

Appendix H

Phase 3 Scoping

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H1 Phase 3 Scoping

H1.1 Introduction

The South East Queensland Desalination Siting Study is a Phased study which involves identifying suitable sites for construction and operation of a desalination plant and associated infrastructure. The components undertaken to date include:

- Phase 1: the objective of which was to undertake a site assessment and selection process, to identify a 'short list' of potential sites for a seawater desalination plant in South East Queensland.
- Phase 2: this is currently being completed and has sought to build on work in Phase 1 to undertake a more in-depth investigation of the identified sites and provide a ranking and scoring mechanism by which to classify the sites as either *Priority*, *Reserved* or *Excluded*.

Subsequent to the completion of the above Phases, Phase 3 will further build on work undertaken in Phase 2 and aims to conduct detailed engineering investigations and refine cost estimates based on risk and cost and facilitate the approvals/consultations necessary for the procurement of sites classified as either priority or reserved. This report synthesises recommendations for all aspects of Phase 2 investigations to set out the scope of works for Phase 3.

H1.2 Objectives

The objective of this section is to provide a more detailed break down of Phase 3 work. Phase 3 work aims to:

- Build on work undertaken in Phase 2 by limiting the number of assumptions;
- Undertake this assessment for reserved and priority sites;
- Develop detailed planning and approvals pathways for procurement of sites;

H1.3 Risk based Cost Estimation

The construction and operation of a desalination plant and associated infrastructure is inherently complex and has many variables which affect the cost of building and operating that infrastructure. Phase 2 studies have made a range of assumptions to provide a base cost for a desalination plant at each of the sites. A qualitative risk analysis has been undertaken as part of Phase 2 studies. Phase 3 investigations will require refinement of the costs provided by verifying the basis of the assumptions made. These assumptions however vary in their impact on overall project costs. The impacts of these assumptions on the overall cost is necessary to direct further work and can be done through a risk based cost estimation exercise.

Risk based cost estimation is an approach which aims to quantify through costs the risks and uncertainty of various assumptions made in the preliminary stages of the study. There are two key components through which this is achieved: qualitative risk assessment and quantitative analysis of likelihood and consequences of those risks on the cost of each component in the project. This would be of great benefit to Phase 3 work as project components that are significant and carry a relatively high uncertainty level can be identified for further detailed investigations. An improvement in cost forecasting will result, and a lowering of that risk over time.

Key steps involved in undertaking a risk based cost estimation exercise include:

- Utilise base costs and schedules provided in Phase 2 for all major activities with the contingency estimates removed;.
- Using Phase 2 risk assessment, verify major risks identified related to shortlisted sites being investigated;

- Quantitatively assess the impact of the various risks on the overall base cost;
- Rank the risks in terms of likelihood and cost impacts; and
- Develop strategies for mitigating the significant risks.

This is a useful process for highlighting the specific focus of Phase 3 work taking account of the work done in Phase 2 and in light of shortlisted sites being investigated.

Phase 2 studies have highlighted the need to undertake some specific investigation to address some of uncertainties inherent in this work. This scoping of Phase 3 in subsequent sections of this report does not utilise the risk based approach.

H1.4 Engineering

H1.4.1 Desalination Process

Establishing water quality requirements and limitations for intake, outfall and treated water will be the key to determining the optimal desalination process. Design should also take current and emerging process technologies into account which may provide cost benefits to the scheme. Phase 3 works should include:

- Raw water quality testing within vicinity of the intended intake location for each priority site. The testing should be undertaken for a sufficient period of time to understand the spatial and temporal variability of key raw water quality parameters. As a minimum 12 months of regular and event based raw water quality testing is recommended to capture seasonal variation of analytes. Assuming reverse osmosis is the desalination technology being carried forward, the raw water quality testing should include all analytes that influence the design of reverse osmosis desalination plants including:
 - Physical water quality (including temperature, pH, DO, ORP, turbidity, conductivity, particle size distribution, particle counts, organic carbon, suspended solids)
 - Chemical water quality (including ionic speciation, alkalinity)
 - Biological water quality (including bacterial counts, nutrient concentration)
 - Fouling indices (including silt density index and other emerging tests such as LC-OCD and picophytoplankton tests)
- Develop a increased understanding of raw water quality risks (both real and perceived) for each plant site based on potential impacts to water quality, If required undertake a quantitative risk assessment of impact of raw water quality on treated water quality for each site.
- Establish treated water quality requirements for the project.
- Develop concept designs for desalination plants at the preferred sites to provide more certainty on costs.
- Consider the deployment of a desalination pilot plant to one or more priority sites to provide more certainty on appropriate desalination pre-treatment processes and process parameters.
- Maintain watching brief on emerging desalination technologies and systems that may reduce the lifecycle cost and environmental impact of desalination and may influence relative site suitability.

H1.4.2 Site investigations

Further investigations of the site will aim to determine likely footprint of the plant on the site and this will be based on more detailed investigations including:

- Geotechnical studies to determine soil structure, soil contamination, the underlying rock structures and presence of acid sulfate soils for each priority site.
- Determine method of treatment required for ASS;
- Detailed topographic survey (e.g. airborne laser scanning) which will be used to accurately determine floor level for site and hence sites' hydraulic pumping requirements;
- Further assessment of integrity of private road, or bridge access which has not been established (e.g. Bribie Island bridge)
- Foundation design based upon detailed geotechnical assessment
- Engineering design of new access road pavements, should they be required.

H1.4.3 Network Integration Pipeline

The planning, design and construction of a network integration pipeline is a big component of a project to build a desalination plant at priority sites. The aim of further work relating to network integration will be to recommend a preferred pipeline route, planning implications and key construction techniques. The optimal solution will be found for delivering product water from the desalination plant to the existing network, taking into account capital and operating costs as well as social and environmental impact. The work required to achieve this objective is discussed below.

Network integration point optimisation

A detailed assessment and optimisation of network integration points is required. This will include:

- Assessment of future projected network demand
- Assessment of predicted seasonal variation in network demand
- Desalination plant operating flow rate scenarios including minimum, average and maximum flow rates to allow for routine shut down and maintenance, operational flexibility and to allow for seasonal variation
- The optimal location and number of network integration points along the pipeline alignment for each site and flow scenario.
- Determine the minimum, average and maximum flow rates to each of the multiple network connection points from each site to the final connection point.

Preliminary Network Analysis

A preliminary network analysis will be undertaken to ensure optimal delivery of product water from the desalination plant to the existing network. It will include the following:

- Pipe sizing and optimisation for each part of the network taking into account the minimum, average and maximum operating flow rates.
- Pump station siting and sizing.
- Optimal storage requirements including the need for, and location of, break pressure tanks along the pipeline.

The optimisation of pipe sizing, associated infrastructure and resulting energy requirements should include a sensitivity analysis comparing capital and operating costs for various pipeline sizing options on an NPV basis.

The development of an optimal pipeline route and associated infrastructure siting should include identification of:

- Required and available land

- Likely ground conditions
- Environmentally sensitive areas, and
- Social constraints

H1.4.4 Intake/Outfall

The focus of further work relating to the intake and outfalls will be to determine the alignment of the intake and outfall including location of the point of intake and point of discharge. Further work will include:

- Hydrodynamic modelling to understand the far field and near field implications of the brine discharge and therefore siting discharge location.
- Near field modelling to inform diffuser design.
- Verify and expand the preliminary diffuser design, and check level required for the header tank for system to discharge under gravity.
- Determine which construction method more economically, environmentally and socially preferred (e.g. tunnelling versus sea-bed laid).
- Joint probability site specific wind, wave and water level data to understand extreme near shore conditions
- Preliminary marine geotechnical surveys in aligning the intake and outfall pipes.
- Investigate the use of Neodren© technology and its applicability as a method of feed water intake.
- Investigate bio-fouling rates to each priority site e.g. conduct field tests as soon as the priority sites are chosen.
- Investigate dry well pump options.
- Confirm intake pump chamber dimensions.
- Verify and expand preliminary concrete weight design for sea-bed laid pipes.
- Verify pump ratings required for the intake and check pump sizes with manufacturers.
- Consult with Queensland Maritime Safety or other relevant bodies on issues relating to constructability.

H1.4.5 Energy and Power Infrastructure

Phase 3 will involve more detailed consultation with Energex to commence more detailed investigations in relation to power supply for priority sites. Phase 3 energy investigations will further clarify available capacity of the existing power infrastructure for use by a desalination plant, and requirements for upgrade or establishment of new sub stations. Cost estimates will be further refined by Energex and may be utilised in risk adjusted cost estimate.

Further investigation into power options should address mechanisms for providing renewable energy to site. It is however understood that these options will vary depending on the time of build for the particular plant.

H1.5 Environmental Investigations

The ecological review that was conducted in Phase 2 identified that the sites have varying degrees of environmental value, and therefore constraint. An outcome of the ecological review in Phase 2 is a number of recommendations specific to each site, relating to further investigations required, obtaining the required approvals and permits, discussions with authorities and consideration of alternative technologies to minimise impacts.

The recommendations are for ecological studies in Phase 3 for priority sites are:

- Detailed field investigations to determine the presence and extent of any significant flora and fauna species under the following acts:

Nature Conservation Act 1992

Environment Protection and Biodiversity Conservation Act 1999

Fisheries Act 1994

- Detailed field investigations to confirm the presence and extent of any significant vegetation communities listed under the:

Vegetation Management Act 1999 (i.e. regional ecosystems)

Water Act 2000 (i.e. riparian vegetation communities)

- Obtain the approvals and permits under the above legislation, where it is deemed necessary.
- Discussions with government bodies such as the QEPA, QPWS, DEWHA¹ and local authorities with regards to potential impacts on areas of interest, e.g. wetlands, National Parks, matters of National Environmental Significance and significant water bodies.
- Consideration of alternative technologies, such as tunnel boring, to reduce the environmental impact on sensitive areas that may be affected by trenched pipeline construction.
- Refine pipeline alignments to minimise impacts to sensitive ecological areas.
- Further investigation into the potential mitigation measures that could be employed at each site, e.g. minimisation of clearing, buffers to adjacent sensitive areas, establishment of environmental offsets and measures to prevent attracting wetland / marine birds to the plant.
- Further investigations into the impact on the marine ecology of Moreton Bay resulting from brine discharge at intended discharge locations.

H1.6 Planning and Approvals

The studies undertaken in Phase 2 identified the relevant planning and approvals considerations and specific constraints that affect the approvals required for development on each of the sites. Prior to Phase 3 it will be necessary to determine what major approvals pathway is to be followed (the process will also vary according to whether or not the desalination plant project is undertaken in accordance with the community infrastructure designation process or a development application process through the local government). The level of complexity (and therefore time and costs) associated with site acquisition and development will vary from site to site.

The scope of the environmental assessment and public consultation requirements that the proposed desalination plant and its ancillaries need to follow in Phase 3 will be prescribed by the approvals pathway followed.

For sites taken forward into Phase 3 the following steps are recommended:

- Discussion with relevant State and local government authorities in regard to the planning and approval requirements relevant to each site;
- Necessary legal advice should be sought where relevant (e.g. Kawana) to determine if constraints will prevent the development.

¹ Queensland Environmental Protection Agency, Queensland Parks and Wildlife Service, Department of Ecology, Water, Heritage and the Arts.

- Building on the permits and approvals identified in Phase 2, the application and assessment process requirements, application costs, supporting information requirements and timeframes should be investigated.

H1.7 Social and Community Consultation

In Phase 2 the social characteristics of the sites were reviewed and the potential social impacts were identified. This was undertaken based on available information and did not involve consultation with the relevant communities who are likely to have a significant interest in the proposal for social, economic and environmental reasons. It is therefore recommended that a detailed community consultation plan is developed early in Phase 3 to gain stakeholder acceptance and ensure feedback can inform design. Consultation should involve actions such as:

- Identification of all stakeholders including the public, community interest groups and government bodies.
- Establishment of a stakeholder database.
- Develop and implement a communication plan, including a mechanism by which to communicate with stakeholders (i.e. Websites, newsletters, public briefings and information sessions).
- Consideration of issues raised during consultation is used to inform the design and final site selection.

H1.8 Cultural Heritage

The eight pre-defined sites reviewed in Phase 2 do not contain any recorded heritage items or features however this assessment was based on published information from public databases. The next steps to be undertaken for priority sites taken forward to Phase 3 are recommended as:

- Full assessment of the cultural heritage value of sites, including shipwrecks (If applicable).
- Further ground investigation for sites to ascertain whether unrecorded items or features exist at the site, and their heritage value.
- The Aboriginal Party/ies relevant to each site should be consulted.
- Complete a cultural heritage survey.
- Preparation of a cultural heritage management plan in accordance with the Aboriginal *Cultural Heritage Act 2003*.