Project Cost Evaluation for Outlet Structures in the Lower Goulburn Levees - PRELIMINARY REPORT

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PURPOSE

The following is a brief report presenting our initial observations following our first structural assessment of the 5 x outlet structures nominated by the GBCMA for evaluation as follows;

1. Loch Garry Regulator
2. Deep Creek Outlet
3. Wakiti Outlet
4. Hagen's Lane
5. Hancock Creek Outlet

BACKGROUND

We understand that the GBCMA is considering the installation of automated outlet control at the above outlet structures to allow the outlets to be operated remotely. This functionality is intended to facilitate the containment of environmental flows within the levees systems and also to possibly enable a managed discharge of floodwaters beyond the levees for controlled inundation of the trees along the waterway.

AVAILABILITY OF GMW DRAWINGS

We have made telephone contact with GM Water regarding the availability of drawings for the existing structures. We were advised that drawings are available, and followed up our initial inquiry with an email request, however as yet we have not received any information.

INITIAL OBSERVATIONS

We have completed our initial site visits and recorded our observations. The site visits were completed over a 2 x day period, commencing Tuesday 1/9/15 and concluding on Wednesday 2/9/15.

Our observations were recorded in a series of site photos. See attached for a copy of our site photo logs. We also prepared some sketches and recorded a series of measurements for each of the structures. Where we were [1]able to use our GPS equipment we completed a limited site survey. Please see also attached a scan of our sketches. Please see below a summary of our initial observations.

METHODOLOGY

The following brief report has been prepared from preliminary information gathered on our initial site visit.

This information is based upon a combination of observations, our site photo logs, some field measurements and some limited survey information where we were able to use the GPS based survey equipment. That equipment relies upon communications via the mobile telephone network, for geo-grid corrections etc. Three of the sites did not have access to the mobile phone network.

In addition to recording the nature of the structure and the conditions of the structures, our notes also include observations regarding the availability of infrastructure necessary for the operation of the remote operation of the outlets, ie. the availability of mobile telephone communications and access to reticulated electricity supplies: the latter being based upon a review of the available aerial imagery and locating nearby poles and wires. This information needs to be followed up with and verified by the relevant supply authorities as part of the next stage of the project.

[1] *The GPS required access to the mobile phone network to function.*

1. Loch Garry Regulator (1/9/15)

- Location
  Situated about 20km north west of Shepparton, and about 4km west of Bunbartha.
  The structure is readily accessed via the Loch W Road from the Shepparton Barmah Road with directional signage in place.
  The access track passes over the levee and continues along the east side of the levee along the upstream side of the structure.

- Description
  The regulator is a long straight concrete structure constructed within the levee, having a level vertical geometry and has an almost north-south orientation.
  A disused timber bridge deck runs along the top of the structure.
  There is a recently installed galvanised steel walkway along the upstream side of the deck.
  The outlet mechanism consists of 48 x cells each about 2.6m wide, with a series of removable, horizontal timber drop boards in each cell on the upstream side about 1.4 to 1.5m high above the inlet invert sill.
  Access along the walkway is controlled with a locked gate at each end.
  The upstream side of the structure is open native bushland and the outlet side is fenced farmland which appears to be used for grazing.
  The receiving waterway is Bunbartha Creek, which flows to the north-west.

- Existing Operation
  The operation of the structure is controlled with a series of 2 x padlocks over each cell.
  The padlocks prevent the removal of a section of the walkway floor over the drop boards.
  Once the floor panel is removed the individual boards can be removed to release water.

- Structure
  The structure consists of a series of regular, vertical, parallel and symmetrically cast insitu, reinforced concrete piers, presumably supported on mass concrete foundations.
  The abutments at each end have been constructed using cast insitu concrete and have wing walls each side at about 45 degrees to the deck alignment.
  The upstream wing walls are slightly longer at about 6.3 and 6.9m, whilst the downstream wing walls are only 6.0 and 5.7m.

- Dimensions
  The structure is 122m long, about 5.5m wide overall (excluding the abutments and wing walls) and the deck has an average height along the upstream side of about 2.5m relative to the ground.

- Inlet Side of Structure
  The upstream side of the structure is readily accessible and appears to be well managed and unaffected by the presence and operation of the structure.
  The cells on the upstream side of the structure are numbered sequentially (in paint) commencing at the north abutment (marked cell no.1) to the south abutment (marked cell no.48).
  There is a low flow channel aligned with the 38th cell, with an invert sill set about 1.5m lower than the sill levels of the other adjacent cells.
  That low flow cell receives flows from a 900mm diameter circular concrete culvert situated about 11m east of the structure under the adjacent track.
  The upstream side of the structure has an almost level sill along its length, except for the low flow channel at cell no.38 and a small 170mm step between cell no.30 and 31.
  The inlet sills of cells no.1 to 30 are 170mm higher than the cells no.31 to 48, and the sill of the low flow cell no 38 which is a further 1.5m lower the latter.
  There are some erosion control measures along the upstream side of the structure including a kerb along part of some of the cells and also a crude concrete blinding treatment in other areas.

- Waterway within Structure
  The waterway within the cells of the structures appears to be clear and not obstructed by debris or any other accumulated sediments.
  The interfaces between the vertical and horizontal surfaces have cast insitu fillets which appear to be in good order.
  The various concrete surfaces appear to be plumb, square and straight, with no signs of deflection or instability.
  There are numerous construction joints within the floor slabs which are beginning to spall and open up, they may eventually expose reinforcement.

- Outlet Side of Structure
  The structure on the outlet side steps down to the deepest cell which is aligned with cell no.38.
  There is a broad, stepped apron on the downstream side of the structure, which discharges onto a variety of surfaces including a series of chutes, some with kerbs and others with toothed energy dissipation outlets and elsewhere stone beached surfaces.
  The receiving waterway on the outlet side of the structure is undefined and severely impacted by erosion associated with the high velocity release of large volumes of water.
  There are extensive fields of displaced stone beaching, pools of water, undercut trees, deep gullies and heavily eroded embankments.
  There are extensive areas of exposed foundations along the downstream side of the structure, which leaves the structure vulnerable to undercutting and may result in future instability.

- Condition Overview
  The timber bridge deck is in an advanced state of deterioration, with various deck and railing elements progressing to collapsing and falling from the structure.
  The downstream side of the structure is heavily degraded and at risk of serious damage arising from a future high flow event.
  The upstream side of the structure is in good order.
  The recently constructed steel walkway is in good order.
  The drop boards all appear to be sound.
  The supporting concrete structure is structurally sound, sturdy and generally in fair to good condition, with signs of some maintenance including crack repairs.
  There are some cracks which have not been repaired, also some exposed reinforcement to be addressed and many of the construction joints are showing signs of spalling and require attention.

- Communications
  The site is accessible to the mobile phone network.

- Electricity
  The nearest reticulated electricity supply is about 1.8km north east of the site, supplying a residence on Burgess Road.

2. Deep Creek Outlet (1/9/15)

- Location
  Situated about 25km north-west of Shepparton, about 950m north of the end of Pogues Road and 5km west of Bunbartha, accessed from the Shepparton-Barmah Road.
  The site is accessed via an unpaved gravel track at the west end of Pogues Road.
  The track passes by the site, about 200m away from the structure.
  The site can be accessed by continuing past the structure another 200m to a tee intersection and then turning left onto a track heading west.
  That track crosses over the levee about 80m north of the site.
  The site can then be accessed along the top of the levee from that crossing.
  There is no directional signage.

- Description
  The structure is a single 7.19m span bridge-like structure constructed within the levee, having a flat, deck level with the top of the levee.
  There are three sets of equal sized, hardwood panel gates on the upstream side of the structure which operate vertically.
  The horizontal alignment of the structure matches the levee which is north-west to south-east.
  The site is about 100m north-east of the east bank of the river.
  The structure is surrounded by open bushland along both sides.
  Direct vehicle access to the outlet side of the structure is obstructed by a gully and fallen timber.
  The receiving waterway is Deep Creek.
  The nearest farmland is situated about 600m east of the site.

- Existing Operation
  The operation of the outlet structure is controlled by lifting the three individual, timber panel gates from a single lift point, located centrally above each panel.
  The gates have been assembled from a series of 4 x horizontal planks which are linked with steel straps bolted to the planks which slide inside tracks within the webs of steel sections attached to the structure for that purpose.
  The gates are very heavy, ie. estimated to be more than 300kg each and require a block and tackle to lift and lower them.
  There are no lifting mechanisms in place on the structure above the gates, only a very lightly fabricated, non-compliant steel handrail held up with fencing wire..

- Structure
  The structure is supported on two abutments which are cast insitu, reinforced concrete.
  There also substantial wing wall set at 45 degrees to the abutments upstream and downstream of the structure.
  The downstream wing walls are longer and have a 4.0m wide apron with an end kerb and energy dissipation devices in place for velocity control.
  The downstream waterway is heavily eroded, with quantities of displaced stone beaching scattered along the downstream invert.
  We assume they are mass concrete abutments which were constructed without any piles or caissons foundations beneath.
  The deck is a series of 5 x parallel, pre-stressed, reinforced concrete planks (no overlay) with a small kerb each side.
  There is light, non-complaint handrail along the upstream side only.

- Dimensions
  The deck of the structure is 7.8m long, about 2.9m wide overall.
  The surface of the deck is 3.05m above the invert of the structure.
  The deck has a clear width between kerbs of about 2.43m, with mid-span kerb slots for deck drainage, no apparent crossfall and a slight longitudinal hog (ie. an upwards deflection at midspan).

- Inlet Side of Structure
  There is a concrete apron on the inlet side of the structure.
  The upstream side of the structure is obstructed by some regrowth.
  There is no apparent erosion or scour.

- Waterway within Structure
  The structure has a clear waterway opening of 7.19m x 2.845m (soffit), however the timber gates are only about 1.2m high.

- Outlet Side of Structure
  The ground immediately below the concrete apron structure on the outlet side has been seriously eroded by the discharge.
  Most of the protective beaching has been displaced.

- Condition Overview
  The structure is in good order, with no apparent structural defects or damages.
  All of the surfaces appear straight, plumb and square.
  The outlet side of the structure has been severely eroded and the structure is vulnerable to future damages in the event of there being further significant discharges.

- Communications
  The site is accessible to the mobile phone network.

- Electricity
  The nearest reticulated electricity supply is about 2.6km south-east of the site, supplying a residence on Pogues Road.
  There is another residence about 1.2km south west of the site, however it is on the west side of the river in Sleeth Road, ie. through the bush.

3. Wakiti Outlet (1/9/15)

- Location
  Situated about 2.7km north-east of McCoy's Bridge south of Nathalia, at Kotupna, about 500m east of the Murray Valley Highway and about 25m north of the north side of the Goulburn River.
  The structure can only be accessed after entering a series of 2 farm gates.
  There is a residence situated about 120m west of the structure.
  The access track passes through the yard of that residence.
  A 3rd farm gate and fence separate the structure from the residence.
  There is a large electrically powered pump station, with a supply pole and pump shed situated between the structure and the house.

- Description
  The outlet structure is constructed from common, solid clay bricks jointed with lime based mortar.
  The structure has a manning's channel shaped waterway, which passes between the two vertical brick abutment faces.
  The abutments have a shelf which separates the upper vertical walls from the sloping lower walls.
  The invert of the waterway is also brick lined and it has a reinforced concrete slab apron on both the inlet and outlet side.
  The abutments are reinforced with sloping buttress shaped walls each side of the waterway on both the inlet and outlet ends of the waterway.
  The abutments are protected by solid brick wing walls which return around the ends of the abutments and along the levee.
  The structure has previously supported a timber bridge deck which is no longer in place.
  The levee alignment is almost east-west at this location and the geometry of the structure is perpendicular to the levee, running almost north-south.
  The structure is surrounded by open bushland.
  The terrain is undulating.
  The downstream or outfall side of the structure has a large pond about 40m long and 30m wide which is filled with water.
  The terrain on the upstream side of the structure is undulating.
  There are several small, native re-growth trees in the waterway immediately upstream of the structure.
  This structure receives water directly from the adjacent Goulburn River and allows it to discharge into the Wakiti Creek system.

- Existing Operation
  The structure is currently not operational, ie. the outlet is open and not controlled.
  There is a trench or rebate set into the brickwork of the structure which extends across the full width of the waterway at the upstream end.
  That trench is about 1 x brick width deep and about 1½ brick lengths wide.
  It extends down the sides of the waterway and across the floor.
  There are several steel bolts protruding from the trench, which appear to have been previously used to secure a control device.
  Based upon the design of the fixings I suspect that device was made from timber.

- Structure
  The brickwork within the structure is laid in stretcher bond pattern, the walls consist of multiple leaf walls interconnected with bonded brickwork and headers.
  Some portions of the brick wall and floor surfaces have been rendered over.
  There are no cavities, nor are there any formal back of wall drains or wall penetrations for same.
  There are 2 x steel bolts and washers through the wing walls on each side.
  The bolts appear to be continuous through the earth fill levee to the opposing wing walls on the other side of the levee.
  The main abutment walls are substantial, being 2 full brick lengths in thickness.
  The wall thicknesses of the wing walls reduce in stages from 2 brick lengths, down to 1½ brick lengths and then finally 1 brick length.
  The junction of the sloping lower walls with the vertical walls is accommodated by the horizontal shelf along the top of the lower wall.
  A portion of the shelf has detached and washed away from the eastern abutment at the upstream side to reveal an opening between the sloping wall and vertical abutment, see attached.
  The cavity appears to have been filled with broken brick rubble, see below reference regarding

related subsidence behind that abutment.
There is a remnant timber slab on the top of the eastern abutment which appears to have been part of the original bridge deck over the structure.

- Dimensions
  The structure has a trapezoidal (Manning's) shaped waterway being 2.5m wide at the base of the channel and widens to a 6.08m wide opening at the top.
  The abutments are 5.6m wide and the original structure is believed to have had a 2.9m soffit.
  The lower sloping wall has a 45 degree side slope and is about 1.35m high with a 0.4m wide horizontal shelf at the top.
  The upper vertical wall is 1.55m above the horizontal shelf.
  The waterway structure is about 8m long along the invert.

- Inlet Side of Structure
  The upstream side of the structure is readily accessible from the levee.
  There is a small concrete apron along the wing walls.

- Waterway within Structure
  The waterway within the structure appears to have a consistent profile and steady gradient.
  Despite the complex slopes associated with the buttresses and wing walls it appears to be hydraulically sound.

- Outlet Side of Structure
  There is a large concrete apron structure constructed on the outlet side, having two distinct slopes, the upper section being 5.0m wide and the lower 2.1m wide.
  I believe that the extensive concrete outfall apron has been added to the structure many years after the original construction.
  The expansive apron has a flat base, with a downwards slope dropping about 0.6m over its width and up-swept sides (or wings) constructed in two panels, with a 27 degree slope which match into the levee and extend the full length of the apron.
  The ground along the outer edge of the apron has been severely undercut.

- Condition Overview
  There are signs of crude repair works on the downstream side of the abutment on the west side.
  A large block of concrete has been cast behind the wing wall which has a severe crack and some lateral displacement.
  Some bricks have also been broken out of the top of the wall at the junction with the abutment.
  There signs of other similar repairs where the brickwork has been damaged and replaced with cast insitu mass concrete.
  As above, there is a missing section of shelf on the east abutment at the upstream end.
  There is also a subsidence behind the abutment wall at that location.
  The upstream end of the structure has significant cracking in the brickwork on both abutments, opposite each other in similar locations.
  The cracks are not fresh or recent, they appear to be very old, with the edges of the broken brickwork weathered and worn.
  The undercutting erosion at the outfall end of the outlet apron is a concern.
  This area needs to be protected against the under cutting effect of high velocity flood waters passing through the structure.

- Communications
  The site was not accessible to the mobile phone network at the time of our survey.

- Electricity
  The nearest reticulated electricity supply is about 50m west of the site, ie. the electricity pole supplying the pump station and residence.

4. Hagen's Lane (2/9/15)

- Location
  This structure is situated about 3.9km north west of McCoy's Bridge on the Murray Valley Highway, and is in the levee on the south side of and adjacent to Hagen's Lane at Kotupna, about 1.4km south of the Hagen's Lane intersection with Hancock's Bridge Road.

- Description
  This structure is a simple, solid, red clay, brick endwall on a 300mm diameter concrete culvert which passes through the levee.
  At this location the levee alignment is almost east-west and the culvert is almost north-south.
  The outlet structure is readily visible from Hagen's Lane.
  The outlet structure is clear and unobstructed.
  The structure discharges into an unnamed tributary of the Wakiti Creek system.

- Existing Operation
  The structure is currently not operational, ie. the outlet is an open pipe and not controlled.

- Outlet Structure
  The outlet structure has a U-shape geometry when viewed in plan.
  The main headwall is small and narrow, the two wing walls are almost parallel to each other and relatively long.
  The top of the wall is the same height along all sides.

- Dimensions
  The pipe is 14.7m long from inlet to outlet.
  The outlet head wall and wing walls are all double brick walls, ie. 230mm wide.
  The outlet structure is 1.43m high, the headwall is 1.05m wide and the wing walls are 1.65m (left) and 1.55m (right) long respectively.

- Inlet Side of Structure
  The upstream side of the structure is a simple, straight endwall with no wing walls.
  This structure and the pipe inlet are concealed beneath an accumulation of timber debris.

- Waterway within Structure
  The pipe is straight and clear, except for the debris at the inlet side.

- Outlet Side of Structure
  The structure on the outlet side is sound, with no apparent damages or defects.

- Condition Overview
  The only concern with this structure is the condition of the inlet.

- Communications
  The site is not accessible to the mobile phone network.

- Electricity
  The nearest reticulated electricity supply is about 2.5km north-east of the site, supplying a residence on the north side of Hancock's Bridge Road.

5. Hancock Creek Outlet (2/9/15)

- Location
  Situated about 4.5km north west of McCoy's Bridge.
  About 1.8km south of Hancock's Bridge Road and about 350m north of the north side of the Goulburn River.
  The site is accessed via a track alongside the levee from the end of Hagen's Lane.
  The structure is about 1,000m west along the track from the south end/corner of Hagen's Lane.

- Description
  The concrete structure has an almost north-south geometry and discharges to the west.
  The structure includes 3 x 1.65m dia. concrete culverts.
  The invert of this structure is estimated to be more than 5m below the crest of the levee.
  This structure discharges water from the Goulburn River into Hancock's Creek.
  Both the levee and the inlet of the structure are sited within an open undulating bushland area.
  The outlet side of the structure is behind a fence the receiving waterway passes through that sparsely vegetated farmland.
  For the purposes of this assessment, we describe the northern most pipe as pipe no.1, the middle culvert as pipe no.2 and the southernmost culvert as pipe no.3.

- Existing Operation
  Discharges through this structure are presently not controlled.

- Structure
  The structure consists of a series of parallel 1.65m dia. reinforced concrete culverts with substantial reinforced concrete inlet and outlet structures.

- Dimensions
  The culverts are estimated to be about 22m long, ie. along the invert.
  The inlet structure headwall is 7.65m wide, about 2.075m high with wing walls about 3.75m long.

- Inlet Side of Structure
  The inlet structure features a steel rail trash rack.
  That trash rack has been destroyed and is no longer functional or repairable.
  Some sections of the rack have detached, some are inside the pipes and others strewn downstream of the structure.
  The inlet structure apron slopes down dramatically to the pipe inlets, being 3.75m wide, it drops about 1.0m to the pipe inverts.
  The waterway has been shaped to direct flows to the culverts.
  The headwalls continue beyond the wing walls and are embedded into the fill of the levee.
  The wing walls are perpendicular to the headwalls.
  The levee embankment is eroded and has some beaching in place.
  There are subsidences over the culverts behind the headwall.
  There is a significant quantity of timber debris trapped within the inlet structure.

- Waterway within Structure
  The 3 pipe culverts were inspected and the following observations noted;
  - pipe no.1 has some disjointed pipes, ie. where the pipes have dropped and retains water. There is also some serious fractures along the obvert of at least 2 pipe lengths.
  - pipe no.2 also has some disjointed pipes, ie. where the pipes have dropped and retains water. The pipe has also broken around the circumference just inside from the inlet endwall.
  - pipe no.3 also has some disjointed pipes, where the pipes have dropped and retains water. The worst joint being just inside the inlet endwall where a rubber ring is draping from the obvert.

- Outlet Side of Structure
  The structure on the outlet side is large structure with a large apron, significant energy dissipation measures, a kerb and high wing walls.
  Some of the energy dissipaters have detached from the apron and are no longer secured.
  There are some large pieces of stone beaching on the apron.
  The kerb at the end of the apron has 2 small slots in it, which appear to be inadequate and do not allow the apron to flush clean.
  The waterway immediately downstream of the outlet structure has extensive stone beaching along the banks.
  However, the waterway invert has been severely impacted by high velocity discharges and flows.
  The invert immediately adjacent to the apron kerb is deeply eroded and apron is being undercut.

- Condition Overview
  The inlet and outlet structures appear to be straight, plumb, square and structurally sound. However, the pipes have some serious problems with broken and damaged pipes.
  If not attended to, these damages may allow water to flow outside the pipes and destabilise the entire structure.
  There is a significant risk that this structure may be seriously damaged, if not lost during another flood event.
- Communications
  The site is not accessible to the mobile phone network.
- Electricity
  The nearest reticulated electricity supply is about 2.5 km north of the site, supplying a residence on the north side of Hancock's Bridge Road.

SUGGESTED APPROACH FOR STAGE 2

In considering the above information we have identified the following tasks for stage 2.

i. Determine Capacity of Existing Control Structure
   - Establish capacity of existing structures.
   - Identify required capacity for new controls.

ii. Identification of Appropriate Outlet Control Device, Communications Systems etc.
   - Investigate available control systems.
   - Identify preferred systems with appropriate capacities and capabilities.
   - Consider electricity needs, ie. solar for daylight operations? Availability of reticulated electricity.
   - Consider functionality, reliability, robustness and durability.
   - Consider capital and operational costs.
   - Consider data needs, alarms, scada systems and protocols etc.
   - Access requirements for installation and maintenance.

iii. Conduct 2nd Site Visit
   - Gather further information as required or verify previous observations.
   - Verify location co-ordinates and invert RL's.
   - Identify any site constraints for installation.
   - Operational considerations.
   - Identify any environmental impacts, ie. clearing, earthworks, access etc. if any.

iv. Develop Scope of Works for Each Structure
   - Establish the needs of the control device at each site.
   - Develop a conceptual design for the installation of a control mechanism at each structure.
   - Consider any waterway protection or restoration works.
   - Structural repairs and any modifications.
   - Investigate likely delivery timelines.

v. Liaise with Relevant Authorities
   - Identify the likely costs to extend existing electricity supply or communications infrastructure to the site.
   - Consider alternative solutions.

vi. Prepare Cost Estimate for Each Structure
   - Likely design and documentation costs.
   - Consider opportunities for competitive pricing.
   - Manufacture, supply, install and commission.

APPENDICES

Site Photos

- Loch Garry Regulator, dated 1/9/15
- Deep Creek Outlet, dated 1/9/15
- Wakiti Outlet, dated 1/9/15
- Hagen's Lane, dated 1/9/15
- Hancock Creek Outlet, dated 1/9/15

Field Note Sketches

- Loch Garry Regulator, dated 1/9/15
- Deep Creek Outlet, dated 1/9/15
- Wakiti Outlet, dated 1/9/15
- Hagen's Lane, dated 1/9/15
- Hancock Creek Outlet, dated 1/9/15

Preliminary GPS Survey Drawings

- Loch Garry Regulator, dated 1/9/15
- Deep Creek Outlet, dated 1/9/15
- Wakiti Outlet, NO SURVEY
- Hagen's Lane, NO SURVEY
- Hancock Creek Outlet, NO SURVEY

Site Location Co-ordinates

	Structure	***Easting & Northing***	***Invert RL***	***Source***
1.	Loch Garry Regulator	E 347,805.445 N 5,989,994.404	104.26	From survey data. (+ or – 0.03m)
2.	Deep Creek Outlet	E 343,408.488 N 5,993,428.747	103.85	From survey data. (+ or – 0.03m)
3.	Wakiti Outlet	E 332,200.38 N 5,997,276.03	108.3m	From Nearmaps AU. (+ or – 10m)
4.	Hagen's Lane	E 327,499.47 N 5,996,876.02	106.1m	From Nearmaps AU. (+ or – 10m)
5.	Hancock Creek Outlet	E 326,593.43 N 5,996,754.42	107.6m	From Nearmaps AU. (+ or – 10m)

Summary Of Observations

Site	Location	Description	Existing Operation	Structure	Dimensions	Inlet Side of Structure	Waterway within Structure	Outlet Side of Structure	Condition Overview	Communications	Electricity
1. Loch Garry Regulator	About 4km west of Bunbartha on west side of Goulburn River.	A significant 48 x span concrete structure, which controls discharge from Goulburn River to Bunbartha Creek.	Manually operated with the manual raising of timber drop boards.	A reinforced concrete structure with 48 x cells. Has a timber deck structure (no longer trafficable).	122m L x 2.5m H x 5.5m W	Wing walls, low flow pipe under track, 47 x cells @ 2.1 x 1.46m 1 x low flow cell @ 2.1 x 2.86m	Clear open, rectangular 48 x sections, with concrete invert and vertical walls.	Concrete wing walls, apron, with multiple chutes and some energy dissipaters Some outfall damage, heavily eroded and undercut.	Some maintenance required, main structure is sound, timber bridge is collapsing, some outfall damage. badly eroded outfall requires attention.	Mobile phone network access is OK.	Nearest reticulated electricity supply is about 1.8km north-east of the site in Burgess Road.
2. Deep Creek Outlet	About 5km west of Bunbartha on west side of Goulburn River.	A single span all concrete structure with timber panel doors, which controls discharge from Goulburn River to Deep Creek.	Vertically operated heavy timber panel (3) doors requiring mechanical lifting assistance.	A modern, reinforced concrete structure, with concrete deck, and steel columns on upstream side supporting the 3 timber doors.	7.19m Span x 4.9m W x 3.05m H	Wing walls, concrete apron, partly obstructed by trees.	Clear, obstructed by 2 x steel columns on upstream side, a single rectangular section, with concrete invert and vertical walls.	Concrete wing walls, large apron, kerb and 2 x rows of energy dissipaters. Heavily eroded and undercut.	Structure is sound, poor handrails, doors are inoperable, eroded outfall requires protection.	Mobile phone network access is OK.	Nearest reticulated electricity supply is about 2.6km south-east of the site in Pogues Road.
3. Wakiti Outlet	About 2.7km north-east of McCoy's Bridge, at Kotupna, north side of Goulburn River.	An old brick inoperable structure, previously controlled discharge to Wakiti Creek from Goulburn River.	No longer operable, no device in place.	A solid brick structure, is in a deteriorated condition, the timber deck and other elements have been removed.	6.05m span between abutments, 5.6m wide abutments, and 2.9m soffit.	Wing walls and concrete apron.	A trapezoidal shaped waterway, 2.5m wide base and 1.35m high sloping sides, 6.05m span between abutments, 2.9m soffit.	Large concrete apron, steep slope, with wing walls. Deep pool, heavily eroded.	Structure is in poor condition with significant cracking and subsidence in abutments.	No mobile phone network access.	Nearest reticulated electricity supply is about 50m west of the site, ie. the electricity pole supplying the pump station and residence.
4. Hagen's Lane	About 3.9km north-west of McCoy's Bridge, at Kotupna, north side of Goulburn River.	A simple 300mm dia. concrete culvert with brick headwalls.	Not fitted with a flap or door.	Pipe culvert with brick endwalls.	The culvert is 14.7m long. The outlet wall is U shaped 1.43m high, headwall 1.05m wide, wing walls are 1.65m & 1.55m long.	Flush brick head wall, 1.6m long and covered in debris.	Pipe is clear except for debris at inlet side.	Clear outlet with simple, narrow concrete apron.	Structure is sound, but not symmetrical.	No mobile phone network access.	Nearest reticulated electricity supply is about 2.5km north-east of the site on north side of Hancock's Bridge Road.
5. Hancock Creek Outlet	About 4.5km north-west of McCoy's Bridge. 1.8km south of Hancock's Bridge Road about 1,000m west from south end/corner of Hagen's Lane	Includes 3 x 1.65m dia. concrete culverts and discharges water from the Goulburn River into Hancock's Creek.	Discharges through this structure are not controlled.	The 3 x culverts have significant concrete inlet and outlet structures.	The 3 x 1.65m RRJ.RC culverts are estimated to be about 22m long.	The inlet structure has a sloping inlet, a destroyed trash rack. The headwall is 7.65m wide, about 2.075m high with perpendicular wing walls about 3.75m long	Pipe no.1 has at least pipe sections with a fractured obverts and disjointed pipes. Pipes No.2 & 3 also have disjointed pipes and retain water.	The outlet structure has walls 2.1m high, perpendicular wing walls, a large 4.75m wide apron with energy dissipaters and a slotted kerb	The inlet and outlet structures are sound, the broken and dropped pipes place this structure at some risk, also damaged energy dissipaters, and a badly eroded waterway are a concern.	No mobile phone network access.	The nearest reticulated electricity supply is about 2.5 km north of the site, supplying a residence on the north side of Hancock's Bridge Road.

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