December 2017

AUSTRALIAN POTASH LIMITED

Lake Wells Potash Project Hydraulic Study

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REPORT

Report Number. 1667336-003-R-Rev0

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1.0 INTRODUCTION

Australian Potash Limited (PAL) is proposing to develop the Lake Wells Potash Project (the project) located some 190 km north-east of Laverton, Western Australia. The project will involve the extraction, evaporation and processing of *in situ* brines from a palaeochannel system to produce a sulfate of potash (SOP) product. Although the layout and design of the project facilities are currently under investigation, and therefore yet to be confirmed, at this stage it is proposed that the brine will be pumped to a series of evaporation ponds where the water will be progressively evaporated and the potash concentrate harvested.

The project area is relatively flat and although flooding in the palaeochannel is likely to occur only infrequently, it is essential that the project facilities be protected to minimise the risk of damage following more extreme storm events. This will minimise the risk of inundation and potential impacts to operations during larger flood events.

To assist in evaluating the likely extent and depth of flood inundation in the palaeochannel area PAL initially engaged Golder Associates Pty Ltd (Golder) in late 2016 to undertake a desktop hydrological assessment for the site. The results of that study were outlined in our report (Golder, 2016) submitted on 23 December 2016.

Subsequent to that report a number of modifications to the project plan adopted in the earlier work were required as a result of:

- Increases in the number and extent of the proposed ponds.
- Increase in the areal extent of the modelling to incorporate additional project areas recently acquired by PAL to the east of the modelled playa area previously considered.
- Recent availability of detailed LiDAR survey information covering the proposed pond area for application in the hydraulic modelling.

A proposal was therefore submitted to PAL (1667336.002.R-Rev0) on 18 May 2017 to update the previous modelling based on the above updates. The study results including a description of the available data and methodologies applied are outlined in this document.

2.0 SCOPE OF WORK

The main aim of the study was to quantify likely extents of flooding within the palaeochannel in the vicinity of the Lake Wells project site. The scope of work proposed to undertake the study is summarised below:

- Review of previously derived flood estimates applied in the initial hydraulic modelling.
- Delineation of catchment boundaries and characterisation of natural surface water drainage patterns.
- Revision of contour plan for the study area to incorporate the recently acquired LiDAR data and development of an updated digital elevation model (DEM) for the project area.
- Hydraulic analysis and flood risk assessment based on quantifying extents and depths of flooding for a range of design floods associated with various annual exceedance probabilities (AEP) range from 0.05 to 0.01 and preparation of associated flood maps detailing estimated peak flood levels and flow velocities.
- Preparation of a brief report outlining the results of the above analyses (this document).

3.0 RESULTS OF ANALYSES

3.1 Review of local climate and design rainfall assessment

No further analyses of climatic conditions in the project area were undertaken for the current study from those previously reported (Golder, 2016). For completeness the results from that study are, however, outlined below.

The project, located in the northern goldfields region of Western Australia, has an arid climate. The closest available climatic station operated by the Australian Bureau of Meteorology (BoM) in the region is located at Carnegie (station no. 013015) some 120 km to the north-west.

In the absence of a local, long-term rainfall and evaporation records, a daily data drilled climate sequence for the Lake Wells site was downloaded from the SILO database. SILO is an enhanced climate database hosted by the Science Delivery Division of the Department of Science, Information Technology and Innovation (DSITI). SILO contains Australian climate data from 1889 to the day prior to download, in a number of ready-to-use formats suitable for research and climate applications. The daily time series of data at a point location is based entirely on interpolated estimates from gridded datasets available over the land area of Australia.

A summary of the monthly climatic averages for selected parameters for the Lake Wells site is presented in Table 1. These data highlight the aridity of the project area with an estimated average annual rainfall of less than 200 mm.

Table 1: Average monthly climatic statistics for Lake Wells

Month	Rainfall (mm)	Evap (mm) (1)	Max. Temp (°C)	Max. Relative Humidity (%)
January	24	424	37.5	22.4
February	33	331	36.0	27.6
March	28	315	33.0	28.5
April	19	213	28.8	31.3
May	18	146	23.7	36.0
June	17	109	19.9	39.9
July	10	117	19.7	36.9
August	7	161	22.2	30.9
September	4	222	26.6	25.0
October	6	303	30.7	20.9
November	12	353	33.3	21.1
December	17	403	36.2	21.3
Annual	195	3095	-	-

Notes: (1) S_{pan} = calibrated class A pan evaporation based on vapour pressure deficit and solar radiation

A number of evaporation and evapotranspiration estimates are available from the SILO datasets. However, to provide an initial estimate of average monthly evaporation for the site the synthetic pan evaporation (S_{pan}) estimates were adopted. S_{pan} represents a calibrated estimate of class A pan evaporation based on vapour pressure deficit and solar radiation and provides a more consistent estimate to the historical evaporation. It will be important to confirm these estimates in later hydrological, planning or design studies.

Design rainfall intensities were derived based on rainfall intensity-frequency-duration (IFD) data for the study area. These were developed using the Bureau of Meteorology's (BOM) CDIRS (Computerised Design IFD Rainfall System), which allows automatic determination of a full set of IFD curves and associated data for any location in Australia. This approach is compatible with the manual procedures described in Australian Rainfall and Runoff (ARR, 2016).

Table 2 summarises design rainfall intensities associated with design storms with durations up to 72 hours and ARIs up to 100 years for the site. The IFD curves are shown graphically in Figure 1.

Table 2: Rainfall intensity (mm/h) for durations and annual exceedance probabilities (AEP)

Duration (mins)	Annual Exceedance Probabilities (AEP)							Duration (Hours)
	0.632	**0.5**	**0.2**	**0.1**	**0.05**	**0.02**	**0.01**	
5	45.0	54.6	87.8	113.4	140.4	181.2	216.0	**0.083**
10	34.5	41.9	67.8	87.0	108.0	138.6	164.4	**0.167**
20	28.3	34.4	55.6	71.6	88.8	113.6	134.4	**0.33**
30	19.0	23.0	37.0	47.8	59.2	76.2	90.6	**0.5**
60	12.0	14.6	23.4	30.2	37.5	48.4	57.7	**1**
120	7.5	9.0	14.4	18.6	23.0	29.8	35.6	**2**
180	5.6	6.8	10.8	13.9	17.3	22.3	26.6	**3**
360	3.5	4.2	6.6	8.5	10.6	13.6	16.1	**6**
720	2.1	2.6	4.1	5.3	6.5	8.3	9.8	**12**
1440	1.3	1.6	2.5	3.2	4.0	5.0	5.9	**24**
2880	0.8	0.9	1.5	1.9	2.4	3.0	3.5	**48**
4320	0.5	0.7	1.1	1.4	1.7	2.2	2.6	**72**

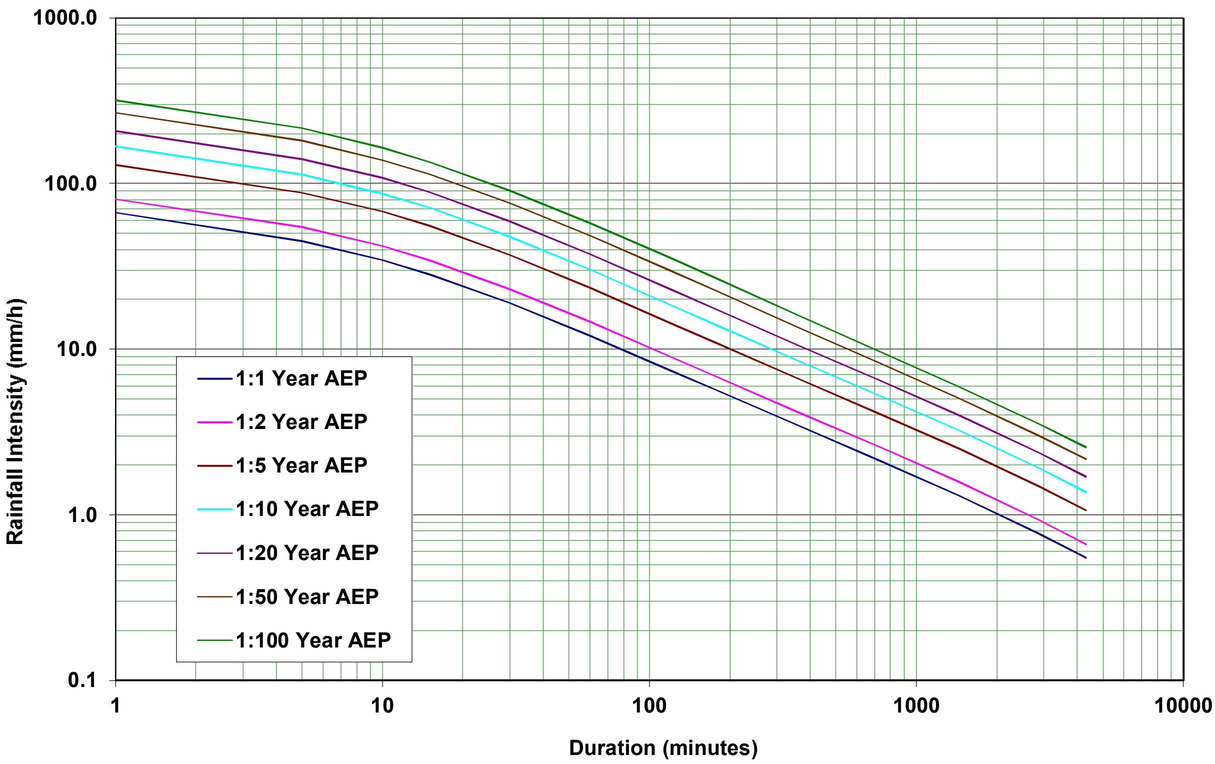

Figure 1: IFD curves for Lake Wells

3.2 Catchment delineation and drainage

The catchment area upstream of the project area and associated main drainage lines were delineated using the CatchmentSIM software (CRC, 2005). This involved developing a digital elevation model (DEM) from available topographic data (Geoscience Australia SRTM-Derived DEM) that extended over the immediate catchment area and further downstream. The extent of the catchment boundary and main drainage lines both upstream of the project site and immediately downstream are shown in Figure 2.

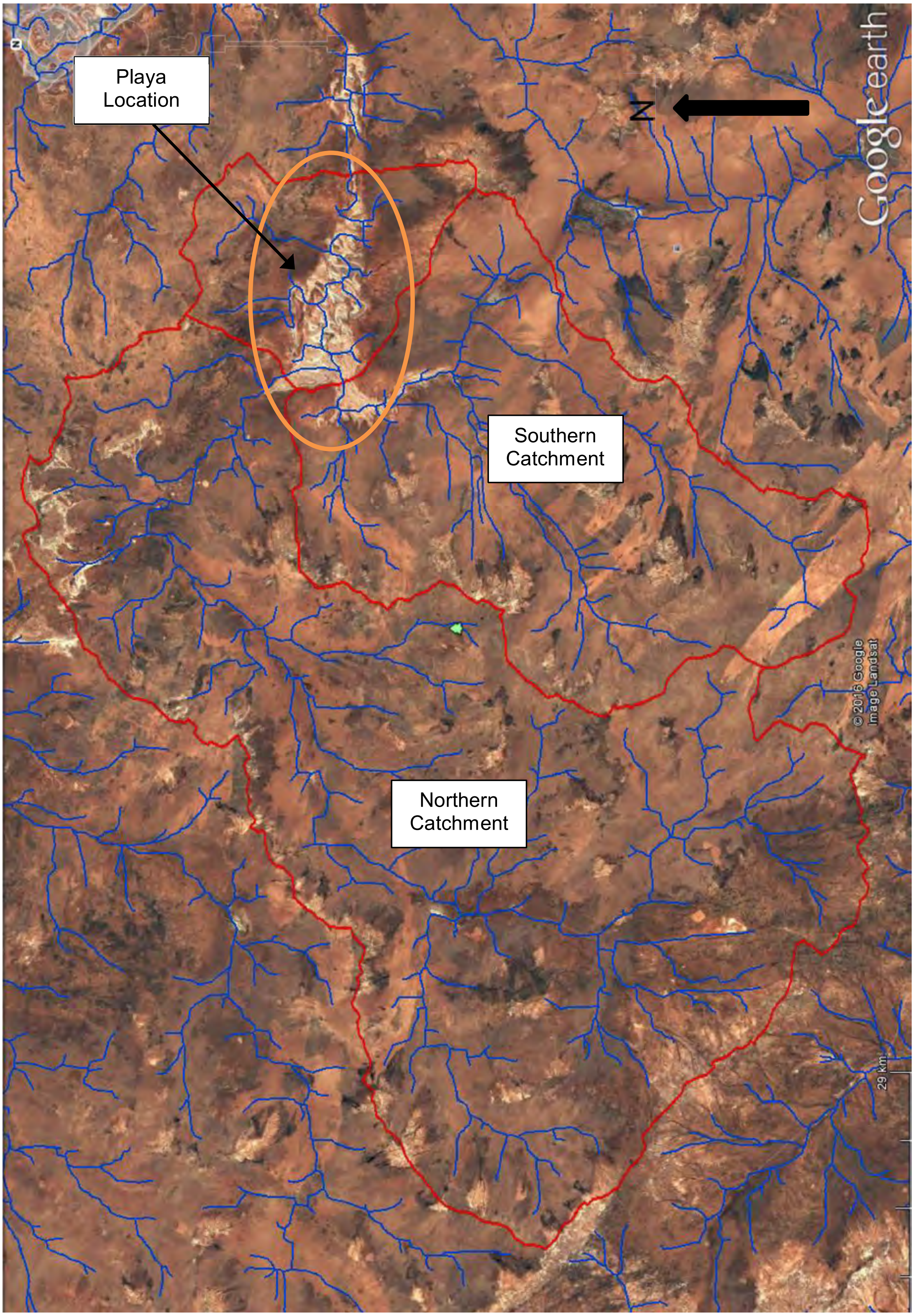

Figure 2: Extent of catchment boundary and main drainage lines

Runoff from the upstream catchments flow into the Lake Wells playa system along two tributaries draining from the north and south of the project site. These converge along the western portion of the Lake Wells playa with the drainage line then changing to an easterly direction. This drainage line continues some 25 km further east to a larger playa system which, although still part of Lake Wells, is aligned south-north.

The overall contributing catchment area at the confluence of the north and south tributaries is estimated to be around 5600 km^2. Including the local areas adjacent to the Lake Wells playas downstream of the convergence point, this increases to around 6100 km^2 (see three boundaries defining two main tributaries and local area adjacent to the playa that can be identified as the lighter colour within the playa network in Figure 2).

Based on a review of the larger regional drainage system and catchment boundaries, the overall playa network at Lake Wells and downstream appears to form part of a much larger internally draining system draining towards Lake Carnegie some 100 km to the north of Lake Wells.

The DEM also indicates that the Lake Wells playa has an extensive series of relatively large and deep depressions, some up to around 3 m to 4 m in depth. This can be seen more clearly on the schematic in Figure 3 showing 2 m contours across the playa area. These depressions currently provide significant surface storage during the conveyance of any upstream flood runoff and also attenuation in peak flows.

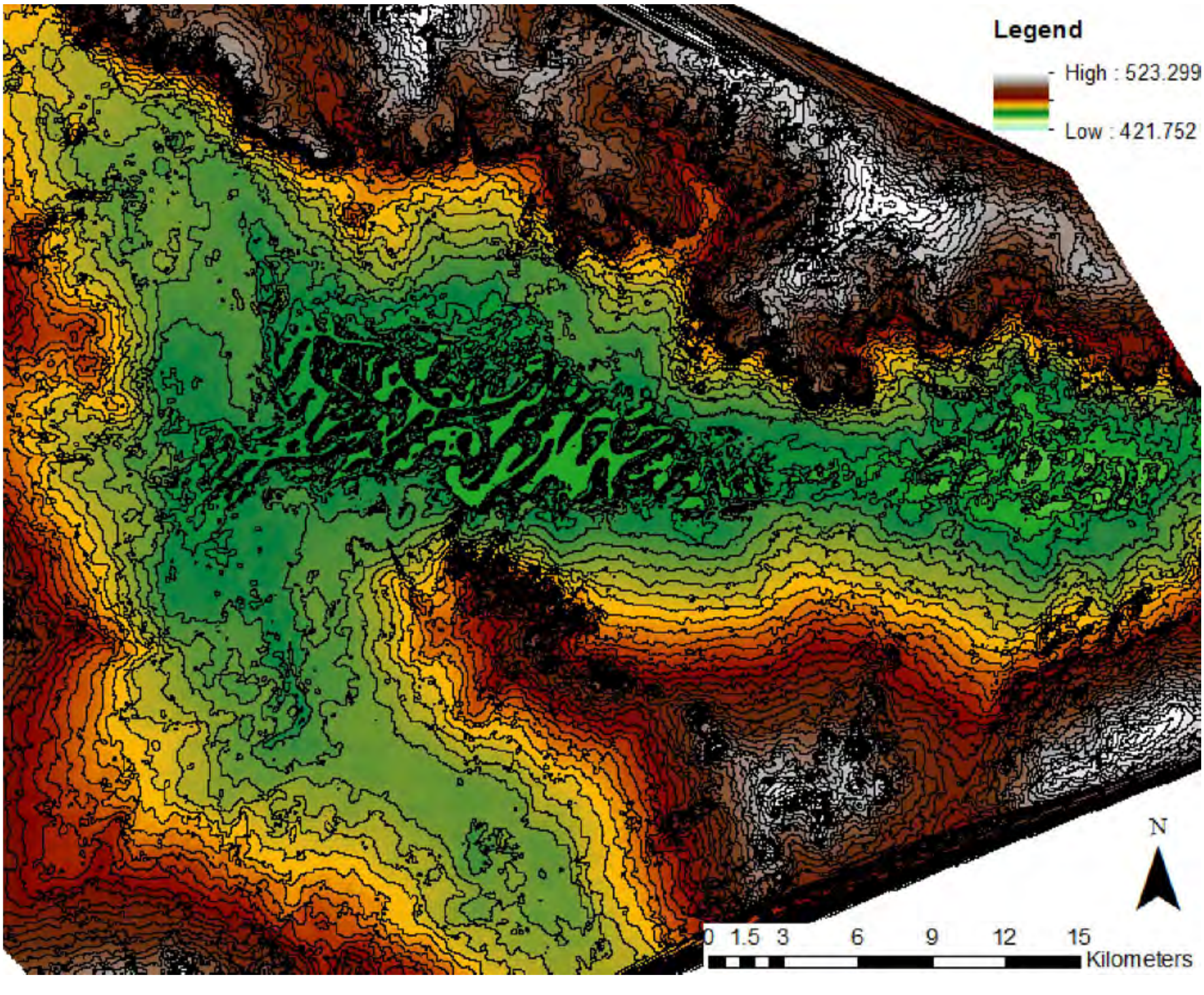

Figure 3: Schematic showing playa area and extent of surface depressions (with 2 m contours)

Channel gradients along the playa in the vicinity of the project site are very low. Typical profiles along the Lake Wells playa in west-east and north-south directions are shown in Figure 4 and Figure 5, respectively. East-west gradients along the playa are indicated to be approximately 0.1 m/km, while those in the north-south direction (noting that the north and south tributaries converge at around the 15 km point along the profile after which the drainage flows to the east) are slightly higher at around 0.3 to 0.5 m/km.

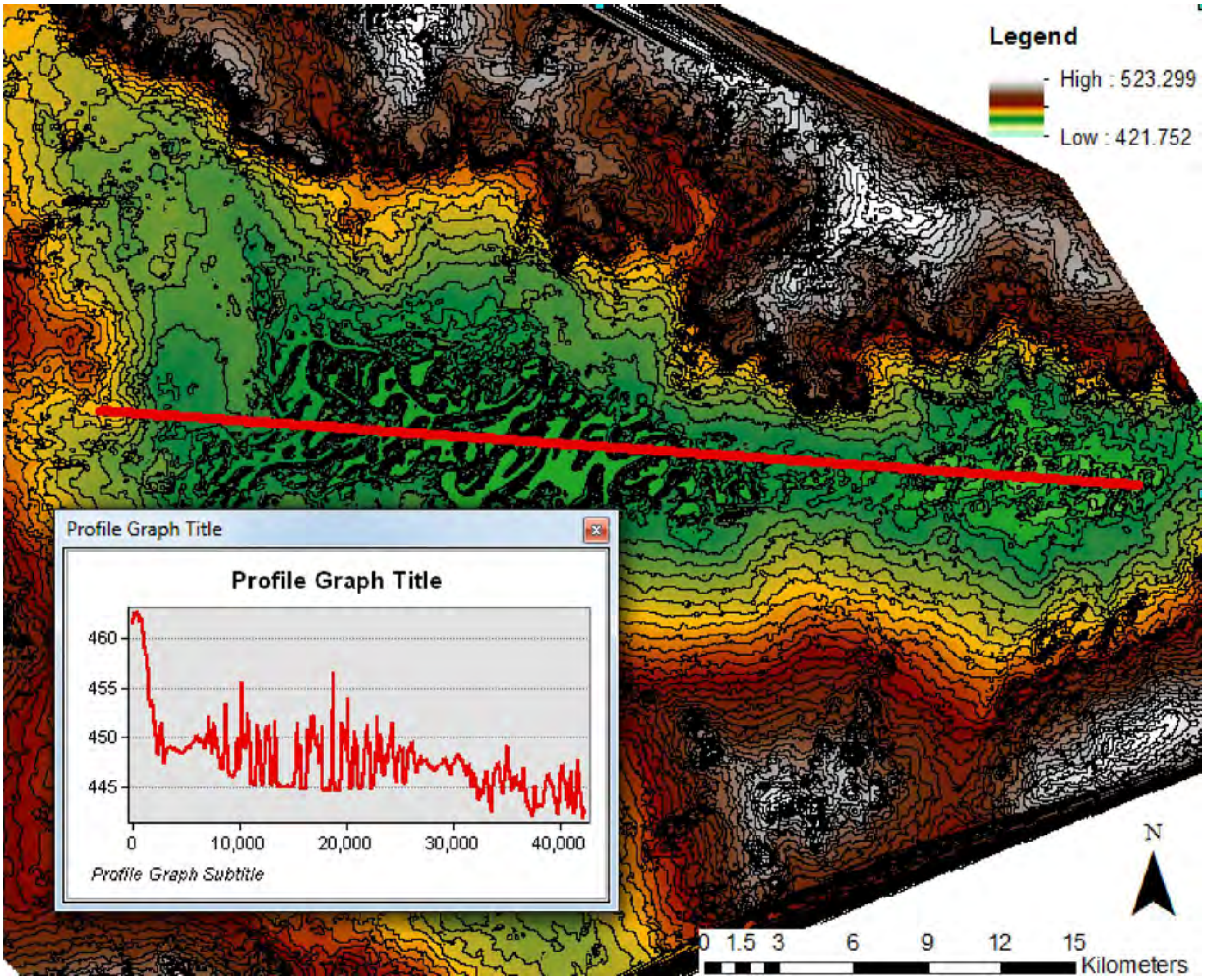

Figure 4: Typical east-west surface profile across Lake Wells

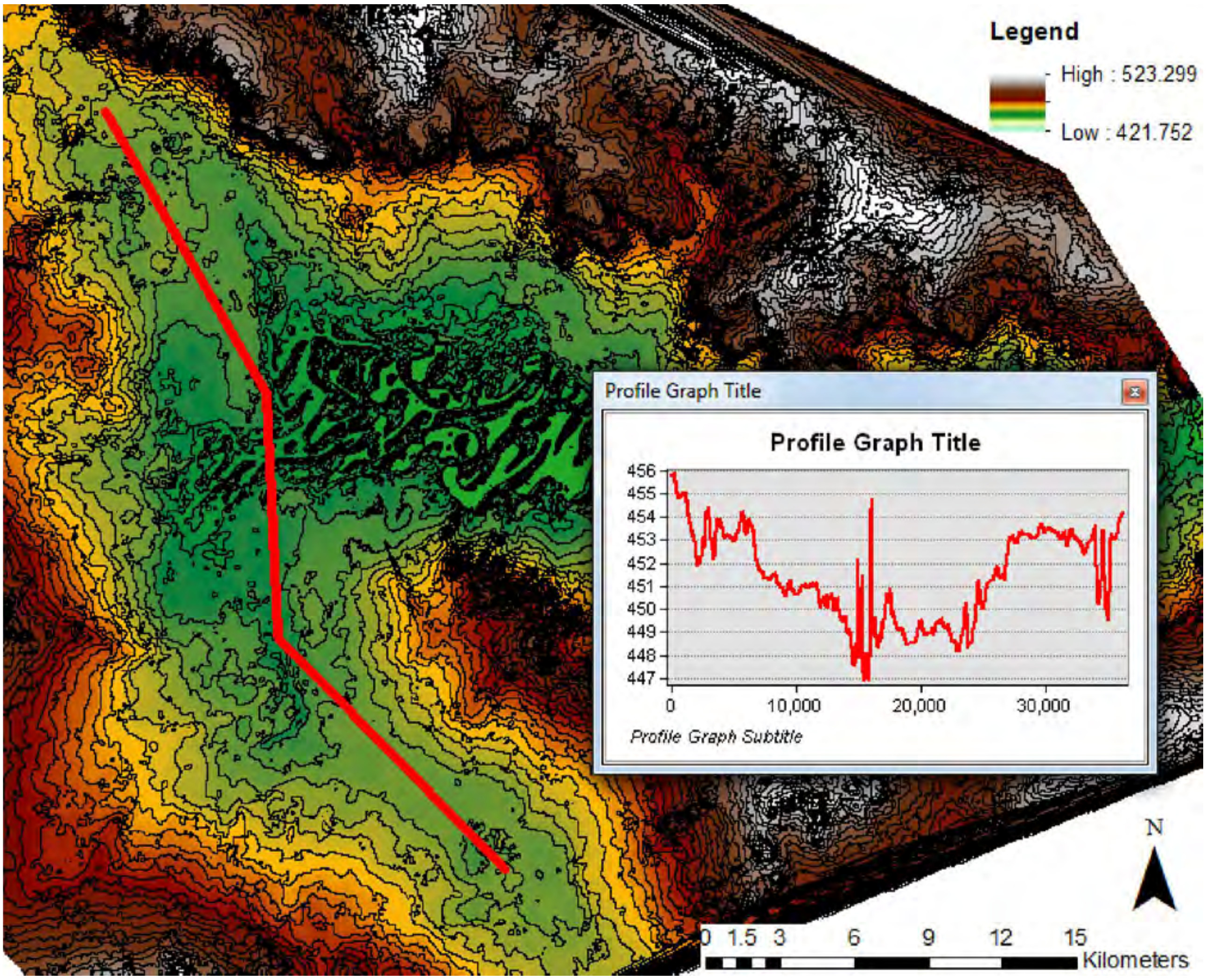

Figure 5: Typical north-south surface profile across Lake Wells

3.3 Flood estimation

Peak design discharges were derived for the Lake Wells catchments (overall catchment area of 6,100 km^2) for a range of annual exceedance probabilities (AEP) ranging from 0.5 to 0.01. An AEP of 0.5 equates to a 50% chance that the event will be equalled or exceeded in any given year, while an AEP of 0.01 equates to a 1% chance. Three alternative approaches were considered, namely:

i) Index Flood method as outlined in Australian Rainfall and Runoff (ARR) (Pilgrim, 1998)

ii) Rational method as outlined in ARR (Pilgrim, 1998)

iii) Flavell method.

The latter, although unpublished, is widely used within Western Australia (WA) and was developed and tested on a relatively large amount of flood data recorded within the Pilbara and Wheatbelt regions of WA. Much of this information was recorded after the development of the other two approaches in the 1980s.

A summary of the flood estimates for the overall catchment (6,100 km^2) based on each method is presented in Table 3.

Table 3: Estimated design floods for Lake Wells based on alternative approaches

Approach	Area (km^2)	Estimated Design Peak Discharge (m^3/s) for AEP					
		0.5	**0.2**	**0.1**	**0.05**	**0.02**	**0.01**
Flood Index – Overall	6,100	26	62	120	210	368	615
Rational – Overall	6,100	28	57	100	173	321	568
Flavell – Overall	6,100	55	68	102	168	327	517
Flavell – Northern	4,077	48	59	86	142	274	434
Flavell – Southern	2,027	54	55	71	116	221	352

The results indicate the flood estimates based on the Flavell method are slightly lower than those derived using the alternative approaches for lower AEPs. However, this estimation procedure is based on a more extensive flood data set and is considered to be more reliable. The results were therefore retained for further assessment.

In undertaking the hydraulic analyses flood hydrographs were required for both the northern and southern tributaries. These were derived using the following approach:

i) Flood peaks for the individual southern and northern catchments for the various AEPs were based on applying Flavell's method (see Table 3).

ii) Given the lack of any recorded local flood data in the region and associated uncertainties in the flood estimates and related hydrological responses across the study area catchments, the estimated peak floods were increased by 50%.

iii) The hydrographs were assumed to be triangular in shape, with a time to peak equal to the time of concentration (t_c) of the catchment and the base length equal to four times the t_c. The 18 hour storm duration was selected as this represented the approximate times of concentration for the northern and southern catchments.

The adopted flood peaks for the northern and southern tributaries, summarised in Table 4, are likely to be conservatively high but will provide an upper limit on the extent and depth of inundation during larger flood events.

Table 4: Adopted peak discharges for north and south tributaries

Tributary	Estimated Design Peak Discharge (m^3/s) for AEP					
	0.5	**0.2**	**0.1**	**0.05**	**0.02**	**0.01**
Northern	81	83	106	173	332	527
Southern	72	88	129	212	411	650

In addition to the upstream catchment inflows, additional runoff will also result from rainfall directly on the playa lake. The hourly design rainfalls for the area based on an 18 hour storm duration (derived from Table 2) were adopted and converted initially to a rainfall excess (that is, runoff) by subtracting the initial and continuing rainfall losses recommended for the region (ARR, 2016). Hourly rainfall excesses were then converted to an average discharge for each hour and were distributed as point inflows along 10 boundaries evenly distributed around the playa area to be modelled in the hydraulic analyses. This distribution provided a representation of the impacts of rainfall directly on the playa itself and immediately adjacent area.

3.4 Hydraulic analyses

3.4.1 Approach

Estimates of the extent and depth of flooding in the vicinity of the south-west arm of the Lake Wells playa system were derived using the HEC-RAS 2D hydraulic model (USACE, 2016). This model allows the user to undertake two-dimensional unsteady flow river hydraulics based on the geometry of the existing river channel and adjacent overbank areas. The inputs to the model include:

i) Flow hydrographs at the upstream model boundaries, as outlined in Section 3.3, and an assumed downstream boundary condition based on a normal flow depth with a channel slope of 0.1 m/km (as observed)

ii) Flow hydrographs associated with ten boundaries evenly distributed around the play lake itself to represent incident rainfall

iii) A terrain model (based on available LiDAR and DEM data) to define the ground elevation within the adopted rectilinear grid

iv) Manning’s n coefficient defining channel and overbank roughness (adopted as 0.035).

In terms of the model grid a mesh 100 m × 100 m grid was developed. This resulted in a total number of cells of around 114,000 covering the model extent. The grid extent, cell discretisation and model boundary locations are shown in Figure 6. This grid was adopted for both cases simulated (see Section 3.4.2).

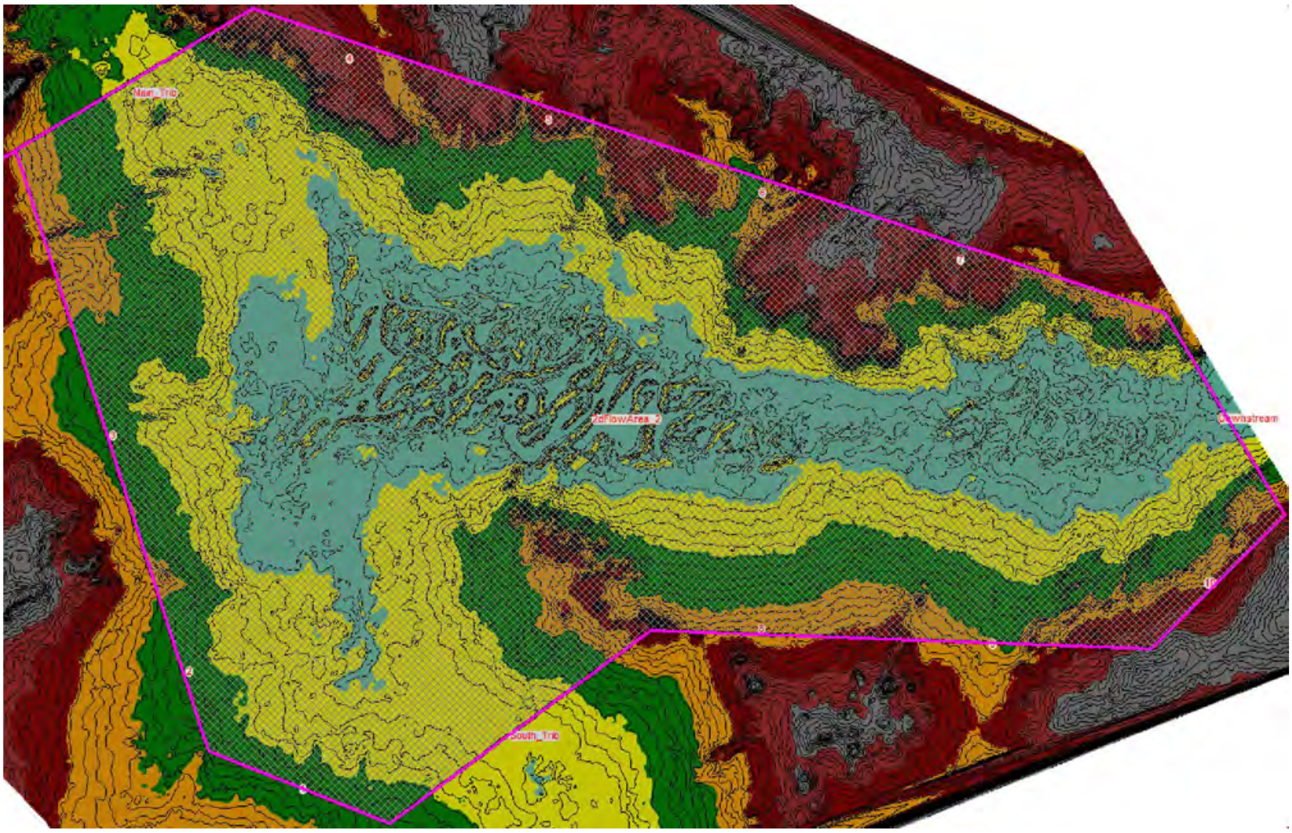

Figure 6: Adopted HEC-RAS model – existing conditions

The model was run over a period of 12 days for all flood events to define both the estimated maximum extent of flooding, and variations in flood levels and flow velocities across the Lake Wells playas.

3.4.2 Results of hydraulic modelling under existing conditions and with project

The results of the flood modelling for Lake Wells Potash Project site under are presented below for two cases, namely:

- Existing conditions (pre-project), and
- Following construction of the proposed ponds and other local project infrastructure.

Two separate geometry files were developed, one based on existing conditions using the available contour data (see Figure 3) and the other based on superimposing the proposed project ponds on the available contour data (see Figure 7). The same cell discretisation was adopted for both models.

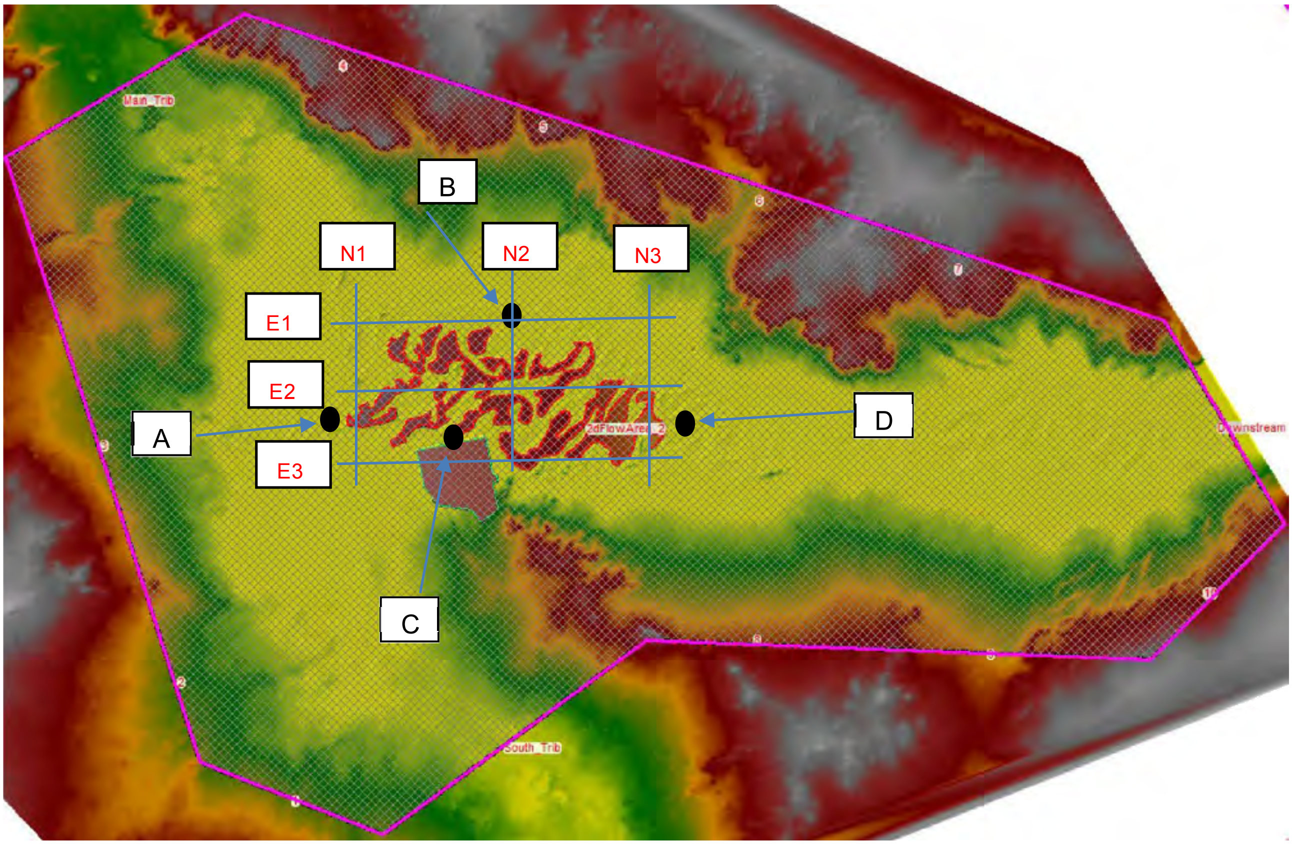

Figure 7: Adopted HEC-RAS model – with project infrastructure

Outputs are presented for each of these cases in Appendix A and Appendix B, respectively, based on the estimated 0.05, 0.02 and 0.01 AEP floods. To provide an indication of the extent of flooding under existing conditions in the vicinity of the proposed airstrip and final production pond these are also highlighted in the figures in Appendix A. The locations of the proposed project ponds and other infrastructure are also outlined in the schematics in Appendix B.

The results present:

- Estimated flood extents and flood water levels for the current conditions, and
- Estimated flood extents; flood water levels and flow velocities with the project infrastructure.

Estimates of water levels in the vicinity of the proposed ponds are presented in Table 5 for both cases and the different AEP floods simulated for locations in the vicinity of the ponds (A, B, C, and D) are presented in Table 5.

Table 5: Estimated peak flood levels and flow velocities

AEP	Pre-Project		Post-Project	
	WL (m AHD)	Flow Velocity (m/s)	WL (m AHD)	Flow Velocity (m/s)
Location A				
0.05	448.41	0.26	448.85	0.30
0.02	448.95	0.41	449.27	0.35
0.01	449.47	0.63	449.74	0.45
Location B				
0.05	447.55	0.03	448.84	0.10
0.02	448.59	0.08	449.27	0.30
0.01	449.10	0.69	449.72	0.75
Location C				
0.05	447.62	0.01	No flooding	-
0.02	448.59	0.03	449.25	0.20
0.01	449.10	0.25	449.65	0.32
Location D				
0.05	445.10	0.10	445.70	0.12
0.02	446.79	0.21	447.26	0.20
0.01	448.50	0.50	448.88	0.30

To provide a more detailed overview of the variation in peak water levels across the project area with the ponds in place a series of sections were drawn both west-east and north-south across the ponds (see Figure 7 for alignments). These sections are presented in showing the peak water levels and ground elevations along each section.

3.4.3 Discussion of results of hydraulic modelling

The key findings based on the collation of data and result of the analyses are outlined below:

- The playa area at Lake Wells is characterised by a series of depressions separated by slightly elevated ridges. It is proposed that a number of these depressions will be utilised as evaporation ponds for the processing of *in situ* brines from the palaeochannel system to produce a sulfate of potash (SOP).
- Based on the results of the 2D hydraulic modelling, floods from the catchment upstream of the proposed project area for floods less than around the 0.05 AEP event are largely contained within the existing depressions. For lower AEP events the more upstream depressions are initially filled and overflow from depression to depression in both lateral and downstream directions. However, even for the 0.01 AEP flood the discharge through the playa area is not large with much of the upstream inflow being retained with the depressions.
- Existing Conditions:
  - The playa area has an extremely low surface gradient in a west-east direction. This, coupled with the progressive retention of flow within the depressions, results in very low flow velocities within the playa area even for larger floods such as the 0.01 AEP event. Flow velocities for this flood are typically less than 0.7 m/s under existing conditions.
  - The extents of inundation for lower AEP events below the 0.05 AEP flood increase under existing conditions although the changes are not significant.

- For existing conditions, flood elevations on the playa area immediately downstream of proposed project extent (Location D) are estimated to be around 445.10 m AHD for the 0.05 AEP event. This is associated with inflows from the minor adjacent catchments with, as mentioned, minimal inflow from the playa area upstream. For lower AEP events the flood elevations increase as upstream inflows contribute. For example, the flood levels for the 0.01 AEP flood are around 448.5 m AHD, which is 3.4 m higher. At the western end of the project area (Location A) flood elevations increase from around 448.4 m AHD for the 0.05 AEP flood to 449.5 m AHD for the 0.01 AEP event, an increase of 1.1 m. Centrally along the project area on the northern side (Location B) and southern side (Location C) the flood levels are comparable at 448.6 m AHD and 449.1 m AHD for the 0.05 and 0.01 AEP events, respectively, a difference of around 0.5 m.
- The flood depths (that is water surface minus ground level) vary considerably across the playa area, reflecting inundation in the numerous depressions.

- With Ponds:
  - Locating proposed evaporation ponds, as well as other site infrastructure, on the playa surface would require the construction of embankments sufficiently high to reduce the risk of overtopping during larger floods.
  - Flood levels at Location A are estimated to increase by around 0.3 m to 0.4 m as a consequence of the ponds for all AEP floods simulated. At Locations B and C the increases are estimated to be larger at around 0.5 m to 0.7 m. Immediately downstream of the pond area, the increases are also estimated to be around 0.3 m to 0.6 m. This is greater than was anticipated as it was expected the flood levels would remain comparable. This suggests the flows between the depressions in the lower section of the project area may have more of an influence than simply the water levels further downstream of the pond area (as would be expected for a system with low flow velocities that would be primarily influenced by downstream backwater impacts).
  - Flow velocities are estimated to increase marginally due to the installation of ponds, although velocities are expected to remain at around 1 m/s and less.
- The model does not consider infiltration during and after flood events. If infiltration occurs at rates commensurate with those considered possible based on anecdotal information of soil conditions observed on site, the duration of inundation will reduce considerably from that occurring if infiltration is limited or negligible. In the latter case the losses would primarily be a result of evaporation.
- The flood estimates adopted in this assessment have been based on scaling those predicted using the Flavell method by 50%. If the actual estimates are more comparable to those based directly on the Flavell method, the extent and depth of inundation for the 0.01 AEP flood would be more similar to that currently estimated for the 0.02 AEP flood, which is around 0.4 m lower.
- The potential impact of surface runoff and flood inundation on embankment and earthworks stability should also be considered. The modelling indicates, however, that the extent of the ponds is unlikely to be sufficiently large to impact on the flood depths and extents of inundation more generally across the playa system.
- Although the ponds and other infrastructure are proposed to be located on the playa the very low flow velocities should minimise the risk of scouring along the toe of the embankments around the ponds. Suitable material for embankment construction must, however, be utilised to ensure the embankments are not susceptible to erosion during larger floods.

- Although potential impacts downstream of the Project area were not assessed as part of this study, from this viewpoint, based on hydraulic modelling undertaken to date, flow velocities in the vicinity of the project area are predicted to be extremely low (sub-critical from a hydraulic perspective). The Project development will therefore have negligible impact on water levels downstream of the site during larger floods. As noted above there is unlikely to be any measurable discharge downstream for floods less than those associated with a 0.02 AEP event. The project ponds will utilise a number of the depressions across the playa area so will marginally reduce the flood storage volume available in the project area. It is therefore possible a very minor increase in the volume of water discharging downstream may occur, but only for floods in excess of the 0.02 AEP event. Although not quantified in this study, this marginal increase is unlikely to have a measurable impact on either volumes or rates of surface runoff draining to the larger lake systems to the east of the Project.

4.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled – “Important Information Relating to this Report”, which is included in Appendix C of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

Report Signature Page

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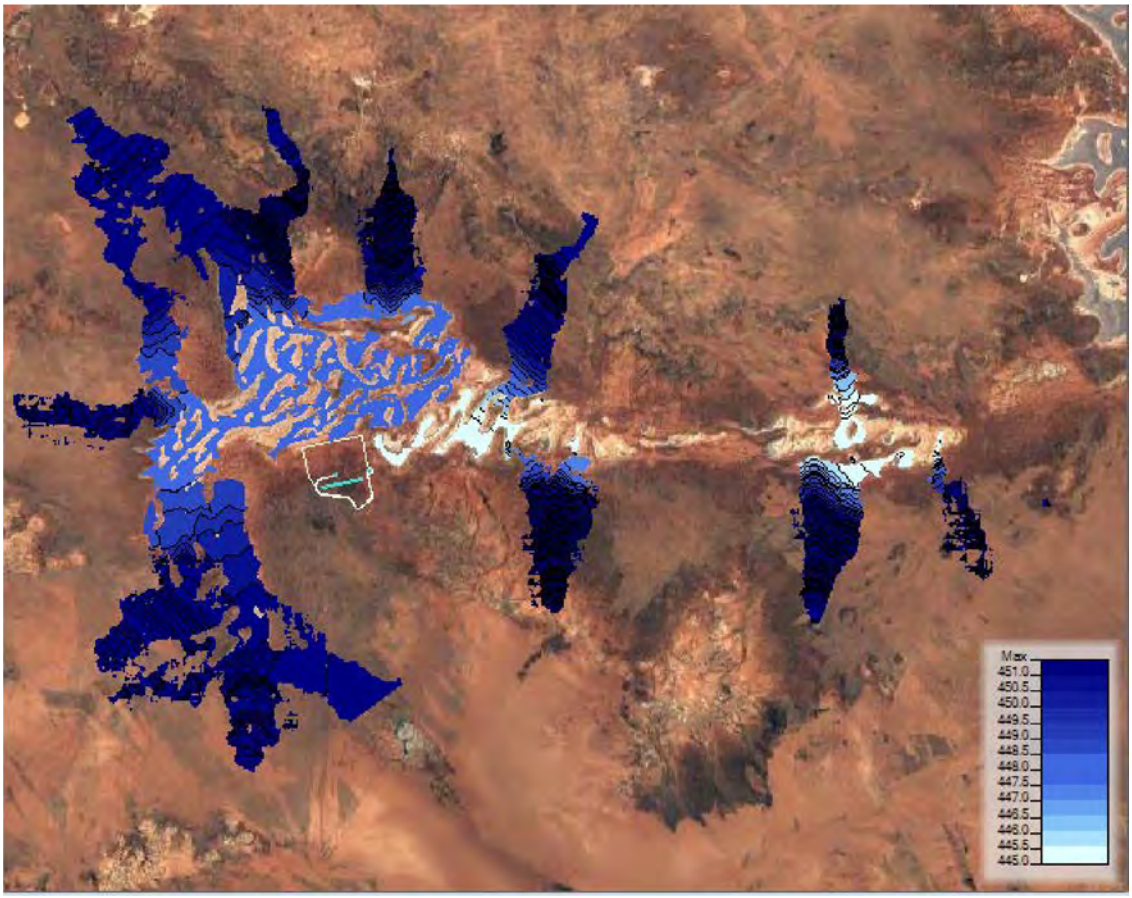
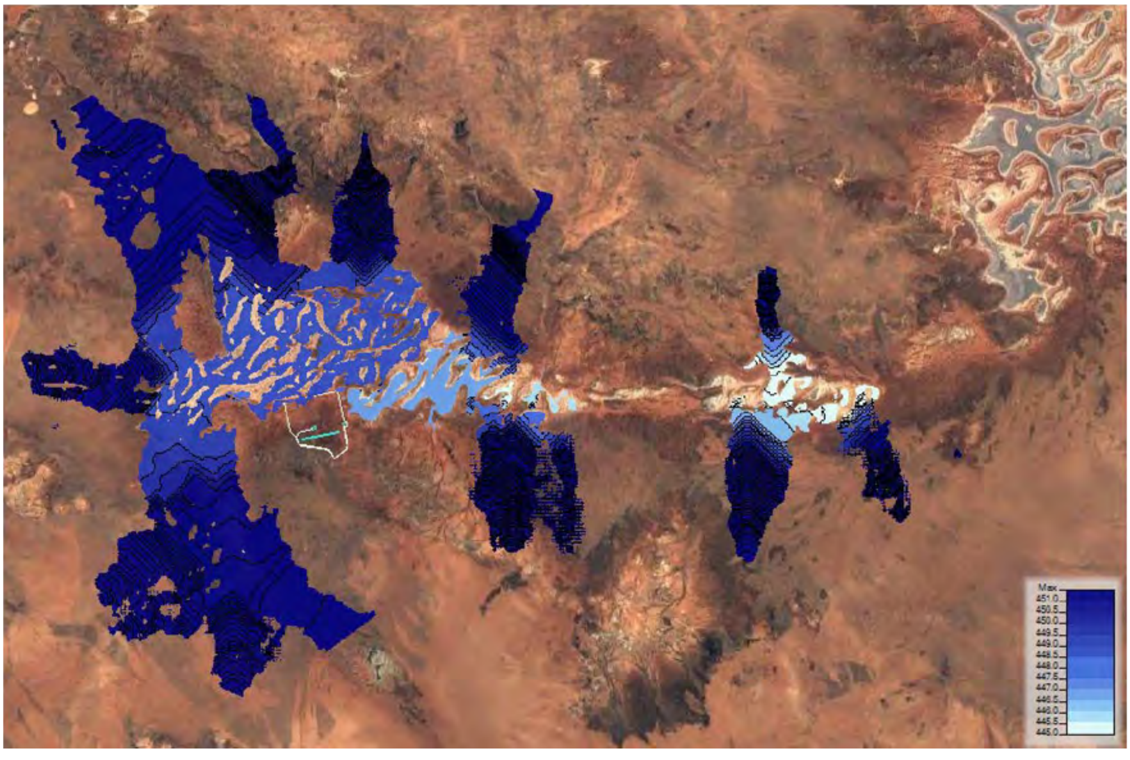
APPENDIX A

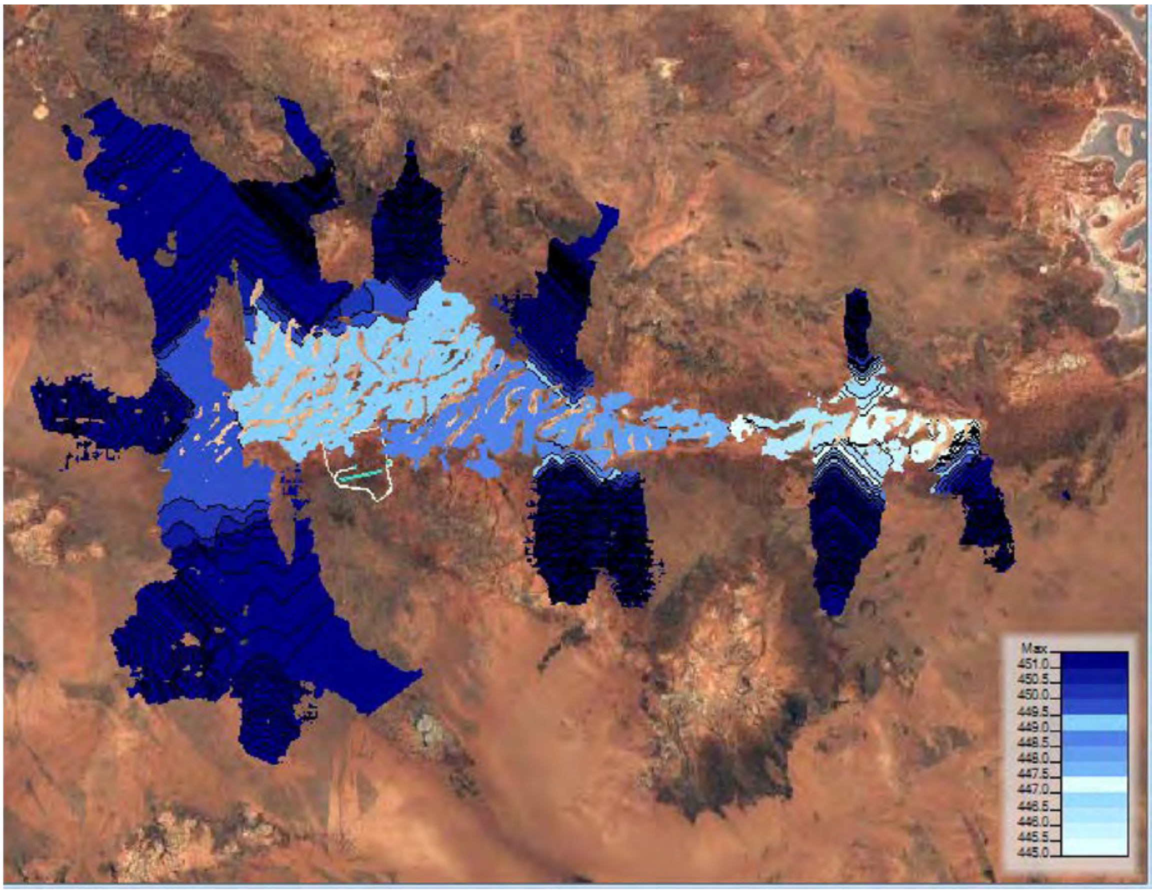
Hydraulic Model Results Under Existing Conditions



Estimated Maximum Flood Levels (m AHD) 0.05 AEP Flood – Existing Conditions



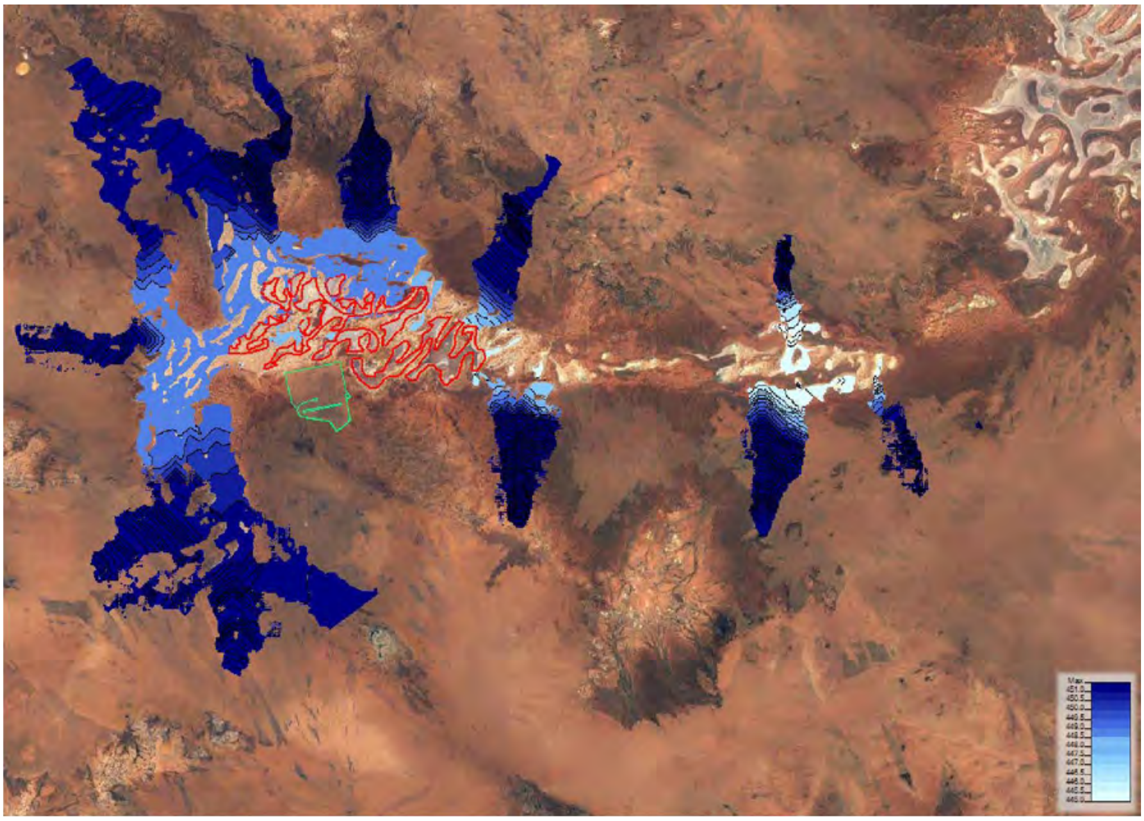
Estimated Maximum Flood Levels (m AHD) 0.02 AEP Flood – Existing Conditions



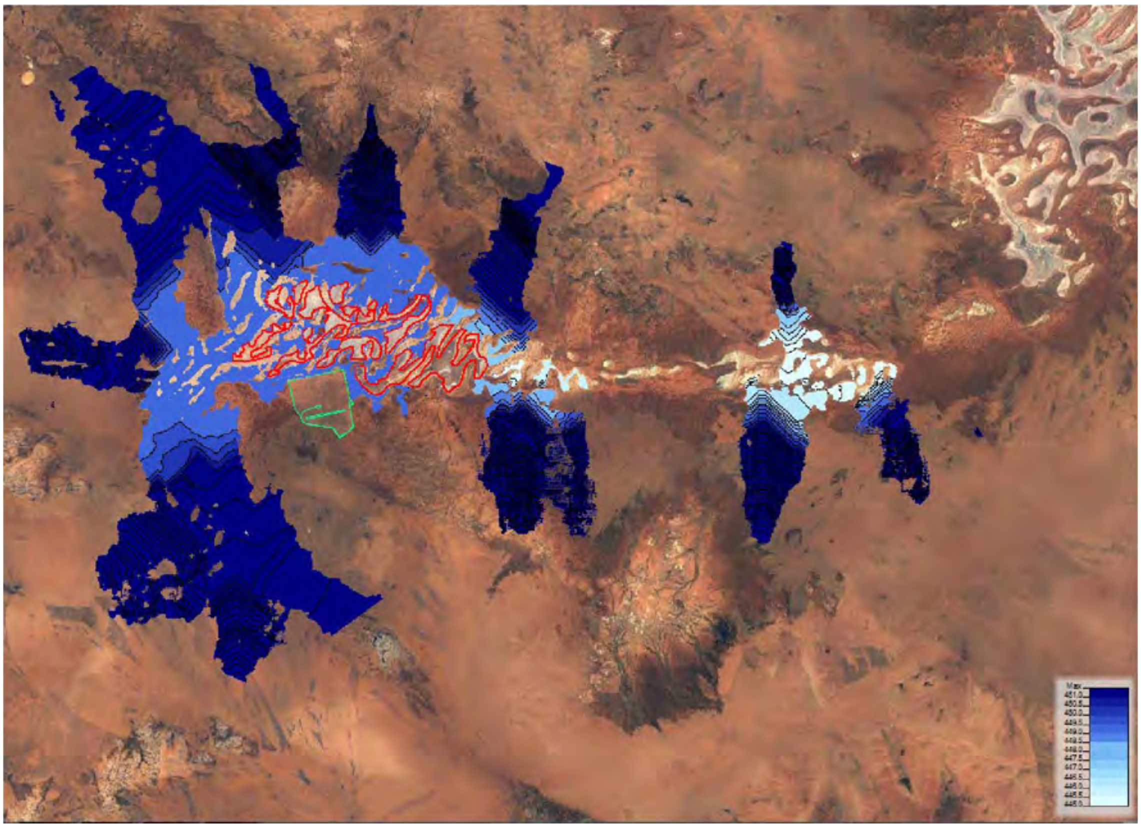
Estimated Maximum Flood Levels (m AHD) 0.01 AEP Flood – Existing Conditions

APPENDIX B

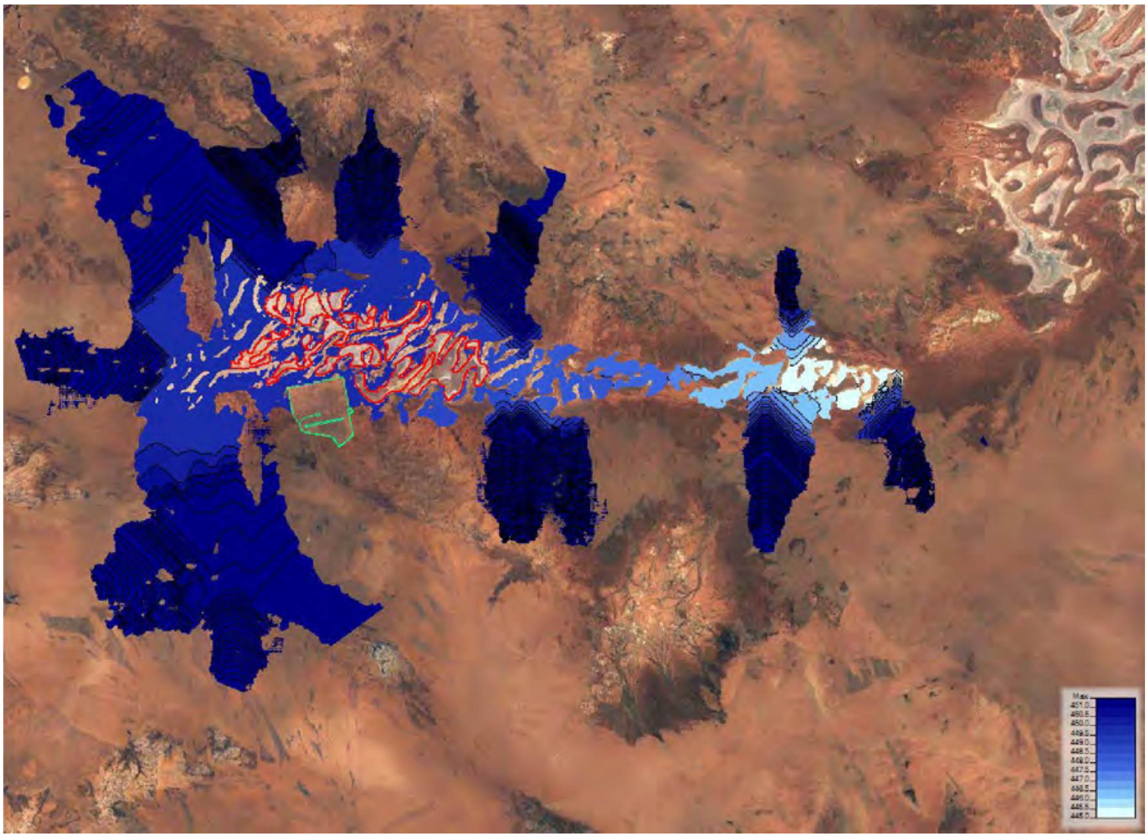
Hydraulic Model Results With Project Infrastructure



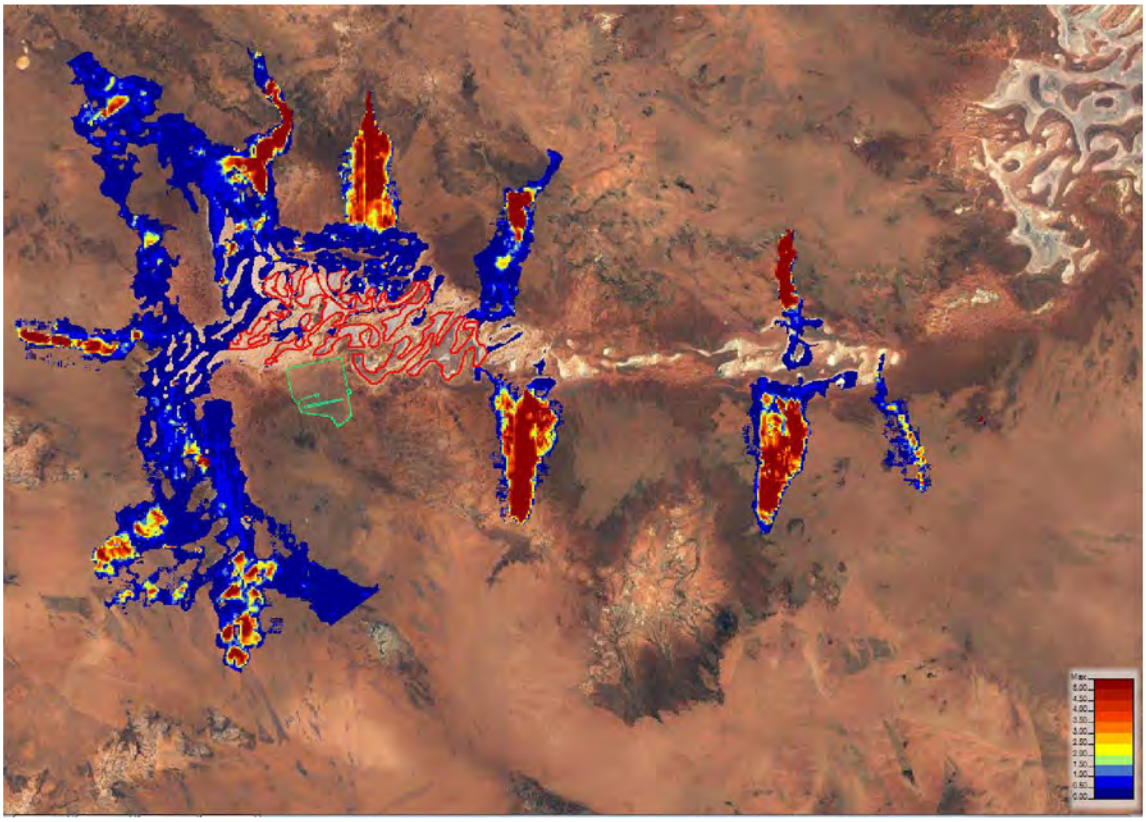
Estimated Maximum Flood Levels (m AHD) 0.05 AEP Flood – With Project Infrastructure



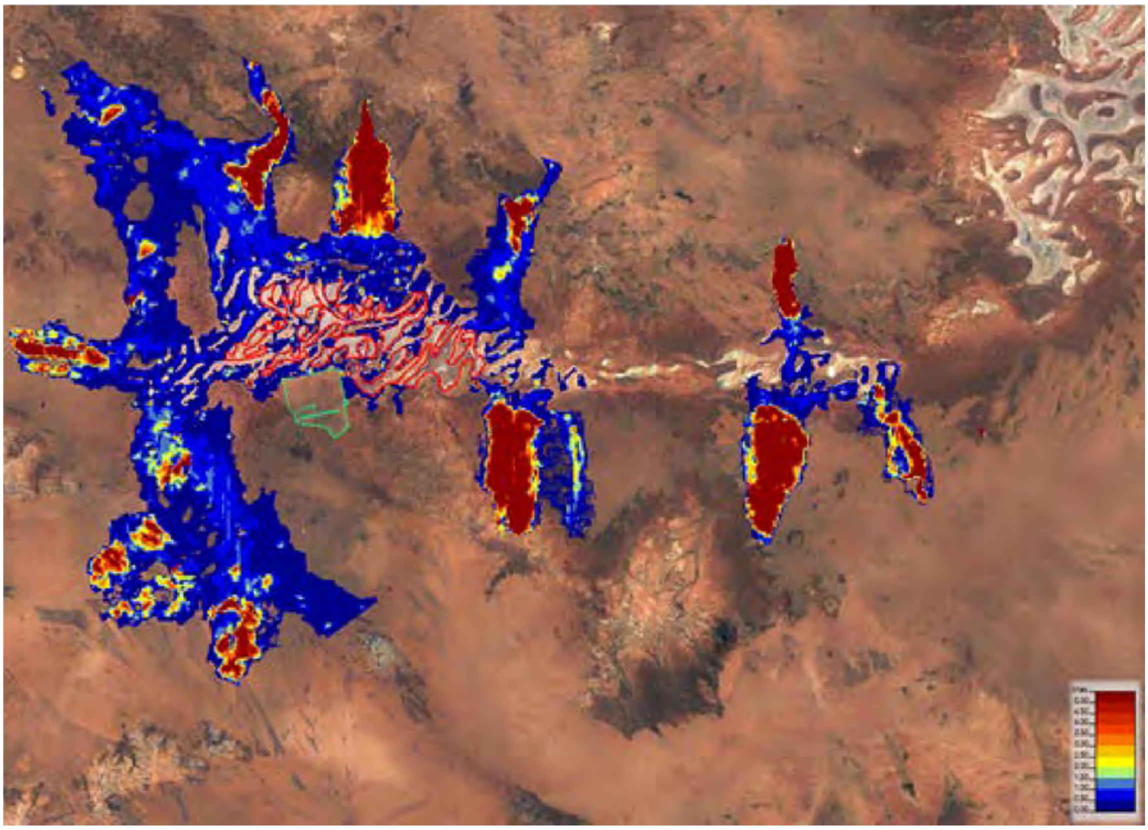
Estimated Maximum Flood Levels (m AHD) 0.02 AEP Flood – With Project Infrastructure



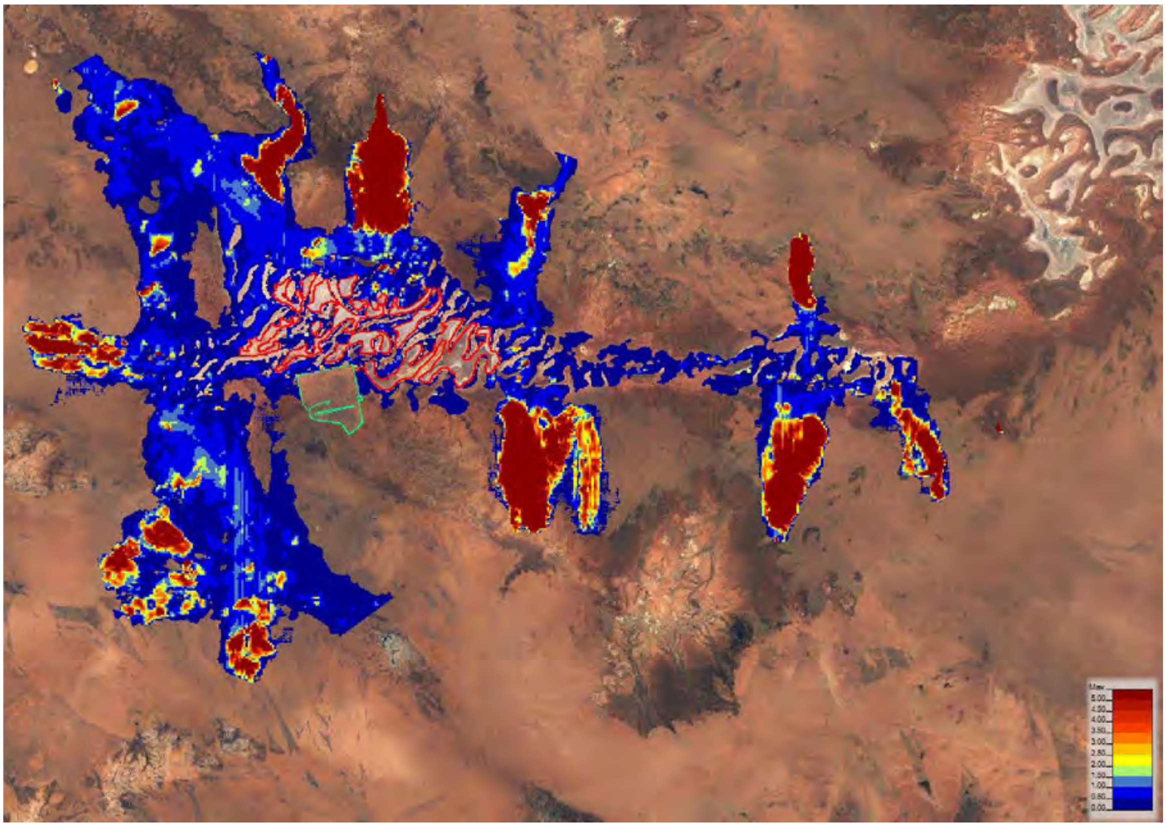
Estimated Maximum Flood Levels (m AHD) 0.01 AEP Flood – With Project Infrastructure



Estimated Maximum Flow Velocities (m/s) 0.05 AEP Flood – With Project Infrastructure



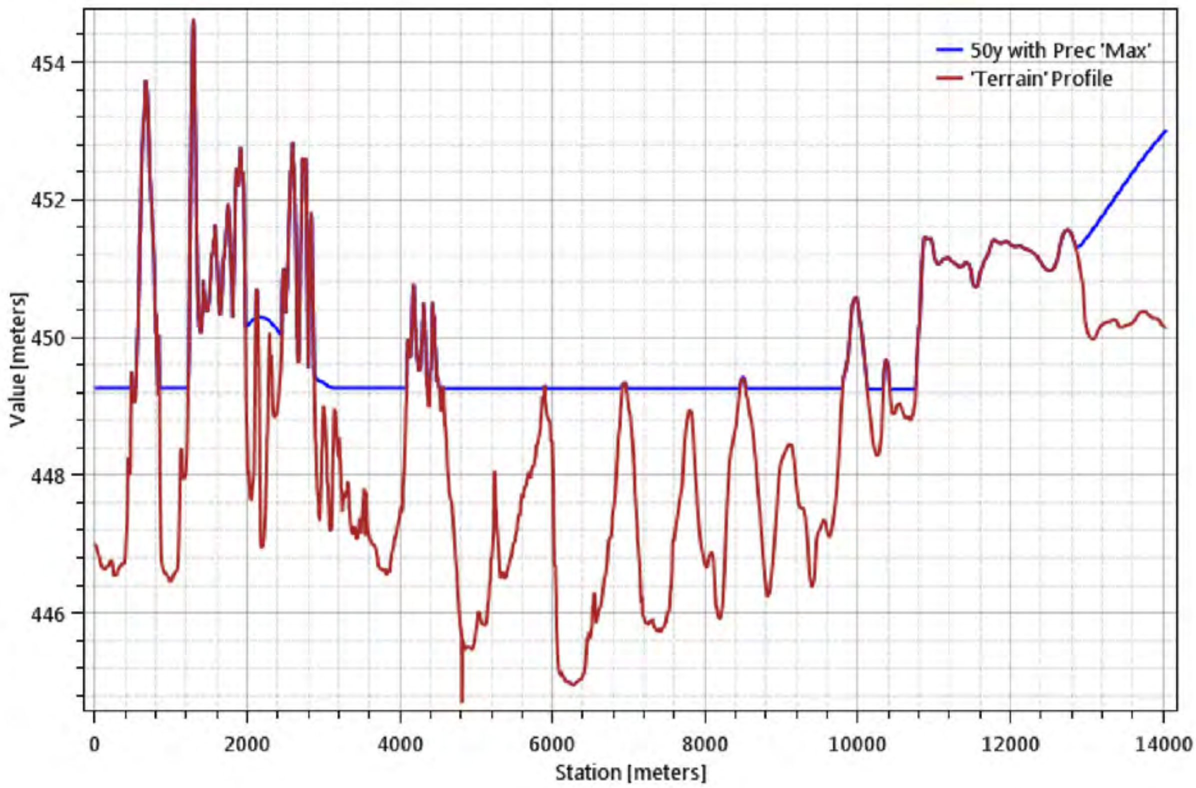
Estimated Maximum Flow Velocities (m/s) 0.02 AEP Flood – With Project Infrastructure



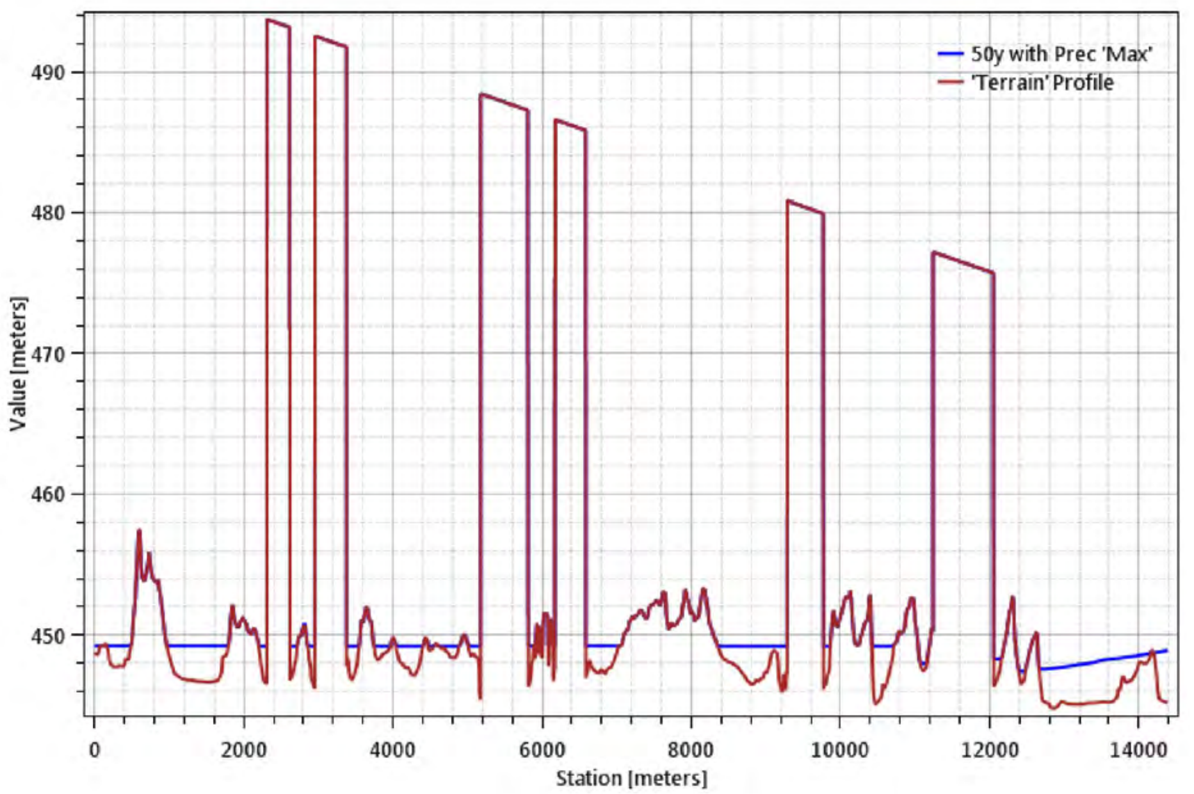
Estimated Maximum Flow Velocities (m/s) 0.01 AEP Flood – With Project Infrastructure

APPENDIX C

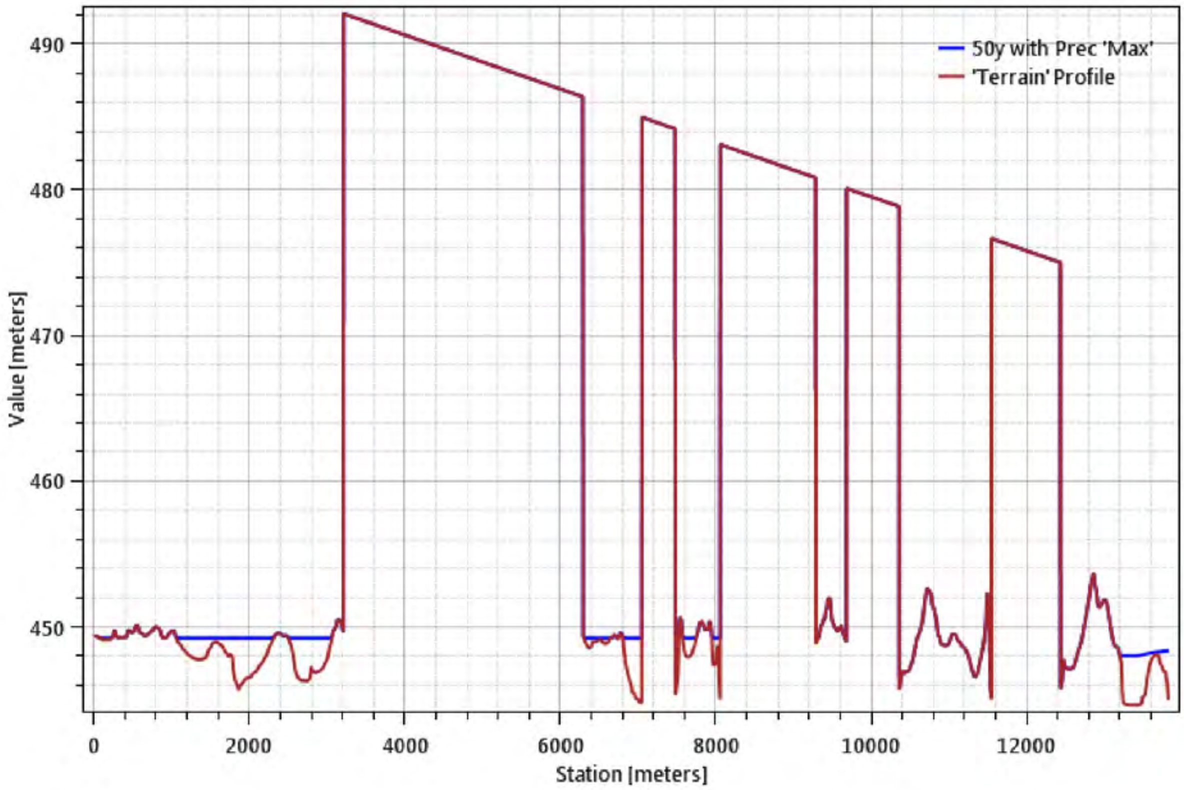
Water Surface Elevations Across Pond Area for 0.02 and 0.01 AEP Floods



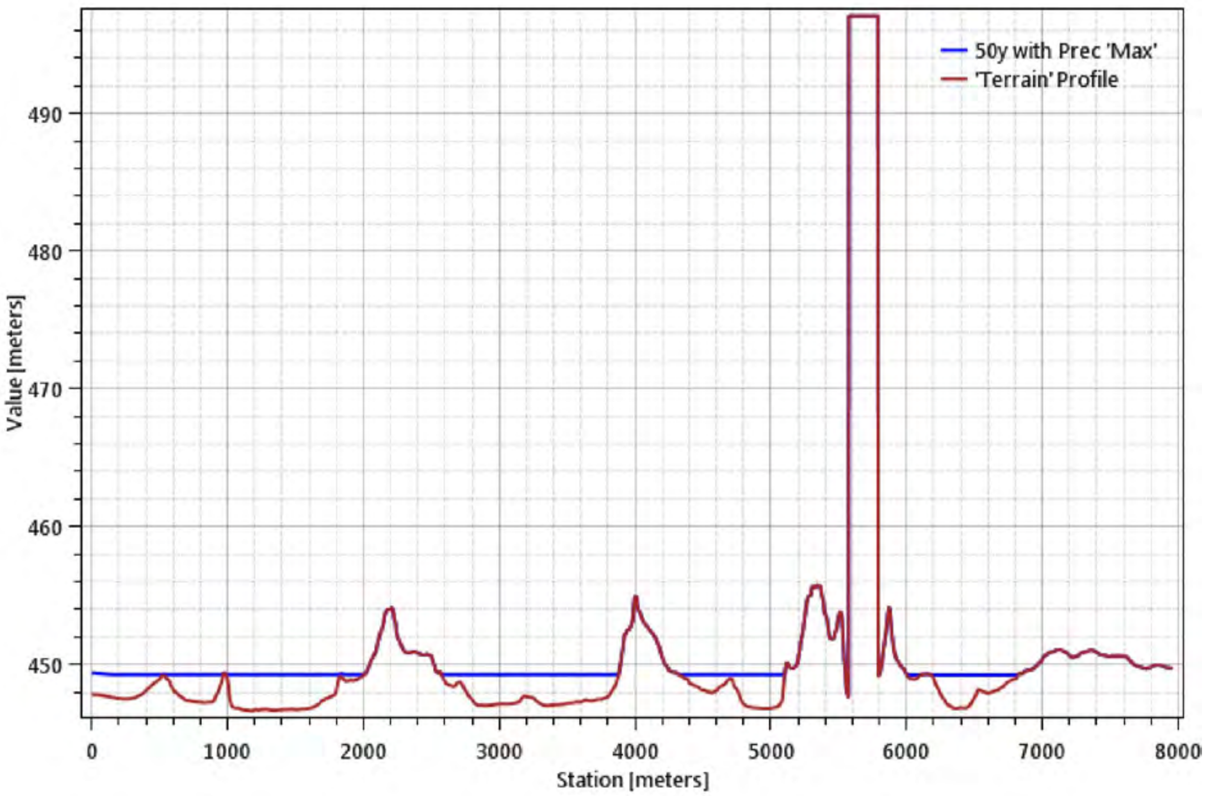
Water Surface Profiles Along E1: 0.02 AEP Flood



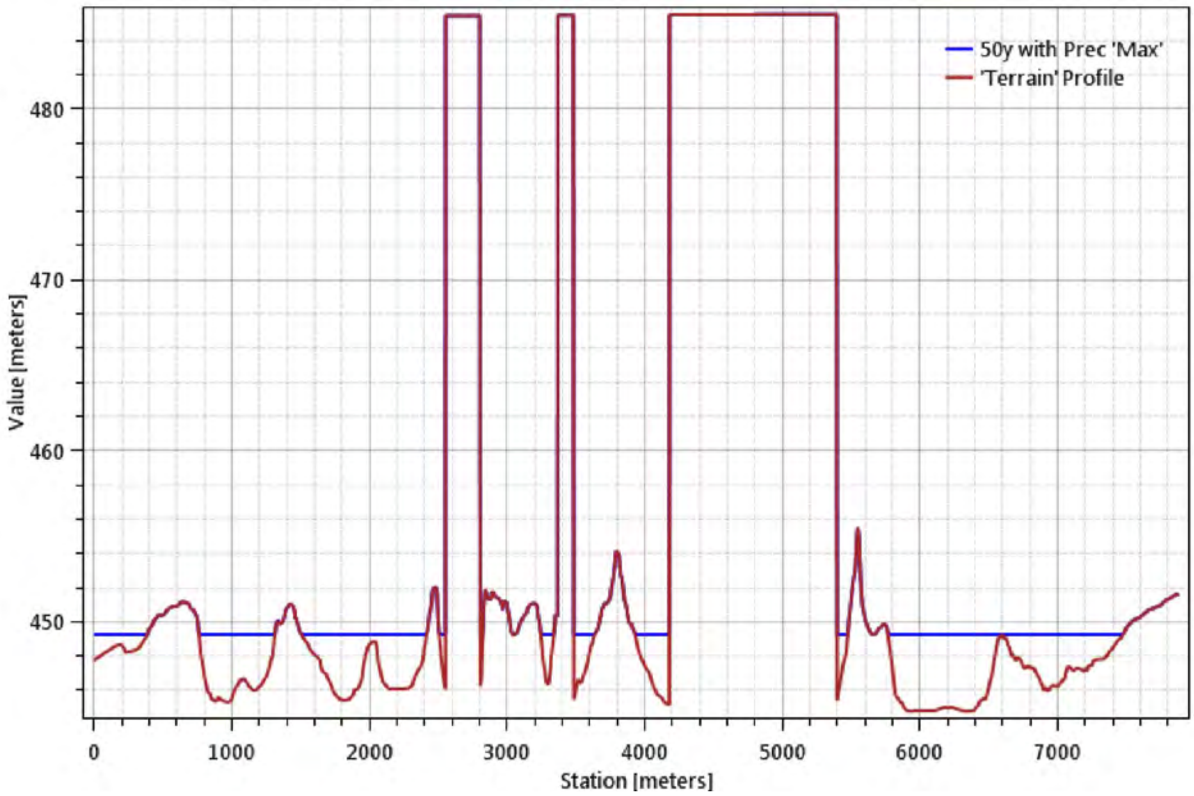
Water Surface Profiles Along E2: 0.02 AEP Flood



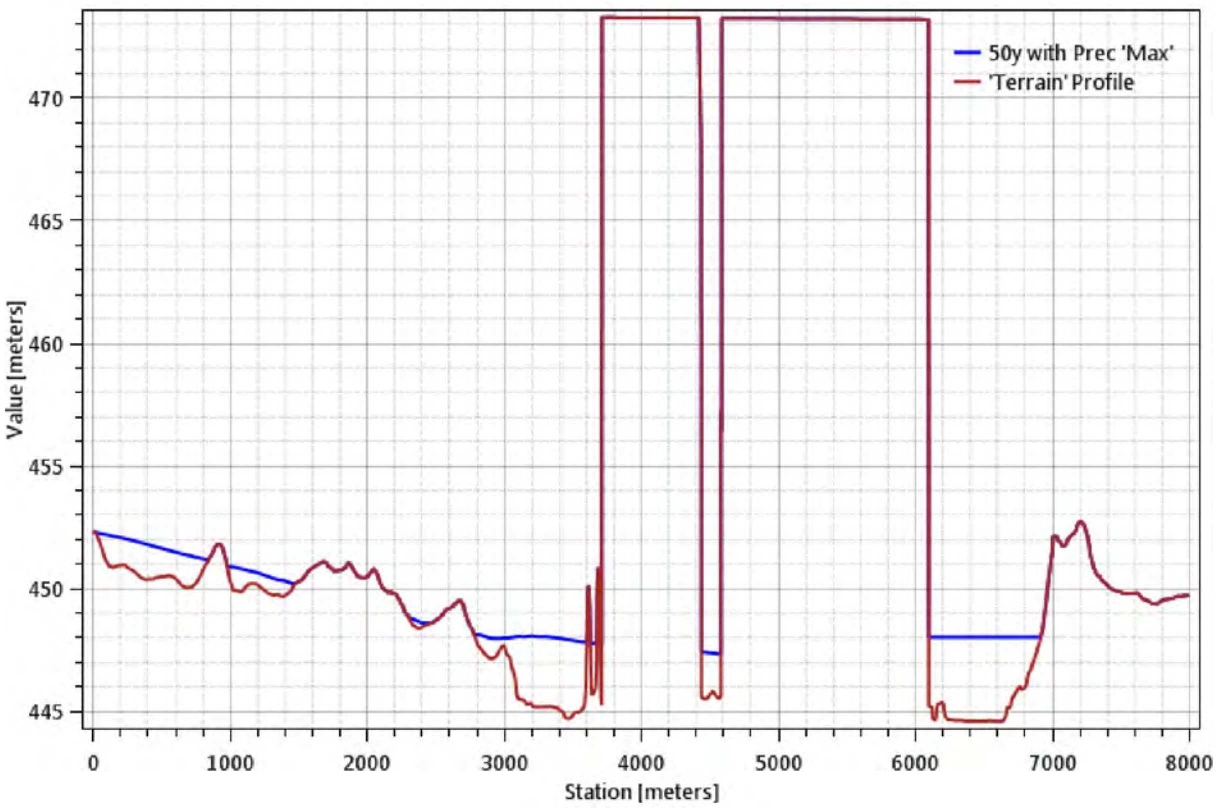
Water Surface Profiles Along E3: 0.02 AEP Flood



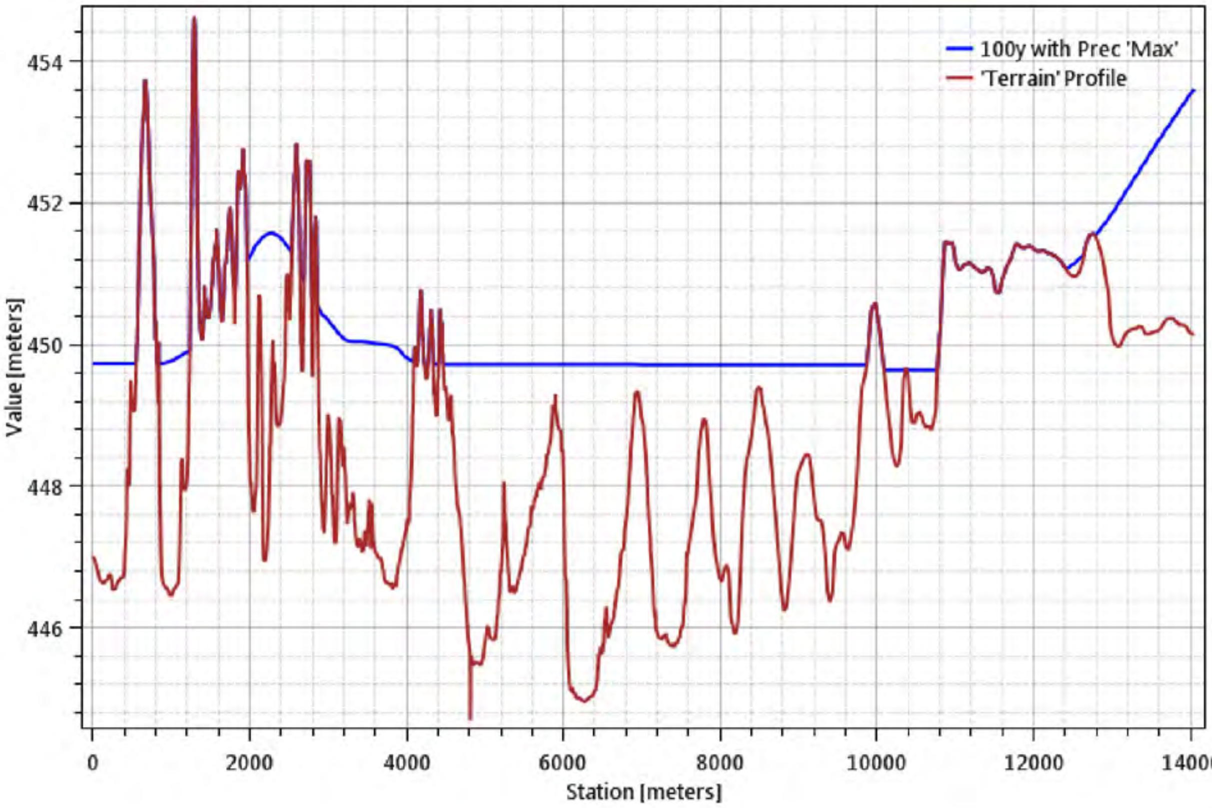
Water Surface Profiles Along N1: 0.02 AEP Flood



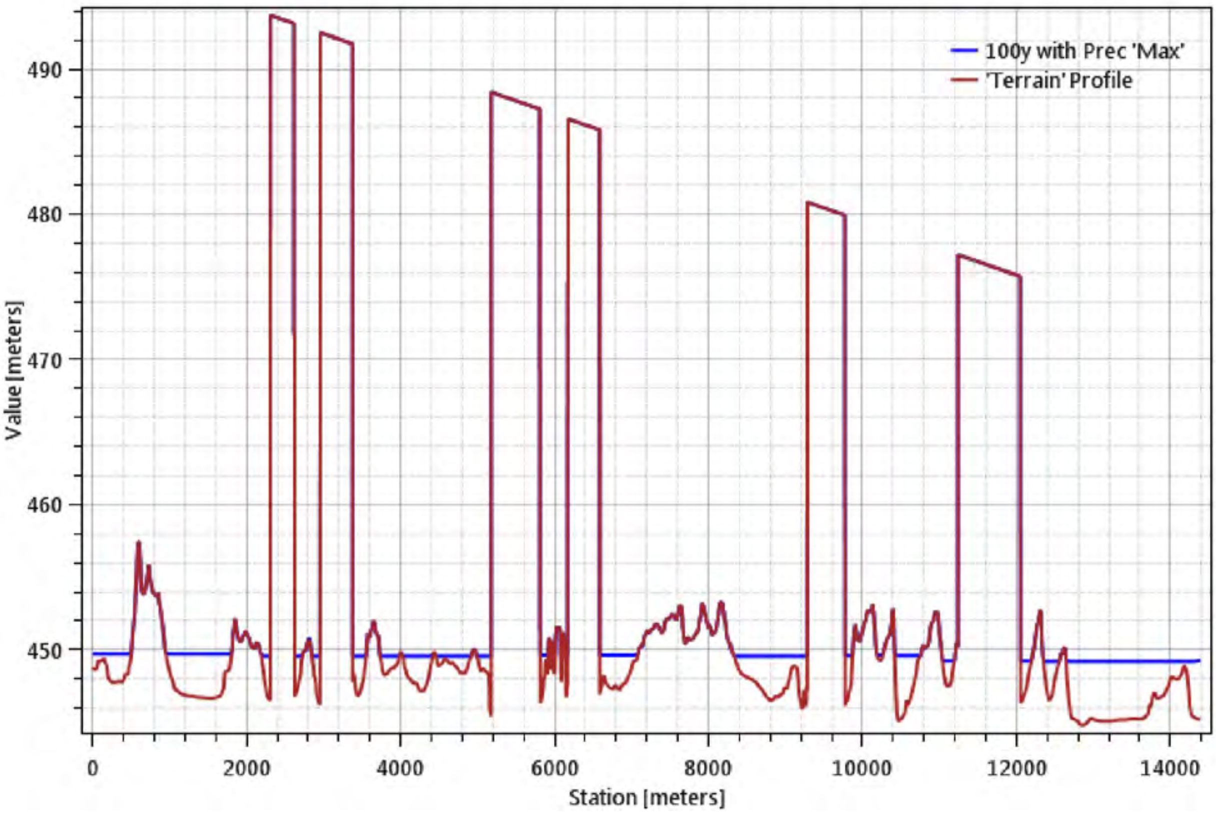
Water Surface Profiles Along N2: 0.02 AEP Flood



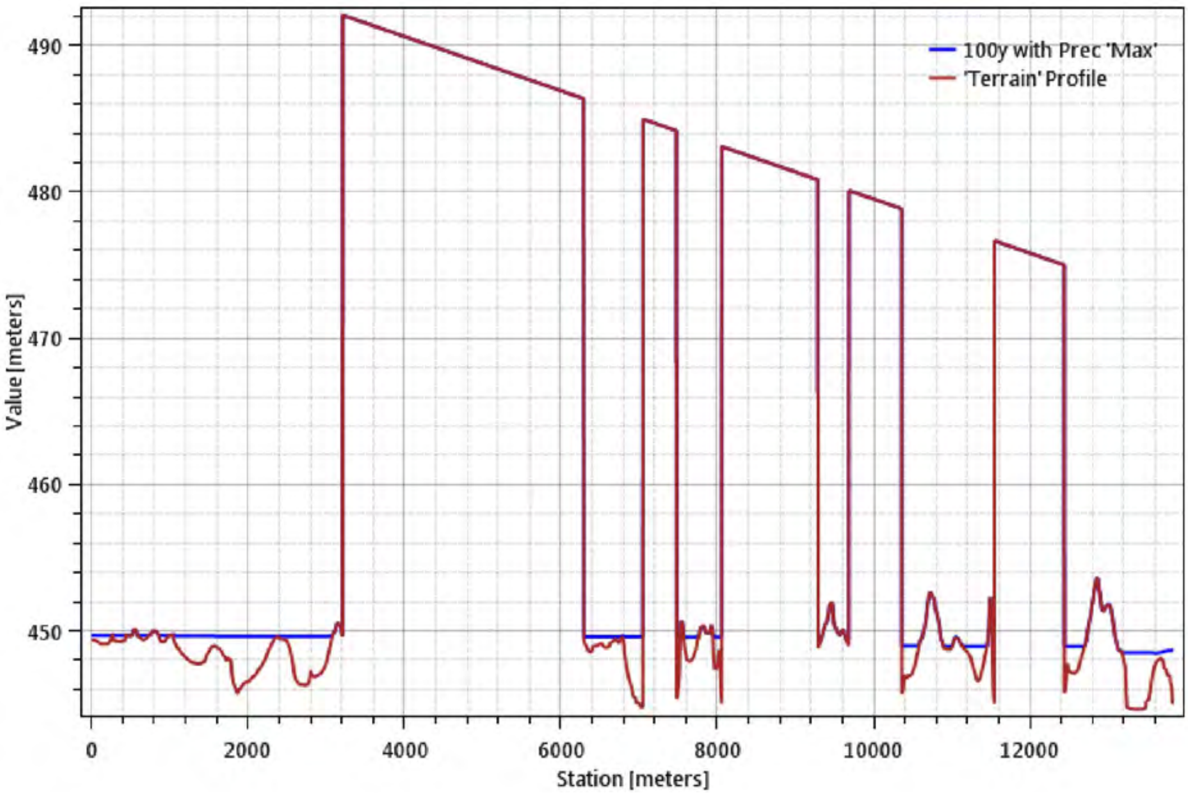
Water Surface Profiles Along N3: 0.02 AEP Flood



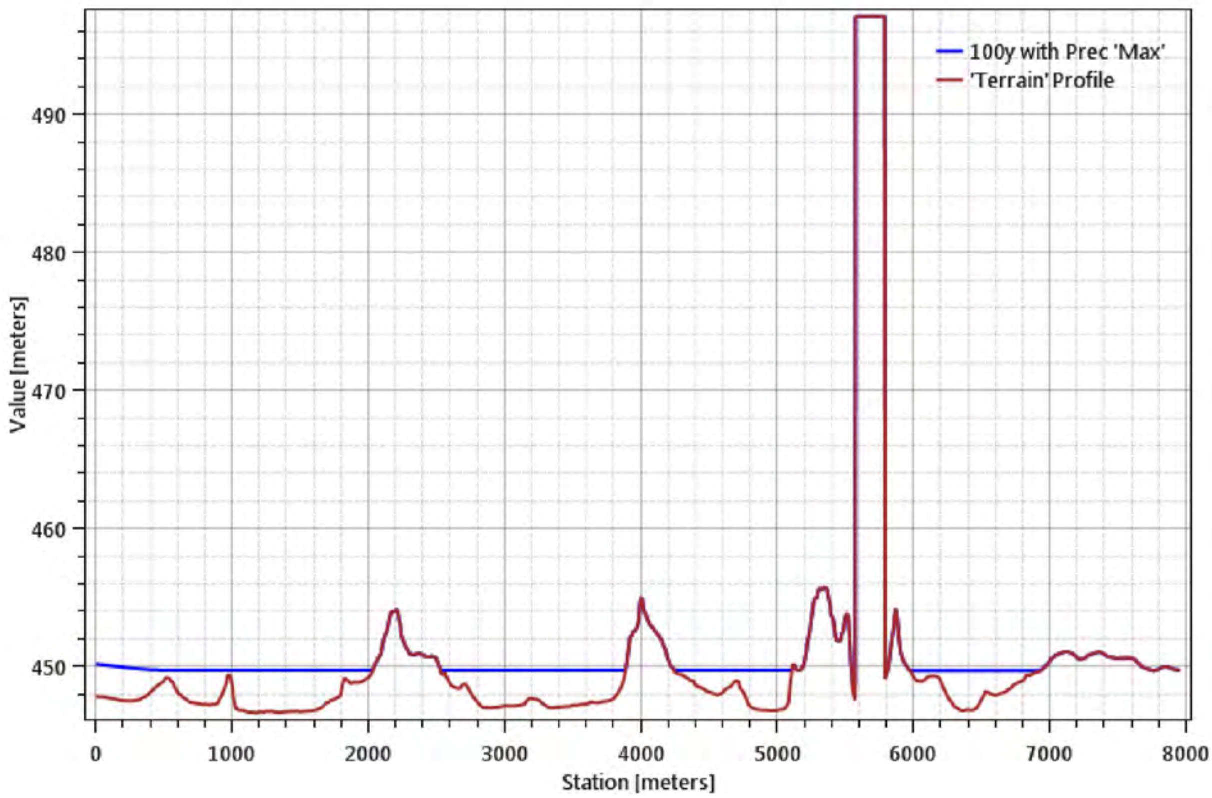
Water Surface Profiles Along E1: 0.01 AEP Flood



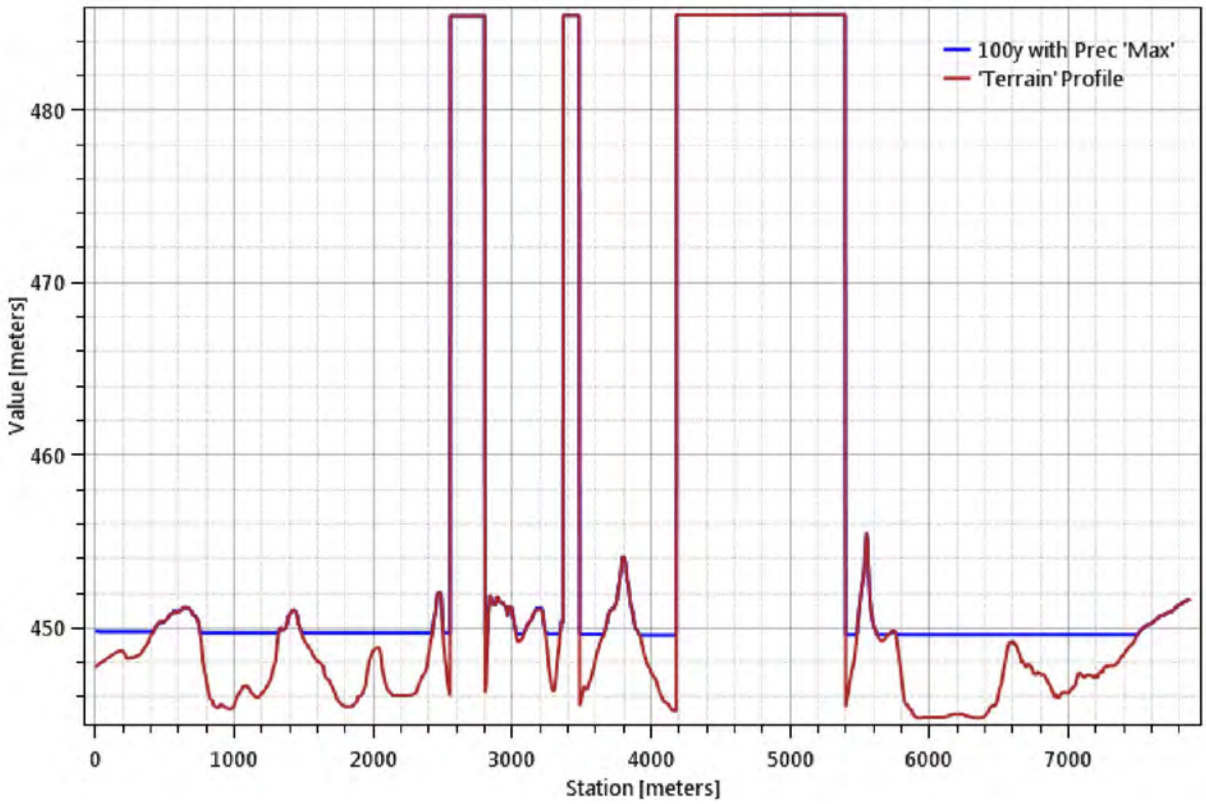
Water Surface Profiles Along E2: 0.01 AEP Flood



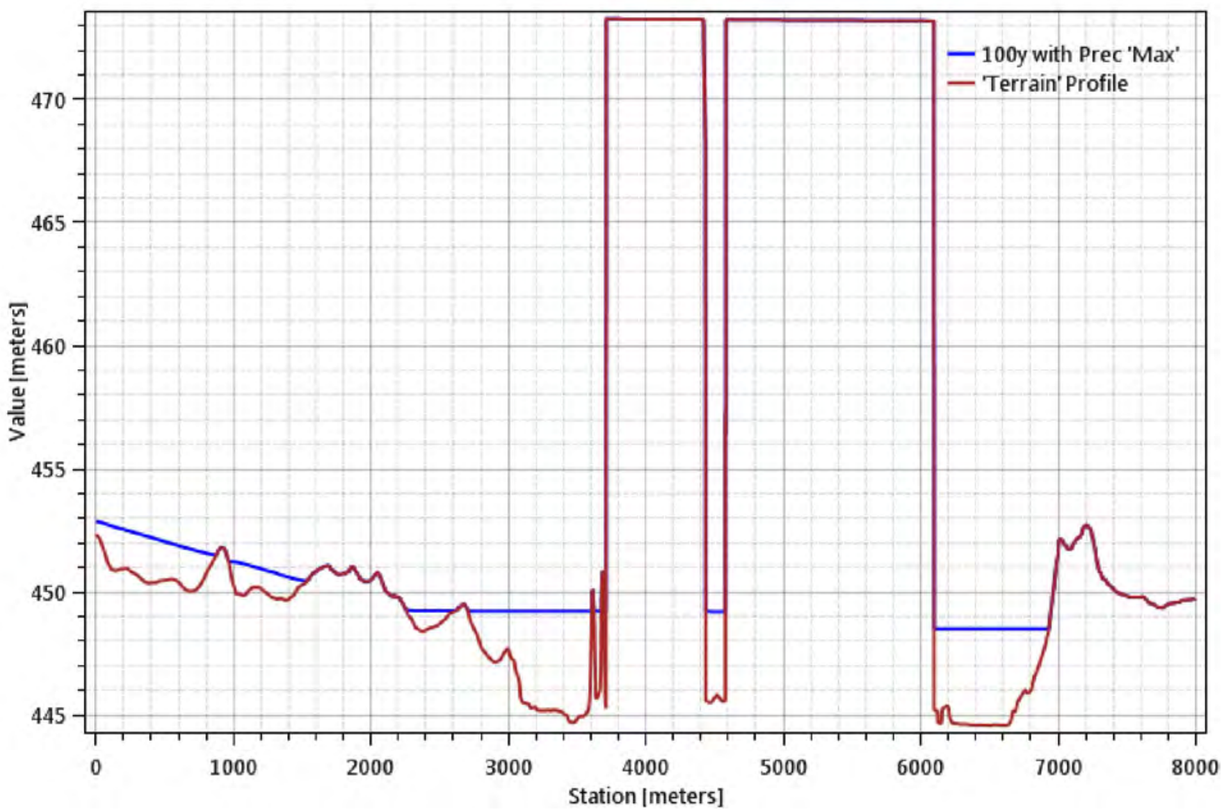
Water Surface Profiles Along E3: 0.01 AEP Flood



Water Surface Profiles Along N1: 0.01 AEP Flood



Water Surface Profiles Along N2: 0.01 AEP Flood



Water Surface Profiles Along N3: 0.01 AEP Flood

APPENDIX D

Important Information

IMPORTANT INFORMATION RELATING TO THIS REPORT

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

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This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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