1,800 ML)

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Environment

Table B1: Summary of Model Results (1,800 ML)

Chainage	Sub Group	No. Extraction Bores	Extraction Duration (days)	Extraction Rate (ML/day)	Distance to 5-meter Drawdown (km)	Proposed Extraction Aquifer
0 - 9 km	-	1	150	1.109	0.144	Hutton Sandstone
			30	0.210	N/A	Hutton Sandstone
9 - 19 km	-	2	330	0.029	0.027	Hutton Sandstone
			60	1.625		
			30	1.653		
		1	60	0.813	0.022	Precipice Sandstone
			30	0.826		
1	30	0.279	N/A	Hutton Sandstone		
19 - 63 km	19 - 30 km	1	120	0.838	0.033	Hutton Sandstone
			150	0.532	N/A	
		1	120	0.838	0.033	Precipice Sandstone
			150	0.532	N/A	
	30 - 41 km	1	90	0.575	0.003	Hutton Sandstone
	41 - 53 km	1	120	0.096	N/A	Precipice Sandstone
			120	0.108		
			120	0.258		
			450	0.096		
	52 - 63 km	1	120	1.526	0.411	Hutton Sandstone
			30	0.150	0.002	Hutton Sandstone
60			0.725			
90			0.150	N/A	Hutton Sandstone	
63 - 90 km	63 - 70 km	1	365	0.003	0.496	Precipice Sandstone
			90	1.710		
			120	0.003	N/A	Precipice Sandstone
			30	0.210		
	70 - 77 km	1	90	0.442	<0.001	Precipice Sandstone
			150	0.092	N/A	Precipice Sandstone
	77 - 83 km	1	390	0.003	<0.001	Precipice Sandstone
			150	0.353		
	83 - 90 km	2	390	0.096	0.041	Precipice Sandstone
			150	1.802		
1		30	0.096	N/A	Precipice Sandstone	
		30	0.210			

Notes:

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N/A = Not applicable as the drawdown in extraction bore is less than 5 meters or extraction rate decreased

Table B2: Distance Between Bores (0 - 9 km chainage in Hutton Sandstone)

	13856	22117	58409	58232
13856	0	9.838	13.497	4.911
22117	9.838	0	12.535	14.696
58409	13.497	12.535	0	16.940
58232	4.911	14.696	16.940	0

Notes:

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RN 58232 is located within the 9 - 19.28 km chainage group

Table B3: Distance Between Bores (0 - 9 km chainage in Precipice Sandstone)

	15793	16752	58700
15793	0	4.854	0.714
16752	4.854	0	4.922
58700	0.714	4.922	0

Notes:

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RN 16752 is located within the 9 - 19.28 km chainage group

Table B4: Distance Between Bores (9 - 19.28 km chainage in Hutton Sandstone)

	13856	16312	58232
13856	0	9.458	4.911
16312	9.458	0	4.601
58232	4.911	4.601	0

Notes:

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RN 13856 is located within the 0 - 9 km chainage group

Table B5: Distance Between Bores (19.28 - 63 km chainage in Hutton Sandstone)

12221	12221	13060	14350	14538	14593	14697	14872	15487	15709	15710	15862	16312	16661	17247	17248	23147	38337	43687	48911	48949	58443	58608	58834	58897
12221	0	10.621	13.417	6.724	2.613	11.061	16.629	5.284	20.975	21.986	11.755	14.285	8.007	17.753	18.609	6.729	5.684	24.204	9.823	8.713	8.215	6.904	2.684	10.045
13060	10.621	0	23.353	15.096	11.101	21.434	27.028	8.940	31.526	32.208	22.299	9.019	7.129	28.359	29.020	14.882	13.235	34.592	19.434	18.863	18.560	16.836	12.715	20.658
14350	13.417	23.353	0	14.830	12.264	3.211	4.589	18.200	9.465	8.936	4.290	27.564	21.263	7.708	6.357	15.145	15.721	11.554	3.984	10.747	5.396	11.696	10.853	5.975
14538	6.724	15.096	14.830	0	9.028	11.693	16.327	6.315	19.570	21.829	11.395	14.717	9.239	16.048	18.074	0.349	1.909	23.398	12.552	5.042	9.719	3.267	7.810	9.298
14593	2.613	11.101	12.264	9.028	0	10.412	15.983	7.674	20.602	21.108	11.444	16.174	10.049	17.604	17.975	9.086	8.208	23.522	8.389	9.981	7.562	8.494	1.954	10.076
14697	11.061	21.434	3.211	11.693	10.412	0	5.595	15.492	10.216	10.936	1.707	24.898	18.634	7.465	7.587	12.016	12.691	13.169	3.632	7.540	2.875	8.517	8.720	2.806
14872	16.629	27.028	4.589	16.327	15.983	5.595	0	20.848	4.902	5.532	5.056	30.238	24.034	3.546	1.993	16.671	17.630	7.578	8.270	11.490	8.470	13.061	14.315	7.111
15487	5.284	8.940	18.200	6.315	7.674	15.492	20.848	0	24.756	26.349	15.802	9.407	3.212	21.328	22.765	6.059	4.408	28.310	14.876	10.751	12.820	8.679	7.914	13.822
15709	20.975	31.526	9.465	19.570	20.602	10.216	4.902	24.756	0	4.273	9.228	34.022	27.968	3.529	3.194	19.918	21.115	4.083	13.156	14.531	13.040	16.408	18.839	11.002
15710	21.986	32.208	8.936	21.829	21.108	10.936	5.532	26.349	4.273	0	10.582	35.748	29.523	6.769	3.789	22.174	23.158	2.924	12.919	16.929	13.772	18.568	19.562	12.642
15862	11.755	22.299	4.290	11.395	11.444	1.707	5.056	15.802	9.228	10.582	0	25.184	18.994	6.168	6.965	11.733	12.611	12.533	5.325	6.799	3.955	8.134	9.633	2.098
16312	14.285	9.019	27.564	14.717	16.174	24.898	30.238	9.407	34.022	35.748	25.184	0	6.304	30.547	32.139	14.382	12.984	37.659	24.100	19.670	22.204	17.674	16.964	23.176
16661	8.007	7.129	21.263	9.239	10.049	18.634	24.034	3.212	27.968	29.523	18.994	6.304	0	24.539	25.959	8.944	7.353	31.512	17.806	13.898	15.914	11.837	10.691	17.027
17247	17.753	28.359	7.708	16.048	17.604	7.465	3.546	21.328	3.529	6.769	6.168	30.547	24.539	0	3.434	16.397	17.614	7.508	10.827	11.008	10.114	12.904	15.766	7.710
17248	18.609	29.020	6.357	18.074	17.975	7.587	1.993	22.765	3.194	3.789	6.965	32.139	25.959	3.434	0	18.421	19.445	5.595	10.179	13.149	10.462	14.821	16.307	8.970
23147	6.729	14.882	15.145	0.349	9.086	12.016	16.671	6.059	19.918	22.174	11.733	14.382	8.944	16.397	18.421	0	1.655	23.746	12.823	5.390	10.009	3.610	7.929	9.636
38337	5.684	13.235	15.721	1.909	8.208	12.691	17.630	4.408	21.115	23.158	12.611	12.984	7.353	17.614	19.445	1.655	0	24.862	13.047	6.687	10.418	4.710	7.357	10.525
43687	24.204	34.592	11.554	23.398	23.522	13.169	7.578	28.310	4.083	2.924	12.533	37.659	31.512	7.508	5.595	23.746	24.862	0	15.516	18.387	16.044	20.183	21.886	14.490
48911	9.823	19.434	3.984	12.552	8.389	3.632	8.270	14.876	13.156	12.919	5.325	24.100	17.806	10.827	10.179	12.823	13.047	15.516	0	9.547	3.025	9.797	7.165	5.664
48949	8.713	18.863	10.747	5.042	9.981	7.540	11.490	10.751	14.531	16.929	6.799	19.670	13.898	11.008	13.149	5.390	6.687	18.387	9.547	0	6.530	2.076	8.123	4.803
58443	8.215	18.560	5.396	9.719	7.562	2.875	8.470	12.820	13.040	13.772	3.955	22.204	15.914	10.114	10.462	10.009	10.418	16.044	3.025	6.530	0	6.823	5.845	3.212
58608	6.904	16.836	11.696	3.267	8.494	8.517	13.061	8.679	16.408	18.568	8.134	17.674	11.837	12.904	14.821	3.610	4.710	20.183	9.797	2.076	6.823	0	6.777	6.040
58834	2.684	12.715	10.853	7.810	1.954	8.720	14.315	7.914	18.839	19.562	9.633	16.964	10.691	15.766	16.307	7.929	7.357	21.886	7.165	8.123	5.845	6.777	0	8.171
58897	10.045	20.658	5.975	9.298	10.076	2.806	7.111	13.822	11.002	12.642	2.098	23.176	17.027	7.710	8.970	9.636	10.525	14.490	5.664	4.803	3.212	6.040	8.171	0

Notes:
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Bold denotes bores are close enough to exceed drawdown threshold
 RN 16312 is located within the 9 - 19.28 km chainage group
 It is not known which aquifer RN 23147 and RN 58897 are screened in, so included in Table A5 and Table A6

Table B6: Distance Between Bores (19.28 - 63 km chainage in Precipice Sandstone)

12627	13180	13881	13882	15417	16028	16065	16686	17945	18207	23147	30421	37507	38658	44404	48816	48911	57701	58897	58907	62077	67229	67232	89599	123105	123167	
0	24.109	32.232	30.337	39.345	22.325	16.926	33.362	23.003	37.515	10.853	37.393	26.889	36.853	27.666	29.345	15.538	40.339	16.368	13.246	35.510	36.786	43.678	35.571	17.850	16.494	
13180	24.109	0	9.696	7.164	17.898	2.189	9.904	17.145	4.092	13.827	14.272	14.257	4.427	13.289	9.616	5.338	14.689	16.634	9.446	16.292	11.980	13.273	19.828	13.695	11.080	9.231
13881	32.232	9.696	0	2.649	8.223	11.878	19.586	10.651	9.250	5.929	23.432	5.197	10.937	5.117	6.551	7.600	19.301	8.527	15.978	21.593	3.934	4.973	11.951	4.026	15.614	18.834
13882	30.337	7.164	2.649	0	10.847	9.353	17.067	12.500	7.397	7.205	21.164	7.194	8.333	6.519	6.810	5.160	18.232	10.015	14.323	20.392	5.176	6.449	13.394	6.664	14.445	16.372
15417	39.345	17.898	8.223	10.847	0	20.070	27.757	9.624	16.865	7.641	31.274	5.477	18.923	7.273	11.759	15.366	25.080	7.593	22.992	27.537	7.746	7.088	9.622	4.204	21.804	26.950
16028	22.325	2.189	11.878	9.353	20.070	0	7.716	18.887	5.070	15.942	12.233	16.431	4.975	15.427	11.277	7.032	14.173	18.734	8.628	15.501	14.128	15.418	21.881	15.868	10.826	7.058
16065	16.926	9.904	19.586	17.067	27.757	7.716	0	25.639	11.609	23.482	6.075	24.106	10.867	23.020	18.104	14.095	15.124	26.225	10.053	15.234	21.749	23.026	29.241	23.561	13.306	1.354
16686	33.362	17.145	10.651	12.500	9.624	18.887	25.639	0	14.101	14.719	27.370	12.678	20.193	13.967	7.622	17.564	18.005	16.085	17.900	20.463	13.468	13.748	18.843	9.133	15.606	24.502
17945	23.003	4.092	9.250	7.397	16.865	5.070	11.609	14.101	0	14.601	14.415	14.391	8.451	13.902	6.508	8.300	11.390	17.405	6.945	13.323	12.563	13.821	20.790	12.824	7.604	10.555
18207	37.515	13.827	5.929	7.205	7.641	15.942	23.482	14.719	14.601	0	28.086	2.246	13.218	0.835	12.410	9.593	25.169	2.829	21.517	27.419	2.061	1.026	6.190	5.600	21.440	22.976
23147	10.853	14.272	23.432	21.164	31.274	12.233	6.075	27.370	14.415	28.086	0	28.358	16.370	27.521	20.367	19.195	12.823	30.901	9.636	11.967	26.194	27.491	34.097	27.192	12.611	5.710
30421	37.393	14.257	5.197	7.194	5.477	16.431	24.106	12.678	14.391	2.246	28.358	0	14.317	1.796	11.235	10.663	24.399	3.656	21.172	26.727	2.540	1.618	6.962	3.564	20.758	23.487
37507	26.889	4.427	10.937	8.333	18.923	4.975	10.867	20.193	8.451	13.218	16.370	14.317	0	12.917	13.072	3.657	18.971	15.799	13.536	20.422	11.795	12.975	18.597	14.849	15.446	10.732
38658	36.853	13.289	5.117	6.519	7.273	15.427	23.020	13.967	13.902	0.835	27.521	1.796	12.917	0	11.580	9.268	24.384	3.506	20.800	26.646	1.344	0.221	6.916	4.881	20.665	22.478
44404	27.666	9.616	6.551	6.810	11.759	11.277	18.104	7.622	6.508	12.410	20.367	11.235	13.072	11.580	0	11.075	13.428	14.825	11.408	15.852	10.472	11.413	18.194	8.405	10.048	17.013
48816	29.345	5.338	7.600	5.160	15.366	7.032	14.095	17.564	8.300	9.593	19.195	10.663	3.657	9.268	11.075	0	19.627	12.230	14.658	21.411	8.138	9.322	15.152	11.370	15.878	13.755
48911	15.538	14.689	19.301	18.232	25.080	14.173	15.124	18.005	11.390	25.169	12.823	24.399	18.971	24.384	13.428	19.627	0	27.828	5.664	2.484	23.115	24.256	31.252	21.820	3.811	13.800
57701	40.339	16.634	8.527	10.015	7.593	18.734	26.225	16.085	17.405	2.829	30.901	3.656	15.799	3.506	14.825	12.230	27.828	0	24.305	30.112	4.842	3.602	3.426	7.121	24.131	25.752
58897	16.368	9.446	15.978	14.323	22.992	8.628	10.053	17.900	6.945	21.517	9.636	21.172	13.536	20.800	11.408	14.658	5.664	24.305	0	6.886	19.468	20.709	27.706	19.207	3.274	8.699
58907	13.246	16.292	21.593	20.392	27.537	15.501	15.234	20.463	13.323	27.419	11.967	26.727	20.422	26.646	15.852	21.411	2.484	30.112	6.886	0	25.359	26.525	33.538	24.225	5.981	13.977
62077	35.510	11.980	3.934	5.176	7.746	14.128	21.749	13.468	12.563	2.061	26.194	2.540	11.795	1.344	10.472	8.138	23.115	4.842	19.468	25.359	0	1.297	8.239	4.645	19.381	21.184
67229	36.786	13.273	4.973	6.449	7.088	15.418	23.026	13.748	13.821	1.026	27.491	1.618	12.975	0.221	11.413	9.322	24.256	3.602	20.709	26.525	1.297	0	7.023	4.660	20.544	22.472
67232	43.678	19.828	11.951	13.394	9.622	21.881	29.241	18.843	20.790	6.190	34.097	6.962	18.597	6.916	18.194	15.152	31.252	3.426	27.706	33.538	8.239	7.023	0	10.222	27.557	28.840
89599	35.571	13.695	4.026	6.664	4.204	15.868	23.561	9.133	12.824	5.600	27.192	3.564	14.849	4.881	8.405	11.370	21.820	7.121	19.207	24.225	4.645	4.660	10.222	0	18.340	22.769
123105	17.850	11.080	15.614	14.445	21.804	10.826	13.306	15.606	7.604	21.440	12.611	20.758	15.446	20.665	10.048	15.878	3.811	24.131	3.274	5.981	19.381	20.544	27.557	18.340	0	11.953
123167	16.494	9.231	18.834	16.372	26.950	7.058	1.354	24.502	10.555	22.976	5.710	23.487	10.732	22.478	17.013	13.755	13.800	25.752	8.699	13.977	21.184	22.472	28.840	22.769	11.953	0

Notes:

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RN 15417 is located within the 63 - 90 km chainage group

RN 16686 is located within the 63 - 90 km chainage group

It is not known which aquifer RN 23147 and RN 58897 are screened in, so included in Table A5 and Table A6

Table B7: Distance Between Bores (63 - 90 km chainage in Precipice Sandstone)

	10594	11104	14582	14583	14584	15417	16270	16686	17849	18173	18195	30318	30506	30507	31409	36120	47325	57615	57781	62877	67232	67280	67281	67410	67624	67625	84032	89504	89510	89540	89572	89724	89763	89764	89775	89853	89854	89855
10594	0	14.827	4.375	6.833	7.530	14.339	5.519	15.618	12.422	11.139	10.267	2.800	4.786	5.639	1.650	13.155	8.281	6.169	2.051	10.358	21.351	8.739	6.558	2.645	8.770	6.339	10.824	8.535	8.625	6.941	13.982	7.028	6.890	8.398	6.041	2.835	2.645	5.295
11104	14.827	0	17.966	20.242	20.085	16.538	9.333	8.399	11.284	8.026	15.031	16.758	18.682	17.534	16.337	2.298	12.965	18.862	15.489	16.795	26.158	16.779	16.419	12.638	22.073	8.660	10.544	17.765	18.168	20.272	23.200	21.723	20.387	19.727	20.731	17.412	12.239	18.870
14582	4.375	17.966	0	2.500	3.205	12.816	9.135	16.819	12.605	12.523	8.869	5.588	6.557	8.707	4.253	16.005	7.901	8.565	2.664	8.160	18.188	12.513	10.229	5.458	4.457	9.334	11.312	5.555	5.446	2.592	10.101	4.352	2.587	4.399	5.718	2.097	6.643	0.962
14583	6.833	20.242	2.500	0	1.469	13.125	11.588	18.409	13.864	14.296	9.518	7.618	8.105	10.571	6.462	18.211	9.200	10.163	5.156	8.342	17.127	14.568	12.284	7.895	1.958	11.676	12.768	5.467	5.179	0.161	8.546	3.770	0.199	3.240	6.431	4.244	9.142	1.545
14584	7.530	20.085	3.205	1.469	0	11.839	11.805	17.658	12.959	13.706	8.396	8.711	9.396	11.760	7.437	17.978	8.398	11.451	5.638	7.072	15.669	15.667	13.379	8.131	2.156	11.680	11.987	4.195	3.861	1.318	7.158	5.222	1.628	1.784	7.869	5.232	9.956	2.441
15417	14.339	16.538	12.816	13.125	11.839	0	11.839	9.624	5.257	8.608	4.091	17.013	18.715	19.977	15.569	14.318	6.265	20.423	12.738	4.784	9.622	22.596	20.652	12.360	13.724	12.325	6.221	7.661	7.978	13.014	9.268	16.764	13.320	10.188	18.509	14.347	14.116	12.969
16270	5.519	9.333	9.135	11.588	11.805	13.811	0	11.630	10.039	7.464	10.345	7.499	9.496	8.864	7.003	7.802	7.768	10.026	6.495	11.379	22.520	9.703	8.399	3.696	13.527	1.699	8.376	10.901	11.189	11.653	16.811	12.507	11.700	12.001	11.405	8.214	2.906	10.090
16686	15.618	8.399	16.819	18.409	17.658	9.624	11.630	0	5.031	4.480	10.017	18.297	20.353	20.332	17.258	6.772	9.261	21.343	15.154	11.908	18.843	21.240	20.028	12.974	19.814	10.009	5.672	14.034	14.472	18.370	18.136	21.153	18.597	16.601	21.460	17.276	13.791	17.475
17849	12.422	11.284	12.605	13.864	12.959	5.257	10.039	5.031	0	3.464	4.997	15.220	17.187	17.762	13.958	9.079	4.712	18.532	11.441	6.880	14.874	19.579	17.943	9.920	15.099	8.367	1.685	9.124	9.556	13.805	13.134	16.946	14.059	11.753	17.779	13.466	11.278	13.126
18173	11.139	8.026	12.523	14.296	13.706	8.608	7.464	4.480	3.464	0	7.150	13.829	15.881	15.952	12.778	5.755	5.519	16.918	10.717	9.004	18.218	17.167	15.786	8.495	15.848	5.777	2.521	10.515	10.948	14.276	15.464	16.816	14.477	12.880	16.994	12.845	12.845	16.240
18195	10.267	15.031	8.869	9.518	8.396	4.091	10.345	10.017	4.997	7.150	0	12.924	14.626	15.907	11.478	12.733	2.586	16.333	8.647	1.908	12.198	18.650	16.648	8.408	10.460	9.061	4.717	4.294	4.705	9.429	8.334	12.989	9.717	6.973	14.508	10.294	10.229	9.131
30318	2.800	16.758	5.588	7.618	8.711	17.013	7.499	18.297	15.220	13.829	12.924	0	2.062	3.166	1.482	15.300	11.046	3.412	4.319	12.832	23.549	6.960	4.672	5.369	9.351	8.671	13.616	10.701	10.707	7.762	15.683	6.310	7.601	9.980	4.107	3.495	4.692	6.271
30506	4.786	18.682	6.557	8.105	9.396	18.715	9.496	20.353	17.187	15.881	14.626	2.062	0	2.736	3.238	17.293	12.899	2.058	5.988	14.357	24.743	6.889	4.764	7.403	9.577	10.719	15.604	12.008	11.951	8.262	16.537	5.810	8.038	10.886	2.808	4.657	6.737	7.013
30507	5.639	17.534	8.707	10.571	11.760	19.977	8.864	20.332	17.762	15.952	15.907	3.166	2.736	0	4.633	16.426	13.871	1.422	7.420	15.930	26.713	4.156	2.066	7.865	12.168	10.361	16.106	13.861	13.872	10.722	18.807	8.541	10.528	13.106	5.495	6.611	6.581	9.324
31409	1.650	16.337	4.253	6.462	7.437	15.569	7.003	17.258	13.958	12.778	11.478	1.482	3.238	4.633	0	14.728	9.674	4.860	2.847	11.354	22.082	8.268	5.990	4.289	8.295	7.945	12.386	9.229	9.244	6.595	14.301	5.831	6.471	8.607	4.430	2.223	4.098	5.024
36120	13.155	2.298	16.005	18.211	17.978	14.318	7.802	6.772	9.079	5.755	12.733	15.300	17.293	16.426	14.728	0	10.684	17.687	13.615	14.499	23.940	16.197	15.538	10.808	20.003	6.841	8.265	15.520	15.928	18.232	20.911	19.905	18.363	17.544	19.155	15.611	10.658	16.884
47325	8.281	12.965	7.901	9.200	8.398	6.265	7.768	9.261	4.712	5.519	2.586	11.046	12.899	13.871	9.671	10.684	0	14.445	6.966	3.950	14.783	16.337	14.424	6.120	10.553	6.479	3.589	4.997	5.429	9.151	10.242	12.236	9.393	7.405	13.206	8.888	7.851	8.414
57615	6.169	18.862	8.565	10.163	11.451	20.423	10.026	21.343	18.532	16.918	16.333	3.412	2.058	1.422	4.860	17.687	14.445	0	7.706	16.192	26.732	5.172	3.353	8.617	11.613	11.449	16.902	13.944	13.910	10.320	18.585	7.712	10.095	12.921	4.491	6.519	7.552	9.058
57781	2.051	15.489	2.664	5.156	5.638	12.738	6.495	15.154	11.441	10.717	8.647	4.319	5.988	7.420	2.847	13.615	6.966	7.706	0	8.517	19.370	10.755	8.540	2.865	7.113	6.829	9.952	6.524	6.594	5.239	11.932	6.308	5.250	6.375	6.360	2.129	3.993	3.626
62877	10.358	16.795	8.160	8.342	7.072	4.784	11.379	11.908	6.880	9.004	1.908	12.832	14.357	15.930	11.354	14.499	3.950	16.192	8.517	0	11.249	18.999	16.891	8.910	9.019	10.276	6.609	2.881	3.218	8.231	6.461	11.992	8.536	5.475	13.878	9.858	10.796	8.232
67232	21.351	26.158	18.188	17.127	15.669	9.622	22.520	18.843	14.874	18.218	12.198	23.549	24.743	26.713	22.082	23.940	14.783	26.732	19.370	11.249	0	30.084	27.903	20.144	16.555	21.258	15.779	12.858	12.843	16.970	8.877	20.766	17.267	13.976	23.530	20.213	22.035	17.830
67280	8.739	16.779	12.513	14.568	15.667	22.596	9.703	21.240	19.579	17.167	18.650	6.960	8.889	4.156	8.268	16.197	16.337	5.172	10.755	18.999	30.084	0	2.288	10.246	16.244	11.396	17.894	17.272	17.348	14.714	22.561	12.697	14.642	16.874	9.605	10.438	8.493	13.229
67281	6.558	16.419	10.229	12.284	13.379	20.652	8.399	20.028	17.943	15.786	16.648	4.672	4.764	2.066	5.990	15.538	14.424	3.353	8.540	16.891	27.903	2.288	0	8.304	13.975	10.034	16.262	15.065	15.126	12.429	20.290	10.528	12.260	14.597	7.550	8.151	6.685	10.941
67410	2.645	12.638	5.458	7.895	8.131	12.360	3.696	12.974	9.820	8.495	8.408	5.369	7.403	7.865	4.289	10.808	6.120	8.617	2.865	8.910	20.144	10.246	8.304	0	9.831	3.984	8.285	7.752	7.968	7.958	13.591	9.101	8.009	8.457	8.609	4.803	1.893	6.407
67624	8.770	22.073	4.457	1.958	2.156	13.724	13.527	19.814	15.099	15.848	10.460	9.351	9.577	12.168	8.295	20.003	10.553	11.613	7.113	9.019	16.555	16.244	13.975	9.831	0	13.561	14.143	6.190	5.811	1.877	7.724	4.350	1.882	3.545	7.509	6.105	11.100	3.500
67625	6.339	8.660	9.334	11.676	11.680	12.325	1.699	10.009	8.367	5.777	9.061	8.671	10.719	10.361	7.945	8.841	6.479	11.449	6.829	10.276	21.258	11.396	10.034	3.984	13.561	0	6.717	10.182	10.515	11.719	16.048	13.084	11.810	11.621	12.371	8.779	3.983	10.255
84032	10.824	10.544	11.312	12.768	11.887</																																	

Chain 0 - 9 km

Coord RN 13856
 lat -26.100090
 long 149.954160

s Drawdown m
 Q Extraction rate 1290 m³/d
 W(u)
 T Transmissivity 150 m²/d
 r Distance from bore to spring m
 S Storage coeff 0.0005
 t time 150 d (June 2011 - October 2011)

Thies Equation

Distance Calculation

Well	Aquifer	r (m)	u	Wu	s	RN	GIS_LAT	GIS_LNG	Extract Lat RAD	Obs Lat RAD	Extract Long RAD	Obs Long RAD	COS a	Angle	Dist (m)	Dist (km)
8356	FORMATION NAME NOT SPECIFIED	0	0	0	0.00	8356	-25.717864	149.864995	-0.455533	-0.448861	2.6171938	2.6156376	0.999976769	0.3905499	43427.163	43.4
8357	HUTTON SANDSTONE	35614.61237	7.04667008	0.000125226	0.00	8357	-25.785086	149.889717	-0.455533	-0.450035	2.6171938	2.6160691	0.999984375	0.3202899	35614.612	35.6
8440	PRECIPICE SANDSTONE	0	0	0	0.00	8440	-25.864604	150.202185	-0.455533	-0.451422	2.6171938	2.6215227	0.999983983	0.3242898	36059.281	36.1
8445	EVERGREEN FORMATION	0	0	0	0.00	8445	-25.650364	150.070267	-0.455533	-0.447683	2.6171938	2.6192203	0.999967533	0.4616299	51338.676	51.3
8449	HUTTON SANDSTONE	43762.75489	10.63988176	-0.000184854	0.00	8449	-25.707300	149.976381	-0.455533	-0.448672	2.6171938	2.6175816	0.999976408	0.3935679	43762.755	43.8
10463	HUTTON SANDSTONE	13210.97374	0.969610151	0.230927971	0.16	10463	-26.051199	150.074714	-0.455533	-0.454679	2.6171938	2.6192979	0.99999785	0.1188091	13210.974	13.2
10475	HUTTON SANDSTONE	72984.94868	29.59334852	-8314921126	0.00	10475	-25.447306	149.878079	-0.455533	-0.444139	2.6171938	2.615866	0.999934383	0.6563694	72984.949	73.0
10578	HUTTON SANDSTONE	64487.90121	23.10383002	-4317940.675	0.00	10578	-25.979536	149.322782	-0.455533	-0.453428	2.6171938	2.6061742	0.999948772	0.5799536	64487.901	64.5
10583	PRECIPICE SANDSTONE	0	0	0	0.00	10583	-25.370832	149.936375	-0.455533	-0.442805	2.6171938	2.6168834	0.999918962	0.729434	81109.355	81.1
10584	HUTTON SANDSTONE	85279.95164	40.40372306	-1.10073E+14	0.00	10584	-25.359943	149.731090	-0.455533	-0.442615	2.6171938	2.6133005	0.999910414	0.766941	85279.952	85.3
10592	PRECIPICE SANDSTONE	0	0	0	0.00	10592	-25.680364	150.053601	-0.455533	-0.448207	2.6171938	2.6189294	0.999971949	0.4291538	47719.728	47.7
10594	PRECIPICE SANDSTONE	0	0	0	0.00	10594	-25.536493	150.162492	-0.455533	-0.445696	2.6171938	2.6208299	0.999946264	0.5939789	66047.44	66.0
10690	HUTTON SANDSTONE	24646.43473	3.374704139	0.008159045	0.01	10690	-25.879253	149.933050	-0.455533	-0.451678	2.6171938	2.6168254	0.999992517	0.2216507	24646.435	24.6
10875	PRECIPICE SANDSTONE	0	0	0	0.00	10875	-25.503869	150.129343	-0.455533	-0.445126	2.6171938	2.6202513	0.999942069	0.6167285	68577.08	68.6
10876	PRECIPICE SANDSTONE	0	0	0	0.00	10876	-25.505448	150.107771	-0.455533	-0.445154	2.6171938	2.6198748	0.999943231	0.6105117	67885.8	67.9
10886	HUTTON SANDSTONE	13151.63802	0.960919904	0.234357097	0.16	10886	-26.134255	150.080270	-0.455533	-0.4456129	2.6171938	2.6193949	0.999997869	0.1182755	13151.638	13.2
10918	EVERGREEN FORMATION	0	0	0	0.00	10918	-25.434251	149.884711	-0.455533	-0.443911	2.6171938	2.6159817	0.99993188	0.6687699	74363.821	74.4
10929	HUTTON SANDSTONE	84267.48273	39.45004804	-5.31929E+13	0.00	10929	-25.343720	149.901868	-0.455533	-0.442331	2.6171938	2.6162812	0.999912528	0.7578357	84267.483	84.3
10930	HUTTON SANDSTONE	61810.44876	21.22517542	-322451.8487	0.00	10930	-25.601477	149.681108	-0.455533	-0.44683	2.6171938	2.6124282	0.999952937	0.5558747	61810.449	61.8
10980	EVERGREEN FORMATION	0	0	0	0.00	10980	-25.232863	149.716934	-0.455533	-0.440397	2.6171938	2.6130534	0.999878491	0.8931964	99318.906	99.3
10981	EVERGREEN FORMATION	0	0	0	0.00	10981	-25.262309	149.689714	-0.455533	-0.44091	2.6171938	2.6125784	0.99988445	0.8710187	98582.857	96.9
10989	PRECIPICE SANDSTONE	0	0	0	0.00	10989	-25.198973	149.824986	-0.455533	-0.439805	2.6171938	2.6149393	0.999874261	0.9086093	101032.74	101.0
10990	EVERGREEN FORMATION	0	0	0	0.00	10990	-25.160640	149.812486	-0.455533	-0.439136	2.6171938	2.6147211	0.999863096	0.9480937	105423.21	105.4
10992	EVERGREEN FORMATION	0	0	0	0.00	10992	-25.233418	149.729711	-0.455533	-0.440406	2.6171938	2.6132764	0.999879367	0.8899692	98960.064	99.0
11007	HUTTON SANDSTONE	93484.81669	48.55228306	-2.94255E+16	0.00	11007	-25.308017	149.641340	-0.455533	-0.441708	2.6171938	2.6117341	0.999892346	0.8407292	93484.817	93.5
11009	HUTTON SANDSTONE	54149.89292	16.29006057	-97.20318814	0.00	11009	-25.656453	149.730933	-0.455533	-0.44779	2.6171938	2.6132978	0.99996388	0.4868917	54149.893	54.1
11104	PRECIPICE SANDSTONE	0	0	0	0.00	11104	-25.621055	150.048223	-0.455533	-0.447172	2.6171938	2.6188355	0.999963958	0.4864555	54091.384	54.1
11140	EVERGREEN FORMATION	0	0	0	0.00	11140	-25.316837	149.563137	-0.455533	-0.441862	2.6171938	2.6103692	0.999887658	0.8588417	95498.836	95.5
11175	HUTTON SANDSTONE	24280.3907	3.275207625	0.009236332	0.01	11175	-25.978976	150.156379	-0.455533	-0.453419	2.6171938	2.6207232	0.999992738	0.2183588	24280.391	24.3
11176	HUTTON SANDSTONE	25025.84816	3.479405979	0.007165861	0.00	11176	-25.962310	150.152212	-0.455533	-0.453128	2.6171938	2.6206505	0.999992285	0.2250629	25025.848	25.0
11306	PRECIPICE SANDSTONE	0	0	0	0.00	11306	-25.663705	150.024896	-0.455533	-0.447916	2.6171938	2.6184284	0.999970379	0.4410011	49037.088	49.0
11501	EVERGREEN FORMATION	0	0	0	0.00	11501	-25.623144	149.502499	-0.455533	-0.447208	2.6171938	2.6093108	0.999940195	0.6266249	69677.513	69.7
11558	PRECIPICE SANDSTONE	0	0	0	0.00	11558	-25.595376	150.013748	-0.455533	-0.446724	2.6171938	2.6182338	0.999960764	0.5075549	56437.532	56.4
11560	HUTTON SANDSTONE	10006.19135	0.556243697	0.496887259	0.34	11560	-26.028977	149.892774	-0.455533	-0.454291	2.6171938	2.6161224	0.999998767	0.0899878	10006.191	10.0
11647	EVERGREEN FORMATION	0	0	0	0.00	11647	-25.534507	149.521153	-0.455533	-0.445661	2.6171938	2.6096364	0.999928139	0.6868887	76378.541	76.4
11648	HUTTON SANDSTONE	77022.90293	32.95848653	-2.222E+11	0.00	11648	-25.477866	149.616107	-0.455533	-0.444673	2.6171938	2.6112937	0.999926922	0.6926836	77022.903	77.0
11692	EVERGREEN FORMATION	0	0	0	0.00	11692	-25.822031	150.289708	-0.455533	-0.450679	2.6171938	2.6230502	0.999974362	0.4102833	45621.419	45.6
11694	HUTTON SANDSTONE	25926.96545	3.734486319	0.005238022	0.00	11694	-26.109532	150.213601	-0.455533	-0.455697	2.6171938	2.6217219	0.999991719	0.2331668	25926.965	25.9
11739	HUTTON SANDSTONE	23891.75794	3.171200541	0.010522537	0.01	11739	-25.890086	149.903606	-0.455533	-0.451867	2.6171938	2.6163115	0.999992968	0.2148637	23891.758	23.9
11758	EVERGREEN FORMATION	0	0	0	0.00	11758	-25.391571	149.733299	-0.455533	-0.443167	2.6171938	2.6133391	0.999917515	0.735917	81830.24	81.8
11764	HUTTON SANDSTONE	70774.12913	27.82765197	-1271234902	0.00	11764	-25.472585	149.835824	-0.455533	-0.44458	2.6171938	2.6151285	0.999938298	0.636487	70774.129	70.8
11765	HUTTON SANDSTONE	62945.1938	22.01165235	-981668.5747	0.00	11765	-25.567301	149.742495	-0.455533	-0.446229	2.6171938	2.6134996	0.999951194	0.5660797	62945.194	62.9
11766	HUTTON SANDSTONE	66539.92903	24.59756753	-29319320.73	0.00	11766	-25.553143	149.684440	-0.455533	-0.445986	2.6171938	2.6124863	0.99994546	0.598408	66539.929	66.5
11850	EVERGREEN FORMATION	0	0	0	0.00	11850	-25.397308	149.754435	-0.455533	-0.443267	2.6171938	2.613708	0.999919847	0.7254403	80665.284	80.7
11878	PRECIPICE SANDSTONE	0	0	0	0.00	11878	-25.752586	150.218598	-0.455533	-0.449467	2.6171938	2.6218091	0.999972993	0.4210927	46823.368	46.8
11882	HUTTON SANDSTONE	29872.77534	4.957681702	0.001222462	0.00	11882	-26.093568	150.253222	-0.455533	-0.455419	2.6171938	2.6224134	0.999989007	0.2686523	29872.775	29.9
11892	EVERGREEN FORMATION	0	0	0	0.00	11892	-25.753975	150.334428	-0.455533	-0.449492	2.6171938	2.6238307	0.99996394	0.486675	54104.672	54.1
12118	EVERGREEN FORMATION	0	0	0	0.00	12118	-25.990643	150.095547	-0.455533	-0.453622	2.6171938	2.6196615	0.999995718	0.167675	18644.614	18.6
12221	HUTTON SANDSTONE	23215.13307	2.994124664	0.01361938	0.01	12221	-25.897309	150.009437	-0.455533	-0.451993	2.6171938	2.6181586	0.999993361	0.2087787	23215.133	23.2
12236	HUTTON SANDSTONE	79185.38767	34.83514234	-1.20209E+12	0.00	12236	-25.502365	149.523888	-0.455533	-0.445103	2.6171938	2.6096842	0.999922761	0.7213131	79185.388	79.2
12238	EVERGREEN FORMATION	0	0	0	0.00	12238	-25.580955	150.094355	-0.455533	-0.446472	2.6171938	2.6196407	0.999956528	0.5342466	59405.737	59.4
12372	HUTTON SANDSTONE	30396.90238	5.133175969	0.000998081	0.00	12372	-25.831753	149.896106	-0.455533	-0.450849	2.6171938	2.6161806	0.999988618	0.2732359	30396.903	30.4
12627	PRECIPICE SANDSTONE	0	0	0	0.00	12627	-25.941818	149.969996	-0.455533	-0.45277	2.6171938	2.6174702	0.999996154	0.1589105	17670.039	17.7
12651	HUTTON SANDSTONE	74954.36253	31.21198035	-42222948690	0.00	12651	-25.653978	149.392501	-0.455533	-0.447746	2.6171938	2.607391	0.999930794	0.6740808	74954.363	75.0
12753	HUTTON SANDSTONE	55024.06001	16.82026211	-259.528754	0.00	12753	-25.655087	149.713608	-0.455533	-0.447766	2.6171938	2.6129954	0.999962704	0.4948433	55024.06	55.0
12838	HUTTON SANDSTONE	24118.35598	3.231639418	0.009753876	0.01	12838	-25.884089	149.924717	-0.455533	-0.451775	2.6171938	2.6166799	0.999992834	0.2169016	24118.356	24.1

Appendix C

Groundwater Model Results (2,700 ML)

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Environment

Table C1: Summary of Model Results (2,700 ML)

Chainage	Sub Group	No. Extraction Bores	Extraction Duration (days)	Extraction Rate (ML/day)	Distance to 5-meter Drawdown (km)	Proposed Extraction Aquifer
0 - 9 km	-	1	150	1.669	0.598	Hutton Sandstone
			30	0.316	N/A	Hutton Sandstone
9 - 19 km	-	2	330	0.043	0.179	Hutton Sandstone
			60	2.446		
			30	2.486		
		1	60	1.223	0.175	Precipice Sandstone
			30	1.243		
		1	30	0.558	N/A	Hutton Sandstone
19 - 63 km	19 - 30 km	1	120	1.261	0.215	Hutton Sandstone
			150	0.800	N/A	
		1	120	1.261	0.215	Precipice Sandstone
			150	0.800	N/A	
	30 - 41 km	1	90	0.575	0.003	Hutton Sandstone
	30 - 53 km	1	120	0.144	N/A	Precipice Sandstone
			120	0.163		
			120	0.389		
			450	0.144		
	52 - 63 km	1	120	2.295	1.160	Hutton Sandstone
			60	0.226	0.079	Hutton Sandstone
			60	1.091		
90			0.226			
63 - 90 km	63 - 70 km	1	365	0.005	1.262	Precipice Sandstone
			90	2.572		Precipice Sandstone
			120	0.005	N/A	Precipice Sandstone
			30	0.316		
	70 - 77 km	1	90	0.665	0.007	Precipice Sandstone
			150	0.138	N/A	Precipice Sandstone
	77 - 83 km	1	390	0.005	0.002	Precipice Sandstone
			150	0.532		
	83 - 90 km	2	390	0.144	0.525	Precipice Sandstone
			150	2.711		
		1	30	0.144	<0.001	Precipice Sandstone
			30	0.316		

Notes:

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N/A = Not applicable as the drawdown in extraction bore is less than 5 meters or extraction rate decreased

Table C2: Distance Between Bores (0 - 9 km chainage in Hutton Sandstone)

	13856	22117	58409	58232
13856	0	9.838	13.497	4.911
22117	9.838	0	12.535	14.696
58409	13.497	12.535	0	16.940
58232	4.911	14.696	16.940	0

Notes:

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RN 58232 is located within the 9 - 19.28 km chainage group

Table C3: Distance Between Bores (0 - 9 km chainage in Precipice Sandstone)

	15793	16752	58700
15793	0	4.854	0.714
16752	4.854	0	4.922
58700	0.714	4.922	0

Notes:

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RN 16752 is located within the 9 - 19.28 km chainage group

Table C4: Distance Between Bores (9 - 19.28 km chainage in Hutton Sandstone)

	13856	16312	58232
13856	0	9.458	4.911
16312	9.458	0	4.601
58232	4.911	4.601	0

Notes:

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RN 13856 is located within the 0 - 9 km chainage group

Table C5: Distance Between Bores (19.28 - 63 km chainage in Hutton Sandstone)

12221	12221	13060	14350	14538	14593	14697	14872	15487	15709	15710	15862	16312	16661	17247	17248	23147	38337	43687	48911	48949	58443	58608	58834	58897
12221	0	10.621	13.417	6.724	2.613	11.061	16.629	5.284	20.975	21.986	11.755	14.285	8.007	17.753	18.609	6.729	5.684	24.204	9.823	8.713	8.215	6.904	2.684	10.045
13060	10.621	0	23.353	15.096	11.101	21.434	27.028	8.940	31.526	32.208	22.299	9.019	7.129	28.359	29.020	14.882	13.235	34.592	19.434	18.863	18.560	16.836	12.715	20.658
14350	13.417	23.353	0	14.830	12.264	3.211	4.589	18.200	9.465	8.936	4.290	27.564	21.263	7.708	6.357	15.145	15.721	11.554	3.984	10.747	5.396	11.696	10.853	5.975
14538	6.724	15.096	14.830	0	9.028	11.693	16.327	6.315	19.570	21.829	11.395	14.717	9.239	16.048	18.074	0.349	1.909	23.398	12.552	5.042	9.719	3.267	7.810	9.298
14593	2.613	11.101	12.264	9.028	0	10.412	15.983	7.674	20.602	21.108	11.444	16.174	10.049	17.604	17.975	9.086	8.208	23.522	8.389	9.981	7.562	8.494	1.954	10.076
14697	11.061	21.434	3.211	11.693	10.412	0	5.595	15.492	10.216	10.936	1.707	24.898	18.634	7.465	7.587	12.016	12.691	13.169	3.632	7.540	2.875	8.517	8.720	2.806
14872	16.629	27.028	4.589	16.327	15.983	5.595	0	20.848	4.902	5.532	5.056	30.238	24.034	3.546	1.993	16.671	17.630	7.578	8.270	11.490	8.470	13.061	14.315	7.111
15487	5.284	8.940	18.200	6.315	7.674	15.492	20.848	0	24.756	26.349	15.802	9.407	3.212	21.328	22.765	6.059	4.408	28.310	14.876	10.751	12.820	8.679	7.914	13.822
15709	20.975	31.526	9.465	19.570	20.602	10.216	4.902	24.756	0	4.273	9.228	34.022	27.968	3.529	3.194	19.918	21.115	4.083	13.156	14.531	13.040	16.408	18.839	11.002
15710	21.986	32.208	8.936	21.829	21.108	10.936	5.532	26.349	4.273	0	10.582	35.748	29.523	6.769	3.789	22.174	23.158	2.924	12.919	16.929	13.772	18.568	19.562	12.642
15862	11.755	22.299	4.290	11.395	11.444	1.707	5.056	15.802	9.228	10.582	0	25.184	18.994	6.168	6.965	11.733	12.611	12.533	5.325	6.799	3.955	8.134	9.633	2.098
16312	14.285	9.019	27.564	14.717	16.174	24.898	30.238	9.407	34.022	35.748	25.184	0	6.304	30.547	32.139	14.382	12.984	37.659	24.100	19.670	22.204	17.674	16.964	23.176
16661	8.007	7.129	21.263	9.239	10.049	18.634	24.034	3.212	27.968	29.523	18.994	6.304	0	24.539	25.959	8.944	7.353	31.512	17.806	13.898	15.914	11.837	10.691	17.027
17247	17.753	28.359	7.708	16.048	17.604	7.465	3.546	21.328	3.529	6.769	6.168	30.547	24.539	0	3.434	16.397	17.614	7.508	10.827	11.008	10.114	12.904	15.766	7.710
17248	18.609	29.020	6.357	18.074	17.975	7.587	1.993	22.765	3.194	3.789	6.965	32.139	25.959	3.434	0	18.421	19.445	5.595	10.179	13.149	10.462	14.821	16.307	8.970
23147	6.729	14.882	15.145	0.349	9.086	12.016	16.671	6.059	19.918	22.174	11.733	14.382	8.944	16.397	18.421	0	1.655	23.746	12.823	5.390	10.009	3.610	7.929	9.636
38337	5.684	13.235	15.721	1.909	8.208	12.691	17.630	4.408	21.115	23.158	12.611	12.984	7.353	17.614	19.445	1.655	0	24.862	13.047	6.687	10.418	4.710	7.357	10.525
43687	24.204	34.592	11.554	23.398	23.522	13.169	7.578	28.310	4.083	2.924	12.533	37.659	31.512	7.508	5.595	23.746	24.862	0	15.516	18.387	16.044	20.183	21.886	14.490
48911	9.823	19.434	3.984	12.552	8.389	3.632	8.270	14.876	13.156	12.919	5.325	24.100	17.806	10.827	10.179	12.823	13.047	15.516	0	9.547	3.025	9.797	7.165	5.664
48949	8.713	18.863	10.747	5.042	9.981	7.540	11.490	10.751	14.531	16.929	6.799	19.670	13.898	11.008	13.149	5.390	6.687	18.387	9.547	0	6.530	2.076	8.123	4.803
58443	8.215	18.560	5.396	9.719	7.562	2.875	8.470	12.820	13.040	13.772	3.955	22.204	15.914	10.114	10.462	10.009	10.418	16.044	3.025	6.530	0	6.823	5.845	3.212
58608	6.904	16.836	11.696	3.267	8.494	8.517	13.061	8.679	16.408	18.568	8.134	17.674	11.837	12.904	14.821	3.610	4.710	20.183	9.797	2.076	6.823	0	6.777	6.040
58834	2.684	12.715	10.853	7.810	1.954	8.720	14.315	7.914	18.839	19.562	9.633	16.964	10.691	15.766	16.307	7.929	7.357	21.886	7.165	8.123	5.845	6.777	0	8.171
58897	10.045	20.658	5.975	9.298	10.076	2.806	7.111	13.822	11.002	12.642	2.098	23.176	17.027	7.710	8.970	9.636	10.525	14.490	5.664	4.803	3.212	6.040	8.171	0

Notes:
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Bold denotes bores are close enough to exceed drawdown threshold
 RN 16312 is located within the 9 - 19.28 km chainage group
 It is not known which aquifer RN 23147 and RN 58897 are screened in, so included in Table A5 and Table A6

Table C6: Distance Between Bores (19.28 - 63 km chainage in Precipice Sandstone)

12627	13180	13881	13882	15417	16028	16065	16686	17945	18207	23147	30421	37507	38658	44404	48816	48911	57701	58897	58907	62077	67229	67232	89599	123105	123167	
12627	0	24.109	32.232	30.337	39.345	22.325	16.926	33.362	23.003	37.515	10.853	37.393	26.889	36.853	27.666	29.345	15.538	40.339	16.368	13.246	35.510	36.786	43.678	35.571	17.850	16.494
13180	24.109	0	9.696	7.164	17.898	2.189	9.904	17.145	4.092	13.827	14.272	14.257	4.427	13.289	9.616	5.338	14.689	16.634	9.446	16.292	11.980	13.273	19.828	13.695	11.080	9.231
13881	32.232	9.696	0	2.649	8.223	11.878	19.586	10.651	9.250	5.929	23.432	5.197	10.937	5.117	6.551	7.600	19.301	8.527	15.978	21.593	3.934	4.973	11.951	4.026	15.614	18.834
13882	30.337	7.164	2.649	0	10.847	9.353	17.067	12.500	7.397	7.205	21.164	7.194	8.333	6.519	6.810	5.160	18.232	10.015	14.323	20.392	5.176	6.449	13.394	6.664	14.445	16.372
15417	39.345	17.898	8.223	10.847	0	20.070	27.757	9.624	16.865	7.641	31.274	5.477	18.923	7.273	11.759	15.366	25.080	7.593	22.992	27.537	7.746	7.088	9.622	4.204	21.804	26.950
16028	22.325	2.189	11.878	9.353	20.070	0	7.716	18.887	5.070	15.942	12.233	16.431	4.975	15.427	11.277	7.032	14.173	18.734	8.628	15.501	14.128	15.418	21.881	15.868	10.826	7.058
16065	16.926	9.904	19.586	17.067	27.757	7.716	0	25.639	11.609	23.482	6.075	24.106	10.867	23.020	18.104	14.095	15.124	26.225	10.053	15.234	21.749	23.026	29.241	23.561	13.306	1.354
16686	33.362	17.145	10.651	12.500	9.624	18.887	25.639	0	14.101	14.719	27.370	12.678	20.193	13.967	7.622	17.564	18.005	16.085	17.900	20.463	13.468	13.748	18.843	9.133	15.606	24.502
17945	23.003	4.092	9.250	7.397	16.865	5.070	11.609	14.101	0	14.601	14.415	14.391	8.451	13.902	6.508	8.300	11.390	17.405	6.945	13.323	12.563	13.821	20.790	12.824	7.604	10.555
18207	37.515	13.827	5.929	7.205	7.641	15.942	23.482	14.719	14.601	0	28.086	2.246	13.218	0.835	12.410	9.593	25.169	2.829	21.517	27.419	2.061	1.026	6.190	5.600	21.440	22.976
23147	10.853	14.272	23.432	21.164	31.274	12.233	6.075	27.370	14.415	28.086	0	28.358	16.370	27.521	20.367	19.195	12.823	30.901	9.636	11.967	26.194	27.491	34.097	27.192	12.611	5.710
30421	37.393	14.257	5.197	7.194	5.477	16.431	24.106	12.678	14.391	2.246	28.358	0	14.317	1.796	11.235	10.663	24.399	3.656	21.172	26.727	2.540	1.618	6.962	3.564	20.758	23.487
37507	26.889	4.427	10.937	8.333	18.923	4.975	10.867	20.193	8.451	13.218	16.370	14.317	0	12.917	13.072	3.657	18.971	15.799	13.536	20.422	11.795	12.975	18.597	14.849	15.446	10.732
38658	36.853	13.289	5.117	6.519	7.273	15.427	23.020	13.967	13.902	0.835	27.521	1.796	12.917	0	11.580	9.268	24.384	3.506	20.800	26.646	1.344	0.221	6.916	4.881	20.665	22.478
44404	27.666	9.616	6.551	6.810	11.759	11.277	18.104	7.622	6.508	12.410	20.367	11.235	13.072	11.580	0	11.075	13.428	14.825	11.408	15.852	10.472	11.413	18.194	8.405	10.048	17.013
48816	29.345	5.338	7.600	5.160	15.366	7.032	14.095	17.564	8.300	9.593	19.195	10.663	3.657	9.268	11.075	0	19.627	12.230	14.658	21.411	8.138	9.322	15.152	11.370	15.878	13.755
48911	15.538	14.689	19.301	18.232	25.080	14.173	15.124	18.005	11.390	25.169	12.823	24.399	18.971	24.384	13.428	19.627	0	27.828	5.664	2.484	23.115	24.256	31.252	21.820	3.811	13.800
57701	40.339	16.634	8.527	10.015	7.593	18.734	26.225	16.085	17.405	2.829	30.901	3.656	15.799	3.506	14.825	12.230	27.828	0	24.305	30.112	4.842	3.602	3.426	7.121	24.131	25.752
58897	16.368	9.446	15.978	14.323	22.992	8.628	10.053	17.900	6.945	21.517	9.636	21.172	13.536	20.800	11.408	14.658	5.664	24.305	0	6.886	19.468	20.709	27.706	19.207	3.274	8.699
58907	13.246	16.292	21.593	20.392	27.537	15.501	15.234	20.463	13.323	27.419	11.967	26.727	20.422	26.646	15.852	21.411	2.484	30.112	6.886	0	25.359	26.525	33.538	24.225	5.981	13.977
62077	35.510	11.980	3.934	5.176	7.746	14.128	21.749	13.468	12.563	2.061	26.194	2.540	11.795	1.344	10.472	8.138	23.115	4.842	19.468	25.359	0	1.297	8.239	4.645	19.381	21.184
67229	36.786	13.273	4.973	6.449	7.088	15.418	23.026	13.748	13.821	1.026	27.491	1.618	12.975	0.221	11.413	9.322	24.256	3.602	20.709	26.525	1.297	0	7.023	4.660	20.544	22.472
67232	43.678	19.828	11.951	13.394	9.622	21.881	29.241	18.843	20.790	6.190	34.097	6.962	18.597	6.916	18.194	15.152	31.252	3.426	27.706	33.538	8.239	7.023	0	10.222	27.557	28.840
89599	35.571	13.695	4.026	6.664	4.204	15.868	23.561	9.133	12.824	5.600	27.192	3.564	14.849	4.881	8.405	11.370	21.820	7.121	19.207	24.225	4.645	4.660	10.222	0	18.340	22.769
123105	17.850	11.080	15.614	14.445	21.804	10.826	13.306	15.606	7.604	21.440	12.611	20.758	15.446	20.665	10.048	15.878	3.811	24.131	3.274	5.981	19.381	20.544	27.557	18.340	0	11.953
123167	16.494	9.231	18.834	16.372	26.950	7.058	1.354	24.502	10.555	22.976	5.710	23.487	10.732	22.478	17.013	13.755	13.800	25.752	8.699	13.977	21.184	22.472	28.840	22.769	11.953	0

Notes:

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RN 15417 is located within the 63 - 90 km chainage group

RN 16686 is located within the 63 - 90 km chainage group

It is not known which aquifer RN 23147 and RN 58897 are screened in, so included in Table A5 and Table A6

Table C7: Distance Between Bores (63 - 90 km chainage in Precipice Sandstone)

	10594	11104	14582	14583	14584	15417	16270	16686	17849	18173	18195	30318	30506	30507	31409	36120	47325	57615	57781	62877	67232	67280	67281	67410	67624	67625	84032	89504	89510	89540	89572	89724	89763	89764	89775	89853	89854	89855	
10594	0	14.827	4.375	6.833	7.530	14.339	5.519	15.618	12.422	11.139	10.267	2.800	4.786	5.639	1.650	13.155	8.281	6.169	2.051	10.358	21.351	8.739	6.558	2.645	8.770	6.339	10.824	8.535	8.625	6.941	13.982	7.028	6.890	8.398	6.041	2.835	2.645	5.295	
11104	14.827	0	17.966	20.242	20.085	16.538	9.333	8.399	11.284	8.026	15.031	16.758	18.682	17.534	16.337	2.298	12.965	18.862	15.489	16.795	26.158	16.779	16.419	12.638	22.073	8.660	10.544	17.765	18.168	20.272	23.200	21.723	20.387	19.727	20.731	17.412	12.239	18.870	
14582	4.375	17.966	0	2.500	3.205	12.816	9.135	16.819	12.605	12.523	8.869	5.588	6.557	8.707	4.253	16.005	7.901	8.565	2.664	8.160	18.188	12.513	10.229	5.458	4.457	9.334	11.312	5.555	5.446	2.592	10.101	4.352	2.587	4.399	5.718	2.097	6.643	0.962	
14583	6.833	20.242	2.500	0	1.469	13.125	11.588	18.409	13.864	14.296	9.518	7.618	8.105	10.571	6.462	18.211	9.200	10.163	5.156	8.342	17.127	14.568	12.284	7.895	1.958	11.676	12.768	5.467	5.179	0.161	8.546	3.770	0.199	3.240	6.431	4.244	9.142	1.545	
14584	7.530	20.085	3.205	1.469	0	11.839	11.805	17.658	12.959	13.706	8.396	8.711	9.396	11.760	7.437	17.978	8.398	11.451	5.638	7.072	15.669	15.667	13.379	8.131	2.156	11.680	11.987	4.195	3.861	1.318	7.158	5.222	1.628	1.784	7.869	5.232	9.956	2.441	
15417	14.339	16.538	12.816	13.125	11.839	0	13.811	9.624	5.257	8.608	4.091	17.013	18.715	19.977	15.569	14.318	6.265	20.423	12.738	4.784	9.622	22.596	20.652	12.360	13.724	12.325	6.221	7.661	7.978	13.014	9.268	16.764	13.320	10.188	18.509	14.347	14.116	12.969	
16270	5.519	9.333	9.135	11.588	11.805	13.811	0	11.630	10.039	7.464	10.345	7.499	9.496	8.864	7.003	7.802	7.768	10.026	6.495	11.379	22.520	9.703	8.399	3.696	13.527	1.699	8.376	10.901	11.189	11.653	16.811	12.507	11.700	12.001	11.405	8.214	2.906	10.090	
16686	15.618	8.399	16.819	18.409	17.658	9.624	11.630	0	5.031	4.480	10.017	18.297	20.353	20.332	17.258	6.772	9.261	21.343	15.154	11.908	18.843	21.240	20.028	12.974	19.814	10.009	5.672	14.034	14.472	18.370	18.136	21.153	18.597	16.601	21.460	17.276	13.791	17.475	
17849	12.422	11.284	12.605	13.864	12.959	5.257	10.039	5.031	0	3.464	4.997	15.220	17.187	17.762	13.958	9.079	4.712	18.532	11.441	6.880	14.874	19.579	17.943	9.920	15.099	8.367	1.685	9.124	9.556	13.805	13.134	16.946	14.059	11.753	17.779	13.466	11.278	13.126	
18173	11.139	8.026	12.523	14.296	13.706	8.608	7.464	4.480	3.464	0	7.150	13.829	15.881	15.952	12.778	5.755	5.519	16.918	10.717	9.004	18.218	17.167	15.786	8.495	15.848	5.777	2.521	10.515	10.948	14.276	15.464	16.816	14.477	12.880	16.994	12.845	12.845	16.994	12.845
18195	10.267	15.031	8.869	9.518	8.396	4.091	10.345	10.017	4.997	7.150	0	12.924	14.626	15.907	11.478	12.733	2.586	16.333	8.647	1.908	12.198	18.650	16.648	8.408	10.460	9.061	4.717	4.294	4.705	9.429	8.334	12.989	9.717	6.973	14.508	10.294	10.229	9.131	
30318	2.800	16.758	5.588	7.618	8.711	17.013	7.499	18.297	15.220	13.829	12.924	0	2.062	3.166	1.482	15.300	11.046	3.412	4.319	12.832	23.549	6.960	4.672	5.369	9.351	8.671	13.616	10.701	10.707	7.762	15.683	6.310	7.601	9.980	4.107	3.495	4.692	6.271	
30506	4.786	18.682	6.557	8.105	9.396	18.715	9.496	20.353	17.187	15.881	14.626	2.062	0	2.736	3.238	17.293	12.899	2.058	5.988	14.357	24.743	6.889	4.764	7.403	9.577	10.719	15.604	12.008	11.951	8.262	16.537	5.810	8.038	10.886	2.808	4.657	6.737	7.013	
30507	5.639	17.534	8.707	10.571	11.760	19.977	8.864	20.332	17.762	15.952	15.907	3.166	2.736	0	4.633	16.426	13.871	1.422	7.420	15.930	26.713	4.156	2.066	7.865	12.168	10.361	16.106	13.861	13.872	10.722	18.807	8.541	10.528	13.106	5.495	6.611	6.581	9.324	
31409	1.650	16.337	4.253	6.462	7.437	15.569	7.003	17.258	13.958	12.778	11.478	1.482	3.238	4.633	0	14.728	9.674	4.860	2.847	11.354	22.082	8.268	5.990	4.289	8.295	7.945	12.386	9.229	9.244	6.595	14.301	5.831	6.471	8.607	4.430	2.223	4.098	5.024	
36120	13.155	2.298	16.005	18.211	17.978	14.318	7.802	6.772	9.079	5.755	12.733	15.300	17.293	16.426	14.728	0	10.684	17.687	13.615	14.499	23.940	16.197	15.538	10.808	20.003	6.841	8.265	15.520	15.928	18.232	20.911	19.905	18.363	17.544	19.155	15.611	10.658	16.884	
47325	8.281	12.965	7.901	9.200	8.398	6.265	7.768	9.261	4.712	5.519	2.586	11.046	12.899	13.871	9.671	10.684	0	14.445	6.966	3.950	14.783	16.337	14.424	6.120	10.553	6.479	3.589	4.997	5.429	9.151	10.242	12.236	9.393	7.405	13.206	8.888	7.851	8.414	
57615	6.169	18.862	8.565	10.163	11.451	20.423	10.026	21.343	18.532	16.918	16.333	3.412	2.058	1.422	4.860	17.687	14.445	0	7.706	16.192	26.732	5.172	3.353	8.617	11.613	11.449	16.902	13.944	13.910	10.320	18.585	7.712	10.095	12.921	4.491	6.519	7.552	9.058	
57781	2.051	15.489	2.664	5.156	5.638	12.738	6.495	15.154	11.441	10.717	8.647	4.319	5.988	7.420	2.847	13.615	6.966	7.706	0	8.517	19.370	10.755	8.540	2.865	7.113	6.829	9.952	6.524	6.594	5.239	11.932	6.308	5.250	6.375	6.360	2.129	3.993	3.626	
62877	10.358	16.795	8.160	8.342	7.072	4.784	11.379	11.908	6.880	9.004	1.908	12.832	14.357	15.930	11.354	14.499	3.950	16.192	8.517	0	11.249	18.999	16.891	8.910	9.019	10.276	6.609	2.881	3.218	8.231	6.461	11.992	8.536	5.475	13.878	9.858	10.796	8.232	
67232	21.351	26.158	18.188	17.127	15.669	9.622	22.520	18.843	14.874	18.218	12.198	23.549	24.743	26.713	22.082	23.940	14.783	26.732	19.370	11.249	0	30.084	27.903	20.144	16.555	21.258	15.779	12.858	12.843	16.970	8.877	20.766	17.267	13.976	23.530	20.213	22.035	17.830	
67280	8.739	16.779	12.513	14.568	15.667	22.596	9.703	21.240	19.579	17.167	18.650	6.960	8.889	4.156	8.268	16.197	16.337	5.172	10.755	18.999	30.084	0	2.288	10.246	16.244	11.396	17.894	17.272	17.348	14.714	22.561	12.697	14.642	16.874	9.605	10.438	8.493	13.229	
67281	6.558	16.419	10.229	12.284	13.379	20.652	8.399	20.028	17.943	15.786	16.648	4.672	4.764	2.066	5.990	15.538	14.424	3.353	8.540	16.891	27.903	2.288	0	8.304	13.975	10.034	16.262	15.065	15.126	12.429	20.290	10.528	12.260	14.597	7.550	8.151	6.685	10.941	
67410	2.645	12.638	5.458	7.895	8.131	12.360	3.696	12.974	9.820	8.495	8.408	5.369	7.403	7.865	4.289	10.808	6.120	8.617	2.865	8.910	20.144	10.246	8.304	0	9.831	3.984	8.285	7.752	7.968	7.958	13.591	9.101	8.009	8.457	8.609	4.803	1.893	6.407	
67624	8.770	22.073	4.457	1.958	2.156	13.724	13.527	19.814	15.099	15.848	10.460	9.351	9.577	12.168	8.295	20.003	10.553	11.613	7.113	9.019	16.555	16.244	13.975	9.831	0	13.561	14.143	6.190	5.811	1.877	7.724	4.350	1.882	3.545	7.509	6.105	11.100	3.500	
67625	6.339	8.660	9.334	11.676	11.680	12.325	1.699	10.009	8.367	5.777	9.061	8.671	10.719	10.361	7.945	8.841	6.479	11.449	6.829	10.276	21.258	11.396	10.034	3.984	13.561	0	6.717	10.182	10.515	11.719	16.048	13.084	11.810	11.621	12.371	8.779	3.983	10.255	
84032	10.824	10.544	11.312	12.768</																																			

Chain 0 - 9 km

Coord	RN 13856		
lat	-26.10090		
long	149.954160		
s	Drawdown		m
Q	Extraction rate		1669 m ³ /d
W(u)			
T	Transmissivity		150 m ² /d
r	Distance from bore to spring		m
S	Storage coeff		0.0005
t	time		150 d (June 2011 - October 2011)

Thies Equation

Distance Calculation

Well	Aquifer	r (m)	u	Wu	s	RN	GIS_LAT	GIS_LNG	Extract Lat RAD	Obs Lat RAD	Extract Long RAD	Obs Long RAD	COS a	Angle	Dist (m)	Dist (km)
8356	FORMATION NAME NOT SPECIFIED	0	0	0	0.00	8356	-25.717864	149.864995	-0.455533	-0.448861	2.6171938	2.6156376	0.999976769	0.3905499	43427.163	43.4
8357	HUTTON SANDSTONE	35614.61237	7.04667008	0.000125226	0.00000	8357	-25.785086	149.889717	-0.455533	-0.450035	2.6171938	2.6160691	0.999984375	0.3202899	35614.612	35.6
8440	PRECIPICE SANDSTONE	0	0	0	0.00	8440	-25.864604	150.202185	-0.455533	-0.451422	2.6171938	2.6215227	0.999983983	0.3242889	36059.281	36.1
8445	EVERGREEN FORMATION	0	0	0	0.00	8445	-25.650364	150.070267	-0.455533	-0.447683	2.6171938	2.6192203	0.999967533	0.4616998	51338.676	51.3
8449	HUTTON SANDSTONE	43762.75489	10.63988176	-0.000184854	0.00	8449	-25.707030	149.976381	-0.455533	-0.448672	2.6171938	2.6175816	0.999976408	0.3935679	43762.755	43.8
10463	HUTTON SANDSTONE	13210.97374	0.969610151	0.230927971	0.20	10463	-26.051199	150.074714	-0.455533	-0.454679	2.6171938	2.6192979	0.99999785	0.1188091	13210.974	13.2
10475	HUTTON SANDSTONE	72984.94868	29.59334852	-8314921126	0.00	10475	-25.447306	149.878079	-0.455533	-0.444139	2.6171938	2.615866	0.999934383	0.6563694	72984.949	73.0
10578	HUTTON SANDSTONE	64487.90121	23.10383002	-4317940.675	0.00	10578	-25.979536	149.322782	-0.455533	-0.453428	2.6171938	2.6061742	0.999948772	0.5799536	64487.901	64.5
10583	PRECIPICE SANDSTONE	0	0	0	0.00	10583	-25.370832	149.936375	-0.455533	-0.442805	2.6171938	2.6168834	0.999918962	0.729434	81109.355	81.1
10584	HUTTON SANDSTONE	85279.95164	40.40372306	-1.10073E+14	0.00	10584	-25.359943	149.731090	-0.455533	-0.442615	2.6171938	2.6133005	0.999910414	0.766941	85279.952	85.3
10592	PRECIPICE SANDSTONE	0	0	0	0.00	10592	-25.680364	150.053601	-0.455533	-0.448207	2.6171938	2.6189294	0.999971949	0.4291538	47719.728	47.7
10594	PRECIPICE SANDSTONE	0	0	0	0.00	10594	-25.536943	150.162492	-0.455533	-0.445696	2.6171938	2.6208299	0.999946264	0.5939789	66047.44	66.0
10690	HUTTON SANDSTONE	24646.43473	3.374704139	0.008159045	0.01	10690	-25.879253	149.933050	-0.455533	-0.451678	2.6171938	2.6168254	0.999992517	0.2216507	24646.435	24.6
10875	PRECIPICE SANDSTONE	0	0	0	0.00	10875	-25.503869	150.129343	-0.455533	-0.445126	2.6171938	2.6202513	0.999942069	0.6167285	68577.08	68.6
10876	PRECIPICE SANDSTONE	0	0	0	0.00	10876	-25.505448	150.107771	-0.455533	-0.445154	2.6171938	2.6198748	0.999943231	0.6105117	67885.8	67.9
10886	HUTTON SANDSTONE	13151.63802	0.960919904	0.234357097	0.21	10886	-26.134255	150.080270	-0.455533	-0.456129	2.6171938	2.6193949	0.999997869	0.1182755	13151.638	13.2
10918	EVERGREEN FORMATION	0	0	0	0.00	10918	-25.434251	149.884711	-0.455533	-0.443911	2.6171938	2.6159817	0.99993188	0.6687699	74363.821	74.4
10929	HUTTON SANDSTONE	84267.48273	39.45004804	-5.31929E+13	0.00	10929	-25.343720	149.901868	-0.455533	-0.442331	2.6171938	2.6162812	0.999912528	0.7578357	84267.483	84.3
10930	HUTTON SANDSTONE	61810.44876	21.22517542	-322451.8487	0.00	10930	-25.601477	149.681107	-0.455533	-0.446683	2.6171938	2.6124282	0.999952937	0.5558747	61810.449	61.8
10980	EVERGREEN FORMATION	0	0	0	0.00	10980	-25.232863	149.716934	-0.455533	-0.440397	2.6171938	2.6130534	0.999878491	0.8931964	99318.906	99.3
10981	EVERGREEN FORMATION	0	0	0	0.00	10981	-25.262309	149.689714	-0.455533	-0.44091	2.6171938	2.6125784	0.99988445	0.8710117	96852.857	96.9
10989	PRECIPICE SANDSTONE	0	0	0	0.00	10989	-25.198973	149.824986	-0.455533	-0.439805	2.6171938	2.6149393	0.999874261	0.9086093	101032.74	101.0
10990	EVERGREEN FORMATION	0	0	0	0.00	10990	-25.160640	149.812486	-0.455533	-0.439136	2.6171938	2.6147211	0.999863096	0.9480937	105423.21	105.4
10992	EVERGREEN FORMATION	0	0	0	0.00	10992	-25.233418	149.729711	-0.455533	-0.440406	2.6171938	2.6132764	0.999879367	0.8899692	98960.064	99.0
11007	HUTTON SANDSTONE	93484.81669	48.55228306	-2.94255E+16	0.00	11007	-25.308017	149.641340	-0.455533	-0.441708	2.6171938	2.6117341	0.999892346	0.8407292	93484.817	93.5
11009	HUTTON SANDSTONE	54149.89292	16.29006057	-97.20318814	0.00	11009	-25.656453	149.730933	-0.455533	-0.44779	2.6171938	2.6132978	0.99996388	0.4869817	54149.893	54.1
11104	PRECIPICE SANDSTONE	0	0	0	0.00	11104	-25.621055	150.048223	-0.455533	-0.447172	2.6171938	2.6188355	0.999963958	0.4864555	54091.384	54.1
11140	EVERGREEN FORMATION	0	0	0	0.00	11140	-25.316837	149.563137	-0.455533	-0.441862	2.6171938	2.6103692	0.999887658	0.8588417	95498.836	95.5
11175	HUTTON SANDSTONE	24280.3907	3.275207625	0.009236332	0.01	11175	-25.978976	150.166379	-0.455533	-0.453419	2.6171938	2.6207232	0.999992738	0.2183588	24280.391	24.3
11176	HUTTON SANDSTONE	25025.84816	3.479405979	0.007165861	0.01	11176	-25.962310	150.152212	-0.455533	-0.453128	2.6171938	2.6206505	0.999992285	0.2250629	25025.848	25.0
11306	PRECIPICE SANDSTONE	0	0	0	0.00	11306	-25.663705	150.024896	-0.455533	-0.447916	2.6171938	2.6184284	0.999970379	0.4410011	49037.088	49.0
11501	EVERGREEN FORMATION	0	0	0	0.00	11501	-25.623144	149.502499	-0.455533	-0.447208	2.6171938	2.6093108	0.999940195	0.6266249	69677.513	69.7
11558	PRECIPICE SANDSTONE	0	0	0	0.00	11558	-25.595376	150.013748	-0.455533	-0.446724	2.6171938	2.6182338	0.999960764	0.5075549	56437.532	56.4
11560	HUTTON SANDSTONE	10006.19135	0.556243697	0.496887259	0.44	11560	-26.028977	149.892774	-0.455533	-0.454291	2.6171938	2.6161224	0.999998767	0.0899878	10006.191	10.0
11647	EVERGREEN FORMATION	0	0	0	0.00	11647	-25.534507	149.521153	-0.455533	-0.445661	2.6171938	2.6096364	0.999928139	0.6868887	76378.541	76.4
11648	HUTTON SANDSTONE	77022.90293	32.95848653	-2.222E+11	0.00	11648	-25.477866	149.616107	-0.455533	-0.444673	2.6171938	2.6112937	0.999926922	0.6926836	77022.903	77.0
11692	EVERGREEN FORMATION	0	0	0	0.00	11692	-25.822031	150.289708	-0.455533	-0.450679	2.6171938	2.6230502	0.999974362	0.4102833	45621.419	45.6
11694	HUTTON SANDSTONE	25926.96545	3.734486319	0.005238022	0.00	11694	-26.109532	150.213601	-0.455533	-0.455697	2.6171938	2.6217219	0.99999171	0.2331668	25926.965	25.9
11739	HUTTON SANDSTONE	23891.75794	3.171200541	0.010522537	0.01	11739	-25.890866	149.903606	-0.455533	-0.451867	2.6171938	2.6163115	0.999992968	0.2148637	23891.758	23.9
11758	EVERGREEN FORMATION	0	0	0	0.00	11758	-25.391571	149.733299	-0.455533	-0.443167	2.6171938	2.6133391	0.999917515	0.735917	81830.24	81.8
11764	HUTTON SANDSTONE	70774.12913	27.82765197	-1271234902	0.00	11764	-25.472585	149.835244	-0.455533	-0.44458	2.6171938	2.6151285	0.999938298	0.636487	70774.129	70.8
11765	HUTTON SANDSTONE	62945.1938	22.01165235	-981668.5747	0.00	11765	-25.567031	149.742495	-0.455533	-0.446229	2.6171938	2.6134996	0.999951194	0.5660797	62945.194	62.9
11766	HUTTON SANDSTONE	66539.92903	24.59756753	-29319320.73	0.00	11766	-25.553143	149.684400	-0.455533	-0.445986	2.6171938	2.6124863	0.99994546	0.598408	66539.929	66.5
11850	EVERGREEN FORMATION	0	0	0	0.00	11850	-25.397308	149.754435	-0.455533	-0.443267	2.6171938	2.613708	0.999919847	0.7254403	80665.284	80.7
11878	PRECIPICE SANDSTONE	0	0	0	0.00	11878	-25.752586	150.218598	-0.455533	-0.449467	2.6171938	2.6218091	0.999972993	0.4210927	46823.368	46.8
11882	HUTTON SANDSTONE	29872.77534	4.957681702	0.001222462	0.00	11882	-26.093568	150.253222	-0.455533	-0.455419	2.6171938	2.6224134	0.999989007	0.2686523	29872.775	29.9
11892	EVERGREEN FORMATION	0	0	0	0.00	11892	-25.753975	150.334428	-0.455533	-0.449492	2.6171938	2.6238307	0.99996394	0.486575	54104.672	54.1
12118	EVERGREEN FORMATION	0	0	0	0.00	12118	-25.990643	150.095547	-0.455533	-0.453622	2.6171938	2.6196615	0.999995718	0.167675	18644.614	18.6
12221	HUTTON SANDSTONE	23215.13307	2.994124464	0.013161938	0.01	12221	-25.897309	150.009437	-0.455533	-0.451993	2.6171938	2.6181586	0.999993361	0.2087787	23215.133	23.2
12236	HUTTON SANDSTONE	79185.38767	34.83514234	-1.20209E+12	0.00	12236	-25.502535	149.523888	-0.455533	-0.445103	2.6171938	2.6096842	0.999922761	0.7121313	79185.388	79.2
12238	EVERGREEN FORMATION	0	0	0	0.00	12238	-25.580955	150.094355	-0.455533	-0.446472	2.6171938	2.6196407	0.999956528	0.5342486	59405.737	59.4
12372	HUTTON SANDSTONE	30396.90238	5.133175969	0.000998081	0.00	12372	-25.831753	149.896106	-0.455533	-0.450849	2.6171938	2.6161806	0.999988618	0.2733659	30396.902	30.4
12627	PRECIPICE SANDSTONE	0	0	0	0.00	12627	-25.941818	149.969996	-0.455533	-0.45277	2.6171938	2.6174702	0.999996154	0.1589105	17670.039	17.7
12651	HUTTON SANDSTONE	74954.36253	31.21198035	-42222948690	0.00	12651	-25.653978	149.392501	-0.455533	-0.447746	2.6171938	2.607391	0.999930794	0.6740808	74954.363	75.0
12753	HUTTON SANDSTONE	55024.06001	16.82026211	-259.528754	0.00	12753	-25.655807	149.713608	-0.455533	-0.447766	2.6171938	2.6129954	0.999962704	0.4948433	55024.06	55.0
12838																

Appendix D

Groundwater Model Results (3,500 ML)

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Environment

Table D1: Summary of Model Results (3,500 ML)

Chainage	Sub Group	No. Extraction Bores	Extraction Duration (days)	Extraction Rate (ML/day)	Distance to 5-meter Drawdown (km)	Proposed Extraction Aquifer
0 - 9 km	-	1	150	2.580	1.215	Hutton Sandstone
			30	0.600	N/A	Hutton Sandstone
9 - 19 km	-	2	330	0.058	0.377	Hutton Sandstone
			60	3.250		
			30	3.306		
		1	60	1.625	0.447	Precipice Sandstone
			30	1.653		
1	30	0.558	<0.001	Hutton Sandstone		
19 - 63 km	19 - 30 km	2	120	0.463	0.120	Hutton Sandstone
			180	1.063		
		1	90	2.887	1.540	Precipice Sandstone
	30		1.525	N/A	Precipice Sandstone	
	30 - 41 km	1	90	1.150	0.130	Hutton Sandstone
	41 - 53 km	1	120	0.200	0.002	Precipice Sandstone
			120	0.225		
			120	0.263		
			450	0.200		
	52 - 63 km	2	120	3.050	0.410	Hutton Sandstone
			60	0.300	0.010	Hutton Sandstone
			60	1.450		
90			0.300	N/A	Hutton Sandstone	
63 - 90 km	63 - 70 km	3	365	0.006	0.127	Precipice Sandstone
			90	3.417		
			120	0.006	<0.001	Precipice Sandstone
			30	0.840		
	70 - 77 km	1	90	0.884	0.038	Precipice Sandstone
	77 - 83 km	1	390	0.006	0.013	Precipice Sandstone
			150	0.706		Precipice Sandstone
	83 - 90 km	5	390	0.190	0.021	Precipice Sandstone
			150	3.600		
30			0.200	N/A	Precipice Sandstone	
30			0.850	N/A	Precipice Sandstone	

Notes:

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N/A = Not applicable as the drawdown in extraction bore is less than 5 meters or extraction rate decreased

Table D2: Distance Between Bores (0 - 9 km chainage in Hutton Sandstone)

	13856	22117	58409	58232
13856	0	9.838	13.497	4.911
22117	9.838	0	12.535	14.696
58409	13.497	12.535	0	16.940
58232	4.911	14.696	16.940	0

Notes:

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RN 58232 is located within the 9 - 19.28 km chainage group

Table D3: Distance Between Bores (0 - 9 km chainage in Precipice Sandstone)

	15793	16752	58700
15793	0	4.854	0.714
16752	4.854	0	4.922
58700	0.714	4.922	0

Notes:

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RN 16752 is located within the 9 - 19.28 km chainage group

Table D4: Distance Between Bores (9 - 19.28 km chainage in Hutton Sandstone)

	13856	16312	58232
13856	0	9.458	4.911
16312	9.458	0	4.601
58232	4.911	4.601	0

Notes:

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RN 58232 is located within the 0 - 9 km chainage group

Table D5: Distance Between Bores (19.28 - 63 km chainage in Hutton Sandstone)

12221	12221	13060	14350	14538	14593	14697	14872	15487	15709	15710	15862	16312	16661	17247	17248	23147	38337	43687	48911	48949	58443	58608	58834	58897
12221	0	10.621	13.417	6.724	2.613	11.061	16.629	5.284	20.975	21.986	11.755	14.285	8.007	17.753	18.609	6.729	5.684	24.204	9.823	8.713	8.215	6.904	2.684	10.045
13060	10.621	0	23.353	15.096	11.101	21.434	27.028	8.940	31.526	32.208	22.299	9.019	7.129	28.359	29.020	14.882	13.235	34.592	19.434	18.863	18.560	16.836	12.715	20.658
14350	13.417	23.353	0	14.830	12.264	3.211	4.589	18.200	9.465	8.936	4.290	27.564	21.263	7.708	6.357	15.145	15.721	11.554	3.984	10.747	5.396	11.696	10.853	5.975
14538	6.724	15.096	14.830	0	9.028	11.693	16.327	6.315	19.570	21.829	11.395	14.717	9.239	16.048	18.074	0.349	1.909	23.398	12.552	5.042	9.719	3.267	7.810	9.298
14593	2.613	11.101	12.264	9.028	0	10.412	15.983	7.674	20.602	21.108	11.444	16.174	10.049	17.604	17.975	9.086	8.208	23.522	8.389	9.981	7.562	8.494	1.954	10.076
14697	11.061	21.434	3.211	11.693	10.412	0	5.595	15.492	10.216	10.936	1.707	24.898	18.634	7.465	7.587	12.016	12.691	13.169	3.632	7.540	2.875	8.517	8.720	2.806
14872	16.629	27.028	4.589	16.327	15.983	5.595	0	20.848	4.902	5.532	5.056	30.238	24.034	3.546	1.993	16.671	17.630	7.578	8.270	11.490	8.470	13.061	14.315	7.111
15487	5.284	8.940	18.200	6.315	7.674	15.492	20.848	0	24.756	26.349	15.802	9.407	3.212	21.328	22.765	6.059	4.408	28.310	14.876	10.751	12.820	8.679	7.914	13.822
15709	20.975	31.526	9.465	19.570	20.602	10.216	4.902	24.756	0	4.273	9.228	34.022	27.968	3.529	3.194	19.918	21.115	4.083	13.156	14.531	13.040	16.408	18.839	11.002
15710	21.986	32.208	8.936	21.829	21.108	10.936	5.532	26.349	4.273	0	10.582	35.748	29.523	6.769	3.789	22.174	23.158	2.924	12.919	16.929	13.772	18.568	19.562	12.642
15862	11.755	22.299	4.290	11.395	11.444	1.707	5.056	15.802	9.228	10.582	0	25.184	18.994	6.168	6.965	11.733	12.611	12.533	5.325	6.799	3.955	8.134	9.633	2.098
16312	14.285	9.019	27.564	14.717	16.174	24.898	30.238	9.407	34.022	35.748	25.184	0	6.304	30.547	32.139	14.382	12.984	37.659	24.100	19.670	22.204	17.674	16.964	23.176
16661	8.007	7.129	21.263	9.239	10.049	18.634	24.034	3.212	27.968	29.523	18.994	6.304	0	24.539	25.959	8.944	7.353	31.512	17.806	13.898	15.914	11.837	10.691	17.027
17247	17.753	28.359	7.708	16.048	17.604	7.465	3.546	21.328	3.529	6.769	6.168	30.547	24.539	0	3.434	16.397	17.614	7.508	10.827	11.008	10.114	12.904	15.766	7.710
17248	18.609	29.020	6.357	18.074	17.975	7.587	1.993	22.765	3.194	3.789	6.965	32.139	25.959	3.434	0	18.421	19.445	5.595	10.179	13.149	10.462	14.821	16.307	8.970
23147	6.729	14.882	15.145	0.349	9.086	12.016	16.671	6.059	19.918	22.174	11.733	14.382	8.944	16.397	18.421	0	1.655	23.746	12.823	5.390	10.009	3.610	7.929	9.636
38337	5.684	13.235	15.721	1.909	8.208	12.691	17.630	4.408	21.115	23.158	12.611	12.984	7.353	17.614	19.445	1.655	0	24.862	13.047	6.687	10.418	4.710	7.357	10.525
43687	24.204	34.592	11.554	23.398	23.522	13.169	7.578	28.310	4.083	2.924	12.533	37.659	31.512	7.508	5.595	23.746	24.862	0	15.516	18.387	16.044	20.183	21.886	14.490
48911	9.823	19.434	3.984	12.552	8.389	3.632	8.270	14.876	13.156	12.919	5.325	24.100	17.806	10.827	10.179	12.823	13.047	15.516	0	9.547	3.025	9.797	7.165	5.664
48949	8.713	18.863	10.747	5.042	9.981	7.540	11.490	10.751	14.531	16.929	6.799	19.670	13.898	11.008	13.149	5.390	6.687	18.387	9.547	0	6.530	2.076	8.123	4.803
58443	8.215	18.560	5.396	9.719	7.562	2.875	8.470	12.820	13.040	13.772	3.955	22.204	15.914	10.114	10.462	10.009	10.418	16.044	3.025	6.530	0	6.823	5.845	3.212
58608	6.904	16.836	11.696	3.267	8.494	8.517	13.061	8.679	16.408	18.568	8.134	17.674	11.837	12.904	14.821	3.610	4.710	20.183	9.797	2.076	6.823	0	6.777	6.040
58834	2.684	12.715	10.853	7.810	1.954	8.720	14.315	7.914	18.839	19.562	9.633	16.964	10.691	15.766	16.307	7.929	7.357	21.886	7.165	8.123	5.845	6.777	0	8.171
58897	10.045	20.658	5.975	9.298	10.076	2.806	7.111	13.822	11.002	12.642	2.098	23.176	17.027	7.710	8.970	9.636	10.525	14.490	5.664	4.803	3.212	6.040	8.171	0

Notes:
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Bold denotes bores are close enough to exceed drawdown threshold
 RN 16312 is located within the 9 - 19.28 km chainage group
 It is not known which aquifer RN 23147 and RN 58897 are screened in, so included in Table A5 and Table A6

Table D6: Distance Between Bores (19.28 - 63 km chainage in Precipice Sandstone)

12627	13180	13881	13882	15417	16028	16065	16686	17945	18207	23147	30421	37507	38658	44404	48816	48911	57701	58897	58907	62077	67229	67232	89599	123105	123167	
12627	0	24.109	32.232	30.337	39.345	22.325	16.926	33.362	23.003	37.515	10.853	37.393	26.889	36.853	27.666	29.345	15.538	40.339	16.368	13.246	35.510	36.786	43.678	35.571	17.850	16.494
13180	24.109	0	9.696	7.164	17.898	2.189	9.904	17.145	4.092	13.827	14.272	14.257	4.427	13.289	9.616	5.338	14.689	16.634	9.446	16.292	11.980	13.273	19.828	13.695	11.080	9.231
13881	32.232	9.696	0	2.649	8.223	11.878	19.586	10.651	9.250	5.929	23.432	5.197	10.937	5.117	6.551	7.600	19.301	8.527	15.978	21.593	3.934	4.973	11.951	4.026	15.614	18.834
13882	30.337	7.164	2.649	0	10.847	9.353	17.067	12.500	7.397	7.205	21.164	7.194	8.333	6.519	6.810	5.160	18.232	10.015	14.323	20.392	5.176	6.449	13.394	6.664	14.445	16.372
15417	39.345	17.898	8.223	10.847	0	20.070	27.757	9.624	16.865	7.641	31.274	5.477	18.923	7.273	11.759	15.366	25.080	7.593	22.992	27.537	7.746	7.088	9.622	4.204	21.804	26.950
16028	22.325	2.189	11.878	9.353	20.070	0	7.716	18.887	5.070	15.942	12.233	16.431	4.975	15.427	11.277	7.032	14.173	18.734	8.628	15.501	14.128	15.418	21.881	15.868	10.826	7.058
16065	16.926	9.904	19.586	17.067	27.757	7.716	0	25.639	11.609	23.482	6.075	24.106	10.867	23.020	18.104	14.095	15.124	26.225	10.053	15.234	21.749	23.026	29.241	23.561	13.306	1.354
16686	33.362	17.145	10.651	12.500	9.624	18.887	25.639	0	14.101	14.719	27.370	12.678	20.193	13.967	7.622	17.564	18.005	16.085	17.900	20.463	13.468	13.748	18.843	9.133	15.606	24.502
17945	23.003	4.092	9.250	7.397	16.865	5.070	11.609	14.101	0	14.601	14.415	14.391	8.451	13.902	6.508	8.300	11.390	17.405	6.945	13.323	12.563	13.821	20.790	12.824	7.604	10.555
18207	37.515	13.827	5.929	7.205	7.641	15.942	23.482	14.719	14.601	0	28.086	2.246	13.218	0.835	12.410	9.593	25.169	2.829	21.517	27.419	2.061	1.026	6.190	5.600	21.440	22.976
23147	10.853	14.272	23.432	21.164	31.274	12.233	6.075	27.370	14.415	28.086	0	28.358	16.370	27.521	20.367	19.195	12.823	30.901	9.636	11.967	26.194	27.491	34.097	27.192	12.611	5.710
30421	37.393	14.257	5.197	7.194	5.477	16.431	24.106	12.678	14.391	2.246	28.358	0	14.317	1.796	11.235	10.663	24.399	3.656	21.172	26.727	2.540	1.618	6.962	3.564	20.758	23.487
37507	26.889	4.427	10.937	8.333	18.923	4.975	10.867	20.193	8.451	13.218	16.370	14.317	0	12.917	13.072	3.657	18.971	15.799	13.536	20.422	11.795	12.975	18.597	14.849	15.446	10.732
38658	36.853	13.289	5.117	6.519	7.273	15.427	23.020	13.967	13.902	0.835	27.521	1.796	12.917	0	11.580	9.268	24.384	3.506	20.800	26.646	1.344	0.221	6.916	4.881	20.665	22.478
44404	27.666	9.616	6.551	6.810	11.759	11.277	18.104	7.622	6.508	12.410	20.367	11.235	13.072	11.580	0	11.075	13.428	14.825	11.408	15.852	10.472	11.413	18.194	8.405	10.048	17.013
48816	29.345	5.338	7.600	5.160	15.366	7.032	14.095	17.564	8.300	9.593	19.195	10.663	3.657	9.268	11.075	0	19.627	12.230	14.658	21.411	8.138	9.322	15.152	11.370	15.878	13.755
48911	15.538	14.689	19.301	18.232	25.080	14.173	15.124	18.005	11.390	25.169	12.823	24.399	18.971	24.384	13.428	19.627	0	27.828	5.664	2.484	23.115	24.256	31.252	21.820	3.811	13.800
57701	40.339	16.634	8.527	10.015	7.593	18.734	26.225	16.085	17.405	2.829	30.901	3.656	15.799	3.506	14.825	12.230	27.828	0	24.305	30.112	4.842	3.602	3.426	7.121	24.131	25.752
58897	16.368	9.446	15.978	14.323	22.992	8.628	10.053	17.900	6.945	21.517	9.636	21.172	13.536	20.800	11.408	14.658	5.664	24.305	0	6.886	19.468	20.709	27.706	19.207	3.274	8.699
58907	13.246	16.292	21.593	20.392	27.537	15.501	15.234	20.463	13.323	27.419	11.967	26.727	20.422	26.646	15.852	21.411	2.484	30.112	6.886	0	25.359	26.525	33.538	24.225	5.981	13.977
62077	35.510	11.980	3.934	5.176	7.746	14.128	21.749	13.468	12.563	2.061	26.194	2.540	11.795	1.344	10.472	8.138	23.115	4.842	19.468	25.359	0	1.297	8.239	4.645	19.381	21.184
67229	36.786	13.273	4.973	6.449	7.088	15.418	23.026	13.748	13.821	1.026	27.491	1.618	12.975	0.221	11.413	9.322	24.256	3.602	20.709	26.525	1.297	0	7.023	4.660	20.544	22.472
67232	43.678	19.828	11.951	13.394	9.622	21.881	29.241	18.843	20.790	6.190	34.097	6.962	18.597	6.916	18.194	15.152	31.252	3.426	27.706	33.538	8.239	7.023	0	10.222	27.557	28.840
89599	35.571	13.695	4.026	6.664	4.204	15.868	23.561	9.133	12.824	5.600	27.192	3.564	14.849	4.881	8.405	11.370	21.820	7.121	19.207	24.225	4.645	4.660	10.222	0	18.340	22.769
123105	17.850	11.080	15.614	14.445	21.804	10.826	13.306	15.606	7.604	21.440	12.611	20.758	15.446	20.665	10.048	15.878	3.811	24.131	3.274	5.981	19.381	20.544	27.557	18.340	0	11.953
123167	16.494	9.231	18.834	16.372	26.950	7.058	1.354	24.502	10.555	22.976	5.710	23.487	10.732	22.478	17.013	13.755	13.800	25.752	8.699	13.977	21.184	22.472	28.840	22.769	11.953	0

Notes:

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Bold denotes bores are close enough to exceed drawdown threshold

RN 15417 is located within the 63 - 90 km chainage group

RN 16686 is located within the 63 - 90 km chainage group

It is not known which aquifer RN 23147 and RN 58897 are screened in, so included in Table A5 and Table A6

Table D7: Distance Between Bores (63 - 90 km chainage in Precipice Sandstone)

	10594	11104	14582	14583	14584	15417	16270	16686	17849	18173	18195	30318	30506	30507	31409	36120	47325	57615	57781	62877	67232	67280	67281	67410	67624	67625	84032	89504	89510	89540	89572	89724	89763	89764	89775	89853	89854	89855
10594	0	14.827	4.375	6.833	7.530	14.339	5.519	15.618	12.422	11.139	10.267	2.800	4.786	5.639	1.650	13.155	8.281	6.169	2.051	10.358	21.351	8.739	6.558	2.645	8.770	6.339	10.824	8.535	8.625	6.941	13.982	7.028	6.890	8.398	6.041	2.835	2.645	5.295
11104	14.827	0	17.966	20.242	20.085	16.538	9.333	8.399	11.284	8.026	15.031	16.758	18.682	17.534	16.337	2.298	12.965	18.862	15.489	16.795	26.158	16.779	16.419	12.638	22.073	8.660	10.544	17.765	18.168	20.272	23.200	21.723	20.387	19.727	20.731	17.412	12.239	18.870
14582	4.375	17.966	0	2.500	3.205	12.816	9.135	16.819	12.605	12.523	8.869	5.588	6.557	8.707	4.253	16.005	7.901	8.565	2.664	8.160	18.188	12.513	10.229	5.458	4.457	9.334	11.312	5.555	5.446	2.592	10.101	4.352	2.587	4.399	5.718	2.097	6.643	0.962
14583	6.833	20.242	2.500	0	1.469	13.125	11.588	18.409	13.864	14.296	9.518	7.618	8.105	10.571	6.462	18.211	9.200	10.163	5.156	8.342	17.127	14.568	12.284	7.895	1.958	11.676	12.768	5.467	5.179	0.161	8.546	3.770	0.199	3.240	6.431	4.244	9.142	1.545
14584	7.530	20.085	3.205	1.469	0	11.839	11.805	17.658	12.959	13.706	8.396	8.711	9.396	11.760	7.437	17.978	8.398	11.451	5.638	7.072	15.669	15.667	13.379	8.131	2.156	11.680	11.987	4.195	3.861	1.318	7.158	5.222	1.628	1.784	7.869	5.232	9.956	2.441
15417	14.339	16.538	12.816	13.125	11.839	0	11.839	9.624	5.257	8.608	4.091	17.013	18.715	19.977	15.569	14.318	6.265	20.423	12.738	4.784	9.622	22.596	20.652	12.360	13.724	12.325	6.221	7.661	7.978	13.014	9.268	16.764	13.320	10.188	18.509	14.347	14.116	12.969
16270	5.519	9.333	9.135	11.588	11.805	13.811	0	11.630	10.039	7.464	10.345	7.499	9.496	8.864	7.003	7.802	7.768	10.026	6.495	11.379	22.520	9.703	8.399	3.696	13.527	1.699	8.376	10.901	11.189	11.653	16.811	12.507	11.700	12.001	11.405	8.214	2.906	10.090
16686	15.618	8.399	16.819	18.409	17.658	9.624	11.630	0	5.031	4.480	10.017	18.297	20.353	20.332	17.258	6.772	9.261	21.343	15.154	11.908	18.843	21.240	20.028	12.974	19.814	10.009	5.672	14.034	14.472	18.370	18.136	21.153	18.597	16.601	21.460	17.276	13.791	17.475
17849	12.422	11.284	12.605	13.864	12.959	5.257	10.039	5.031	0	3.464	4.997	15.220	17.187	17.762	13.958	9.079	4.712	18.532	11.441	6.880	14.874	19.579	17.943	9.920	15.099	8.367	1.685	9.124	9.556	13.805	13.134	16.946	14.059	11.753	17.779	13.466	11.278	13.126
18173	11.139	8.026	12.523	14.296	13.706	8.608	7.464	4.480	3.464	0	7.150	13.829	15.881	15.952	12.778	5.755	5.519	16.918	10.717	9.004	18.218	17.167	15.786	8.495	15.848	5.777	2.521	10.515	10.948	14.276	15.464	16.816	14.477	12.880	16.994	12.845	12.845	16.884
18195	10.267	15.031	8.869	9.518	8.396	4.091	10.345	10.017	4.997	7.150	0	12.924	14.626	15.907	11.478	12.733	2.586	16.333	8.647	1.908	12.198	18.650	16.648	8.408	10.460	9.061	4.717	4.294	4.705	9.429	8.334	12.989	9.717	6.973	14.508	10.294	10.229	9.131
30318	2.800	16.758	5.588	7.618	8.711	17.013	7.499	18.297	15.220	13.829	12.924	0	2.062	3.166	1.482	15.300	11.046	3.412	4.319	12.832	23.549	6.960	4.672	5.369	9.351	8.671	13.616	10.701	10.707	7.762	15.683	6.310	7.601	9.980	4.107	3.495	4.692	6.271
30506	4.786	18.682	6.557	8.105	9.396	18.715	9.496	20.353	17.187	15.881	14.626	2.062	0	2.736	3.238	17.293	12.899	2.058	5.988	14.357	24.743	6.889	4.764	7.403	9.577	10.719	15.604	12.008	11.951	8.262	16.537	5.810	8.038	10.886	2.808	4.657	6.737	7.013
30507	5.639	17.534	8.707	10.571	11.760	19.977	8.864	20.332	17.762	15.952	15.907	3.166	2.736	0	4.633	16.426	13.871	1.422	7.420	15.930	26.713	4.156	2.066	7.865	12.168	10.361	16.106	13.861	13.872	10.722	18.807	8.541	10.528	13.106	5.495	6.611	6.581	9.324
31409	1.650	16.337	4.253	6.462	7.437	15.569	7.003	17.258	13.958	12.778	11.478	1.482	3.238	4.633	0	14.728	9.674	4.860	2.847	11.354	22.082	8.268	5.990	4.289	8.295	7.945	12.386	9.229	9.244	6.595	14.301	5.831	6.471	8.607	4.430	2.223	4.098	5.024
36120	13.155	2.298	16.005	18.211	17.978	14.318	7.802	6.772	9.079	5.755	12.733	15.300	17.293	16.426	14.728	0	10.684	17.687	13.615	14.499	23.940	16.197	15.538	10.808	20.003	6.841	8.265	15.520	15.928	18.232	20.911	19.905	18.363	17.544	19.155	15.611	10.658	16.884
47325	8.281	12.965	7.901	9.200	8.398	6.265	7.768	9.261	4.712	5.519	2.586	11.046	12.899	13.871	9.671	10.684	0	14.445	6.966	3.950	14.783	16.337	14.424	6.120	10.553	6.479	3.589	4.997	5.429	9.151	10.242	12.236	9.393	7.405	13.206	8.888	7.851	8.414
57615	6.169	18.862	8.565	10.163	11.451	20.423	10.026	21.343	18.532	16.918	16.333	3.412	2.058	1.422	4.860	17.687	14.445	0	7.706	16.192	26.732	5.172	3.353	8.617	11.613	11.449	16.902	13.944	13.910	10.320	18.585	7.712	10.095	12.921	4.491	6.519	7.552	9.058
57781	2.051	15.489	2.664	5.156	5.638	12.738	6.495	15.154	11.441	10.717	8.647	4.319	5.988	7.420	2.847	13.615	6.966	7.706	0	8.517	19.370	10.755	8.540	2.865	7.113	6.829	9.952	6.524	6.594	5.239	11.932	6.308	5.250	6.375	6.360	2.129	3.993	3.626
62877	10.358	16.795	8.160	8.342	7.072	4.784	11.379	11.908	6.880	9.004	1.908	12.832	14.357	15.930	11.354	14.499	3.950	16.192	8.517	0	11.249	18.999	16.891	8.910	9.019	10.276	6.609	2.881	3.218	8.923	6.461	11.992	8.536	5.475	13.878	9.858	10.796	8.232
67232	21.351	26.158	18.188	17.127	15.669	9.622	22.520	18.843	14.874	18.218	12.198	23.549	24.743	26.713	22.082	23.940	14.783	26.732	19.370	11.249	0	30.084	27.903	20.144	16.555	21.258	15.779	12.858	12.843	16.970	8.877	20.766	17.267	13.976	23.530	20.213	22.035	17.830
67280	8.739	16.779	12.513	14.568	15.667	22.596	9.703	21.240	19.579	17.167	18.650	6.960	8.889	4.156	8.268	16.197	16.337	5.172	10.755	18.999	30.084	0	2.288	10.246	16.244	11.396	17.894	17.272	17.348	14.714	22.561	12.697	14.542	16.874	9.605	10.438	8.493	13.229
67281	6.558	16.419	10.229	12.284	13.379	20.652	8.399	20.028	17.943	15.786	16.648	4.672	4.764	2.066	5.990	15.538	14.424	3.353	8.540	16.891	27.903	2.288	0	8.304	13.975	10.034	16.262	15.065	15.126	12.429	20.290	10.528	12.260	14.597	7.550	8.151	6.685	10.941
67410	2.645	12.638	5.458	7.895	8.131	12.360	3.696	12.974	9.820	8.495	8.408	5.369	7.403	7.865	4.289	10.808	6.120	8.617	2.865	8.910	20.144	10.246	8.304	0	9.831	3.984	8.285	7.752	7.968	7.958	13.591	9.101	8.009	8.457	8.609	4.803	1.893	6.407
67624	8.770	22.073	4.457	1.958	2.156	13.724	13.527	19.814	15.099	15.848	10.460	9.351	9.577	12.168	8.295	20.003	10.553	11.613	7.113	9.019	16.555	16.244	13.975	9.831	0	13.561	14.143	6.190	5.811	1.877	7.724	4.350	1.882	3.545	7.509	6.105	11.100	3.500
67625	6.339	8.660	9.334	11.676	11.680	12.325	1.699	10.009	8.367	5.777	9.061	8.671	10.719	10.361	7.945	8.841	6.479	11.449	6.829	10.276	21.258	11.396	10.034	3.984	13.561	0	6.717	10.182	10.515	11.719	16.048	13.084	11.810	11.621	12.371	8.779	3.983	10.255
84032	10.824	10.544	11.312	12.768	11.887</																																	

Chain 0 - 9 km

Coord	RN 13856	
lat	-26.100090	
long	149.954160	
S	Drawdown	m
Q	Extraction rate	2218 m ³ /d
W(u)		
T	Transmissivity	150 m ² /d
r	Distance from bore to spring	m
S	Storage coeff	0.0005
t	time	150 d (June 2011 - October 2011)

Thies Equation

Distance Calculation

Well	Aquifer	r (m)	u	Wu	s	RN	GIS_LAT	GIS_LNG	Extract Lat RAD	Obs Lat RAD	Extract Long RAD	Obs Long RAD	COS a	Angle	Dist (m)	Dist (km)
8356	FORMATION NAME NOT SPECIFIED	0	0	0	0.00	8356	-25.717864	149.864995	-0.455533	-0.448861	2.6171938	2.6156376	0.999976769	0.3905499	43427.163	43.4
8357	HUTTON SANDSTONE	35614.61237	7.04667008	0.000125226	0.00	8357	-25.785086	149.889717	-0.455533	-0.450035	2.6171938	2.6160691	0.999984375	0.3202889	35614.612	35.6
8440	PRECIPICE SANDSTONE	0	0	0	0.00	8440	-25.864604	150.202185	-0.455533	-0.451422	2.6171938	2.6215227	0.999983983	0.3242889	36059.281	36.1
8445	EVERGREEN FORMATION	0	0	0	0.00	8445	-25.650364	150.070267	-0.455533	-0.447683	2.6171938	2.6192203	0.999967533	0.4616998	51338.676	51.3
8449	HUTTON SANDSTONE	43762.75489	10.63988176	-0.000184854	0.00	8449	-25.707030	149.976381	-0.455533	-0.448672	2.6171938	2.6175816	0.999976408	0.3935679	43762.755	43.8
10463	HUTTON SANDSTONE	13210.97374	0.969610151	0.230927971	0.27	10463	-26.051199	150.074714	-0.455533	-0.454679	2.6171938	2.6192979	0.99999785	0.1188091	13210.974	13.2
10475	HUTTON SANDSTONE	72984.94868	29.59334852	-8314921126	0.00	10475	-25.447306	149.878079	-0.455533	-0.444139	2.6171938	2.6158866	0.999934383	0.6563694	72984.949	73.0
10578	HUTTON SANDSTONE	64487.90121	23.10383002	-4317940.675	0.00	10578	-25.979536	149.322782	-0.455533	-0.453428	2.6171938	2.6061742	0.999948772	0.5799536	64487.901	64.5
10583	PRECIPICE SANDSTONE	0	0	0	0.00	10583	-25.370832	149.936375	-0.455533	-0.442805	2.6171938	2.6168834	0.999918962	0.729434	81109.355	81.1
10584	HUTTON SANDSTONE	85279.95164	40.40372306	-1.10073E+14	0.00	10584	-25.359943	149.731090	-0.455533	-0.442615	2.6171938	2.6133005	0.999910414	0.766941	85279.952	85.3
10592	PRECIPICE SANDSTONE	0	0	0	0.00	10592	-25.680364	150.053601	-0.455533	-0.448207	2.6171938	2.6189294	0.999971949	0.4291538	47719.728	47.7
10594	PRECIPICE SANDSTONE	0	0	0	0.00	10594	-25.536493	150.162492	-0.455533	-0.445696	2.6171938	2.6208299	0.999946264	0.5939789	66047.44	66.0
10690	HUTTON SANDSTONE	24646.43473	3.374704139	0.008159045	0.01	10690	-25.879253	149.933050	-0.455533	-0.451678	2.6171938	2.6168254	0.999992517	0.2216507	24646.435	24.6
10875	PRECIPICE SANDSTONE	0	0	0	0.00	10875	-25.503869	150.129343	-0.455533	-0.445126	2.6171938	2.6202513	0.999942069	0.6167285	68577.08	68.6
10876	PRECIPICE SANDSTONE	0	0	0	0.00	10876	-25.504448	150.107771	-0.455533	-0.445154	2.6171938	2.6198748	0.999943231	0.6105117	67885.8	67.9
10886	HUTTON SANDSTONE	13151.63802	0.960919904	0.234357097	0.28	10886	-26.134255	150.080270	-0.455533	-0.456129	2.6171938	2.6193949	0.999997869	0.1182755	13151.638	13.2
10918	EVERGREEN FORMATION	0	0	0	0.00	10918	-25.434251	149.884711	-0.455533	-0.443911	2.6171938	2.6159817	0.99993188	0.6687699	74363.821	74.4
10929	HUTTON SANDSTONE	84267.48273	39.45004804	-5.31929E+13	0.00	10929	-25.343720	149.901868	-0.455533	-0.442331	2.6171938	2.6162812	0.999912528	0.7578357	84267.483	84.3
10930	HUTTON SANDSTONE	61810.44876	21.22517542	-322451.8487	0.00	10930	-25.601477	149.681108	-0.455533	-0.446883	2.6171938	2.6124282	0.999952937	0.5558747	61810.449	61.8
10980	EVERGREEN FORMATION	0	0	0	0.00	10980	-25.232863	149.716934	-0.455533	-0.440397	2.6171938	2.6130534	0.999878491	0.8931964	99318.906	99.3
10981	EVERGREEN FORMATION	0	0	0	0.00	10981	-25.262309	149.689714	-0.455533	-0.44091	2.6171938	2.6125784	0.99988445	0.8710187	96852.857	96.9
10989	PRECIPICE SANDSTONE	0	0	0	0.00	10989	-25.198973	149.824986	-0.455533	-0.439805	2.6171938	2.6149393	0.999874261	0.9086093	101032.74	101.0
10990	EVERGREEN FORMATION	0	0	0	0.00	10990	-25.160640	149.812486	-0.455533	-0.439136	2.6171938	2.6147211	0.999863096	0.9480937	105423.21	105.4
10992	EVERGREEN FORMATION	0	0	0	0.00	10992	-25.233418	149.729711	-0.455533	-0.440406	2.6171938	2.6132764	0.999879367	0.8899692	98960.064	99.0
11007	HUTTON SANDSTONE	93484.81669	48.55228306	-2.94255E+16	0.00	11007	-25.308017	149.641340	-0.455533	-0.441708	2.6171938	2.6117341	0.999892346	0.8407292	93484.817	93.5
11009	HUTTON SANDSTONE	54149.89292	16.29006057	-97.20318814	0.00	11009	-25.656453	149.730933	-0.455533	-0.44779	2.6171938	2.6132978	0.99996388	0.4869817	54149.893	54.1
11104	PRECIPICE SANDSTONE	0	0	0	0.00	11104	-25.621055	150.048223	-0.455533	-0.447172	2.6171938	2.6188355	0.999963958	0.4864555	54091.384	54.1
11140	EVERGREEN FORMATION	0	0	0	0.00	11140	-25.316837	149.563137	-0.455533	-0.441862	2.6171938	2.6103692	0.999887658	0.8588417	95498.836	95.5
11175	HUTTON SANDSTONE	24280.3907	3.275207625	0.009236332	0.01	11175	-25.978976	150.156379	-0.455533	-0.453419	2.6171938	2.6207232	0.999992738	0.2183588	24280.391	24.3
11176	HUTTON SANDSTONE	25025.84816	3.479405979	0.007165861	0.01	11176	-25.962310	150.152212	-0.455533	-0.453128	2.6171938	2.6206505	0.999992285	0.2166285	25025.848	25.0
11306	PRECIPICE SANDSTONE	0	0	0	0.00	11306	-25.663705	150.024896	-0.455533	-0.447916	2.6171938	2.6184284	0.999970379	0.4410011	49037.088	49.0
11501	EVERGREEN FORMATION	0	0	0	0.00	11501	-25.623144	149.502499	-0.455533	-0.447208	2.6171938	2.6093108	0.999940195	0.6266249	69677.513	69.7
11558	PRECIPICE SANDSTONE	0	0	0	0.00	11558	-25.595376	150.013748	-0.455533	-0.446724	2.6171938	2.6182338	0.999960764	0.5075549	66437.532	66.4
11560	HUTTON SANDSTONE	10006.19135	0.556243697	0.496887259	0.58	11560	-26.028977	149.892774	-0.455533	-0.454291	2.6171938	2.6161224	0.999998767	0.0899878	10006.191	10.0
11647	EVERGREEN FORMATION	0	0	0	0.00	11647	-25.534507	149.521153	-0.455533	-0.445661	2.6171938	2.6096364	0.999928139	0.6868887	76378.541	76.4
11648	HUTTON SANDSTONE	77022.90293	32.95848653	-2.222E+11	0.00	11648	-25.477866	149.616107	-0.455533	-0.444673	2.6171938	2.6112937	0.999926922	0.6926836	77022.903	77.0
11692	EVERGREEN FORMATION	0	0	0	0.00	11692	-25.822031	150.289708	-0.455533	-0.450679	2.6171938	2.6230502	0.999974362	0.4102833	45621.419	45.6
11694	HUTTON SANDSTONE	25926.96545	3.734486319	0.005238022	0.01	11694	-26.109532	150.213601	-0.455533	-0.455697	2.6171938	2.6217219	0.999991719	0.2331668	25926.965	25.9
11739	HUTTON SANDSTONE	23891.75794	3.171200541	0.01022537	0.01	11739	-25.890086	149.903606	-0.455533	-0.451867	2.6171938	2.6163115	0.999992968	0.2148637	23891.758	23.9
11758	EVERGREEN FORMATION	0	0	0	0.00	11758	-25.391571	149.733299	-0.455533	-0.443167	2.6171938	2.6133391	0.999917515	0.735917	81830.24	81.8
11764	HUTTON SANDSTONE	70774.12913	27.82765197	-1271234902	0.00	11764	-25.472585	149.835824	-0.455533	-0.44458	2.6171938	2.6151285	0.999938298	0.636487	70774.129	70.8
11765	HUTTON SANDSTONE	62945.1938	22.01165235	-981668.5747	0.00	11765	-25.567031	149.742495	-0.455533	-0.446229	2.6171938	2.6134966	0.999951194	0.5660797	62945.194	62.9
11766	HUTTON SANDSTONE	66539.92903	24.59756753	-29319320.73	0.00	11766	-25.553143	149.684420	-0.455533	-0.445986	2.6171938	2.6124863	0.99994546	0.589408	66539.929	66.5
11850	EVERGREEN FORMATION	0	0	0	0.00	11850	-25.397308	149.754435	-0.455533	-0.443267	2.6171938	2.613708	0.999919847	0.7254403	80665.284	80.7
11878	PRECIPICE SANDSTONE	0	0	0	0.00	11878	-25.752586	150.218598	-0.455533	-0.449467	2.6171938	2.6218091	0.999972993	0.4210927	46823.368	46.8
11882	HUTTON SANDSTONE	29872.77534	4.957681702	0.001222462	0.00	11882	-26.093568	150.253222	-0.455533	-0.455419	2.6171938	2.6224134	0.999998007	0.2686523	29872.775	29.9
11892	EVERGREEN FORMATION	0	0	0	0.00	11892	-25.753975	150.334428	-0.455533	-0.449492	2.6171938	2.6238307	0.99996394	0.486575	54104.672	54.1
12118	EVERGREEN FORMATION	0	0	0	0.00	12118	-25.990643	150.095547	-0.455533	-0.453622	2.6171938	2.6196615	0.999995718	0.166765	18644.614	18.6
12221	HUTTON SANDSTONE	23215.13307	2.994124464	0.013161938	0.02	12221	-25.897309	150.009437	-0.455533	-0.451993	2.6171938	2.6181586	0.999993361	0.2087787	23215.133	23.2
12236	HUTTON SANDSTONE	79185.38767	34.83514234	-1.20209E+12	0.00	12236	-25.502535	149.523888	-0.455533	-0.445103	2.6171938	2.6096842	0.999922761	0.7121313	79185.388	79.2
12238	EVERGREEN FORMATION	0	0	0	0.00	12238	-25.580955	150.094355	-0.455533	-0.446472	2.6171938	2.6196407	0.999956528	0.5342486	59405.737	59.4
12372	HUTTON SANDSTONE	30396.90238	5.133175969	0.000998081	0.00	12372	-25.831753	149.896106	-0.455533	-0.450849	2.6171938	2.6161806	0.999988618	0.2733659	30396.902	30.4
12627	PRECIPICE SANDSTONE	0	0	0	0.00	12627	-25.941818	149.969996	-0.455533	-0.45277	2.6171938	2.6174702	0.999996154	0.1589105	17670.039	17.7
12651	HUTTON SANDSTONE	74954.36253	31.21198035	-4222948690	0.00	12651	-25.653978	149.392501	-0.455533	-0.447746	2.6171938	2.607391	0.999930794	0.6740808	74954.363	75.0
12753	HUTTON SANDSTONE	55024.06001	16.82026211	-259.528754	0.00	12753	-25.655087	149.713608	-0.455533	-0.447766	2.6171938	2.6129954	0.999962704	0.4948433	55024.06	55.0
12838	HUTTON SANDSTONE	24118.35989	3.231639418	0.00975												

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