

REFERRAL OF A PROJECT FOR A DECISION ON THE NEED FOR ASSESSMENT UNDER THE *ENVIRONMENT EFFECTS ACT 1978*

REFERRAL FORM

The *Environment Effects Act 1978* provides that where proposed works may have a significant effect on the environment, either a proponent or a decision-maker may refer these works (or project) to the Minister for Planning for advice as to whether an Environment Effects Statement (EES) is required.

This Referral Form is designed to assist in the provision of relevant information in accordance with the *Ministerial Guidelines for assessment of environmental effects under the Environment Effects Act 1978* (Seventh Edition, 2006). Where a decision-maker is referring a project, they should complete a Referral Form to the best of their ability, recognising that further information may need to be obtained from the proponent.

It will generally be useful for a proponent to discuss the preparation of a Referral with the Department of Planning and Community Development (DPCD) before submitting the Referral.

If a proponent believes that effective measures to address environmental risks are available, sufficient information could be provided in the Referral to substantiate this view. In contrast, if a proponent considers that further detailed environmental studies will be needed as part of project investigations, a more general description of potential effects and possible mitigation measures in the Referral may suffice.

In completing a Referral Form, the following should occur:

- Mark relevant boxes by changing the font colour of the 'cross' to black and provide additional information and explanation where requested.
- As a minimum, a brief response should be provided for each item in the Referral Form, with a more detailed response provided where the item is of particular relevance. Cross-references to sections or pages in supporting documents should also be provided. Information need only be provided once in the Referral Form, although relevant cross-referencing should be included.
- Responses should honestly reflect the potential for adverse environmental effects. A Referral will only be accepted for processing once DPCD is satisfied that it has been completed appropriately.
- Potentially significant effects should be described in sufficient detail for a reasonable conclusion to be drawn on whether the project could pose a significant risk to environmental assets. Responses should include:
 - a brief description of potential changes or risks to environmental assets resulting from the project;
 - available information on the likelihood and significance of such changes;
 - the sources and accuracy of this information, and associated uncertainties.
- Any attachments, maps and supporting reports should be provided in a secure folder with the Referral Form.
- A CD or DVD copy of all documents will be needed, especially if the size of electronic documents may cause email difficulties. **Individual documents should not exceed 2MB.**

- A completed form would normally be between 15 and 30 pages in length. Responses should not be constrained by the size of the text boxes provided. Text boxes should be extended to allow for an appropriate level of detail.
- The form should be completed in MS Word and not handwritten.

The party referring a project should submit a covering letter to the Minister for Planning together with a completed Referral Form, attaching supporting reports and other information that may be relevant. This should be sent to:

Postal address

**Minister for Planning
PO Box 500
EAST MELBOURNE VIC 3002**

Couriers

**Minister for Planning
Level 17, 8 Nicholson Street
EAST MELBOURNE VIC 3002**

In addition to the submission of the hardcopy to the Minister, separate submission of an electronic copy of the Referral via email to ees.referrals@dpcd.vic.gov.au is encouraged. This will assist the timely processing of a referral.

PART 1 PROPONENT DETAILS, PROJECT DESCRIPTION & LOCATION

1. Information on proponent and person making Referral

Name of Proponent:	State Owned Enterprise for Irrigation Modernisation in Northern Victoria, trading as Northern Victoria Irrigation Renewal Project (NVIRP)
Authorised person for proponent:	Murray Smith
Position:	Chief Executive Officer
Postal address:	PO Box 1665, Shepparton, VIC 3632
Email address:	murray.smith@NVIRP.com.au
Phone number:	1300163006
Facsimile number:	(03) 5820 4555
Person who prepared Referral:	Ross Plunkett
Position:	Manager Planning
Postal address:	PO Box 1665, Shepparton, VIC, 3632
Email address:	ross.plunkett@NVIRP.com.au
Phone number:	1300163006
Facsimile number:	(03) 5820 4555
Available industry & environmental expertise: (areas of 'in-house' expertise & consultancy firms engaged for project)	<p>The preparation of this referral has been co-ordinated by the Office of Water from the Department of Sustainability and Environment. The process has been overseen by a Steering Committee comprising representation from the following organisations:</p> <ul style="list-style-type: none"> • Goulburn Broken Catchment Management Authority • North Central Catchment Management Authority • Department of Sustainability and Environment (head office and regional staff) • Department of Primary Industries • Goulburn-Murray Water • NVIRP. <p>The members of the Steering Committee have expertise in the following areas:</p> <ul style="list-style-type: none"> • Managing environmental approval processes relevant to major projects, including water projects; • Biodiversity management of river and wetlands at local and catchment scale; • Surface and groundwater management; • Supporting improvements in agricultural practices; • Supporting community participation in catchment management; • Developing policy for natural resource management. <p>Assistance has also been provided by Sinclair Knight Merz Pty. Ltd (SKM). SKM is an engineering and environmental consultancy. SKM staff based in Melbourne and Tatura have extensive relevant experience.</p>

2. Project – brief outline

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Project title: Northern Victorian Irrigation Renewal Project (NVIRP), also referred to as the Food Bowl Modernisation Project

Project location: (describe location with AMG coordinates and attach A4/A3 map(s) showing project site or investigation area, as well as its regional and local context)

The NVIRP area is within the Goulburn Murray Irrigation District (**GMID**). The GMID is located in northern Victoria and extends from Nyah in the west to Yarrawonga in the east. Attachment 1 is a map of the NVIRP area.

The NVIRP area is located within the lower portions of the catchments of the Goulburn, Broken, Campaspe, Loddon and Avoca Rivers. The landscape is generally flat and highly modified by the development of irrigation infrastructure. Land use in the area is predominantly irrigated agriculture. Major enterprise types include dairy (irrigated pasture production), intensive horticulture (stone and pome fruits and citrus) and viticulture.

The Shepparton Irrigation Area and part of the Central Goulburn Irrigation Area identified on the plan as G-MW Modernisation Project – Shepparton IA and G-MW Modernisation Project – CG1, 2, 3 & 4 are not part of the NVIRP area, and are not part of this referral.

Short project description (few sentences):

The NVIRP is the modernisation of the irrigation delivery infrastructure to reduce water losses and provide additional water for the environment, irrigators and Melbourne. Irrigation modernisation has two major components, namely:

1. Channel system automation and remediation. The installation of modern regulators and meters will allow more accurate measurement of flows and more effective operation, maintenance and renewal of the public channel system. The remediation includes repair, replacement or upgrade of channels or piping to reduce leakage, seepage and evaporation; and
2. Reconfiguration, involving rationalisation of channels and farm outlets and selected replacement of channels with pipelines where appropriate

Installation of the measurement and metering technology will provide a more accurate calculation of water delivery through each section of the GMID and will progressively facilitate the identification of priority sites for repair or reconfiguration.

The NVIRP will be undertaken in two stages, based on funding arrangements. Stage 1 of the NVIRP is funded by the Victorian Government, Melbourne Water and Goulburn-Murray Water and will consist of:

1. Replacement of manual flow regulators with automated regulator gates on the larger carrier and trunk channels (trunks and carriers) determined to be the "Backbone" of the future modernised irrigation system;
2. Replacement of out-dated Dethridge meters with meters that comply with the new National standards for accuracy for the measurement of water flow onto farms;
3. Channel lining and other remediation through targeted and prioritised repair in channel segments where identified losses are unacceptable;
4. Reconfiguration and connections back to the Backbone; and
5. Centralised control of all automatic gates.

Stage 2 of the NVIRP will be funded by the Commonwealth Government and will consist of a continuation of replacement of meters, channel lining and other remediation and reconfiguration as appropriate.¹

Additional information about these components can be found in the following sections.

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¹ Stage 2 funding is conditional upon the project satisfying Commonwealth due diligence requirements. Project governance arrangements will be confirmed when funding arrangements are confirmed.
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3. Project description

Aim/objectives of the project (what is its purpose / intended to achieve?):

The NVIRP's objectives are to recover water delivery losses from the GMID to provide additional water for the environment, to improve reliability of water supply to irrigators, to contribute to Melbourne's water supply and to provide a sustainable irrigation system.

The NVIRP also aims to ensure the continued economic viability of the GMID, and to contribute to a more flexible response to meeting all the State's water needs, particularly during drought periods, in accordance with the policy objectives presented in *Our Water, Our Future – The Next Stage of the Government's Water Plan* (released in June 2007).

The NVIRP Stage 1 is planned to recover an average of 225 GL of water per year that is currently wasted through leakage, seepage, evaporation, meter error and system inefficiencies. The NVIRP Stage 2 will complete the modernisation process and achieve up to a further 200 GL of average annual savings.²

Use of saved water

The 225 GL average annual Stage 1 water savings will be shared equally between the environment (75 GL), irrigators (75 GL) and supply to Melbourne (75 GL). The water to Melbourne is to be delivered by the Sugarloaf Pipeline, which has been the subject of a separate referral process.

The Stage 2 average annual water savings of up to 200 GL will be shared equally between the environment (up to 100 GL) and irrigators (up to 100 GL).

Thus, the cumulative share of water savings accruing to the environment is up to 175 GL on average, each year. The environment's water allocation will be released from storage when required by environmental water managers to meet specific watering needs.

Improved water supply to farms

In addition to providing up to 175 GL extra irrigation entitlement, the project will also improve service delivery for irrigators through automated outlets with shorter ordering times, and more consistent, high flows. It is anticipated that irrigators will respond to the increased level of service via the adoption of new technologies and reconfiguration of their properties to maximise productivity. An extensive customer engagement program, including group meetings and individual farm visits, is being developed to make irrigators aware of the opportunities for use of the higher water entitlement and improved operation of their farms.

Regional development

The project will also provide flow-on effects in generating regional economic development opportunities. Regional Development Victoria is providing \$1.4 million to develop the Food Bowl Marketing Prospectus, and to support a range of initiatives to attract agricultural, food and other value-adding related investment.

Stage 1 works will be funded by \$600 million from the Victorian Government, \$300 million from Melbourne Water and \$100 million from Goulburn-Murray Water.

Stage 2 will be funded by the Federal Government with investment of up to a further \$1 billion.

² NVIRP is responsible for the works program. Government currently is finalising Technical Guidelines for Water Savings to formalise the link between works and expected water savings.

³ *Moving Forward: Update – The Next Two Years 2008 to 2010*. (2008). Victorian Government Department of Innovation, Industry and Regional Development, Melbourne.
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Background/rationale of project (describe the context / basis for the proposal, eg. for siting):

Government's Water Policy

The background and rationale for the NVIRP are addressed in *Our Water, Our Future: The Next Stage of the Government's Water Plan* (the "Water Plan"). The NVIRP is a key element of the Victorian Government's plan to provide improved water security in the face of drought and climate change. The Water Plan includes several key components:

- The NVIRP;
- A proposed desalination plant to supply 150 GL/year for Melbourne;
- Expansion of the "Water Grid" to connect water supply sources to the main urban demand areas and provide interconnection between these areas;
- Upgrading the Eastern Treatment Plant to provide 100 GL/year of recycled water; and
- Continuation and extension of existing water conservation programs.

The Water Plan provides both additional water sources and the transport network to enable flexible and effective use of these resources. An important aspect of this is the provision of security through diversity of supply.

The Importance of the Goulburn Murray Irrigation District

The NVIRP is located in the northern irrigation region of Victoria. Irrigated agriculture generates approximately \$9 billion in production annually and approximately \$1.53 billion in exports. Prior to the drought, the food processing industry was one of Victoria's fastest growing industries, its main exporter and a major employer. Victoria's food industry is a mainstay of rural and regional economies.

The GMID produces approximately 30% of Victoria's gross value of agricultural production including 75% of pome and stone fruit, 95% of grape production and 30% of Australia's milk production. In addition, 95% of Australia's tomato processing capacity is located in the region.

This supply of high quality agricultural commodities has underpinned the investment of many of Australia's largest food processing companies in the region, particularly in the areas of fruit and vegetable processing, dairy products and wine production. Companies include SPC Ardmona, Simplot Australia, Cedenco Australia, Unilever, Heinz Watties, Campbells Soups Australia, Fonterra and Murray Goulburn Co-operative.

Over the past 7 years, this region has seen significant growth in food and related industries with over \$665 million of new investment and the creation of over 1,650 jobs. To maintain this growth, particularly in an environment of sustained deficient rainfall, strategic investment in Victoria's irrigation infrastructure is essential. The NVIRP aims to make farms more productive by providing modernised irrigation infrastructure to support greater water use efficiency.

Problems with the Existing Irrigation System in the GMID

The irrigation delivery system in the GMID has deteriorated with age and approximately 30% of water diverted for irrigation is not delivered, instead being lost in the delivery system through leakage, seepage, evaporation, inaccurate meters and other system inefficiencies. This represents about 850 GL of water in a long-term average year. Table 1 provides a break-down of annual average water savings from Stage 1.

Salinisation of wetlands, waterways and soils associated with shallow groundwater tables, resulting from leakage and seepage from channels, irrigation practices, as well as other sources of recharge, is a substantial threat to environmental values and sustainable irrigation throughout large areas of the GMID.

In addition, the current configuration of the irrigation infrastructure in the GMID has not changed substantially since it was originally constructed. At that time, property sizes were typically smaller than today, with large sections of the GMID dominated by soldier settlement schemes. Each of these smaller properties was provided with a supply point from the irrigation network.

The changing needs of irrigators in terms of location of supply, type of supply and the level of service are considered via the reconfiguration process. Over recent decades, technological upgrades and changed economic drivers have resulted in many smaller properties being consolidated into larger enterprises. This has meant that a single property may have numerous connections (supply points) to the irrigation network, some of which may be redundant and have the potential to be rationalised. The modernised connections will have substantial benefits in being remotely controlled, operate over a larger range of supply conditions and be fitted with more accurate metering.

The NVIRP aims to identify opportunities to re-design and reconfigure parts of the irrigation network to better meet the needs of the current and future irrigation customers. This may occur via the decommissioning of parts of the network, relocation of supply points (meters), conversion from open channels to pipelines or other means.

Greater certainty of the environmental provision in the GMID

The average annual savings of up to 175 GL for the environment will be used to improve the health of priority stressed rivers and wetlands, and will be held as an environmental entitlement by the Minister for Environment. This entitlement will have the same characteristics as entitlements of consumptive water users. The Environmental Water Holder will receive seasonal allocations and be able to call allocated water out of storage as required, just as irrigators do.⁴ This will provide greater flexibility to manage environmental watering to target priority environmental needs and respond to the risk posed by climate change.

The environment's share of water savings from the NVIRP will be over and above The Living Murray and Snowy commitments. The use of environmental water will target priority Victorian wetlands and tributaries. This will also have flow on benefits when the water enters the River Murray, where it then can be "reused" to meet the needs of the Murray and its floodplains and wetlands, including the Kerang Lakes, Barmah Forest, Gunbower Forest, Hattah Lakes, Lindsay-Wallpolla Island and various other sites along the River Murray.

Environmental water from NVIRP may also be used for drought measures, such as emergency watering of River Red Gums and provision of critical drought refuge for threatened species (e.g. Murray Hardyhead).

Further information on the characteristics and usage of the environment's share of the water savings is provided in Attachment 2. [Note that this attachment discusses the 75 GL of savings to be held by Victoria. Victoria will work with the Commonwealth to seek complementary use of the up to 100 GL from Stage 2.]

Table 1. Components of system water savings in the NVIRP Area.

Loss Component	Savings Estimate (GL) (Stage 1)
Outfalls	50
System Filling	0
Evaporation	6
Seepage	17
Leakage	67
Leakage - outlets	15
Un-metered D&S	0
Theft	2
Meter Inaccuracy	68
Total	225

⁴ Further information on the Environmental Water Holder and integrated management of environmental water across Northern Victoria is provided in *Sustainable Water Strategy: Northern Region* (Draft for Community Comment). (2008). Victorian Government Department of Sustainability and Environment, Melbourne. Pp.138–139.

Note that this table shows water savings estimates for the NVIRP area only, not for the entire GMID.

Main components of the project (nature, siting & approx. dimensions; attach A4/A3 plan(s) of site layout if available):

For the purposes of the NVIRP, the irrigation supply network is divided into two main parts, namely:

- **Backbone:** the network of large trunk and carrier channels that have approximately 2,000 ML/year (20 ML/day Delivery share⁵) of water use or greater; and
- **Connections:** the local area distribution system from the Backbone to the individual farm, defined as having less than 2,000 ML/year of water use.

The NVIRP will consist of:

- Modernisation of the larger carrier and trunk channels which form the Backbone including;
 - Automation of channel control structures;
 - Strategic measurement of all off-takes and all outfalls on the Backbone;
 - Rationalising and upgrading regulating structures and other structures;
 - Improving the standard of water supply service;
 - Progressive channel bank and bed remediation where required to reduce channel seepage and leakage. This will be targeted at high loss sites;
 - Centralised control of automated control structures.
- Metering farm outlets, including:
 - After rationalisation, replacement of existing Dethridge meters with new accurate meters on customer supply points on the Backbone;
 - Central control of high-flow farm outlets.
- Creation of new direct connections to the Backbone, where appropriate, as part of channel system reconfiguration.

Specific details of the proposed Stage 1 works are provided below. Note that that works specifications presented in the tables below are indicative only. The development of the Stage 2 works program will be informed by the more accurate measurements of flows and losses enabled by Stage 1. Stage 2 works covered by this referral are of the same nature as the Stage 1 works described below, though will be focussed predominantly around Connections and completion of the channel bank and bed remediation.

Channel automation of the Backbone

The flow of water through channels is now controlled by the manual manipulation of flow regulators (check and drop-bar structures). All structures that are currently manually operated on the Backbone will be replaced with automated gates. Gate installation on regulators in the main channel system can only take place outside the irrigation season, that is, during the winter months (usually between May and August) when the channels are not operational for the purposes of supplying irrigation water (i.e. when water levels are low).

Major offtake structures at the headworks of the individual channel systems which are generally fitted with earlier generations of gates, actuation and control, will be upgraded, where necessary, to be compliant with the modernised Backbone.

A number of control structures will be made redundant by automation and rationalisation/removal of customer supply points. Structure rationalisation/removal may result in channel bank raising works to maintain channel operation levels, or farm infrastructure to maintain customer level of service.

⁵ Delivery shares provide an entitlement to have water delivered via a channel to land in an irrigation district.
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All offtakes structures from the Backbone to channels that deliver less than 20 ML per day delivery share (the remaining system) will be automated and fitted with flow monitoring devices. An iterative procedure of estimating water balances and pondage (water loss) tests then will be undertaken to develop the channel remediation works program for the Backbone and to assist in prioritising connections. The works required to automate the channels, in terms of control structures and structure replacement, are summarised in Table 2.

Table 2. Summary of proposed Stage 1 channel automation works.

Automation Works	Total for adopted option
Channel length – km	2,650
Channel Control Structures - sites	2,020
Channel Control Structures - gates	3,130
Major Offtake Structure works	15
Structure Replacement	110
Structure Refurbishment	110
Outfalls Relocated/Enlarged	50

Channel remediation on the Backbone

Channel remediation works will comprise:

- lining of channels - full length of all pools where pool length on the lighter (more sandy) soils. Sandy soils have higher leakage rates than clay soils. However, as it is not possible to predict leakage rates accurately and iterative procedure will be adopted.
- rebuilding of channel banks where the channel bank is in a state of disrepair.

These works will rectify high seepage and high bank leakage by using water loss data, which will only be able to be collected following automation of the Backbone. These records will be used to identify the location of channel pools with high losses. The numbers of gates will be further refined following customer consultation and additional investigations.

The likely locations where channel remediation treatments will be applied have been identified by mapping of soil types, asset condition and other factors. The indicative works are shown in Table 3.

Table 3. Summary of proposed Stage 1 channel remediation works.

Remediation Works	Total Potential Remediation (km)	Adopted Remediation (km)
Channel Lining (Plastic)	750	320
Bank Remodelling	250	105
Total Channel Remediation	1,000	425

Installation of the measurement and metering technology will provide a more accurate calculation of water delivery through each section of the NVIRP area and will facilitate the identification of priority sites for repair or reconfiguration. **Stage 1 will therefore be predominately focussed on the Backbone modernisation while Stage 2 will be more related to Connections and rationalisation.**

Metering

There are 24,135 customer supply points in the NVIRP area, including 14,747 Dethridge meter outlets. Dethridge meters suffer from under-registration, particularly at low flows, and from leakage through and around the meter.⁶ Consequently, Dethridge meters will not meet the new National Metering Standards. Dethridge meters also are not appropriate for a modern irrigation system because they are prone to fluctuations in flow that create inefficiencies on farm, and are not amenable to automated remote control or meter reading.

The NVIRP will replace Dethridge meters with modern, accurate meters. MagFlow (magnetic flow) and FlumeGates™ (automated gates) will be used for irrigation meters, and mechanical meters will be used for small volume domestic and stock supplies. NVIRP has developed

⁶ In-situ REVS Testing of Large Dethridge Wheels in the GMID. (2008). Hydro Environmental Pty. Ltd. for Goulburn-Murray Water.
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principles to inform the selection of the type of meters to be installed at customer supply points. These principles aim to ensure that the meter meets the service requirements of the customer.

Connections to the Backbone

Farms are progressively increasing in size through property amalgamation. Irrigation infrastructure that was designed to service individual properties each with a 30 cow dairy herd, is now servicing a much larger consolidated property that manages 300 cows. As a result, much of the historic public connection system is now located within the boundaries of the larger properties, getting in the way of the farm operation.

The connection requirements of a modern farming enterprise are vastly different from the conditions of the original design. When a property changes its supply point from a spur or distribution channel to the Backbone, it is referred to as a 'new connection'.

Future connections (Stage 1) in the region will comprise four distinct groups:

- Existing connection to the Backbone (about 43% of current supply points) — A large number of supply points are already supplied off the Backbone. Changes to these existing connections will be limited to some rationalisation of outlets, all will be modernised and the level of service will be the new Backbone standard level of service;
- New connection to the Backbone (about 10% of current supply points) — These customers will seek a new connection to the Backbone. The connection could be individual or a private or public group, and could be supplied by a new pipeline or channel;
- Remaining existing customers (about 46% of current supply points) — These properties will continue to utilise the existing local distribution supply system (spurs) and outlets; and
- Rationalising of existing supply system (might be 1–5% of current supply points) — This will be achieved through the removal of outlets and connections from redundant channels at the end of the spur channels.

The major types of works that will achieve loss reduction and modern connections are likely to revolve around individuals or groups of individuals developing alternative connections involving the shifting of the meter to the Backbone and removal of public channels by:

- replacing channels with pipes, alternative channel supply route;
- water trade (i.e. effectively changing the location of the Delivery Shares);
- buying and selling properties;
- undertaking farm works to make channels obsolete;
- giving up an existing, unused supply point;
- providing alternative supply for a neighbour; and
- remodelling the channel (or operating it more efficiently) to incorporate it into the farm system.

Ancillary components of the project (eg. upgraded access roads, new high-pressure gas pipeline; off-site resource processing):

To accommodate traffic generation associated with the rehabilitation and/ or rationalisation of some channels, some improvements to the existing local road network may be required. The exact location of any road (or other access) upgrades has not been determined at this time. Any potential environmental impact of this work will be managed via the SEMP process described in section 18.

In addition, it is likely that the provision of mains power will be required via the expansion of the local electricity transmission network at selected sites. Whilst most upgraded channel regulators are able to be operated via solar power, mains power will be required for the operation of some of the larger structures, particularly offtake structures from the main channels. Also any pump stations associated with proposed pipelines will require a power supply. The exact location of where mains power may need to be provided has not been determined at this time. Any potential environmental impact of this work will be managed via the SEMP process described in section 18.

Key construction activities:

All of the proposed components of the project are essentially minor civil works that will be repeated at multiple locations. The works will be managed and executed by NVIRP and its contractors. Attachment 3 provides pictures of typical civil works.

The replacement of regulating structures involves the modification of the existing concrete superstructure of the regulators, the removal of the manual stop log fixtures and the installation of the new automatic gate structure. Other minor works include installation of radio telemetry components, solar power and walkways.

The upgrade of meters involves the removal of existing Dethridge wheels from their concrete emplacements. In most cases, the concrete emplacements will be removed and replaced with new electromagnetic flow meter in a pipe configuration or a gated weir arrangement in a concrete emplacement.

The targeted prioritisation and repair of channels potentially involves a range of construction activities, including earthworks to repair or replace sections of channel bank, and the installation of appropriate lining materials, such as plastic or clay, across the full cross section of the channel.

Many works will be scheduled to occur outside of the scheduled irrigation season (ie from mid May – mid August) to ensure that there is no impact on irrigation deliveries. During this period of time, channels will be either lowered or emptied.

Reconfiguration of the irrigation network involves rationalisation of local area channel systems to better match current and expected future land use and connection back to the backbone. A range of actions may form part of this process, including the decommissioning of existing infrastructure. Reconfiguration may involve the construction of new channels or pipelines or the relocation or installation of new meter outlets. Most reconfiguration works will be undertaken as part of Stage 2. The exact location and extent of new channels and pipelines cannot be known at this time. However, any new channel or pipeline construction would be undertaken in accordance with the EMS and likely occur across agricultural land.

Key operational activities:

Targeted channel remediation works will enable water to be saved by preventing seepage and leakage losses. Modernisation and reconfiguration involves re-designing irrigation systems based on the future needs of irrigators and the operation of the system – when completed it will reflect the different service delivery requirements of irrigators.

Once the NVIRP is complete, the upgraded irrigation network will be operated significantly more efficiently than at present, and will be more responsive to irrigator needs. Operation of the modernised irrigation system will be the responsibility of Goulburn-Murray Water (G-MW). G-MW will be responsible for delivering water in accordance with the Environmental Watering Plans for wetlands and waterways potentially affected by the project. As the system operator, G-MW will also release water savings from storage to meet the demands of the environment, irrigators and the Melbourne supply system.

Key decommissioning activities (if applicable):

Through the reconfiguration process, sections of the irrigation network will be identified that are no longer viable for economic or environmental reasons. In these cases, the existing irrigation infrastructure in these locations would be decommissioned. Before decommissioning occurs, a checklist will be developed to ensure that existing and future environmental needs, flood flow needs and water quality needs of any environmental features dependant on this infrastructure are appropriately managed.

Similarly, for areas where reconfiguration of the existing infrastructure involves the replacement of the open channel network with alternative supply systems, such as pipelines, there will be a requirement to decommission the existing open channel.

All decommissioning activities undertaken as part of the NVIRP will be managed via the SEMP process described in Section 18 to manage or mitigate any risk to environmental values.

Is the project an element or stage in a larger project?

No Yes If yes, please describe: the overall project strategy for delivery of all stages and components; the concept design for the overall project; and the intended scheduling of the design and development of project stages).

No

Is the project related to any other past, current or mooted proposals in the region?

No Yes If yes, please identify related proposals.

The current projects in the GMID that are related to the NVIRP are identified below.

1) Strategic Measurement Project

Commencing in 2006, the Strategic Measurement Project involved installing new continuous water measurement structures at strategically selected major channel off-takes and outfalls across the GMID. The Project provides important data on irrigation system losses, which have informed the design of the NVIRP works.

2) Reconfiguration Program

Goulburn-Murray Water is implementing a \$56 million reconfiguration program within the GMID that reviews, rationalises and re-invests in delivery infrastructure to address the changing needs of irrigators. Victorian Government policy is to take a consultative approach to reconfiguration, involving both customers and the broader community.⁷ To this end, G-MW has developed principles and methodologies to guide the development and implementation of reconfiguration. The existing G-MW managed reconfiguration program has now been integrated with the NVIRP.

3) Central Goulburn 1 - 4 and Shepparton Modernisation Projects

Parts of the Central Goulburn Irrigation Area and the Shepparton Irrigation Area and (identified on the plan in Attachment 1 as G-MW Modernisation Project – Shepparton IA and G-MW Modernisation Project – CG1, 2, 3 & 4) are the subject of separate projects for modernisation of irrigation infrastructure. These projects have trialled the technology to be used and have provided a good understanding of potential water savings, customer engagement and environmental monitoring.

4) Sugarloaf Pipeline Project (external to GMID)

The Sugarloaf pipeline will transfer the 75 GL average annual share of water savings from NVIRP assigned to supply Melbourne to Sugarloaf Reservoir. This project was the subject of a separate environmental referral made by the proponent, Melbourne Water Corporation.

⁷ *Our Water Our Future Victorian Government White Paper*. (2004). Victorian Government Department of Sustainability and Environment, Melbourne. P.82.

4. Project alternatives

Brief description of key alternatives considered to date (eg. locational, scale or design alternatives. If relevant, attach A4/A3 plans):

Given the nature of the irrigation system, the NVIRP is essentially a program of renewal and modernisation within the existing footprint, so an alternative external to this system was not considered. However, three project alternatives were considered for Stage 1:

- Option 1: Modernisation of all GMID channels with a capacity greater than 50 ML/day;
- Option 2: Modernisation of only those large channels which match demand, in order to tailor the works to reflect irrigation needs of the future; or
- Option 3: Do nothing.

Table 4 summarises the difference between Option 1 and Option 2 in terms of works components.

Table 4. Summary of difference in works components between Option 1 and Option 2.

Component of works	Option 1	Option 2 (preferred)
Channel Control Structures - gates	3,720	3,130
Length of channel automated (km)	3,200	2,650
Length of potential channel remediation (km)	1,230	1,000

To inform the selection of Option 2 (i.e. to determine the extent of channel automation), a methodology was developed to assess a number of attributes that are relevant to future irrigation in the region, including environmental considerations. This methodology assessed attributes such as:

- Suitability of land for irrigation, including sub-soil salinity, surface drainage and sub-surface drainage;
- Location of demand for irrigation water;
- Location of prime development zones;
- Alignment with pre-existing projects, such as the \$56-million reconfiguration program.

The methodology analysed future infrastructure requirements against tailored water supply services. This process enabled the design of the NVIRP Backbone works to focus upon automating those trunk and carrier channels that are likely to be required to deliver water to areas with a sustainable irrigation future.

The analysis drew together the relevant irrigation and land-use data from the GMID regional atlases, additional data held by Goulburn-Murray Water, and the knowledge gained through planning the GMID modernisation at a more local level.

Option 2 has been selected as the preferred approach to modernisation. The potential environmental impact would be comparable for Options 1 and 2, due to the very similar locations and nature of works.

Option 3 represents the baseline from which the potential environmental, social and economic impacts of Option 2 are evaluated.

Brief description of key alternatives to be further investigated (if known):

n/a

5. Proposed exclusions

Statement of reasons for the proposed exclusion of any ancillary activities or further project stages from the scope of the project for assessment:

Construction of the early works for the NVIRP has been excluded from the scope of the project for assessment. The early works consisted of the replacement of approximately 1,000 manual flow regulators and 1047 Dethridge meters, and rationalisation of 380 meter outlets, in the Central Goulburn, Rochester, Pyramid/Boort, Murray Valley and Torrumbarry irrigation areas, and commenced in May 2008. It was determined that these works could be excluded because they were minor civil works undertaken within the existing footprint of the channel network, and at sites where there is existing infrastructure. The early works were not expected to have any environmental impact or change to water flows to wetlands or waterways of environmental significance. The early works were managed via a specific Environmental Management System (EMS).

The current referral excludes any works associated with changing the fundamental operational protocols of on-line wetland storages and waterways, especially the Kerang Lakes in the Torrumbarry Irrigation System and Gunbower Creek and Pyramid Creek. This is because the operation of these on-line wetland storages and waterways will remain unchanged. The Kerang Lakes are Ramsar listed and any significant change to their operation, if required, would necessitate a separate referral.

6. Project implementation

Implementing organisation (ultimately responsible for project, ie. not contractor):

Implementation

The Northern Victoria Irrigation Renewal Project (NVIRP) has been established under the *State Owned Enterprises Act 1992* to implement the NVIRP (Stage 1). NVIRP will exist for the duration of the project.

NVIRP's key responsibility is to establish strong links with irrigators and the community to develop a timetable for works and the realisation of water savings. NVIRP is collaborating with regional agencies, including Goulburn-Murray Water, local government and catchment management authorities to capitalise on the project's social, economic and environmental benefits and link into current government programs and initiatives, to avoid duplication of effort across the region in delivering the project.

NVIRP will engage the expertise needed to deliver the various components of the project (i.e. to develop specific design and construction partnerships).

Ownership and Operation

Goulburn-Murray Water will be responsible for the on-going ownership and operation of the modernised irrigation system. (Goulburn-Murray Water is the trading name of the Goulburn-Murray Rural Water Corporation, which derives its powers from the *Water Act 1989* and is responsible to the Victorian Minister for Water.)

Goulburn-Murray Water provides rural water services (irrigation, stock and domestic) to 14,000 properties across the GMID.

Implementation timeframe:

Stage 1 of the NVIRP is expected to commence in May 2009 to be completed by 2012, with works undertaken each year. The water savings will be delivered progressively to beneficiaries.

A timeline for Stage 2 of the NVIRP has not been finalised yet.

Proposed staging (if applicable):

The installation of channel automation technology is a necessary precursor to any channel remediation works. By accurately measuring water levels, channel automation technology enables high loss (high leakage and seepage) sections of the channel to be identified and targeted for repair.

The requirement to monitor flows more accurately using the newly installed automation technology means that the exact location and timing of all channel remediation works cannot be provided at this time. For this reason, implementation of the channel remediation works is proposed to be undertaken within a project Environment Management Strategy that will identify potential environmental sensitivities and develop mitigation measures, where required that prevent or minimise project impacts on any environmental values (see section 18).

The consultative approach taken to the Connections program requires a substantial lead time before construction, to work with customers to tailor individual supply arrangements most suited to their business.

7. Description of proposed site or area of investigation

Has a preferred site for the project been selected?

No Yes If no, please describe area for investigation.

If yes, please describe the preferred site in the next items (if practicable).

The works are located within the GMID (see Attachment 1- excludes Shepparton Irrigation Area and Central Goulburn Channels 1-4)).

There is no 'preferred site(s)' for the NVIRP works given that the location of works will be determined progressively as accurate measuring technology identifies infrastructure at discrete sites throughout the GMID that require work. The precise location of works will be determined based on the SEMP's discussed in section 18.

General description of preferred site, (including aspects such as topography/landform, soil types/degradation, drainage/ waterways, native/exotic vegetation cover, physical features, built structures, road frontages; attach ground-level photographs of site, as well as A4/A3 aerial/satellite image(s) and/or map(s) of site & surrounds, showing project footprint):

The NVIRP works will be undertaken at locations within or immediately adjacent to the existing irrigation infrastructure (see Attachment 1). Given the extensive area of the GMID, a detailed response is not possible.

Site area (if known): (hectares)

The NVIRP covers an area of approximately 68,000 km² in the GMID, between Nyah and Yarrawonga in northern Victoria.

Route length (for linear infrastructure) (km) **and width** (m)

Within the 86% of the GMID that forms the project area of the NVIRP there are approximately 6,200 km of irrigation supply channels. Works associated with the NVIRP will be undertaken at locations throughout the extent of this existing infrastructure.

Current land use and development:

The NVIRP area is currently farmland used for irrigated agriculture and horticulture. Major enterprises are dairying, stone and pome fruit and citrus production, viticulture along with some beef cattle and sheep grazing. The area is predominantly private landholdings, along with some areas of public land. The proposed works will be mainly on the existing irrigation channels.

Waterways and wetlands potentially affected by the operation of the rehabilitated irrigation system comprise public natural waterways (some of which are used as natural irrigation carriers) and wetlands, most of which are currently set aside as water reserves or conservation reserves.

Description of local setting (eg. adjoining land uses, road access, infrastructure, proximity to residences & urban centres):

The NVIRP area is situated in a rural setting that has evolved into its current configuration as a result of the development of irrigated agriculture. The region is typically closely settled with relatively high population densities relative to regions dominated by other types of agriculture.

Regional features include:

- Shepparton is the regional centre with a population of around 40,000;
- Numerous medium sized towns acting as local service centres for the surrounding agricultural enterprises (Yarrawonga, Cobram, Numurkah, Nathalia, Mooropna, Tatura, Kyabram, Rochester, Echuca, Cohuna, Kerang, Swan Hill);
- Other small townships that provide limited services to the surrounding area, but act as a community hub;
- The northern boundary of the GMID is the River Murray and its associated public lands; and
- Murray Valley Highway, Midland Highway, Goulburn Valley Highway, Calder Highway and several rail lines.

Planning context (eg. strategic planning, zoning & overlays, management plans):

The Farming Zone is the key zone to affect the NVIRP. The irrigation infrastructure of the GMID is also located within a range of other zones within the seven local government areas in the project area. These other zones include:

- Industrial Zone 1
- Township Zone
- Residential 1 Zone
- Rural Living Zone
- Low Density Residential
- Public Use Zone – Service and Utility
- Public Use Zone – Transport
- Public Park and Recreation Zone
- Public Conservation and Resource Zone
- Road Zone
- Special Use Zone.

Key overlays and Schedules which apply include:

- Land Subject to Inundation Overlay — located throughout the project area along the majority of the waterways
- Heritage Overlay — predominately located in townships throughout the project area, however, some areas in rural areas are affected
- Rural Floodway Overlay — located throughout the project area along a significant amount of the waterways
- Environmental Significance Overlay — located in the north-west of the project area surrounding the towns Quambatook, Kerang, Cohuna, Koondrook and Lake Boga
- Wildfire Management Overlay — located in the east of the project area, extending from the Shepparton area, through Murchison, Rushworth and Nagambie
- Restructure Overlay — significant areas include an area east of Echuca and along Elmore-Raywood Road Kamarooka
- Vegetation Protection Overlay — scattered throughout the project area
- Salinity Management Overlay — significant areas are located around Dookie, north-west of Murchison and the area around Heathcote-Rochester Road.

Maps showing additional detail of the location of these zones and overlays can be found in Attachments 4A and 4B

Local government area(s):

The NVIRP works are located within the following Local Government Areas:

- Shire of Moira
- City of Greater Shepparton
- Shire of Campaspe
- City of Greater Bendigo
- Shire of Loddon
- Shire of Gannawarra
- Rural City of Swan Hill

A map showing the relevant Local Government Areas is contained in Attachment 5.

8. Existing environment

Overview of key environmental assets/sensitivities in project area and vicinity (cf. general description of project site/study area under section 7):

The GMID is located in the northern parts of the Goulburn-Broken and North Central Catchment Management Authority Regions. The irrigation areas comprising the GMID are located in the Victorian Riverina, Murray Fans, Goldfields, Northern Inland Slopes and Murray Mallee Bioregions.

Development of intensive irrigated agriculture throughout the GMID has significantly impacted on the environmental values of the region. Native vegetation is extremely limited in its extent and quality. For example, 93% of native vegetation the Victorian Riverina has been cleared in the Goulburn-Broken Catchment.⁸ Agricultural practices, such as land-forming, have resulted in a significant reduction in the extent of wetland areas throughout the GMID (particularly ephemeral wetlands). These factors have contributed to an overall decline in the availability of potential habitat for native flora and fauna, and a reduction in the abundance and diversity of native flora and fauna across the region.

The environmental potential risks (sensitivities) related to the NVIRP are:

- The impact of reduced irrigation losses on remaining wetlands;
- The impact of reduced irrigation losses on waterways;
- Impact of works construction on remnant native vegetation located on or adjacent to channels.

⁸ Threatened flora and fauna species and non-threatened vertebrate fauna in the Goulburn Broken Catchment: status, trends and management (2002). Report for the Goulburn-Broken Catchment Management Authority by Paul Ryan, Ecolines Environmental Services.
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9. Land availability and control

Is the proposal on, or partly on, Crown land?

No Yes If yes, please provide details.

The channel upgrades and remediation works will be undertaken within freehold reserves and easements owned and managed by Goulburn-Murray Water. However, it is possible that some works may be undertaken on Crown Land. It is proposed that a process for confirming the land tenure of all works sites be undertaken by NVIRP and where necessary, the appropriate consents and licences will be sought from DSE Public Land Management.

Current land tenure (provide plan, if practicable):

Most of the channel upgrades and remediation works will be undertaken within easements owned and managed by Goulburn-Murray Water. Parts of the works might be undertaken on Crown Land, but where possible this will be avoided.

In addition, works may need to be undertaken on private land where an easement has not been applied or as a result of reconfigurations or the installation of a new pipeline. In these cases, a new easement will be sought.

Intended land tenure (tenure over or access to project land):

Some channel upgrades and reconfiguration works may need to be undertaken on private land where an easement has not been obtained or as a result of reconfigurations or the installation of new infrastructure. In these instances a new freehold reserves will be sought.

The reconfiguration of some parts of the irrigation network may result in changes to land tenure.

Other interests in affected land (eg. easements, native title claims):

The works proposed to be undertaken are within the clans areas of multiple Aboriginal groups who are at various stages within the process of application for Native Title determination. The relevant Native Title Claims include:

- Dja Dja Wurrung Peoples (active claim);
- Wamba Wamba, Barapa Barapa and Wadi Wadi Peoples (active claim);
- Yorta Yorta Clans (a determination has been made that native title does not exist over the claim area); and
- Taungarung Peoples (claim discontinued)

The NVIRP will be undertaken in accordance with the requirements of the *Native Title Act 1993* [Commonwealth] in relation to native title.

10. Required approvals

State and Commonwealth approvals required for project components (if known):

The following statutory considerations and consents may be required for the project:

- Relevant authorisations and consents under the *Planning and Environment Act 1987* to provide for buildings and works, removal of native vegetation and preparation of an Offset Plan, creation or removal or variation of easements, establishment of project infrastructure or the acquisition of land (as required);
- A Cultural Heritage Management Plan approved in accordance with the *Aboriginal Heritage Act 2006*;

Discussions are taking place with Aboriginal Affairs Victoria and local Aboriginal community groups to confirm requirements with regard to this Act, specifically the requirement to prepare a Cultural Heritage Management Plan(s).

- Permits to take native flora under the *Flora and Fauna Guarantee Act 1988*;

It is considered unlikely that this Act will be triggered because works will occur on freehold land (predominantly G-MW freehold reserve and easements), rather than Crown land. However, any requirements will be dealt with via the process proposed for compliance within the Site Environmental Management Plans proposed to be prepared for all construction activities.

- Consents under a range of acts such as the *Land Act 1958* and the *Crown Land (Reserves) Act 1978* to enable access to and use of public land for project infrastructure.

Should work be required to be undertaken on Crown Land, appropriate consents and licences will be sought from DSE Public Land Management.

Consents may also required under Acts such as the *Water Act 1989* and the *Water Industries Act 1994* if waterways are impacted upon. Consents may also be required under the *Fisheries Act 1995*, *Wildlife Act 1975*, *Road Management Act 2004* and *National Parks Act 1975*.

In addition, the project will be referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* for a decision on whether approval is required under that Act.

Have any applications for approval been lodged?

No Yes If yes, please provide details.

No

Approval agency consultation (agencies with whom the proposal has been discussed):

The NVIRP has been discussed with the Department of Planning and Community Development (Environment Unit), and the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA).

Other agencies consulted:

Other agencies consulted include Heritage Victoria (DPCD), Department of Primary Industries, Goulburn-Broken Catchment Management Authority, North Central Catchment Management Authority, Goulburn-Murray Water and the Department of Sustainability and Environment (Flora and Fauna, Public Land Management, Office of Water).

PART 2 POTENTIAL ENVIRONMENTAL EFFECTS

11. Potentially significant environmental effects

Overview of potentially significant environmental effects (identify key potential effects and comment on their significance and likelihood, as well as key uncertainties):

A number of environmental effects may result from the implementation of the NVIRP. These may either relate to construction activities or ongoing system operation.

Construction Impacts

The first sub-set of environmental impacts associated with the NVIRP may occur during the construction phase of the project. These impacts potentially relate to terrestrial flora and fauna. The exact locations where all the channel upgrades and reconfiguration works are to take place have not been determined.

It is considered that any impact of construction work would be minor because the majority of these works will take place in sites that have suffered from historical disturbance via the original construction and ongoing maintenance of the existing infrastructure. However, potential impacts of construction works at each location will be assessed and managed at the appropriate time through the Environmental Management System (described in section 18).

Operational Impacts

Given that the focus of the project is improvement in the overall efficiency of the irrigation infrastructure in the GMID, the majority of these operational environmental effects relate to water environments. Attachment 6 (Final Report) details all of the environmental impact assessments undertaken for water environments. Water environments are divided into three main categories, namely:

Waterways

Changes in the delivery patterns of bulk irrigation water via natural waterways (rivers and streams) may impact on aquatic environments in waterways such as the Goulburn, Campaspe, Loddon and Murray Rivers. An assessment of the likely impact on the flow regime of these waterways has been undertaken (see Attachment 6, chapter 5), which has concluded that, generally, the NVIRP is likely to change flow patterns in the major rivers to bring them marginally closer to their natural flow regime than at present. In doing so, the flow regimes in these rivers will be brought marginally closer to that recommended by scientists in studies of environmental flow requirements for the river systems. (This is discussed further in section 13).

An assessment of the potential impact of reduced channel outfalls on waterways in the GMID has identified 16 waterways where the reduction in outfalls, as a result of the NVIRP, has a potential environmental impact, or where there is insufficient information to make a determination at this time (see section 13, and Attachment 6, chapter 6 for details of the assessment methodology). A process is proposed to more accurately assess any impact and develop a management strategy, including Environmental Watering Plans, for each of these waterways to minimise and mitigate any negative impacts. This is explained in more detail in section 13.

Groundwater

Reduction in leakage and seepage from the irrigation network are likely to reduce accessions to regional groundwater (see Attachment 6, chapter 7). It is considered that this impact will be beneficial, particularly in terms of reduced salinisation.

Wetlands

An assessment of the potential impact of reduced channel outfalls on the 1137 wetlands in the GMID identified 23 wetlands which contain significant values and which may experience potentially significant hydrological change, as a result of the NVIRP (see section 13, and Attachment 6, chapter 8 for details of the assessment methodology). A subsequent 'groundtruthing' report for these 23 wetlands has now been completed and has prioritised the development of Environmental Watering Plans for 10 wetlands that have been confirmed as impacted by NVIRP works. This report reviewed the findings of the desktop report (refer to Attachment 6) in more detail including on-site inspections and found that of the 23 wetlands previously identified only these 10 would be impacted by NVIRP works and specifically reduced outfalls. Furthermore, reductions in summer wetting may lead to a watering regime that more closely resembles the natural wetting and drying patterns. Where environmental values in these wetlands have become dependant on the artificial watering regime, this will be taken into consideration in their Environmental Watering Plan.

12. Native vegetation, flora and fauna

Native vegetation

<p>Is any native vegetation likely to be cleared or otherwise affected by the project?</p> <p><input type="checkbox"/> NYD <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes If yes, answer the following questions and attach details.</p>
<p>Yes</p> <p>The NVIRP will be managed in accordance with the requirements of <i>Victoria's Native Vegetation Management Framework</i>, and will apply the three-step approach to Net Gain⁹, namely:</p> <ol style="list-style-type: none"> 1. Avoidance of vegetation clearance and other adverse impacts, where possible; 2. Minimising impacts through appropriate consideration in planning processes; 3. Identifying appropriate offset options. <p><u>1. Avoidance of vegetation clearance and other adverse impacts</u></p> <p>Working within the existing channel footprint will enable clearance of native vegetation to be avoided for most activities. Where pipelines or new channels are to be constructed, the route will avoid native vegetation, where possible.</p> <p>The Site Environmental Management Plans will require that significant flora be identified and noted on all design and construction drawings. All areas containing flora of local, State or national significance are to be physically protected prior to any works. These areas are to be identified to all relevant personnel.</p> <p>The Site Environmental Management Plans also will require that appropriate action is taken to avoid the spread of weeds and disease, which could otherwise reduce the quality of native vegetation.</p> <p><u>2. Minimising impacts through appropriate consideration in planning processes</u></p> <p>The Site Environmental Management Plans will provide for minimising impacts of works on native vegetation, through requiring that contractors erect temporary fencing around vegetation to be retained, prior to any work on site. The area to be fenced will include a buffer around vegetation to ensure no heavy machinery movement over the root zone because such disturbance has the potential to damage or kill vegetation.</p> <p><u>3. Identifying appropriate offset options</u></p> <p>It is likely that there will be a requirement to remove or disturb some vegetation in order to complete some parts of the irrigation system infrastructure upgrade. As most of the works will be undertaken on land surfaces that have been modified by past channel and infrastructure construction, the associated vegetation is unlikely to represent remnant native vegetation. Where remnant original native vegetation is affected, the offset requirements of the native vegetation planning provisions will apply.</p> <p>Prior to any works being planned, the construction contractor will be required, through Site Environmental Management Plans, to investigate the extent of native vegetation to be removed, document its quality (habitat score or scattered tree size) and determine the offset target. NVIRP will be responsible for identifying and securing the necessary offset by consolidating offsets from the project into one offset plan for valuable remnant areas of indigenous vegetation within the appropriate bioregion.</p>
<p>What investigation of native vegetation in the project area has been done? (briefly describe)</p> <p>No formal investigation into the potential impact on terrestrial native vegetation has been undertaken as the exact location of works to be undertaken is yet to be determined.</p>

⁹ *Victoria's Native Vegetation Management: a Framework for Action* (2002). Victorian Government, Melbourne.
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What is the maximum area of native vegetation that may need to be cleared?

NYD Estimated area(hectares)

The maximum area of native vegetation that could potentially be cleared has not yet been determined. No large-scale clearance of native vegetation is proposed as part of the NVIRP. Any removal of native vegetation will be incidental and only to the extent required to complete construction works. Impacts on native vegetation will be managed through contractor Site Environmental Management Plans, local planning provisions and permits and in accordance with the requirements of *Victoria's Native Vegetation Management Framework*.

How much of this clearing would be authorised under a Forest Management Plan or Fire Protection Plan?

N/A approx. percent (if applicable)

Which Ecological Vegetation Classes may be affected? (if not authorised as above)

NYD Preliminary/detailed assessment completed. If assessed, please list.

The NVIRP will be implemented throughout the GMID, which is located within the Victorian Riverina, Murray Fans, Murray Mallee, Goldfields and Northern Inland Slopes Bioregions. Native vegetation across much of this area is highly fragmented with only small patches of native vegetation remaining. Typically the landscape is dominated by irrigated agriculture (including irrigated pasture, horticulture and viticulture).

A large range of Ecological Vegetation Classes (EVCs) are located in the immediate area of the proposed works. However, any impact on these EVCs has not been determined, due to the exact location of work not having been confirmed. A complete list of EVCs in the GMID can be found in Attachment 7. The following indicates the number of EVCs for each Bioregion:

- Victorian Riverina Bioregion — 55 EVCs
- Murray Fans Bioregion — 49 EVCs
- Murray Mallee Bioregion — 15 EVCs
- Northern Inland Slopes Bioregion — 7 EVCs
- Goldfields Bioregion — 6 EVCs

The Bioregional Conservation Status of these EVCs varies. Many are listed as being endangered or vulnerable due to the extent of past vegetation removal.

Have potential vegetation offsets been identified as yet?

NYD Yes If yes, please briefly describe.

No potential native vegetation offsets have been identified at this stage because the extent of impact on native vegetation is yet to be determined. Any vegetation clearance will be managed in accordance with the requirements of *Victoria's Native Vegetation Management Framework*.

Other information/comments? (eg. accuracy of information)

NYD = not yet determined

Flora and fauna

What investigations of flora and fauna in the project area have been done?

(provide overview here and attach details of method and results of any surveys for the project & describe their accuracy)

Specific investigations relating to impacts on terrestrial flora and fauna from construction activities have not been undertaken at this stage due to uncertainty regarding the location of any construction activities that may impact on terrestrial biodiversity values. Most of the proposed construction activities will be undertaken at sites that have previously been disturbed via the initial construction and ongoing maintenance of the irrigation infrastructure. Potential impacts of construction works on flora and fauna will be assessed through the EMS and Site Environmental Management Plans discussed in section 18.

The operational impact of changes in water flow on flora and fauna has been considered. A desktop assessment of the flora and fauna values associated with the wetlands and waterways in the GMID has been completed (see Attachment 6, chapters 6 and 8). The assessment of the potential impact of reduced channel outfalls on waterways and wetlands which contain significant values, and which may be negatively impacted upon by the NVIRP, is discussed in section 13 and in the Attachment 6, chapters 6 and 8). A subsequent 'groundtruthing' report for these 23 wetlands has now been completed and has prioritised the development of Environmental Watering Plans for 10 wetlands that have been confirmed as impacted by NVIRP works. (Refer to Attachment 11) This process referred to in section 18 discusses the need to develop and implement an Environmental Watering Plan for each of these waterways and wetlands to minimise and mitigate any potential negative impacts.

Have any threatened or migratory species or listed communities been recorded from the local area?

NYD No Yes If yes, please:

- List species/communities recorded in recent surveys and/or past observations.
- Indicate which of these have been recorded from the project site or nearby.

A range of threatened or migratory species have been recorded throughout the GMID. This list can be found in Attachment 8. A total of 275 threatened or migratory species have historically been recorded. This list is extremely large and represents all of the records from a project area of 68,000 km².

Most of the proposed construction activities will be undertaken at sites that have previously been disturbed via the initial construction and ongoing maintenance of the irrigation infrastructure. In view of the low likelihood and frequency of disturbance to habitat of threatened or migratory species, it is anticipated that any potential environmental impact of this work on listed threatened or migratory species can feasibly be managed via the EMS and SEMP process described in section 18.

If known, what threatening processes affecting these species or communities may be exacerbated by the project? (eg. loss or fragmentation of habitats) Please describe briefly.

The most significant threatening process with regard to these species relates to changes in the wetting and drying regime of some wetlands, or changes in water flows in waterways, as a result of reductions in channel outfall water.

At this stage, 16 waterways have been identified where a change in water regime due to the NVIRP may have a negative impact on important ecological values, or where there is insufficient information to make a determination at this time. (refer to Attachment 6) In each of these instances a management and mitigation strategy is proposed in order to minimise and mitigate these impacts. A 'groundtruthing' report of the 23 wetlands identified in the desktop assessment as being potentially impacted by NVIRP has now been completed and has prioritised the development of Environmental Watering Plans for 10 wetlands. This report reviewed the findings of the desktop report (refer to Attachment 6) in more detail including on-site inspections and found that of the 23 wetlands previously identified only these 10 would be impacted by NVIRP works and specifically reduced outfalls. Additional detail on these measures can be found in section 13. The relevant wetlands and waterways for which mitigation plans may be developed are listed in Tables 7 and 8.

Are any threatened or migratory species, other species of conservation significance or listed communities potentially affected by the project?

NYD No Yes If yes, please:

- List these species/communities;
- Indicate which species or communities could be subject to a major or extensive impact (including the loss of a genetically important population of a species listed or nominated for listing) Comment on likelihood of effects and associated uncertainties, if practicable.

Wetlands

The regional wetland impact assessment process (see Attachment 6, chapter 8) identified that there were 23 wetlands in the GMID with significant environmental values that could have their wetting regime substantially altered as a result of the implementation of the NVIRP, or for which there was insufficient information to make a determination. Specifically this relates to the reduction in channel outfalls associated with project implementation.

A subsequent 'groundtruthing' report for these 23 wetlands has now been completed and has prioritised the development of Environmental Watering Plans for 10 wetlands that have been confirmed as impacted by NVIRP works. Table 5 below identifies threatened species under the *Flora and Fauna Guarantee Act 1988*, the number of potentially impacted wetlands where these species have been recorded and the total number of wetlands in the GMID where they have been recorded.

Table 5. Species listed as threatened under the *Flora and Fauna Guarantee Act 1988* recorded at the 23 short-listed wetlands.

Threatened Species Name	Total number of potentially impacted wetlands where species recorded	Total number of wetlands in GMID where species recorded
Fish		
Murray Hardyhead	1	7*
Amphibians		
Growthling Grass Frog	2	21
Birds		
Baillon's Crake	1	16
Blue-billed Duck	7	47
Brolga	5	66
Caspian Tern	4	39
Freckled Duck	8	53
Great Egret	15	222
White-bellied Sea-Eagle	3	60
Intermediate Egret	5	46
Little Egret	2	28

* Note that due to taxonomic difficulties, some older records of Murray Hardyhead may be inaccurate.

Fish

Murray Hardyhead *Craterocephalus fluviatilis* [information on this species is drawn from the National Recovery Plan for the Murray Hardyhead *Craterocephalus fluviatilis* (2008), G. Backhouse, J. Lyon & B. Cant, Victorian Government Department of Sustainability & Environment.]

The threatened Murray Hardyhead is a small freshwater fish endemic to the low Murray-Darling River system in Victoria, South Australia and New South Wales. The fish typically occurs in still waters, such as lakes. There is a population of Murray Hardyhead in Round Lake — one of the 10 wetlands requiring the development of Environmental Watering Plans. One other wetland, Lake Elizabeth, historically held population of the species, but these populations are no longer extant.

The extended drought is a major threat to the Murray Hardyhead, with record-low flows in the Murray River resulting in much wetland habitat drying, and increasing salinity in remanent habitat

Four populations are suspected of being lost since 2000. Surveys within the last 10 years have confirmed the presence of Murray Hardyhead in four wetlands in Victoria: Round Lake, Woorinen North Lake, Cardross Lakes and Lake Hawthorn.

In 2002, the condition of Round Lake for Murray Hardyhead was described as moderate to poor, due to low water level, high turbidity and possible high nutrient levels. Since 2001-02, the wetland has received water from an environmental water allocation, in addition to irrigation outfalls, to maintain suitable water quality. The volume of water outfallen to Round Lake has been substantially reduced during the drought period, as a result of low irrigation allocations and "tighter" operation of the delivery system. In recent years, the volume of water from the environmental water allocation has substantially exceeded the volume from irrigation outfalls (e.g. from 2004–2006, the average environmental allocation to the Lake was 250 ML/yr and the average outfall water was 130 ML/yr). Emergency watering of Round Lake using 518 ML, was undertaken in October 2007 to prevent the habitat being lost due to the drought.

Round Lake currently does not have an official management plan. An Environmental Watering Plan for this wetland would focus on maintaining the Murray Hardyhead population, by establishing a legal requirement to provide a volume of water to Round Lake to replace that water which previously spilled to the wetland from outfalls. Any Watering Plan would source additional water to maintain the fish population. Thus, the NVIRP would result in more deliberate and controlled management of the wetland for environmental values.

Amphibians

Growling Grass Frog or Southern Bell Frog *Litoria raniformis*

The threatened Growling Grass Frog is a large frog, endemic to south-eastern Australia, including Victoria, New South Wales, Tasmania and the Australian Capital Territory. The species occurs throughout much of Victoria, excluding arid and alpine regions. Typical habitat for the species in Victoria is the edge of permanent water, particularly still or slow-flowing water, including streams, lakes, farm dams and irrigation channels, where there is abundant aquatic vegetation.

The Growling Grass Frog has been recorded at two out of the 10 wetlands requiring development of Environmental Watering Plans, being Johnson Swamp and Little Lake Boort. (However, an absence of record does not preclude the species from being present at other wetlands). The records are incidental and do not indicate the relative importance of these wetlands as Growling Grass Frog habitat. It is therefore difficult to determine whether water regime changes at these wetlands would have a substantial impact on the abundance, distribution and viability of the species throughout the GMID.

Reduction of inflows to wetlands generally is recognised as a threat to the Growling Grass Frog. Thus, without mitigation action the NVIRP could have some impact on the suitability of some wetland habitat for the species. The Environmental Watering Plans will take into account the ecological management objectives for the wetlands.

The Growling Grass Frog, particularly tadpoles, cannot tolerate high salinity levels. Therefore, the reduction in salinisation resulting from NVIRP is expected to benefit the species; however, this benefit cannot be quantified.

The range of the threatened Giant Bullfrog *Limnodynastes interioris* also includes part of the GMID, although the species has not been recorded at any of the short-listed wetlands. The Giant Bullfrog is largely restricted to the floodplains of the Murray River.

Birds

Many waterbirds, including most of the threatened species in the table above and migratory species in the table below, occur across most of the state in a range of wetlands in varying numbers, depending on the size of the wetland. Furthermore, these species are highly mobile, moving from place to place in response to rainfall and runoff to wetlands. These aspects of their behaviour make them comparatively adaptable to changes in wetland condition and the advent of Environmental Watering Plans is expected to enhance habitats for most species in the affected wetlands. Therefore, the risk of a significant impact on these waterbirds from changes in the water regime at wetlands arising from the project is considered very low.

Table 6. Migratory waterbird species recorded at the 23 short-listed wetlands.

Migratory Species Name (JAMBA/CAMBA)	Total number of potentially impacted wetlands where species recorded	Total number of wetlands in GMID where species recorded
Caspian Tern	4	39
Glossy Ibis	4	42
Great Egret	15	222
Latham's Snipe	3	48
White-bellied Sea-Eagle	3	60
Wood Sandpiper	1	4

Brolga *Grus rubicunda* [information on this species is drawn from the Action Statement for Brolga (2003). Victorian Government Department of Sustainability & Environment.]

The threatened Brolga warrants specific mention because it breeds at some of the short-listed wetlands, and pairs display fidelity to breeding sites. The Brolga is a large crane with populations occurring in northern and south-eastern Australia. Within Victoria, Brolga occur in the north and southwest of the State, with the northern population in the GMID numbering about 60–70 birds. The species feeds in wetlands, including deep freshwater marshes and permanent water, as well as on terrestrial areas, such as vegetable crops. Shallow freshwater marshes with emergent vegetation are preferred breeding habitat.

There are records of Brolga at five of the 23 short-listed wetlands [note that Bray's Swamp is listed twice — as two "cells" of the same wetland complex]. The current extent of management for Brolga varies widely between wetlands. Bray's Swamp is activity managed to support breeding of Brolga and other waterbirds. The management plan and associated land holder agreement are regularly updated¹⁰ Other wetlands with records of Brolga currently do not have management plans (e.g. Hunt's Swamp), and are not actively managed for the species.

The Brolga is threatened by loss of wetland habitat. For example, since European settlement the area of shallow freshwater marshes in the Goulburn-Broken and North-Central regions has declined by 40% and 59% respectively. Alteration of flood regimes in wetlands associated with irrigation threatens Brolga, as it may cause nest abandonment. Finally, salinisation may reduce the suitability of wetland habitat.

The 23 wetlands originally short-listed for further investigation and development of Environmental Watering Plans represents a significant proportion of the remaining area of shallow freshwater marshes (18%) and deep freshwater marshes (14.5%) in the GMID (see Attachment 6, chapter 8).

The development of Environmental Watering Plans will enable careful control of watering regimes to provide more suitable conditions for Brolga. NVIRP will enable deliberate provision of water at favourable times, as well as providing greater control to facilitate exclusion of irrigation water from wetlands at times when allowing water levels to recede is necessary to support breeding.

¹⁰ Bray's Swamp Wetland Management Plan (2001/2008). Victorian Government Department of Primary Industry, Tatura.

Waterways

The potential presence of threatened species in waterways potentially affected by the NVIRP was also considered in determining the necessity for further investigation and mitigation of potential impacts.

Trout Cod *Maccullochella macquariensis* [information on this species is drawn from the National Recovery Plan for the Trout Cod *Maccullochella macquariensis* (2008), Trout Cod Recovery Team, Victorian Government Department of Sustainability & Environment.]

The threatened Trout Cod is a large freshwater fish endemic to the Murray-Darling System. Only one natural population remains in the wild — in the Murray River (NSW) between Yarrowonga Weir and Barmah Forest. The species appears to favour deep pools with snags in relatively fast-flowing streams.

Historically, there were wild populations of Trout Cod in the Goulburn, Broken and Campaspe Rivers. However, there have been no recent records of wild adult Trout Cod in these rivers, and the natural populations are probably extinct. Following restocking of the Goulburn River, a spawning population of Trout Cod was established. However, no Trout Cod has been recorded in the Goulburn since the massive fish kill event of January 2004.

River regulation and extraction of water for irrigation are listed as threats to the Trout Cod. The lower reaches of the Goulburn River currently receives some outfall water from the irrigation system. This volume of outfall water will reduce under NVIRP. However, there is an existing requirement to provide for minimum environmental flows in the lower Goulburn River. This obligation will continue with water being released from storage to maintain minimum flows.

Overall, NVIRP will shift flows in the Goulburn River and Murray River marginally towards a more natural pattern of lower summer-autumn flows and higher winter-spring flows. The availability of up to 175 GL/yr of additional water for environmental flows resulting from NVIRP might provide a benefit to the Trout Cod in the Murray River and in the Goulburn River (if any Trout Cod are extant); however understanding of flow requirements of Trout Cod is insufficient to determine if this would provide a benefit to the Trout Cod. The availability of additional environmental water could enable releases to maintain water quality, thereby potentially preventing fish kill events, such as that which occurred in the Goulburn River in January 2004. However, fish kills may occur without warning and without obvious cause.

Murray Cod *Maccullochella peelii peelii* [information on this species is drawn from Management of Murray Cod in the Murray-Darling Basin: Statement, recommendations and supporting papers (2005), M. Lintermans & B. Phillips (eds) Proceedings of a workshop held in Canberra ACT, 3–4 June 2004, Murray-Darling Basin Commission, Canberra.]

The threatened Murray Cod is a very large, freshwater fish that is endemic to the Murray-Darling River System. The species typically inhabits the main channel of turbid rivers where there is favourable habitat, such as snags or under-cut banks. The Murray Cod has undergone a substantial decline in the Victorian tributaries of the Murray River.

Murray Cod are present in the major waterways in the GMID, including the lower Goulburn River, Broken Creek, Loddon River, Campaspe River, Avoca River and Gunbower Creek. As for other native fish, Murray Cod have suffered from fish kills in recent years in several river systems, including the Goulburn, Loddon and Campaspe Rivers and Broken Creek.

There is a broad range of threats to the Murray Cod, ranging from climate change and illegal fishing to genetic issues associated with stock and translocation. Reduced river flows and poor water quality, particularly salinisation, are threats to the Murray Cod. The additional water provided by the NVIRP is expected to benefit the Murray Cod. As with Trout Cod, the linkages between hydrological conditions and population response are not well understood, so that it is not possible to quantify benefits to fish populations. However, there is some evidence that Murray Cod recruitment is more successful in years with higher flows following spawning.

The NVIRP is expected to be neutral with respect to other threats to Murray Cod from the

irrigation system, namely loss of fish into irrigation channels and water-quality problems that might be associated with the use of herbicides to control aquatic weeds in channels.

Other riverine species

The Murray Hardyhead, Trout Cod and Murray Cod are also members of the Lowland Riverine Fish Community of the Southern Murray-Darling Basin, which is listed as Threatened under the *Flora and Fauna Guarantee Act 1988*. Other members of the Lowland Riverine Fish Community, including the Freshwater Catfish *Tandanus tandanus* and Silver Perch *Bidyanus bidyanus*, occur in the waterways of the GMID. The responses of these species to NVIRP are expected to be similar to the responses for Trout Cod and Murray Cod described above.

The Broad-shelled Turtle (*Chelodina expansa*) is listed on the Department of Sustainability and Environment's Advisory listed of rare and threatened fauna. This species is also listed on the Victorian *Flora and Fauna Guarantee Act 1988* as a protected species. The Broad-shelled Turtle inhabits permanent streams and waterholes throughout its range, but is essentially a river turtle (Cogger 2000). Most records of species in Victoria are from the River Murray and associated habitats.

The Broad-shelled Tortoise survivability depends upon permanency of water levels in the Turtle's habitat. Long term survivability of this species may also be negatively impacted by predation of nesting sites by foxes; habitat loss through anthropogenic causes, excessive water salt and turbidity levels (Goodwin and Hopkins 2005). Decrease of flood frequency due to river regulation and compaction of the floodplain have also reduced the vigor of this species (Goodwin and Hopkins 2005).

Effective management of environmental water, control of pest animals (pigs and foxes), rehabilitation of riparian and wetland ecosystems and incorporation of large woody debris back into river systems may enhance the long term viability of this species

The proposed NVIRP will have an insignificant impact on flow regimes and water levels in the River Murray. In addition, environmental watering plans for wetlands and streams will ensure that where this species is potentially affected by this project, its water requirements will be taken into consideration. In view of this, significant impacts on this species are not anticipated.

Is mitigation of potential effects on indigenous flora and fauna proposed?

NYD No Yes If yes, please briefly describe.

The operational impact of changes in water flow on threatened, migratory or listed species has been considered of particular importance as the intensity of agriculture throughout much of the region has significantly altered environmental conditions, such that there are very few areas remaining other than wetland areas that support listed threatened species.

As discussed above, the risks to wetlands and waterways and in particular listed threatened and migratory species, is considered to be low and mitigation, including enhancement of habitats, is considered to be highly feasible, given the success of watering plans in wetlands elsewhere in the region.

A formal process is proposed for the mitigation of significant impacts on the 10 impacted wetlands and 16 potentially impacted waterways as a result of the NVIRP (see section 18). One of the key aspects of this process will be a detailed determination of the biodiversity significance of these wetlands and waterways, including their role in providing habitat for listed threatened flora and fauna and migratory species.

Environmental Watering Plans will be developed for any wetlands or waterways where it is assessed that the NVIRP related change is likely to have a significant impact on the environment. The watering plans will set out an environmental watering regime to minimise and mitigate the impact of the NVIRP and to support ecological values within the GMID.

There may be greater risk to biota under the current system operation where, in response to drought and limited water allocations, Goulburn-Murray Water have introduced a Loss Management Program resulting in tighter system operation that has reduced outfalls without consideration of the impact.

Goulburn-Murray Water, the responsible party for the ongoing operation of the irrigation system, currently works with catchment management authorities, other agencies and landholders to deliver environmental water to wetlands and waterways of environmental significance. Recent examples of successful environmental watering in the GMID are provided below.

Reedy Swamp and Kinnairds Wetland: Ephemeral wetlands

In partnership with agencies and the landholder, G-MW has assisted in the delivery of environmental water to Reedy Swamp regularly since 1997. The most recent delivery of 544 ML of environmental water delivery occurred in autumn 2008. This Environmental Water Allocation means that the wetland is currently functioning as an important drought refuge. Over 3500 birds have been counted on the wetland including 500 Pacific Black Ducks, 1000 Hardheads, 8 Shovellers (threatened), 40 Chestnut Teals and 200 Swans. Four species of frogs have also been recorded.

Filling of Kinnairds Wetland with an Environmental Water Allocation 426 ML has recently finished, and waterbird breeding has commenced, at a time when suitable breeding habitat is rare in Victoria due to drought.

Both Reedy Swamp and Kinnairds Wetland have a management plan in place. G-MW, Goulburn-Broken Catchment Management Authority and SKM received both a Banksia Environmental Award (2000) and an IEAust Engineering Excellence Award (1999) for the Muckatah Surface Water Management Strategy, of which hydrological management of Kinnairds Wetland is a significant component.

Protection of Murray Hardyhead in Round and Woorinen North Lakes: Permanent wetlands

The threatened Murray Hardyhead population in Round Lake is being protected with environmental water. Woorinen North Lake is maintained as a condition of Goulburn-Murray Water's bulk entitlement, which grants it permission to take and supply water in the area.

The watering programs at Round, Woorinen North and the small section of Cardross Lakes are likely responsible for saving the Murray Hardyhead in Victoria¹¹ [Cardross Lakes are not within the GMID]. The fish bred well last spring/summer and are showing signs of another good breeding season this spring/summer. Topping up the areas to replace water lost through evaporation is vital to maintaining these populations and support breeding.

Gunbower Forest — A Ramsar listed wetland

Gunbower Forest is a River Redgum Forest on floodplain on the Murray River north-west of Echuca. Because of its high environmental values, it has been designated as one of the Living Murray icon sites. It is also an internationally significant Ramsar site, providing important habitat for migratory waterbirds.

In autumn 2008, 7.7 GL of environmental water was delivered to Gunbower Forest. Of this water, 2 GL was drawn from the Murray River entitlement, distributed via the Living Murray Environmental Watering Group. The remaining 5.7 GL was from the Victorian Flora and Fauna entitlement.

To get water to the site, it was delivered through the G-MW distribution network, along the National Channel and Gunbower Creek. North Central CMA worked closely with DSE, Goulburn-Murray Water and River Murray Water to efficiently deliver this water to the Forest. To make most efficient use of water, it was delivered on the tail end of the irrigation season to minimise losses without affecting anyone else's access to channel space. Irrigators were not impacted by environmental water delivery.

An area of approximately 1050 ha was inundated. Of the 1050 ha, about 500 ha is River Red Gum floodplain forest and the remaining 550 ha is open wetlands. This mix provides feeding and roosting habitat for waterbirds.

Other information/comments? (eg. accuracy of information)

¹¹ Status of Murray Hardyhead (*Cratocephalus fluviatilis*) populations in three lakes in the Kerang region, Victoria (2007–2008). (2008). D. Stoessel, Arthur Rylah Institute for Environmental Research, Heidelberg. Version 4 September 2007

13. Water environments

<p>Will the project require significant volumes of fresh water (eg. > 1 GI/yr)?</p> <p><input checked="" type="checkbox"/> NYD <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If yes, indicate approximate volume and likely source.</p>
<p>Will the project discharge waste water or runoff to water environments?</p> <p><input checked="" type="checkbox"/> NYD <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If yes, specify types of discharges and which environments. No</p>
<p>Are any waterways, wetlands, estuaries or marine environments likely to be affected?</p> <p><input checked="" type="checkbox"/> NYD <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes If yes, specify which water environments, answer the following questions and attach any relevant details.</p>
<p>Wetlands</p> <p>The GIS analysis completed as part of the regional wetland risk assessment (see Attachment 6, chapter 8) identified all listed threatened or migratory species that have historically been recorded either at, or near these sites (within 500 m for fauna, or 50 m for flora). Additional information was also incorporated from the WetSys Database held by DSE in Epsom, the Biodiversity Action Planning database held by DPI in Tatura, and a series of relevant technical reports.</p> <p>A total of 1137 wetlands have been identified within the GMID. The values and extent of linkage, if any, with the irrigation system were investigated, in order to identify wetlands with significant ecological values which may be affected by changes in water flow due to the NVIRP. A four step analysis process was undertaken:</p> <ol style="list-style-type: none"> 1. Identify wetlands in the GMID with significant environmental values; 2. Determine the type of connection to the irrigation system; 3. Determine relative contribution of irrigation water to the wetland water regime; 4. Identify priority wetlands for detailed investigation and impact mitigation. <p>Step 1 – Wetlands with significant environmental value – Ramsar sites, Directory of Important Wetlands, wetlands of bio-regional significance, other wetlands with significant flora and fauna</p> <p>Of the 1137 wetlands in the GMID it has been determined that 573 wetlands have a significant environmental value. The values considered include:</p> <ul style="list-style-type: none"> • listing under the Ramsar Convention; • listing under 'A Directory of Important Wetlands in Australia'; • listing as bio-regionally significant wetland; • the presence of water dependant threatened species listed as Victorian Rare or Threatened Species (VROTS); • the presence of listed, threatened or migratory species under the Victorian <i>Flora and Fauna Guarantee (FFG) Act 1988</i> and/or the Commonwealth <i>Environment Protection and Biodiversity Conservation (EPBC) Act 1999</i>.

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Step 2 – Wetland connection to the irrigation system – channel outfall, irrigation drain, on-line, groundwater or no connection.

For those wetlands identified as having significant environmental values, the linkages of the wetland to the irrigation system were assessed. The wetlands were categorised by connection type, and each category rated in accordance with likelihood of impact from the NVIRP as follows:

- wetlands directly connected to irrigation channel outfalls — high potential impact;
- wetlands connected to the regional drainage network (and hence a secondary connection to channel outfalls) — medium to high potential impact;
- on-line wetlands, wetlands fed by groundwater or seepage, wetlands receiving local catchment run-off and floodplain wetlands — low to medium potential impact.

A total of 78 wetlands were assessed as having significant environmental values and medium to high potential impact from the NVIRP (see Attachment 6, chapter 8).

Step 3 – Relative contribution of irrigation water to wetland watering regime – contribution of outfalls to the total water regime in wetlands that have significant environmental values.

The relative contribution of channel outfalls to the water regime was considered for each of these 78 wetlands. This contribution was qualitatively assessed by comparing the current and historic (i.e. prior to construction of the irrigation system) water regimes in each wetland, using specific knowledge about the relative contribution of irrigation versus non-irrigation water in each wetland and by considering the size of each wetland. The NVIRP is likely to have only a small effect on the water regime of wetlands that currently receive small amounts of water from the irrigation system, but will have a greater impact on wetlands where irrigation contributions compensate for the loss of natural winter inundation. Where it was not possible on available data and knowledge to assess the specific irrigation contributions to the wetlands for this risk assessment, a precautionary approach was taken to include them for further investigation.

Step 4 – Determine priority wetlands for detailed investigation and impact mitigation – wetlands with significant environmental values and whose water regime is likely to be significantly altered by the NVIRP, or for which data is insufficient to determine the extent of potential impact, will be prioritised for detailed assessment and potential impact mitigation.

Of the 78 wetlands with significant environmental values and medium to high potential impact from the NVIRP, a total of 23 were assessed as potentially impacted as a result of water regime changes associated with the NVIRP. These wetlands are listed in Table 7. A subsequent 'groundtruthing' report for these 23 wetlands has now been completed and has prioritised the development of Environmental Watering Plans for 10 wetlands that have been confirmed as impacted by NVIRP works. This report reviewed the findings of the desktop report (refer to Attachment 6) in more detail including on-site inspections and found that of the 23 wetlands previously identified only these 10 would be impacted by NVIRP works and specifically reduced outfalls. (Refer to Attachment 11) A priority list for developing environmental watering plans for these 10 wetlands has also been established. The investigation and mitigation measures to be undertaken in relation to these wetlands are discussed further below.

Abbr. Wetland 1994 Number	Wetland Name	Wetland Status	"Ground Truthing" Priority Wetland Assessment Report*
344450	McDonalds Swamp	Bioregional significance	By 2010
312051	Hunts Swamp		
088586	Little Wallenjoe Swamp - (Wallenjoe Wetlands)	Directory Important Wetlands	
366715	Round Lake	Bioregional significance	By 2011
372703	Tresco Lake (Golf Course Lake)	Bioregional significance	
551457	Lake Elizabeth	Bioregional significance	By 2009
310694	Bray's Swamp		
313709	Bray's Swamp	Bioregional significance	
323733	Merrigum Swamp	Bioregional significance	
355320	Johnson Swamp	Ramsar	By 2009
558639	Thunder Swamp	Bioregional significance	
569655	Black Box Swamp		
577650	Dunn's Swamp		
1000002	KanyPELLa Basin	Directory Important Wetlands	
450990	Little Lake Boort	Bioregional significance	By 2010
507077	Lake Yando	Bioregional significance	By 2010
524142	Lake Leaghur	Bioregional significance	By 2010
533258	Lake Meran	Bioregional significance	By 2010
541289	Little Lake Meran	Bioregional significance	By 2010
587335	Lake Murphy	Bioregional significance	By 2009
810092	Richardsons Lagoon		
825022	Murphys Swamp	Bioregional significance	
950996	Unnamed		

* Refer to attachment 11 Priority Wetlands requiring an environmental watering plan to be prepared.

Table 7. Wetlands short-listed for further investigation and those confirmed as requiring the development of Environmental Watering Plans.

Waterways

See section on stream flows below.

Are any of these water environments likely to support threatened or migratory species?

NYD No Yes If yes, specify which water environments.

DSE records show that water dependent threatened or migratory species have been sighted at 411 wetlands within the GMID (36%). However only 74 of these wetlands are connected to the irrigation system (either directly or through the drainage network). All of these wetlands were considered under the risk assessment outlined above, and, if appropriate, placed on the short-list of 23 wetlands for detailed investigation and impact mitigation. For further information see Attachment 6, chapter 8)

The relationship between listed threatened and migratory species and the affected wetlands is discussed above in section 12.

The existence of threatened or migratory species in waterways which may be affected by NVIRP has also been considered, as discussed in the section on streamflows below.

Are any potentially affected wetlands listed under the Ramsar Convention or in 'A Directory of Important Wetlands in Australia'?

NYD No Yes If yes, please specify.

There are three wetland complexes in the NVIRP area that are listed under the Ramsar convention. These are Barmah Forest, Gunbower Forest and the Kerang Lakes. These wetland complexes consist of a total of 230 individual wetlands.

Barmah and Gunbower Forests are managed in accordance with a pre-existing Management Plan, including artificial control of water flows and flooding from existing environmental entitlements. The change in River Murray flow arising from reduced channel outfalls is estimated to be very small (1% to 3% of flow) depending on season and location (Yarrawonga or Torrumbarry). This small reduction will also be offset by benefits to the River Murray obtained from the 175GL of water savings that will target Victorian rivers and streams upstream. Furthermore, the change is towards natural flow with increases during winter and spring and decreases in summer and autumn, hence the impact of NVIRP on the River Murray flow regime is very small. For this reason the minor changes in flow regime of the Murray River, from which these wetlands receive water, will not affect these now highly managed systems.

There are 12 wetlands or wetland complexes in the NVIRP area that are listed in 'A Directory of Important Wetlands in Australia'. These are Avoca Floodway, Beveridge Island, Broken Creek, Gunbower Forest, Wallenjoie Wetlands, Kow Swamp, Muckatah Depression, Lower Goulburn Floodplain, Kanyapella Basin, Splatt's Lagoon, Tragowel Swamp and Turner Lagoon). These wetlands and wetland complexes represent a total of 122 individual wetlands.

Of these 12 listed wetlands and wetland complexes only 16 individual wetlands are connected to irrigation channel outfalls and, therefore, potentially impacted by the NVIRP.

Of the 16 individual wetlands that may be affected, it has been determined that the reduction in channel outfalls associated with the implementation of the NVIRP may significantly impact on only one wetland (Johnson Swamp) via changes to the water regime. This wetland is included in the 10 wetlands discussed earlier in this referral.

A series of mitigation measures (see below) have been identified to mitigate the potential impact of the NVIRP on the values of this wetland..

Could the project affect streamflows?

NYD No Yes If yes, briefly describe implications for streamflows.

Streamflows may be affected by the NVIRP due to changes in the timing, magnitude and location of delivery of bulk water entitlements and/or to changes in channel outfalls to waterways.

Impact of changes to bulk water delivery

Several natural waterways have been incorporated into the bulk water supply network for the GMID, including the Goulburn, Broken, Campaspe, Loddon and Murray Rivers. The use of natural waterways for irrigation water delivery has significantly changed the natural flow pattern of these waterways such that winter/spring high-flow period has reduced and the summer/autumn low flow has increased. The NVIRP may alter flow regimes in these rivers due to changes in the timing, magnitude and location of irrigation water delivery.

An assessment was made of the likely changes in the flow regime of major waterways (Goulburn, Campaspe, Loddon and Murray Rivers) as a result of the NVIRP (see Attachment 6, chapter 5). Note that the type of hydrological modelling undertaken (monthly time step) is appropriate for examining broad trends, but cannot be used to quantify the ecological benefits of the additional up to 175 GL of environmental water. Clearly, however, it is anticipated that these benefits from this environmental water will be significant and improve the health of priority stressed rivers including those listed below (see Attachment 2). Although the environmental water will target Victorian streams, this will also have flow on benefits to the River Murray where it can be 'reused to meet the needs of the Murray and its wetlands and floodplains.

The assessment indicated that, generally, the changes in river flow regimes brought about under

the NVIRP are insignificant, particularly when examined in terms of the annual flow volume. Furthermore, the changes will be a small reduction in summer flows and a small increase in winter flows, bringing the flow regime closer to that which would have been observed under natural conditions and the characteristics of the recommended environmental flow regimes.

Goulburn River

In reaches upstream of Lake Nagambie the NVIRP will result in a small reduction in summer flows and a small increase in winter flows, bringing the flow regime marginally closer to that which would have been observed under natural conditions. This change is unlikely to cause any adverse ecological impact. In summer months, water savings will lessen the volume required for release from storage to meet irrigation demand.

There is a minimum flow requirement for the lower Goulburn River under the Goulburn System Bulk Entitlement. This requirement will continue to be met (see Attachment 6, chapter 6 for additional explanation of bulk entitlements and minimum flow requirements).

Campaspe River

For the Campaspe River modelling has indicated that there is likely to be a small change in flow pattern relative to the base case scenario. This change is unlikely to cause any adverse ecological impact. The change is caused by decreased need to use the flows in the Campaspe River to supplement flows in the Waranga Western Channel, and due to an increase in the average volume of spills from Lake Eppalock. The most downstream reach of the Campaspe River (Campaspe Siphon to River Murray) is not affected by irrigation demands and hence summer flows are not impacted upon by the NVIRP in this reach.

There is a minimum flow requirement for the Campaspe under the Campaspe System Bulk Entitlement, which will continue to be met.

Loddon River

For the Loddon River the NVIRP will bring the flow regime marginally closer to natural flow regime; however, this is unlikely to cause appreciable ecological change.

River Murray

The change in River Murray flow arising from reduced channel outfalls is estimated to be very small (1% to 3% of flow) depending on season and location. This small reduction will also be offset by benefits to the River Murray obtained from the 175GL of water savings that will target Victorian rivers and streams upstream. (Yarrawonga or Torrumbarry). Furthermore, the change is towards natural flow with increases during winter and spring and decreases in summer and autumn, hence the impact on the River Murray flow regime is very small.

Impact as a result of reduced channel outfalls

The NVIRP aims to reduce channel outfalls by 85% due to increased efficiency in distribution of water throughout the GMID. An investigation was therefore undertaken to consider the potential impact of this reduction in channel outfalls on waterways. The investigation process was similar to that undertaken in relation to wetlands and it is described briefly below. A detailed account of this methodology and the results can be found in Attachment 6, chapter 6.

Step 1: Identify natural waterways which receive channel outfalls

Initially a GIS analysis was undertaken to identify all natural waterways in the GMID that received water from channel outfalls. 260 outfalls were identified, of which 229 were outfalls to waterways.

Step 2: Assess flow change due to reduction in channel outfall

For each of these waterways, an assessment was made of the relative contribution of channel outfalls to the flow regime. Data from stream flow gauges and measurement of outfalls were used to develop flow duration curves for each site considered. The actual flow duration curves derived from the stream flow data were then compared with the modelled flow duration curves, assuming the contribution to flow from channel outfalls had been removed.

This analysis produced a list of waterways potentially significantly impacted upon by reduction in channel outfalls. Where the effect of reduced channel outfalls was unknown, that waterway was retained for further investigation.

For channel outfalls entering drainage systems, this analysis was highly conservative because

outfalls were measured at the point where the water entered the drainage system, rather than where it entered the waterway. Typically there is significant attenuation of flows in drains due to seepage, evaporation and opportunistic diversion of the water by irrigators, so that only a small proportion of the outfall water reaches the waterway.

Step 3: Assess environmental values in waterways where flow regime might be affected

An assessment was made of the environmental values in each of the waterways flagged in step 2, and whether these values could be affected by flow reductions. Information from the native fish database (including threatened species), regional river health strategies and drainage strategies was used to inform the assessment of environmental values. Consultation with regional experts was also undertaken.

Step 4: Determine waterways for detailed investigation and impact mitigation

Of the waterways identified under step 1, the assessments undertaken in steps 2 and 3 resulted in identification of 16 waterways for further investigation. These waterways are listed in Table 8. Most waterways were listed because there was some uncertainty regarding changes in flow regime or their environmental values. The investigation and mitigation measures to be undertaken in relation to these waterways are discussed further below.

Table 8. Waterways short-listed for further investigation and development of Environmental Watering Plans.

Irrigation Area	Waterway	Expected change in flow regime	Unknown change in flow regime	Presence of environmental values
Murray Valley	Broken Creek		√	√
	Sheepwash Creek		√	?
	Tongalong Creek		√	√
	Tullah Creek		√	√
Central Goulburn (5-9)	Goulburn River		√	√
	Yambuna Creek		√	?
	Wells Creek	√		?
Rochester	Campaspe River		√	√
Torrumbarry	Loddon River d/s Kerang		√	√
Pyramid-Boort	Bannacher / Pennyroyal Ck		√	√
	Calivil Creek	√		?
	Loddon River	√		√
	Nine Mile Creek	√		?
	Pyramid Creek	√		?
	Sevens Creek			√
	Twelve Mile Creek		√	√

Salinity impacts

An assessment of the salinity impacts of the NVIRP has been made with respect to Victoria's obligations with respect to managing salinity in the River Murray, as contained in Schedule C to the Murray-Darling Basin Agreement.

Additional investigation will be carried out to quantify the final salinity impacts of the NVIRP once the scope of the works program is finalised; however, preliminary results indicate that the NVIRP is likely to result in a beneficial reduction in salinity in the River Murray (a salinity credit), attributable to the use of the environment's share of the water savings.¹²

¹² DSE currently is developing policy around the calculation of salinity impacts for water savings projects, and whether it takes into account the use of the saved water.

Could regional groundwater resources be affected by the project?

NYD No Yes If yes, describe in what way.

The NVIRP potentially impacts on the availability of groundwater resources through savings in channel seepage and channel leakage.

The impact of seepage and leakage losses on groundwater systems was assessed, both immediately adjacent to channels and outfalls, and at the regional scale. The assessment described the potential impacts of the Stage 1 works program, but the trends and magnitude of impact are expected to be similar for the Stage 2 works.

The results indicate some capacity to impact groundwater levels immediately adjacent to channels. However, at a regional scale, over the last 15 years, climate and associated reduced allocations have resulted in a water table reduction to provide considerable benefits in relation to salinity management. In relative terms the impact of the NVIRP is very small compared with recent climate related trends.

The total reduction in accession to groundwater from the NVIRP was estimated as 23 GL per year. A substantial portion of this recharge would otherwise be pumped out again to control shallow groundwater tables, or recharge high salinity groundwater areas.

This reduction in accession to groundwater is consistent with the objectives and directions of Regional Catchment Strategies in the GMID that have been implemented over the last 15 years to reduce soil salinisation and nutrient loading to rivers.

The study identified a number of positive impacts of the NVIRP on groundwater, including contribution to reduction of salinisation through lowering of saline water tables and improving water quality through reduced saline groundwater flows to waterways. (The outcropping of saline groundwater, or saline groundwater rising to the root zone of crops pasture and native vegetation is major cause of salinity induced damage locally.) Furthermore, increased access to water through surface irrigation rather than groundwater would reduce the cost and greenhouse gas generation associated with pumping groundwater.

Groundwater in the GMID is currently managed through Groundwater Management Plans (for deep lead aquifers), and these will continue to be the primary mechanism for managing groundwater use and ensuring that groundwater pumping continues to be sustainable.

See Attachment 6, chapter 7 for further details of the assessment of potential groundwater impacts of the NVIRP.

Could environmental values (beneficial uses) of water environments be affected?

NYD No Yes If yes, identify waterways/water bodies and beneficial uses (as recognised by State Environment Protection Policies)

Yes

The implementation of the NVIRP has the potential to impact upon environmental values (beneficial uses) of waterways and wetlands throughout the GMID.

The State Environment Protection Policy (Waters of Victoria) divides the State of Victoria into a range of segments with Wetlands and Lakes contained within one segment and Rivers and Streams throughout the State divided into five segments. All of the Rivers and Streams within the GMID fall into the Murray and Western Plains segment. A range of beneficial uses (current or future environmental values) are listed for each segment as part of the SEPP.

For the Wetlands and Lakes segment, eight beneficial uses are listed in the SEPP. The NVIRP might impact on some of these beneficial uses for the 10 wetlands identified as linked to the irrigation system (e.g. aquatic ecosystems, water based recreation).

For the Murray and Western Plains segment, ten beneficial uses are listed in the SEPP. As noted above the NVIRP is not expected to have a significant impact on the flow regime of the major rivers in the GMID. Furthermore, modelling of the impact of channel upgrades and remediation works of the NVIRP on river flows has shown that for most of the major rivers, the NVIRP will move flows marginally closer to a more natural regime (Attachment 6, chapter 5). Given this, it is assumed that any impact on the beneficial uses associated with these waterways will be positive.

The impacts of the NVIRP on beneficial uses associated with the 10 wetlands and 16 waterways short-listed will be considered during the further investigation proposed for those areas. Management and mitigation measures through the Environmental Watering Plans will be determined in accordance with the process described below.

Could aquatic, estuarine or marine ecosystems be affected by the project?

NYD No Yes If yes, describe in what way.
Yes — refer to previous sections.

Is there a potential for extensive or major effects on the health or biodiversity of aquatic, estuarine or marine ecosystems over the long-term?

No Yes If yes, please describe. Comment on likelihood of effects and associated uncertainties, if practicable.

The provision of up to 175 GL annual average water to the environmental reserve is expected to improve the ecological health of aquatic ecosystems over the long term.

Is mitigation of potential effects on water environments proposed?

NYD No Yes If yes, please briefly describe.
Yes

A formal management strategy, within NVIRP's Environmental Management System, will be used to mitigate the potential effects of the NVIRP on the 10 impacted wetlands and 16 waterways identified as potentially impacted. The elements of this management strategy are outlined below. NVIRP will be responsible for implementing this component of this Environmental Management Strategy.

Identification of potentially impacted wetlands and waterways

The identification of these priority wetlands and waterways is complete. The methodology is detailed above and in Attachment 6. A further 'groundtruthing' report on these potentially affected wetlands has now been completed (Refer to Attachment 11)

Detailed investigations of potentially impacted wetlands and waterways

Each potentially impacted wetland and waterway will be subject to a program of ongoing investigations to determine its:

- Biodiversity significance, including habitat value for threatened flora and fauna and for migratory species;
- Historic and current watering or flow regime;
- Potential impact of current watering or flow regime from NVIRP; and
- Watering or flow requirements required to maintain existing values.

The detailed investigations will draw upon a range of information sources, including:

On ground surveys

On ground surveys represent an important mechanism for identifying the current habitat condition of a wetland or waterway. Where appropriate, fauna and flora surveys will be conducted. However, surveys at one point in time provide only a "snapshot" of the environmental values a wetland or waterway is supporting at a given point in time, and may not detect species that intermittently use wetlands when conditions are suitable. In contrast, fringing vegetation is a legacy of the history of the water regime. Thus, it provides an important insight to the contemporary watering requirements of the wetland or waterway and how suitable the wetland or waterway is likely to be as habitat for particular species.

On ground surveys are also important for confirming that water spilling from the irrigation and network currently is reaching the short-listed wetlands and waterways. For instance, where there is opportunistic diversion of water from drains by irrigators, the water recorded as outfalling to a drain may not reach a wetland along that drain. On ground surveys to "ground truth" the results of the GIS analysis commenced in October 2008 and have now been completed for wetlands. This has resulted in a management strategy and a priority listing of 10 wetlands of the 23 stated for which Environmental Watering Plans will be required as a result of reduced outfall water from the modernised system. (Refer to Attachment 11)

Analyses of records on ecological values

Many species, particularly migratory waterbirds, are highly mobile and may only be occasional or seasonal visitors to a site. Analysis of records may confirm whether a given site provides suitable habitat for particular species or group of species. Many wetlands and waterways are ephemeral, and would naturally fill/flow during winter and spring. While on ground surveys could be scheduled to coincide with the wetter months of the year, if the current dry conditions persist, past records may be crucial for establishing ecological values.

Analysis of data on watering

Data on pre-project flows within waterways and into wetlands is important to understand the impact of the NVIRP. This includes determining the relative contributions of water entering the wetland or waterway from the irrigation system and water entering the wetland or waterway from other sources, particularly natural run-off.

Expert local knowledge

Local landholders, natural historians, catchment managers and operators of the irrigation system represent important supplementary sources of information, particularly historic conditions. Consequently it is proposed to further consult with these groups to further develop detailed understand of the ecology of the short-listed wetlands and waterways.

Refinement of short-list of potentially impacted wetlands and waterways

The short-list of wetlands and waterways that are considered potentially impacted by the NVIRP will be refined based upon the results of the detailed investigations.

Where the volume and timing (and quality) of water entering the wetland or waterway from the irrigation system is found not to align with the ecological requirements of that wetland or waterway, or to be insignificant compared with natural in-flows, the wetland or waterway may be declared not at risk from the NVIRP, and removed from the list of priority sites requiring Environmental Watering Plans under the Environmental Management System. It is proposed that NVIRP maintain a register of potentially impacted wetlands and waterways. Wetlands and waterways could only be removed (or added) to the register upon approval from DSE. This requirement would be formalised in the governance arrangements outlined in the Environmental Management System.

Where the detailed investigations confirm that any change in watering associated with the NVIRP may have a deleterious effect on significant environmental values, an Environmental Watering Plan will be developed for the wetland or waterway.

A 'groundtruthing' report for these 23 wetlands has now been completed and has prioritised the development of Environmental Watering Plans for 10 wetlands that have been confirmed as impacted by NVIRP works. This report reviewed the findings of the desktop report (refer to Attachment 6) in more detail including on-site inspections and found that of the 23 wetlands previously identified only these 10 would be impacted by NVIRP works and specifically reduced outfalls. The current list of potentially at risk waterways contains 16 waterways where there is uncertainty regarding the impact of the NVIRP. If this uncertainty regarding the likely impact of NVIRP on the waterway cannot be clarified with confidence, then that asset will remain on the register.

Development of Environmental Watering Plans for wetlands and waterways

For each potentially impacted wetland and waterway, an Environmental Watering Plan will be developed that:

- 1) Clearly defines key environmental values for which the wetland or waterway is being managed (what is being protected/maintained). Issues to be addressed may include volumes, timing, quality, flood mitigation, delivery capacity, salinity migration, opportunities for environmental watering and social and recreational objectives;
- 2) Sets management targets or objectives based on benchmarking the condition of the wetland or waterway and its values;
- 3) Defines an environmental watering regime (timing, duration and volume of flows) to:
 - i. mitigate the impact of the NVIRP; and
 - ii. support the key environmental values; and
 - iii. maintain management benchmarks
- 4) Sources the water to deliver the environmental watering regime;
- 5) Defines the infrastructure requirements to deliver environmental water — a key input to the design of NVIRP works; and
- 6) Develops draft protocols for ongoing water supply.

The structure of the Environmental Watering Plans is included as Attachment 13.

While NVIRP will seek guidance from the Technical Advisory Committee, NVIRP will be responsible for the development of each Environmental Watering Plan, and gaining approval for the relevant Plan, in advance of any operational changes to a given wetland or waterway.

NVIRP has engaged a panel of technical experts to form a Peer Review Committee to review the plans during their development, prior to their completion and to provide an ongoing review role during their initial implementation. The Peer Review Committee has expertise in stream and wetland ecology, irrigation design and assessment of environmental impacts. Members of the Peer Review Committee are:

- Terry Hillman from Terry Hillman Consulting with expertise in stream and wetland ecology;
- Brett Lane from Brett Lane and Associates with expertise in wetland ecology; and
- Peter Alexander from Hydroenvironmental Pty Ltd with expertise in irrigation design and environmental impacts.

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The approval process will be formalised in the governance arrangements outlined in the Environmental Management System. However, it is anticipated that the Secretary DSE would approve each Watering Plan, together with the relevant environment water manager and land manager, where applicable.

The Victorian Government's Response to the Foodbowl Steering Committee Final Report (Dec 2007) stated that water savings from NVIRP are total volumes saved less the volumes of water required to ensure no net impacts due to the project on high environmental values.

Governance

The suggested governance arrangements for the strategic management of short-listed wetlands and waterways is outlined below:

- **Department of Sustainability and Environment**

Role: Approves Environmental Watering Plans, in conjunction with the environmental water manager and the landholder; ensures congruence with government policy; brokers negotiations for optimal environmental watering outcomes, above and beyond mitigation of impacts, where appropriate.

- **NVIRP**

Role: Responsible owner of the EMS, including the development of Environmental Watering Plans (see section 18 and section 11). Coordinates and provides financial resources to support the development of Environmental Watering Plans to ensure a consistent approach across the GMID.

Ensures contractors comply with EMS requirements, including ensuring that infrastructure requirements for delivery of environmental water are incorporated into the works program, where required.

- **Regional agencies (including Catchment Management Authorities)**

Role: Potentially manage development of individual Environmental Watering Plans drawing upon internal and external expertise, as required (if contracted by NVIRP to do so). Ensure that Environmental Watering Plans leverage existing management plans and operational arrangements. Will be responsible for ongoing management and review of Environmental watering Plans.

- **Contractor for the NVIRP Works**

Role: Develops SEMP for infrastructure for the provision of water to the wetland or waterway.

- **Goulburn-Murray Water**

Role: Owner and operator of the irrigation system. Delivers environmental flows in accordance with Environmental Watering Plans.

Policy Context

In consultation with stakeholders, the Department of Sustainability and Environment currently is developing formal principles around the responsibilities of different agencies (Catchment Management Authorities, water corporations) for the management of water to be delivered to wetlands through the irrigation delivery system. These principles will inform the Environmental Watering Plans.

The Victorian Government Response to the Foodbowl Steering Committee Final Report (Dec 2007) identified that the water savings from NVIRP are total volumes less the volumes of water required to ensure no net impacts due to the project on high environmental values. The Environmental Watering Plans will be consistent with this position.

Other information/comments? (eg. accuracy of information)

14. Landscape and soils

Landscape

Has a preliminary landscape assessment been prepared?

No Yes If yes, please attach.

The project is not anticipated to have significant impacts on valuable landscapes. Works will be confined to areas that have been subject to extensive alteration as part of irrigation infrastructure establishment and maintenance since the advent of irrigation in northern Victoria. For this reason a landscape assessment has not been prepared.

Is the project to be located either within or near an area that is:

• **Subject to a Landscape Significance Overlay or Environmental Significance Overlay?**

NYD No Yes If yes, provide plan showing footprint relative to overlay.

Works will be located within the vicinity of the *Environmental Significance Overlay (Schedule 2 - Shepparton Waste Water Treatment Complex Environmental Significance Area)* of the Greater Shepparton Planning Scheme.

The purpose of this overlay is maintain a buffer around the Waste Water Treatment Complex to restrict the intensity of the housing development in proximity to the complex and to direct residential development at an urban scale away from it. This will safeguard the complex's operations and avoid any future conflict with any residential expansion of Shepparton. A buffer will also protect existing and future landowners from effects of the complex. The works associated with the NVIRP will not have any impacts on this overlay.

There are Environmental Significance Overlays relating to drainage and flooding along the Murray; however, these are not applicable to the project.

Of the 10 impacted wetlands, 9 have ESOs (see Table 9A below). The overlays provide for the protection of the environmental assets via the control of development adjacent to these features (see Table 9B below). The proposed mitigation strategies for any impacts associated with the NVIRP are in keeping with the objectives of these overlays.

No Landscape Significance Overlays will be affected by the NVIRP.

Table 9A. Impacted wetlands with Environmental Significance Overlays.

Wetland Name	Overlays	Local Government Area
McDonald's Swamp	ESO Schedule 3	Gannawarra
Round Lake	ESO Schedule 1	Swan Hill
Lake Elizabeth	ESO Schedule 4	Gannawarra
Johnson Swamp	ESO Schedule 4	Gannawarra
Little Lake Boort	ESO Schedule 1	Loddon
Lake Yando	ESO Schedule 1	Loddon
Lake Meran	ESO Schedule 3 ESO Schedule 4	Gannawarra
Little Lake Meran	ESO Schedule 3 ESO Schedule 4	Gannawarra
Lake Murphy	ESO Schedule 3 ESO Schedule 4	Gannawarra

Table 9B. Summary of Environmental Significance Overlays and implications for NVIRP.

Summary of Overlay	Implications for NVIRP
ESO1 provides for protection of waterway, wetlands and lakes environs	Permit triggers relate to building controls rather than land management and so the works proposed under NVIRP are unlikely to trigger a permit requirement
ESO 3 provides for the protection the environmental quality of lakes and wetlands in the Kerang Wetlands in keeping with the North Central Regional Catchment Strategy	Provides a mechanism for permit applications that may impact on the environmental values to be referred to DSE and/or Parks Victoria for comment.
ESO4 provides for the control of development in areas potentially subject to flooding or waterlogging	ESO4 is not relevant to NVIRP

- **Identified as of regional or State significance in a reputable study of landscape values?**
 NYD No Yes If yes, please specify.
- **Within or adjoining land reserved under the *National Parks Act 1975*?**
 NYD No Yes If yes, please specify.

Several sites that have been reserved under the *National Parks Act 1975* are located either within or adjacent to the GMID.

Given the uncertainty regarding the exact location of works it is considered possible that some of the works proposed to be undertaken as part of the NVIRP may occur within or adjoining one of these sites. However, works will mostly be undertaken within the footprint of existing infrastructure at these sites and significant impacts on the aesthetic and landscape values of these parks are not anticipated.

Parks Victoria is represented on the Technical Advisory Committee that has been convened to advise NVIRP on the development of Environmental Watering Plans. Parks Victoria would need to approve any Environmental Watering Plans for wetlands that it manages.

<p>• Within or adjoining other public land used for conservation or recreational purposes? <input type="checkbox"/> NYD <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes If yes, please specify.</p> <p>Numerous sites that have been reserved for conservation and recreation purposes are located either within or adjacent to the GMID. Given this, and the uncertainty regarding the exact location of works it is considered possible that some of the works proposed to be undertaken as part of the NVIRP may occur within or adjoining one of these sites. The EMS will include provision for appropriate management of works within or adjoining such public land.</p>
<p>Is any clearing vegetation or alteration of landforms likely to affect landscape values? <input type="checkbox"/> NYD <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If yes, please briefly describe.</p> <p>Some vegetation is likely to be removed during construction to accommodate the works and associated access. However, as the channels are located in a flat to gently undulating cleared farmland landscape that is highly modified, the sensitivity of this landscape to project impacts is considered low.</p> <p>Reconfiguration, construction and closure of some channels may alter the appearance of some areas through the removal of topsoil and excavation and grading. This land will be remediated and revegetated as required by Site Environmental Management Plans, so any impacts will be temporary.</p> <p>Views to the works will be limited, being seen in short-distance views from surrounding farmland and some local roads. Existing topography and vegetation will often screen views, and where necessary, planting will be used to further screen views. These issues will be explored and appropriate response developed in Site Environmental Management Plans.</p> <p>There will be a residual visual impact in sections of channel bank where vegetation needs to be removed and could not be replaced due to the maintenance requirements (for example, some willows along channel banks). The radio masts that allow remote control of regulator gates are typically visible at short-distances from regulator sites, but are not considered to affect the visual amenity of the agricultural landscape (see Attachment 3 for photographs of radio masts). Any new pumps will be appropriately housed and positioned.</p>
<p>Is there a potential for effects on landscape values of regional or State importance? <input checked="" type="checkbox"/> NYD <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes Please briefly explain response.</p> <p>No landscape values of regional or State importance have been identified within the NVIRP area.</p> <p>Is mitigation of potential landscape effects proposed? <input type="checkbox"/> NYD <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If yes, please briefly describe.</p> <p>See above.</p>
<p>Other information/comments? (eg. accuracy of information)</p> <p>n/a</p>

Soils

Is there a potential for effects on land stability, acid sulphate soils or highly erodible soils?

NYD No Yes If yes, please briefly describe.

The preliminary wetland impact assessment (see Attachment 6, chapter 8) identified 23 wetlands where potential changes to the water regime as a result of the NVIRP could have a negative impact on the environmental values, including consideration of changes in water flow which would be sufficiently large to change the wetland type. Fifteen of these potentially at risk wetlands are ephemeral and 8 are classified as open water, permanent saline or semi-permanent saline.

The ephemeral wetlands are unlikely to have sulphidic sediments, the precursors of acid sulphate soils. These tend not to build up to harmful levels in wetlands that have annual wetting and drying cycles¹³. The remaining wetlands are at a higher risk of developing sulphidic sediments, which may occur in wetlands that are permanently inundated (often artificially) and have some saline inflows (usually via groundwater or disposal of irrigation drainage).

Acidification and other impacts associated with oxidation of sulphidic sediments occur when the sediments dry (oxidise) and are then re-wet. Therefore, if the NVIRP causes a partial or full drying phase to occur at these wetlands, there may be at risk of acidification.

The Murray-Darling Basin Commission (MDBC) has recently commenced a project that aims to assess the spatial extent of, and risk posed by, acid sulphate soils at wetlands within the Murray-Darling Basin and to identify management/mitigation options¹⁴. Data on all wetlands within the GMID that are connected to the irrigation delivery or drainage system have been provided to the MDBC and are being analysed as part of this project ("Assessment of Acid Sulphate Soils Risk at Key Wetlands in the Murray-Darling Basin").

Providing this information will facilitate an assessment of the risk of acid sulphate soils at these wetlands, providing consistency with risk assessment and management strategies across the Murray-Darling Basin, as well as ensuring the broader context (e.g. impact of drought) is taken into account.

Should the work undertaken by the MDBC, or undertaken by NVIRP, identify that particular wetlands in the GMID are at risk of developing acid sulphate soils specific investigations and mitigation measures will be incorporated in the proposed impact mitigation process, including Environmental Watering Plans, as described in section 18 above.

The NVIRP works are not considered likely to create significant risk of land instability or erosion due to the generally flat topography of the region. The only Erosion Management Overlay for the GMID is in the Dookie Hills, which outside of the works area (refer to Attachment 4). The construction contractor will be required to consider and manage erosion as part of their Site Environmental Management Plan for all construction activities. Specific techniques will be implemented such as the installation of soil erosion and sedimentation controls before, during and after construction activity.

¹³ Baldwin D.S., Hall, K.C., Rees, G.N., Richardson, A.J. (2007) Development of a protocol for recognizing sulfidic sediments (potential acid sulphate soils) in freshwater wetlands. *Ecological Management and Restoration* 8: 56–60.

¹⁴ Murray-Darling Basin Commission (2008) Assessment of Acid Sulfate Soils Risk at Key Wetlands in the Murray-Darling Basin — Project Strategy (unpublished).
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Are there geotechnical hazards that may either affect the project or be affected by it?

NYD No Yes If yes, please briefly describe.

No geotechnical investigations have been undertaken to date to identify any geotechnical hazards that may either affect the project or be affected by it. However, it is expected that some testing would be required where channels are to be reconfigured or new channels are to be built or where pipelines are to be laid.

These investigations will identify any geotechnical hazards and allow for the appropriate mitigations to be developed and implemented, in accordance with the Site Environmental Management Plans within the Environmental Management System.

Other information/comments? (eg. accuracy of information)

15. Social environments

Is the project likely to generate significant volumes of road traffic, during construction or operation?

NYD No Yes If yes, provide estimate of traffic volume(s) if practicable.

The works associated with the NVIRP will not generate significant volumes of road traffic, during construction or operation.

Is there a potential for significant effects on the amenity of residents, due to emissions of dust or odours or changes in visual, noise or traffic conditions?

NYD No Yes If yes, briefly describe the nature of the changes in amenity conditions and the possible areas affected.

There is no potential for significant effects on the amenity of residents, due to emissions of dust or odours or changes in visual, noise or traffic conditions associated with the NVIRP. The works themselves do not emit dust, noise or odour or generate traffic in their own right apart from the occasional maintenance inspection.

Issues such as the emission of dust or odours during the construction phase of the project will be considered and mitigated via the procedures contained in the EMS and will be specifically included in Site Environmental Management Plans.

In addition, all works will be managed to ensure compliance with the relevant SEPPs and EPA Guidelines and other legislation as required.

Irrigation infrastructure is located within rural farming areas and is generally located adjacent to property boundaries and along road sides, which are situated well away from residences in the area.

Any new pipelines or channels will be appropriately located to avoid being located within proximity of existing residences or land zoned for those purposes.

Is there a potential for exposure of a human community to health or safety hazards, due to emissions to air or water or noise or chemical hazards or associated transport?

NYD No Yes If yes, briefly describe the hazards and possible implications.

There is no potential for exposure of a human community to health or safety hazards, due to emissions to air or water or noise or chemical hazards or associated transport associated with the NVIRP. The works themselves do not emit to the air, water or noise or odour, use chemicals or generate traffic in their own right apart from the occasional maintenance inspection.

In addition, all works will be managed to ensure compliance with the relevant SEPPs and EPA Guidelines and other legislation as required.

Is there a potential for displacement of residences or severance of residential access to community resources due to the proposed development?

NYD No Yes If yes, briefly describe potential effects.

There is no potential for displacement of residences or severance of residential access to community resources due to the NVIRP as works will be located predominantly within existing channels and easements. Where new pipelines or channels are proposed, these will be appropriately located to ensure no residences or access to residences is displaced.

In addition, as noted above, irrigation infrastructure is located within rural farming areas and is generally located adjacent to property boundaries and along road sides, which are situated well away from residences in the area.

Are non-residential land use activities likely to be displaced as a result of the project?

NYD No Yes If yes, briefly describe the likely effects.

The NVIRP will not directly result in displacement of non-residential land use activities. However, the Connections Program may result in irrigators modifying their irrigation practices or their on farm irrigation layout. In some cases it may result in a conversion of land use from irrigated agriculture to less intense dry land agriculture.

The Connections Program is very site specific in terms of works and the corresponding impact on farmers and their families. The Connections program involves NVIRP working with individuals and groups of irrigators to achieve a rationalised and more efficient connections system. The types of works are outlined in Section 3.

Do any expected changes in non-residential land use activities have a potential to cause adverse effects on local residents/communities, social groups or industries?

NYD No Yes If yes, briefly describe the potential effects.

In some cases, rationalisation and modernisation of delivery system assets will necessitate changes to farm type from irrigation to dryland agriculture. However, this work will be undertaken only after consultation with and agreement by the landholders. Modernisation will be delivered through a whole-of-system approach. This will mean that when decisions are made about delivery system infrastructure upgrades, full consideration will be given to management and infrastructure requirements on affected farms. The process to achieve this is being developed in consultation with irrigators and other stakeholders. The outcome will be enhanced operation of farm business to take advantage of improved services levels (e.g. higher flow rates, more consistent flow rates, shorter ordering times, automated operation of service points).

Reconfiguration will result in more efficient and effective irrigation, and, in this respect, the changes not will not cause adverse effects on local residents/communities, social groups or industries.

Is mitigation of potential social effects proposed?

NYD No Yes If yes, please briefly describe.

A number of measures are in place to mitigate any potential adverse social effects. These

measures are described below.

Analysis of Customer Needs

Careful analysis of the irrigation customer profile has been used to increase understanding of the particular connection needs of all categories of water user. This includes analysis of the factors affecting the investment outlook in the various farming industries and, therefore, future service needs. Detailed case studies also are being used to inform this analysis.

Incentives Package

An incentives package is being developed that recognises that changes arising from the Connections Program will involve significant costs and disruption to farm operations. Key principles guiding the development of the incentives package are:

- The aim is to support works to achieve a modern connection that:
 - leaves the landholder in a better or neutral position;
 - provides for a system that facilitates modern irrigation practices on farm;
 - is cost effective i.e. pays for eligible works up to the value of benefits determined by benchmarks;
 - provides offsets for ongoing maintenance.
- The incentives package is to be simple to access and should encourage timely completion of works;
- A range of activities will be eligible. Payments are based on outcomes generated to provide irrigators with flexibility to implement works that are appropriate for their individual situation;
- The incentives package should target areas to provide best return for investment, and where the opportunities and receptiveness associated with change is the greatest.

Communications and Engagement

A communications plan is being developed that focuses on a partnership approach, tailored to match the particular needs of each category of customer and the nature of the particular change to their farm operations.

Key elements of the communications plan include:

- Development and dissemination of Connections Program Guidelines;
- Customer group meetings, modelled upon the Reconfiguration Pod meetings in the Pyramid-Boort area [refer to the section 3 for a description of G-MW's existing Reconfiguration Program];
- An initial farm assessment for every irrigator on the Backbone or participating in the Connections Program. A key feature of this assessment will be a high level of landowner participation. Where there are opportunities to improve farm operation, the customer may then be referred to a Farm Design Specialist (e.g. DPI or private irrigation designer) to undertake more detailed analysis;
- Other farm visits to inform customers about a range of education, financial assistance, planning and counselling assistance;

Complementary Programs

The Victorian Government has recently committed to the Linking Farm and Catchment Programs to Irrigation Modernisation Initiative to integrate current farm extension programs with delivery modernisation programs.¹⁵

The Government's \$205 million Future Farming strategy also was released in 2008 to support innovation, and increase the productivity and competitiveness of Victorian farming.¹⁶

Other information/comments? (eg. accuracy of information)

¹⁵ *Sustainable Water Strategy: Northern Region* (Draft for Community Comment). (2008). Victorian Government Department of Sustainability and Environment, Melbourne. P.133.

¹⁶ *Future Farming: Productive, Competitive and Sustainable* (2008). Victorian Government Department of Primary Industry, Melbourne.

Cultural heritage

Have relevant Indigenous organisations been consulted on the occurrence of Aboriginal cultural heritage within the project area?

- No If no, list any organisations that it is proposed to consult.
 Yes If yes, list the organisations so far consulted.

Consultation has commenced with Aboriginal Affairs Victoria and local aboriginal groups regarding the occurrence and management of Aboriginal cultural heritage in the project area.

The works proposed to be undertaken are within the designated areas of multiple Aboriginal groups who are at various stages within the process of application for Native Title determination. The relevant Native Title Claims include:

- Dja Dja Wurrung Peoples (active claim);
- Wamba Wamba, Barapa Barapa and Wadi Wadi Peoples (active claim);
- Yorta Yorta Clans (a determination has been made that native title does not exist over the claim area); and
- Taungarung Peoples (claim discontinued)

The NVIRP will be undertaken in accordance with the requirements of the *Native Title Act 1993* [Commonwealth] in relation to native title.

Given that there is a likelihood that the provisions of the *Native Title Act 1993* or requirements of the *Aboriginal Heritage Act 2006* may apply to some of the NVIRP works, it is proposed that NVIRP will develop a formal process to consult with all of these groups.

Specific consultation is proposed to be undertaken with the Yorta Yorta Clans in order to meet the requirements of the Yorta Yorta Co-operative Management Agreement.

It is also proposed to consult with the Hume and Loddon-Mallee offices of Aboriginal Affairs Victoria (AAV), DSE, Goulburn-Murray Water and representatives from any relevant Registered Aboriginal Party (RAP) to discuss the project, stakeholder expectations, legislative requirements, including the requirements for a Cultural Heritage Management Plan.

What investigations of cultural heritage in the project area have been done?

(attach details of method and results of any surveys for the project & describe their accuracy)

No matters of cultural heritage are expected to occur within the channels given the extensive disturbance which has occurred within these areas over the years.

Desktop investigations have been undertaken to determine the cultural heritage values of the project area as follows.

- A search has been undertaken by SKM's Cultural Heritage Team of the Site Register held by AAV to determine the location of all recorded sites within the project area.
- A series of maps have been produced in consultation with SKM's Cultural Heritage Team to identify areas of Cultural Heritage Sensitivity as defined under the *Aboriginal Heritage Act 2006* and where these areas intersect with the locations of irrigation infrastructure and hence potential works locations within the NVIRP area. These maps indicate points of intersection of the channel network with prior stream beds.

These two sources of information, together with consultation with AAV, will be utilised to determine any requirements for preparation of a Cultural Heritage Management Plan(s).

Is any Aboriginal cultural heritage known from the project area?

NYD No Yes If yes, briefly describe:

- Any sites listed on the AAV Site Register
- Sites or areas of sensitivity recorded in recent surveys from the project site or nearby
- Sites or areas of sensitivity identified by representatives of Indigenous organisations

The location of sites listed on the AAV Site Register, sites or areas of sensitivity recorded in recent surveys from the project site or nearby and areas of Cultural Heritage Sensitivity as defined under the *Aboriginal Heritage Act 2006* are shown in the maps contained in Attachment 9.

Are there any cultural heritage places listed on the Heritage Register or the Archaeological Inventory under the *Heritage Act 1995* within the project area?

NYD No Yes If yes, please list.

There are a number of sites within the NVIRP area which are listed on the Heritage Register or the Heritage Inventory under the *Heritage Act 1995*. However most of these sites are not expected to be affected by works along the channels. Once the exact location of the works is confirmed, the location of such sites will be confirmed and the appropriate recommendations and / or protection measures will be undertaken.

Is mitigation of potential cultural heritage effects proposed?

NYD No Yes If yes, please briefly describe.

Potential indigenous cultural heritage effects would be mitigated via the completion of the Cultural Heritage Management Plan(s), as required, or other mechanism, as agreed with AAV. The soil in the existing channel network has been previously disturbed in the construction of the channels, so that a Cultural Heritage Management Plan may not be required for works occurring in channels.

In terms of non- indigenous cultural heritage effects, Heritage Victoria currently is working with Goulburn-Murray Water to determine the heritage values of the channel system and associated irrigation features, as part of the Victorian Water Supply Heritage Study. As the exact locations of the works are unknown it is difficult to confirm whether there will be any effect on the NVIRP as a result of the study, at this stage. However, mapping of all of the sites identified in to date in the *Victorian Water Supply Heritage Study* has been undertaken (see Attachment 10). The majority of the sites noted within this study relate to urban water supply rather than rural water supply. The majority of the rural water supply sites are weirs, pump stations and ancillary buildings such as former offices or works depots. No irrigation regulators or outlets (Dethridge wheels) were identified. Four irrigation channels were identified:

- Waranga Western Channel;
- Yarrawonga Main Channel;
- Stuart Murray Canal; and
- Cattanch Canal.

All of these major channels are key components of the irrigation distribution system in the GMID and will be retained.

Other information/comments? (eg. accuracy of information)

All works when required will be undertaken by a qualified cultural heritage consultant.

16. Energy, wastes & greenhouse gas emissions

<p>What are the main sources of energy that the project facility would consume/generate?</p> <p><input type="checkbox"/> Electricity network. If possible, estimate power requirement/output</p> <p><input type="checkbox"/> Natural gas network. If possible, estimate gas requirement/output</p> <p><input type="checkbox"/> Generated on-site. If possible, estimate power capacity/output</p> <p><input type="checkbox"/> Other. Please describe.</p> <p>Please add any relevant additional information.</p> <p>The current irrigation infrastructure system is gravity fed and as such does not consume / generate any energy.</p> <p>The new automated works are powered by solar technology. Where channels are to be replaced by pipes, some pressure pumping will be required to move water through the supply system. This will ensure limited pumping is required once the water is on-farm. These pumps will power from the existing electricity grid.</p>
<p>What are the main forms of waste that would be generated by the project facility?</p> <p><input type="checkbox"/> Wastewater. Describe briefly.</p> <p><input type="checkbox"/> Solid chemical wastes. Describe briefly.</p> <p><input type="checkbox"/> Excavated material. Describe briefly.</p> <p><input type="checkbox"/> Other. Describe briefly.</p> <p>Please provide relevant further information, including proposed management of wastes.</p> <p>Typical waste generated from channel upgrade and reconfiguration works includes concrete rubble, timber and metal waste generated by the removal of old drop bars, meters and walkways. All waste will be disposed of in accordance with the Environmental Management System, which will detail the appropriate disposal measures for specific types of waste. Installing new regulator gates in pre-existing placements minimises waste. Where possible materials (such as metal waste) will be recycled.</p> <p>Any material excavated as part of the channel reconfiguration and rehabilitation works will be transported to an appropriate facility for disposal. Alternatively, fill may be used on-farm to fill in disused channels. Where topsoil is present, it will be removed and stockpiled, together with leaf and plant litter, and used for site rehabilitation.</p>
<p>What level of greenhouse gas emissions is expected to result directly from operation of the project facility?</p> <p><input checked="" type="checkbox"/> Less than 50,000 tonnes of CO₂ equivalent per annum</p> <p><input type="checkbox"/> Between 50,000 and 100,000 tonnes of CO₂ equivalent per annum</p> <p><input type="checkbox"/> Between 100,000 and 200,000 tonnes of CO₂ equivalent per annum</p> <p><input type="checkbox"/> More than 200,000 tonnes of CO₂ equivalent per annum</p> <p>Please add any relevant additional information, including any identified mitigation options.</p> <p>Any modification of the irrigation infrastructure in the GMID as a result of the NVIRP will still see the majority of water supplied to irrigators via gravity fed systems.</p> <p>The reconfiguration of some sections of the irrigation system will see them converted from a gravity system to a pressure pipeline system that will require some pumping. It is expected that some high pressure pumping will be required to supply both stock and domestic requirements and small-medium agricultural irrigation requirements. The use of high pressure pumping at the supply stage will limit the amount of pumping required on farm (which may be already occurring) thereby potentially offsetting any emissions from current pumping activities.</p>

It is estimated that the reconfiguration activities associated with the NVIRP will require installation of about 270 pumps, and a further 160 pumps on farm.

The factors estimate emissions of CO₂, CH₄ and N₂O expressed together as **CO₂-e**, or the **CO₂ equivalent**. To calculate the CO₂-e the following calculation is used:

$$tCO_2-e = (Q \times EF) / 1000$$

Where:

- Q (Activity) is the electricity consumed (kWh);
- EF is the relevant emission factor expressed in kgCO₂-e/kWh
- 1000 converts kg to tonnes

The Full Fuel Cycle Emission Factor of **1.31** was used in calculating the greenhouse gas impacts of the NVIRP pumping.

The Table 10 provides an estimate of the CO₂-e for Stage 1 of the NVIRP.

Table 10. Estimated CO₂ emissions from NVIRP Stage 1.

Component of FBM (St 1)	Irrigation Type	Number of Pumps	kWh per Pump	Total kWh	Total CO ₂ -e (tonnes)
Reconfigured Components of Irrigation Supply Network	Large	10	25,000	250,000	328
	Medium	35	12,000	420,000	550
	Small	50	12,000	600,000	786
	Rural Residential	175	1,500	262,500	344
On Farm	Large	50	12,000	600,000	786
	Medium	50	8,000	400,000	524
	Small	40	8,000	320,000	419
	Rural Residential	20	500	10,000	13
Total		430		2,862,500	3,750

Therefore, due to the high reliance on gravity to provide the required volumes and head of water, the NVIRP Stage 1, CO₂ equivalent emissions are less than 50,000 tonnes per year. Using the known pump requirements of comparable irrigation systems, the equivalent pump requirements and estimated the total emissions to equate to around 3,750 tonnes of CO₂-e per annum were calculated. This estimate is only for the pumping component of the NVIRP and ignores emissions for construction, installation and other components of the system.

17. Other environmental issues

Are there any other environmental issues arising from the proposed project?

No Yes If yes, briefly describe.

18. Environmental management

<p>What measures are currently proposed to avoid, minimise or manage the main potential adverse environmental effects? (if not already described above)</p> <p><input type="checkbox"/> Siting: Please describe briefly <input type="checkbox"/> Design: Please describe briefly</p> <p>Within section 13 a process is outlined that will mitigate any potential impact on wetlands and waterways (and their component values) that have been identified as potentially impacted by the implementation of the NVIRP.</p> <p>A key component of this mitigation process is consideration of how environmental water delivery will be incorporated into the design of the modernised irrigation infrastructure. In some cases, specific infrastructure may be required to allow for the targeted delivery of environmental water to key sites in order to mitigate any impact of the NVIRP.</p> <p><input checked="" type="checkbox"/> Environmental management: Please describe briefly.</p> <p>In order to minimise and mitigate any impact of construction works it is proposed that an Environmental Management System (EMS) will be used. NVIRP has appointed a consultant to assist with the development of an EMS that is suitable for project implementation and which is compliant with the International Standard ISO 14001:2004. The consultancy involves three components:</p> <ul style="list-style-type: none"> • Design and scoping of the EMS (commenced) • Development of each of the components of the EMS (commenced) • Development of an EMS Procedures Manual that documents the EMS enabling an understanding of the EMS and relevant responsibilities by NVIRP staff, contractors and other relevant stakeholders.. <p>The design and scoping phase of the EMS development commenced over 14 to 15 January 2009 and included a workshop with NVIRP, the Managing Contractor and DSE. A Project Plan for the EMS development for NVIRP is provided in Attachment 12. A draft roadmap is currently being developed, in accordance with the Project Plan, which outlines the tasks and responsibilities for the development of each EMS component. All contractors engaged to undertake construction activities associated with the NVIRP will be required to comply with this EMS.</p> <p>The EMS utilised for the implementation of the NVIRP will require the consideration of potential environmental regulatory requirements, the assessment of risk and controls to manage these risks. This will be done via a process that breaks the project down into works parcels, details the regulatory and policy requirements for each works parcel and provides guidance on managing the project for compliance.</p> <p>NVIRP is also committed to engaging a suitably qualified peer reviewer to independently review the EMS prior to its finalisation and implementation by NVIRP. The proposed elements of the EMS are described below.</p> <p><u>Context</u> Key Environmental Issues: Description of actual and potential environmental impacts, risk assessment methodology and procedures, as well as decision criteria, to guide the project design. Environmental Management Principles, Objectives, Targets and Performance Criteria: for environmental outcomes to guide monitoring and management of the works. This will include any particular requirements of the environmental referral agencies/relevant ministers. Regulatory Framework: Outlines the relevant legislation and the specific regulatory obligations in relation to the NVIRP.</p> <p><u>Management Processes</u> Overarching Roles & Responsibilities for EMS implementation and approvals. Site Environmental Management Plans (SEMPs): The Site Environmental Management Plans for each location in which works are to be undertaken will include identification of statutory approvals, assessment of environmental risks of the work and identifying controls for on-site management (including specific approval requirements) prior to commencement. They will also outline roles and responsibilities and training requirements. Individual components of the SEMP will be approved by relevant authorities with the overall approval responsibilities for these plans</p>

being with DSE Statewide Services.

The EMS will include generic templates for SEMP's for particular types of works (e.g. installation of regulator gates, channel bank works and channel lining). The template is to be completed by contractors for each parcel of works in a given location to take account of specific local conditions. SEMP's should identify all actual and potential environmental impacts.

Matters to be considered in SEMP's include, where applicable:

- native vegetation,
- native fauna,
- terrestrial and aquatic ecology management,
- land condition/reinstatement,
- weed management,
- traffic management,
- erosion and sedimentation management,
- air quality and dust management,
- groundwater management,
- waterway management,
- waste management,
- noise and vibration management,
- hazardous substance management,
- cultural heritage management, and
- contingency procedures.

Training: Describes how contractors will be trained in environmental awareness, SEMP development, standards and compliance.

Wetland and Waterway Investigation Methodology: Provides a standard process for assessing environmental values at sites where a potential impact has been identified from the operation of the modernised system

Outline of Environmental Watering Plan: Provides an outline of the components of an Environmental Watering Plan (refer to Section 13 and Attachment 13) to ensure that Plans are consistent and comprehensive across different sites

Terms of Reference for the Technical Advisory Committee: Describes the responsibilities, composition and operating arrangements for the Technical Advisory Committee to advise NVIRP on the development of Environmental Watering Plans.

Consultation & Communication

This includes the communication and stakeholder engagement program. NVIRP communications strategies will be in place to provide guidance and processes for communication for all stages of the project. This will include consultation with respect to Aboriginal heritage.

Monitoring & Compliance

Monitoring: Strategy for environmental monitoring of project works and site management.

Auditing: Procedures for auditing, reporting and evaluation of environmental performance. Implementation of the project will include auditing activities to ensure that the commitments made in each SEMP and Environmental Watering Plan are met. Reporting and evaluation against environmental objectives and performance criteria will also be undertaken. Procedures for the auditing process will be established in the EMS. Consequences associated with non-compliance of SEMP requirements will be covered in contracts between contractors and NVIRP. The outcomes from audits and monitoring will also be used to refine operational procedures, if necessary.

Complaints management and reporting procedure: Provides guidance and processes for communication, complaints and associated reporting.

Reporting: The EMS will define the reporting structure and responsibilities to ensure that information is provided to relevant agencies.

Goulburn-Murray Water, the party responsible for the operation of the modernised irrigation system, has an ISO14001 certified EMS.

Other: Please describe briefly

Add any relevant additional information.

19. Other activities

Are there any other activities in the vicinity of the proposed project that have a potential for cumulative effects?

NYD No Yes If yes, briefly describe.

20. Investigation program

Study program

Have any environmental studies not referred to above been conducted for the project?

No Yes If yes, please list here and attach if relevant.

There are numerous completed environmental studies that, although not directly related to the NVIRP, will inform the development of Environmental Management Plans where required. These include management plans or related studies for a number of the 10 wetlands identified for development of Environmental Watering Plans and environmental flow studies for 3 out of the 16 short-listed waterways.

Has a program for future environmental studies been developed?

No Yes If yes, briefly describe.

Yes

NVIRP has convened a Technical Advisory Committee with representation from the Department of Sustainability and Environment, North Central Catchment Management Authority, Goulburn-Broken Catchment Management Authority, Goulburn-Murray Water, the Department of Primary Industries and Parks Victoria.

Its terms of reference (draft) define the role of the Technical Advisory Committee as being to provide advice to NVIRP on the following matters:

- The sequence of developing Environmental Watering Plans for short-listed wetlands and waterways (e.g. which wetlands/waterways to target first) taking into account the NVIRP works schedule, and lead times to develop Environmental Watering Plans.
- A consistent and rigorous methodology for surveys or assessment of wetlands and waterways, where further information on the associated environmental values is required to determine if the asset is of conservation significance.
- A consistent and rigorous methodology for other investigations required to understand and/or mitigate environmental risks associated with the NVIRP.
- The broad structure and content of Environmental Watering Plans.
- Where appropriate, to review the findings of surveys and other investigations, as they become available, to advise whether mitigation action (i.e. an Environmental Watering Plan) is required.
- Advise NVIRP on whether it is appropriate to seek to remove [or add] a wetland or waterway from the register of priority environmental assets.
- Identify any other opportunities for alignment of Environmental Watering Plans with existing or emerging catchment management programs.
- Ensure that the views of relevant stakeholders are canvassed in developing Environmental Watering Plans. For example, the requirements of the landholder of the asset and/or associated delivery infrastructure, or recreational users of a wetland, where a particular priority wetland/waterway has significant social values
- Ensure that the requirements for infrastructure to supply environmental water are communicated to NVIRP, and that delivery of environmental water is considered in the works program.
- Review Environmental Watering Plans as they are developed for quality, completeness and practicality.

Consultation program

Has a consultation program conducted to date for the project?

No Yes If yes, outline the consultation activities and the stakeholder groups or organisations consulted.

A Steering Committee was convened in July 2007 to make recommendations to Government on key implementation options for the project. The Committee included membership from 11 stakeholder groups representing a broad range of interests, including irrigators, the environment and local government.

Details of that consultation program are provided in Food Bowl Modernisation Project Steering Committee Report (November 2007).

Has a program for future consultation been developed?

NYD No Yes If yes, briefly describe.

Yes

Refer to section 15.

Authorised person for proponent:

I, Murray Smith, Chief Executive Officer, NVIRP, confirm that the information contained in this form is, to my knowledge, true and not misleading.

Signature

Date: 16 February 2009

Person who prepared this referral:

I, Ross Plunkett, Manager Planning, confirm that the information contained in this form is, to my knowledge, true and not misleading.

Signature

Date: 16 February 2009

List of Attachments

Attachment 1	Map of the NVIRP area
Attachment 2	Benefits of 75 GL of water for the environment
Attachment 3	Photographs of typical civil works
Attachment 4	Map of planning zones & overlays
Attachment 5	Map of Local Government Areas
Attachment 6	Final Report: Environmental Referrals
Attachment 7	List of EVCs in the GMID
Attachment 8	List of threatened and migratory species in the GMID
Attachment 9	Maps of sites of indigenous cultural significance
Attachment 10	Map from Victorian Water Supply Heritage Study
Attachment 11	Northern Victoria Irrigation Renewal Project - Priority Wetland Assessment (Groundtruthing Report)
Attachment 12	NVIRP EMS – Framework
Attachment 13	Structure of Environmental Water Plan