Innovation for a Permanent Solution

The Bendigo Groundwater Project

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On behalf of the Bendigo community, the Department of Environment, Land, Water and Planning (DELWP) is inviting innovative ideas for the long-term management of groundwater in historic mine workings beneath the City of Bendigo. The ideas will build on existing investment and infrastructure to protect waterways, heritage and local amenity. This information pack contains guidance about how to submit ideas that address a unique groundwater issue.

The Bendigo Groundwater Project

Bendigo is a major provincial city (pop. 110,000) in the State of Victoria, Australia. It is located in the centre of the state, around 150kms north of the state capital Melbourne. The city was founded on gold mining in the 1850s.

The city has a naturally shallow water table. The historic shafts and voids that still exist under the city provide preferential flow paths for the groundwater which may then discharge into local waterways from low lying shafts.

Historically groundwater pumping has been used to suppress groundwater levels in active mine workings. When underground mining ceased in 2011, the pumping stopped and groundwater levels began to rise to their naturally shallow levels.

Groundwater discharging from these mine shafts may release odorous hydrogen sulphide gas causing public amenity issues. The groundwater also contains naturally occurring arsenic, heavy metals and dissolved salts. The quality of the water has the potential to impact the waterway environment and downstream users of the water. The rising water levels also have the potential to impact local infrastructure, including the Central Deborah Gold Mine tourist attraction.

The Bendigo Groundwater Project aims to develop a long term, sustainable water management approach to manage adverse impacts of the presence of groundwater within these historic mine voids. In managing groundwater to prevent discharge from historical mine shafts, the water could be treated to provide an additional source of water for beneficial use. In doing so, waterways, local amenity and underground tours at the historic Central Deborah Gold Mine will be protected.

The Victorian Government has committed funding for an interim solution that includes operation of a refurbished water treatment facility to manage the groundwater. The current project only manages the volume of water pumped from the Central Deborah Gold Mine and will be in place for up to four years to allow for the development of a permanent solution. The permanent solution needs to identify ongoing funding and governance options, as well as incorporating the management of groundwater from historic mines other than Central Deborah.

Through the Innovation for a Permanent Solution process, the Bendigo Groundwater Project aims to gather concepts about how Bendigo might best manage groundwater in historic mine voids, consistent with community and stakeholder expectations. It is expected that the investment to date in research, design, planning and the infrastructure used in the interim solution will be used to inform the long-term solution.

Who can submit an idea?

Anyone can submit an idea for managing groundwater from mine voids in Bendigo. Ideas are invited from any person or organisation that can meet the project criteria.

Register your interest at bendigo.groundwater@delwp.vic.gov.au to receive the latest information and process updates.
Why contribute an idea

By participating in the Innovation for a Permanent Solution, you can contribute to the improvement of Bendigo’s liveability and sustainability and protect Bendigo’s heritage for future generations.

In addition to reducing the impacts of the groundwater, the project has a significant opportunity to produce an additional water source that could reduce pressure on urban water supplies and increase water security.

Your ideas will build on existing investment and contribute to a permanent, sustainable solution to a long-standing problem in Bendigo. While ideas are submitted with no guarantee or obligation, there is scope for involvement in future stages of the project to:
• further test and develop your concept
• test and develop other short-listed ideas
• undertake feasibility assessment of whole ideas or components of ideas.

What ideas are wanted

Ideas must meet the project objective and address project ideas criteria.

We invite a range of ideas, from whole-project solutions to ideas that address specific elements of a larger solution. Promising ideas that are elements of the solution, rather than whole-projects, may be packaged with other ideas into complete projects.

At this first step of Innovation for a Permanent Solution, DELWP welcomes ideas ranging from conceptual ideas to fully developed solutions.

Please note that ideas already investigated and deemed unfeasible will not be further considered without substantial new evidence or justification.

Details of ideas investigations to date can be found in Appendix D.

Ideas may be big or small. They may belong in some or all the following categories: water extraction, water treatment, in situ solutions, water reuse, reuse of by-products, governance arrangements, funding models, operation & energy management.

How to submit ideas

Ideas template
To be eligible for consideration, all ideas must be submitted using the submission template, distributed with this information pack or available on DELWP’s website, www.water.vic.gov.au/groundwater/bendigo
Supplementary information and diagrams may be attached along with the idea template.

Submission date
Ideas must be submitted by 5pm on Friday 23 February 2018

Lodgement method
Ideas must be submitted to bendigo.groundwater@delwp.vic.gov.au
File attachments must not exceed 30MB.

Project objective
The objective of this project is to identify a permanent solution to prevent untreated water or odour discharging from mine shafts in Bendigo that can be fully operational by 30 June 2021.

Project ideas criteria
Guiding principles for the Bendigo Groundwater Project were developed by the Community Reference Group and the State Local Government Advisory Group (see Appendix G). To ensure the final project is feasible and meets the principles, the project ideas must address the following criteria:

All ideas must:
• Be effective at addressing the objectives of the project
• Minimise or avoid discharge to the environment
• Avoid leaving a legacy of environmental or health impact for later generations to manage
Bendigo Groundwater Project
Innovation for a Permanent Solution
Briefing Pack

• Embed innovative approaches
• Have low energy and chemical requirements
• Have affordable capital and operating costs
• Provide value to the Bendigo community
• Be proven and operational by 30 June 2021
• Be flexible to take advantage of future technological developments in water and waste treatment
• Be compatible with underground mining in Bendigo (e.g. not dependent on nor prohibitive of)
• Be compliant with relevant regulations.

Whole-project ideas must:
• Apply to the reefs shown in Appendix H
• Protect business and infrastructure assets (including operation of Central Deborah Gold Mine)
• Have clear governance with accountability to the Bendigo community and government

Please note: proposals that include funding models and governance arrangements are encouraged.

Key parameters
The interim solution manages up to 2ML/d extracted from the Central Deborah shaft and controls levels in Deborah Reef, southern sections of the Sheepshead reef, the Swan Decline and Garden Gully Reef.

On the best available information, it is expected that the permanent solution will need to achieve the following requirements (see Appendix H for map of reefs):

• Treat up to 2.5ML/d groundwater
  – 1.5-2 ML/d Deborah reef and inter-connected workings
  – 0.4-0.8ML/d Garden Gully reef
  – 0.04 ML/d Hustlers reef
• Monitor and/or treat groundwater in
  – New Chum north and south reef (volumes uncertain)
• Final/treated Groundwater Quality
  – Treated water shall be of a quality suitable for the proposed end use, as defined by State Environmental Protection Policy (SEPP) guidelines.

  – A summary of the water quality within the voids is included in Appendix I.
  • Odour
    – No discernible odour
  • Amenity
    – Maintain water level at Central Deborah Gold Mine at minus 40 mAHD (260m below natural surface)

Project area

The project area encompasses reefs with a known history of discharge as shown in the figure below.

The Deborah, Sheepshead, Garden Gully and Hustlers reefs currently require groundwater management. Reefs which may discharge in the future include New Chum North and New Chum South.

Priority will be given to reefs with a known current or potential impact from groundwater. However, management solutions should consider all reefs shown. A detailed map of the project area is shown in Appendix H.
Other information ideas should include:
Bearing in mind that knowledge gaps are acceptable, all ideas should include any available information or recommendations on the following:

**General**
- Who will fund the project
- Indicative capital costs
- Indicative operational costs
- How the idea aligns with potential funding models
- Any significant regulatory concerns regarding the idea

**Extraction**
- Locations of groundwater extraction(s)
- Volume of extracted water
- Infrastructure for extraction(s) and transmission of water (e.g. pipes)

**Treatment**
- Capacity (volume) for treatment
- Treatment level (quality)
- Location of treatment
- Energy requirement for treatment

**In situ**
Respondents with ideas to treat water at the source should include information on:
- The technology or method to be used
- How the technology has been tested

**Waste stream**
- Salt stream disposal
- Metal (including arsenic) stream disposal
- Ability to reduce waste stream volumes
- Odour management

**Beneficial use**
- How the idea provides benefit to the environment
- How the idea provides benefit to the community drinking water supply
- How the idea provides benefit to the community water supply (e.g. parks and gardens)
- How the idea provides benefit to the community irrigation/stock and domestic water supply

Whole-project ideas should also include:
- Evidence supporting the idea (e.g. proven technologies, successful similar approach)
- If idea requires a field trial
- If idea has had a detailed feasibility assessment
- Governance arrangements
- How the idea can align with existing governance arrangements
- Management arrangement
- Ownership arrangements
- Income generation (e.g. water sales, by-product sale)
- Cost offset (e.g. use of solar for energy)

**Knowledge and resource gaps are okay**
We recognise that ideas will come from a range of places including people and organisations with varying levels of expertise and/or resources to develop ideas. Given this, DELWP encourages respondents to be candid about knowledge or resource gaps.

**The interim solution**
DELWP has appointed Coliban Water to manage the construction and operation of the interim groundwater management solution for the Bendigo Groundwater Project until 30 June 2021.

There is an expectation that the investment in the interim solution will be maximised in the final solution. Approaches will clearly demonstrate how they have considered the investment in research and infrastructure to date and how the proposed solutions would deliver greatest overall value for money and benefit to the Bendigo community.

A detailed description of the interim solution can be found in Appendix B.

**Use of existing infrastructure**
To minimise the cost of the interim solution existing infrastructure owned by the mining licensee (GBM Gold) has been used. Some of this infrastructure may also be available for the final solution, however no commitment or agreement has been made regarding access to the following assets beyond the interim solution;
- Dewatering pipelines between various shafts (Central Deborah, Londonderry, Eureka)
• New Moon Shaft pump set
• New Moon groundwater treatment plant
• Transfer pipelines from New Moon to Lake Neangar

Additional infrastructure used in the interim solution includes:
• Transfer pipelines from Lake Neangar to Epsom Water Reclamation Plant (Coliban Water)
• Central Deborah Shaft pump set (Bendigo Heritage Attractions)

A more detailed description of existing infrastructure can be found in Appendix B.

Long term solutions may incorporate some or all of this infrastructure. Alternatively, solutions independent of third party assets are also strongly encouraged.

Where to find information

In developing the immediate and interim solutions, considerable research and technical studies have been conducted for the management of the groundwater from mine voids in Bendigo.

A range of information is available to help parties submit good quality ideas. A summary of reports is available in Appendix D and the reports are available on request by emailing bendigo.groundwater@delwp.com.au

Find out more

Information sessions

Information sessions, providing an overview of the project followed by a Q & A session will be held in Bendigo and Melbourne in January if there is sufficient interest. Register your attendance at bendigo.groundwater@delwp.vic.gov.au

Contact details

For any other enquiries or information contact Natalie Trotter, Project Manager, Bendigo Groundwater Project;
T: (03) 5430 4501
E: bendigo.groundwater@delwp.vic.gov.au

How ideas are assessed

Once ideas have been submitted, they will be collated by the Project Team and evaluated using the ideas criteria by the Community Reference Group (CRG) and the Technical Advisory Group (TAG). Final recommendations will be made by the State Local Government Advisory Group (SLGAG) to the Minister for Water.

Ideas that pass the first evaluation will be further developed using professional services. Elemental ideas will be combined into full end-to-end concepts, where necessary. The CRG and TAG will consider projects, and the SLGAG will select projects to undergo a full cost benefits analysis before making recommendations to the Minister.

A flow chart for each step in the process is given in Appendix E.
Appendix A  Historical solutions

The objective of the Bendigo Groundwater Project is to prevent untreated water or odour discharging from mine shafts in Bendigo. Historically this has been achieved via two methods:

1. **Extraction**: Water from the voids is extracted so that the water level in the network of mine shafts is always below the sill of the lowest shaft in each unconnected reef. In the past few decades this has been achieved by:
   a. Extracting water from the New Moon Mine shaft so that the water level in the Garden Gully Reef remains below the collar of the North New Moon Nine shaft.
   b. Transferring water from other reefs (ones not connected to the Garden Gully Reef), and pumping that water into the Garden Gully Reef at Londonderry Mine shaft.

2. **Disposal**: Water pumped from the voids needs to discharge somewhere. In the past few decades, this disposal has been to the Woodvale Ponds as part of mining operations. Before that (pre1980s) the water was discharged untreated into Bendigo Creek and other creeks. For a short period in the late 2000’s a groundwater treatment plant with up to 5ML capacity operated at the New Moon Mine. Water from this GWTP was discharged to Lake Neangar and Eaglehawk Golf course under license from EPA. It was also linked to Coliban Waters Epsom Water Reclamation Plant for beneficial re-use in the wider Bendigo Region.
Appendix B  Interim Solution (currently in place)

The interim water management solution aims to ensure that no discharges occur as a result of the ongoing dewatering of Central Deborah Gold Mine.

With storages nearing capacity, there was a need to adopt a proven solution that could be implemented quickly while work on a longer-term solution could be completed. The interim solution was adopted as it could meet the project criteria of preventing untreated discharges to local waterways, its ability to be implemented quickly, its use of existing infrastructure and proven technology, and its ability to provide water of sufficient quality for reuse or environmental discharge.

The solution includes;

- Water extraction from Central Deborah Gold Mine (1.5-2ML/d pumped from minus 40mAH to surface 220mAHD). *Owned and managed by Bendigo Heritage Attractions operators of the Gold Mine.*
- Pumping of groundwater into the Londonderry Shaft on the Garden Gully reef via poly-pipe located in the bed of the Bendigo Creek. *Managed by Bendigo Heritage Attractions operators of the Gold Mine, pipelines owned by GBM Gold.*
- Extraction of on average 2ML/d water at New Moon Mine Shaft on the Garden Gully Reef (730 ML/yr). The *New Moon Mine pump and pipeline are owned by GBM Gold, Coliban Water have an exclusive lease of the GWTP until 30 June 2021.*
- Treatment of water at a groundwater treatment plant (GWTP) located at New Moon to remove salt, arsenic and other heavy metals. The treatment is a two-stage process consisting of;
  - Pre-treatment
  - Oxidation
  - Coagulation & flocculation (using chemical dosing)
  - Filtration
  - Reverse Osmosis (RO) Desalination
  - 4 train process, using both brackish and seawater RO Membranes. *The New Moon GWTP is owned by GBM Gold, Coliban Water have an exclusive lease of the GWTP until 30 June 2021. The treatment process uses some assets owned by GBM Gold and are managed by Coliban Water.*
- Pumping of treated water from the New Moon GWTP to Coliban Water’s Epsom Water Recycling Plant for blending with treated effluent (when available) before discharge to Bendigo Creek. *Pipelines used for transporting water are owned by GBM Gold (New Moon to Lake Neangar section) and managed by Coliban Water (Lake Neangar to Epsom WRP section), pumping is managed by Coliban Water.*
- Pumping of brine to Coliban Water’s Epsom Water Recycling Plant for evaporation from a purpose-built lagoon. *Managed by Coliban Water*

The interim solution is managed and operated by Coliban Water and will operate until 30 June 2021, with DELWP maintaining overall project responsibility.

The interim solution is limited to managing water from Central Deborah Gold Mine and associated reefs and the Garden Gully Reef line. Treatment of water from the existing Hustlers Reef discharge is not included as part of the interim solution.

Energy Use

The energy used to operate the interim solution is typical of a standard desalination plant. It is anticipated that energy use for in Interim Solution will be less than 11,000GJ per annum. This consists of;

- GWTP ~ 6,000 GJ
- Water & brine transfer from New Moon to Epsom < 1,100GJ
- Brine Storage pond mixing and aeration < 50GJ
- Central Deborah dewatering ~3000GJ
By-products
There are two major by-products from the treatment process – sludge from the pre-treatment stage and brine from the desalination process.

- Pre-treatment
  Pre-treatment includes chemical dosing and oxidation of the groundwater, followed by filtration. This process removes most of the heavy metals present in the water including; arsenic and manganese. The waste sludge will be dewatered and transported off site to an appropriately licensed landfill.

- Brine
  The majority of the arsenic and other heavy metals are removed in the pre-treatment stage. The brine will likely comprise mostly of sodium chloride and sulphates, among other ions.

Further information
More detail on the interim solution is available in Coliban Water’s EPA Works Approval submission. This document can be found on the EPA website below under Transaction No: 1002394
Appendix C  Long term solution arrangements

_Innovation for a Permanent Solution_ relates to the long-term solution for managing groundwater from mine voids in Bendigo. Ideas may use the two-step extraction/disposal model described in Appendix A or Appendix B, or may use some in-situ technology/methods to treat the water at the source, with extraction at Central Deborah only.

If ideas use the two-step extraction/disposal model, future long-term arrangements can be considered as follows:

1. **Extraction** DELWP expects that the means for extracting water from the mine voids will probably be very similar (possibly identical) to that described in Appendix A and Appendix B for the Interim Solution. However, the purpose of the _Innovation for a Permanent Solution_ is to incorporate management of additional reefs and to generate other ideas for extraction that achieve the project objectives.

   Assets that may be available for long-term extraction include:
   a. Central Deborah Shaft Pump set (Bendigo Heritage Attractions)
   b. Discharge pipelines from Eureka and Central Deborah Shaft to Londonderry Shaft (GBM Gold)
   c. New Moon Shaft Pump set (GBM Gold)
   d. New assets proposed as part of your _Innovation for a Permanent Solution_.

2. **Treatment and Use** The focus of _Innovation for a Permanent Solution_ is finding long-term disposal and reuse solutions for the water, probably extracted from New Moon Mine shaft. Assets that may be available for disposal and reuse include:
   a. Existing mine dewatering infrastructure; such as pipelines and treatment plant (GBM Gold).
   b. A 270ML brine storage pond at the Bendigo Water Reclamation Plant for storage and partial evaporation of brine generated at the New Moon groundwater treatment plant (Coliban Water).
   c. Existing Bendigo Water Reclamation Plant and outfall to Bendigo Creek (Coliban Water)
   d. Existing water recycling pipeline network and Spring Gully storage (Coliban Water)
   e. Existing Coliban Rural Channel network (Coliban Water)
   f. Existing landfills (local government or private operator) for disposal of thickened sludge from the New Moon groundwater treatment plant to a suitable landfill in accordance with regulations.
   g. New assets proposed as part of your _Innovation for a Permanent Solution_ idea.
## Appendix D  Technical information

The following reports are available by contacting the Bendigo Groundwater Project Team at [bendigo.groundwater@delwp.vic.gov.au](mailto:bendigo.groundwater@delwp.vic.gov.au)

<table>
<thead>
<tr>
<th>Information</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Mining Groundwater Management (DEWLP, 2016)</td>
<td>Compilation of information from a range of previous studies. Describes current understanding of key processes associated with rising groundwater levels in mine workings beneath Bendigo.</td>
</tr>
<tr>
<td>Pre-feasibility assessment of interim and longer-term options to manage mine void water (Jacobs, 2015)</td>
<td>Identify and evaluate long and short-term options to manage rising groundwater in mine voids beneath Bendigo.</td>
</tr>
<tr>
<td>Bendigo Rising Groundwater Levels Engineered Wetland Feasibility Study (GHD, 2015)</td>
<td>Assess the feasibility of wetlands to passively remove arsenic and other metals from groundwater, including concept design. Included a high level environmental and human health risk assessment for two scenarios: (i) Do nothing; and (ii) Engineered wetland. The study concluded that a wetland treatment on its own would not treat water to the appropriate standard.</td>
</tr>
<tr>
<td>Bendigo Rising Water Levels Permeable Reactive Barrier Trial Design Report (GHD, 2016)</td>
<td>Determine the feasibility of a PRB as a passive management measure to remove arsenic, sulfide and other metals from discharging groundwater. The study concluded that due to the characteristics of the water and the high flow rates required the costs associated with PRB treatment would be prohibitive.</td>
</tr>
<tr>
<td>Baseline ecological and surface water quality assessment – sampling (GHD, 2016)</td>
<td>Collection of baseline data on the condition of the environment in various catchments likely to experience groundwater discharge from historical mine shafts.</td>
</tr>
<tr>
<td>Baseline ecological and surface water quality assessment – waterway characterisation (GHD, 2016)</td>
<td>Establish background ecological condition for possible use in future risk assessment (depending on EPA’s requirements) that would enable comparison of impacts against locally established guidelines (as opposed to the default ANZECC guidelines).</td>
</tr>
<tr>
<td>Options to manage waste streams from treatment of groundwater (Jacobs, 2015)</td>
<td>To quantify waste stream volumes and chemistry from the existing water treatment plant at New Moon, identify and cost options to manage the individual and collective waste streams from the treatment of groundwater at the facility. The study was completed prior to operation of the Interim Solution and is based on the process and infrastructure previously used at the site.</td>
</tr>
<tr>
<td>Bendigo Region Groundwater and Mine Water (URS, 2014)</td>
<td>Undertake monitoring to obtain data to increase understanding of groundwater recovery rates and inform a water balance in and around mine workings.</td>
</tr>
<tr>
<td>Mine Shaft Discharges, Bendigo Region (URS, 2015)</td>
<td>Determine risks associated with groundwater and H₂S discharges from select historical mine shafts and identify mitigation measures. The five historical mine shafts were: Catherine United Shaft; Shamrock Shaft; Red White and Blue (RWB) United Shaft; North New Moon Shaft; and Hustler Royal Reserve No. 2.</td>
</tr>
</tbody>
</table>
Appendix E  Detailed ideas assessment process

Step 1  
Innovation for a Permanent Solution

Step 2  
First evaluation

Step 3  
Idea development

Step 4  
Cost benefits analysis

Step 5  
Final decision

Parties develop ideas that address project objectives and criteria

SLGAG review ideas and advice and recommend ideas for further development

Ideas considered by TAG and CRG who provide feedback to SLGAG

Project team collate and do high level assessment against criteria

Ideas tested and developed professionally as required

Ideas considered by TAG and CRG who provide opinions to SLGAG

SLGAG review ideas and advice and provide recommendation on options for full CBA

SLGAG consider CBA and recommendations and make final recommendations to Minister

CBA results considered by CRG & TAG who provide recommendations to SLGAG

Full CBA conducted on proposed projects

Project endorsed by Government
## Appendix F  Groups involved in assessing ideas

<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Title</th>
<th>Role</th>
</tr>
</thead>
</table>
| TAG     | Technical Advisory Group                  | To provide independent technical advice to the SLGAG, the CRG and the Bendigo Groundwater Project Team. TAG will be review ideas against technical project criteria for technical merit and feasibility. They will assess:  
- completeness of idea  
- technical feasibility  
- aspects requiring further investigation  
TAG will make recommendations to the SLGAG about the technical merit and feasibility of ideas. |
| SLGAG   | State and Local Government Advisory Group  | To consider relevant information and stakeholder inputs, including the recommendations of the CRG and TAG. SLGAG will decide which options should be considered for a full cost benefits analysis and ultimately prepare a recommendation outlining an option, or options, to manage the issue. |
| CRG     | Community Reference Group                 | To advise the SLGAG about the preferred option(s) for holistic management of groundwater discharge from historical mining works in Bendigo, including a breadth of community perspectives on the range of options. |
| Project Team | Bendigo Groundwater Project Team | To facilitate development of long term solutions including:  
- identification and development of a range of management options  
- presentation of information to CRG, TAG and SLGAG  
- alignment with project objectives and community and stakeholder expectations  
DELWP has overall responsibility for the Groundwater Project. This includes chairing the governance groups of the Project Control Board and Project Steering Committee. |
The following principles for the Bendigo Groundwater Project were developed in consultation with the Community Reference Groups and the State and Local Government Advisory Group. The final solutions considered in a cost benefits analysis, which may be made up of several ideas, should address all 14 principles.

The final projects will be assessed on the extent that they:

**Principle 1.** Apply to all reefs across the project area

**Principle 2.** Where possible address the causes of the issues

**Principle 3.** Minimise or avoid discharges to the environment which may be harmful to human and/or ecosystem health and would detract from local amenity

**Principle 4.** Avoid leaving a legacy of environmental or health impact for later generations to manage

**Principle 5.** Embed innovative approaches to the treatment or management of groundwater and contaminants

**Principle 6.** Have a low requirement for energy, chemical, management and external funding inputs.

**Principle 7.** Have affordable capital and operating costs

**Principle 8.** Provide value to the Bendigo community through uses of the groundwater and any wastes

**Principle 9.** Protect business and infrastructure assets (including operation of Central Deborah Goldmine)

**Principle 11.** Be able to be proven and operational by 30 June 2021

**Principle 12.** Be flexible to take advantage of future technological developments and local initiatives in water and waste treatment and use.

**Principle 13.** Have clear governance, with accountability to the Bendigo community and government

**Principle 14.** Not include Woodvale Evaporation Ponds as part of the solution
Appendix H  Detailed project area
## Appendix I  Historic water quality data

Summary table of historic water quality data for Central Deborah Shaft and New Moon Shaft

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Historic Range of Median Values from data sets (or details of Detection)</th>
<th>New Moon Mine 2015</th>
<th>New Moon Mine 2016</th>
<th>Central Deborah Mine 2016</th>
<th>Data source</th>
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<tr>
<td>Ammonia</td>
<td>mg/L</td>
<td>0.08</td>
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<td>GHD</td>
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<td>Arsenic</td>
<td>mg/L</td>
<td>2.2</td>
<td>2.99</td>
<td>1.6-2.2</td>
<td>3.4-4.2</td>
<td>AGC, CW</td>
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<tr>
<td>Arsenious acid - As III</td>
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<td></td>
<td>GHD</td>
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<td>Arsenic - As V</td>
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<td>1.25</td>
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<td>GHD</td>
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<td>Arsenic (Filtered/Dissolved)</td>
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<td>Barium</td>
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<td></td>
<td>DEPI, CW</td>
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<td>Cadmium</td>
<td>mg/L</td>
<td>Detections - Max 0.02</td>
<td>0.0001</td>
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<td>AGC, URS</td>
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<td>Calcium</td>
<td>mg/L</td>
<td>110-120</td>
<td>92</td>
<td>83-91</td>
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<td>DEPI, AGC, URS, CW</td>
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<td>Chromium</td>
<td>mg/L</td>
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<td>COD</td>
<td>mg/L</td>
<td>20-75</td>
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<td>&lt;10-24</td>
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<td>DEPI, AGC, CW</td>
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<td>Copper</td>
<td>mg/L</td>
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<td></td>
<td>AGC, GHD, URS</td>
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<tr>
<td>Cyanide</td>
<td>mg/L</td>
<td>Detections - Max 3.8</td>
<td>&lt;0.004</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
<td>AGC, CW</td>
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<td>Free Cyanide</td>
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<td>GHD</td>
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<td>Weak Acid Dissociable Cyanide</td>
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<td></td>
<td>GHD</td>
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<tr>
<td>Dissolved Oxygen</td>
<td>mg/L</td>
<td>0.6</td>
<td>1.6-5.9</td>
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<td>AGC, CW</td>
</tr>
<tr>
<td>EC</td>
<td>μS/cm</td>
<td>6270-6890</td>
<td>7160</td>
<td>5900-6200</td>
<td>7000</td>
<td>DEPI, UM, AGC, CW</td>
</tr>
<tr>
<td>Fluoride</td>
<td>mg/L</td>
<td>0.6</td>
<td>0.23-0.48</td>
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<td>DEPI</td>
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<tr>
<td>Hardness</td>
<td>mg/L as CaCO3</td>
<td>1234</td>
<td>1000-1100</td>
<td>1200</td>
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<td>AGC, CW</td>
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<tr>
<td>Parameter</td>
<td>Unit</td>
<td>Historic Range of Median Values from data sets (or details of Detection)</td>
<td>New Moon Mine 2015</td>
<td>New Moon Mine 2016</td>
<td>Central Deborah Mine 2016</td>
<td>Data source</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>---------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>mg/L</td>
<td>2.4 &lt;0.1</td>
<td></td>
<td></td>
<td></td>
<td>URS</td>
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<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.34 0.13</td>
<td></td>
<td>0.08-0.28</td>
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<td>AGC, CW</td>
</tr>
<tr>
<td>Iron (Filtered/Dissolved)</td>
<td>mg/L</td>
<td>2.56 (0.025)</td>
<td></td>
<td></td>
<td></td>
<td>DEPI – (UM filtered value significantly lower suggests oxidation and sedimentation has occurred in sample)</td>
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<tr>
<td>Lead</td>
<td>mg/L</td>
<td>Detections - 0.04 and 0.003</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>AGC, GHD, URS</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/L</td>
<td>222-330 237 200-220</td>
<td></td>
<td></td>
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<td>DEPI, MCL, AGC, URS, CW</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>0.71 0.636 0.23-0.29 0.76-0.83</td>
<td></td>
<td></td>
<td></td>
<td>AGC, CW</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/L</td>
<td>Detection - 0.0001, 0.001</td>
<td>&lt;0.0001, 0.001</td>
<td></td>
<td></td>
<td>DEPI, AGC Limit of detection typically &lt;0.0001</td>
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<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>0.017 0.002</td>
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<td>URS</td>
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<tr>
<td>Nitrate + Nitrite as N</td>
<td>mg/L</td>
<td>0.13 &lt;0.01-.08 &lt;0.01</td>
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<td>GHD, CW</td>
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<tr>
<td>Total Phosphorus as P</td>
<td>mg/L</td>
<td>1.27 0.52-0.69 1.1</td>
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<td></td>
<td></td>
<td>GHD, CW</td>
</tr>
<tr>
<td>pH</td>
<td>pH units</td>
<td>6.9-7.0 7.31 7.7-8.2 7.3-7.4</td>
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<td></td>
<td></td>
<td>UM, AGC, DEPI, CW</td>
</tr>
<tr>
<td>Silica</td>
<td>mg/L</td>
<td>29 13-17 23-25</td>
<td></td>
<td></td>
<td></td>
<td>AGC, CW</td>
</tr>
<tr>
<td>Sodium</td>
<td>mg/L</td>
<td>918-1100 1160 890-940 970-1000</td>
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<td>DEPI, AGC, URS, CW</td>
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<tr>
<td>Sulfite</td>
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<td>URS</td>
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<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>339-550 275 380-430 250-270</td>
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<td>DEPI, UM, CW</td>
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<tr>
<td>Sulfide</td>
<td>mg/L</td>
<td>25 8.9,25 &lt;0.1-.03 22</td>
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<td>AGC, GHD, URS, CW</td>
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<tr>
<td>TOC</td>
<td>mg/L</td>
<td>2 0.8-2 1.3-3</td>
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<td>GHD, CW</td>
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<tr>
<td>Thiosulfate</td>
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<td>4</td>
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<td>URS</td>
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### Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Historic Range of Median Values from data sets (or details of Detection)</th>
<th>New Moon Mine 2015</th>
<th>New Moon Mine 2016</th>
<th>Central Deborah Mine 2016</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Alkalinity</td>
<td>mg/L as CaCO3</td>
<td>492</td>
<td>560-610</td>
<td>1100</td>
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<td>DEPI, CW</td>
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<tr>
<td>TDS</td>
<td>mg/L</td>
<td>4145-4310</td>
<td>3790, 4650</td>
<td>3500-3600</td>
<td>4200</td>
<td>DEPI, UM, AGC, GHD, URS, CW</td>
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<tr>
<td>Total Suspended Solids</td>
<td>mg/L</td>
<td>11-20</td>
<td>&lt;2-5</td>
<td>2-3</td>
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<td>DEPI, AGC, CW</td>
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<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>0.05</td>
<td>&lt;0.005</td>
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<td>AGC</td>
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<tr>
<td>Zinc (Filtered/Dissolved)</td>
<td>mg/L</td>
<td>Detections - Max 0.012</td>
<td>0.009</td>
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<td>DEPI, UM, URS</td>
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</table>

*Table adapted from GHD PRB Feasibility Study 2015.*

- DELWP = DELWP Sampling and Testing Regime Data, 24/04/2014-28/04/2014
- UM = Historic Bendigo Mining Limited Data from New Moon Shaft 28/01/2010-30/11/2011
- GHD – GHD New Moon Samples 2015
- CW - Coliban Water New Moon and Central Deborah 2016
Appendix J  Use of submissions and treatment of Intellectual Property

How submissions will be used
Submissions will be collated by the project team and shared with the Technical Advisory Group, Community Reference Group and the State and Local Government Advisory Group for their review.

The use of the template based response is intended to allow us to collect sufficient information about your idea while minimising the disclosure of proprietary or copyright information. If your submission has insufficient material for us to fully assess the idea, we may seek further information from you.

In the first steps of the process ideas are submitted with no obligation or guarantee.

Ideas that progress through the first evaluation will likely be further developed using professional services (consultants). This may include the combining of part or elemental ideas into full end-to-end concepts. It is at this stage of the process appropriate contractual arrangements will be entered into.

Intellectual property
You confirm that you own or have the right to use any copyright material included in your content and that you are not infringing any person’s rights by submitting the content to the Bendigo Groundwater Project.

Use of your intellectual property
DELWP would like to be able to use any ideas submitted as part of this process for further consultation and/or to develop a project engineering solution for Bendigo’s groundwater. When you submit an idea, you agree that you also grant DELWP a non-exclusive, irrevocable and royalty-free licence to use any intellectual property contained in your submissions for these purposes. The licence is also transferable to enable DELWP to engage consultants to work with these ideas in developing the solution. If you don’t agree to this, please indicate this in your submission and DELWP will either discuss further with you or discard your submission.