Scarlett and Rosedale Bank Stabilization: Rosebud River

Prepared for:

DRUMHELLER VALLEY

Town of Drumheller

Prepared by:

RIDGE ENVIRONMENTAL PLANNING LTD

September 2024

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1. Introduction

1.1 Project Background

The Town of Drumheller is proposing to update both the Scarlett Berm and Rosedale Berm in Rosedale, a subdivision of Drumheller, Alberta at SW-28-28-19-W4M. These projects will encompass, but are not limited to, construction and bank and toe stabilization using rip-rap and willows. Vegetated rip-rap will be used for armouring; willow stakes will be planted in interstitial spaces of armoured berm.

The scope of work includes the following:

- Vegetation clearing;
- Isolation of in-stream works;
- Fish rescue;
- Construction of embankments;
- Installation of rip-rap and gravels;
- Installation of willow states and soil wraps, and
- Bank stabilization.

1.2 Project Location

1.2.1 Scarlett Berm

The Scarlett Berm is in Drumheller, Alberta, in the community of Rosedale, within SW-28-28-19-W4M. Scarlett Berm runs perpendicular to Hwy 56, and parallel to the Rosebud River (**Figure 1**). Scarlett Berm is located adjacent on the West bank of the river adjacent to two privately owned properties approximately 100 m downstream of the Hwy 56 crossing and just upstream of the abandoned Canadian National Railway (CNR) bridge. The berm is anticipated to occupy an area of approximately 175 m^2 below the ordinary high-water mark over a length of 50 m.

1.2.2 Rosedale Berm

The Rosedale Berm project is located approximately 250 m downstream of the Hwy 56 crossing and 60 m downstream of the CNR bridge, east of two privately owned properties (**Figure 1**). The Rosedale berm will be about 70 m long and will occupy an area of 359 m^2 below the high-water mark.

1.3 Project Timing

The Scarlett and Rosedale Berm projects are scheduled to start in mid to late summer of 2025, and will occur outside of the Restricted Activity Period (RAP), of April 16 to July 15, for the Rosebud River.

2. Regulatory Setting

RIDGE Environmental Planning Ltd. (RIDGE) was retained to provide regulatory support for this project, which is subject to the following provincial and federal regulations:

- The *Water Act*, Alberta Environment and Protected Areas (AEPA)
- The *Fisheries Act*, Fisheries and Oceans Canada (DFO)-Fish and Fish Habitat Protection Program
- The *Canadian Navigable Waters Act*, Transport Canada-Navigation Protection Program (NPP)

As part of supporting regulatory applications, RIDGE completed a desktop review of historical information and field visits to assess fish habitat adjacent to the project area.

Figure 1 - ***Scarlett and Rosedale Berm Locations.***

3. Methodology

3.1 Review of Existing Information

A review of background information on fish and fish habitat in the Rosebud River was completed and included:

- Code of Practice Brooks Management Area Map (Government of Alberta [GoA] 2006)
- Fish and Wildlife Management Information System (FWMIS) database (AEPA 2023)
- DFO Aquatic Species at Risk map (DFO 2023)
- Fall Riverine Habitat Inventory of the Red Deer & Rosebud Rivers in 08/09/10/11-29-20 W4M and 20/29-28-19 W4M Resiliency and Flood Mitigation Program (Applied Aquatic Research Ltd. 2021)

3.2 Site Visit

Site visits were completed on October 18, 2023, and August 13, 2024, to collect site-specific fish habitat data in the vicinity of the project. Fish habitat information was collected via industry-standard protocols:

- A Hierarchical Approach to Classifying Stream Habitat Features (Hawkins et al. 1993)
- A General Fish and Riverine Habitat Inventory, Athabasca River, April to May 1992. Final Report for the Northern River Basins Study Project No. 32 (RL&L. 1994)

The study area included the Rosebud River along the length of Scarlett and Rosedale Berms, and downstream to include the potential zone of impact, which could extend to the Red Deer River downstream. A total of three transects were surveyed throughout the study area.

At each transect, the following physical parameters were recorded:

- Rooted width;

- Wetted width;
- Water depth;
- Substrate composition;
- Channel characteristics;
- Bank characteristics;
- Cover types and abundance;
- Riparian vegetation;
- Water quality parameters, and
- Photographs.

Habitat channel unit occurrence was tallied throughout the study area to determine percent composition.

3.3 Fish Habitat Evaluation

Fish habitat potential was assessed according to local fish species known to inhabit the area, species-specific life history requirements, and physical and chemical properties of the watercourse within the study area. Life history requirements of fish species include spawning, rearing, overwintering, feeding, and migration were evaluated (Nelson and Paetz 1992, Langhorne et al. 2001). Criteria used to determine habitat quality and suitability was as follows:

Nil to Low – does not provide basic habitat requirements to complete any life history stages and is limited in quantity or to seasonal availability.

Moderate to High – provides some or all habitat requirements to complete life history stages for that species and is available most or all year.

4. Results

4.1 Existing Information

4.1.1 Code of Practice

According to the Brooks Management Area map (GoA 2006) and FWMIS, the Rosebud River is a Class C water body (ID 2201) and has a Restricted Activity Period (RAP) of April 16 to July 15.

4.1.2 FWMIS Database Search

The Rosebud and Red Deer Rivers contain a variety of forage, large-bodied, and sport fish species (**Tables 1 and 2** below; **Appendix C**). Of the species present, Sauger (*Sander canadensis*) is listed provincially as *Sensitive*.

4.1.3 DFO Aquatic Species at Risk Map

Results from the DFO Aquatic Species at Risk Map indicate that no species at risk are found within near the project (DFO 2023) (**Appendix D**).

Table 1 *- Fish Species Documented in the Rosebud River*

Common Name	Scientific Name	Occurrence	Alberta Status[1]	COSEWIC Status[2]	SARA Status[3]
Flathead Chub	*Platygobio gracilis*	Native	Secure	Not listed	Not listed
Goldeye	*Hiodon alosoides*	Native	Secure	Not Listed	Not Listed
Longnose Sucker	*Catostomus catostomus*	Native	Secure	Not Listed	Not Listed

Common Name	Scientific Name	Occurrence	Alberta Status[1]	COSEWIC Status[2]	SARA Status[3]
Quillback	*Carpiodes cyprinus*	Native	Undetermined	Not Listed	Not Listed
Sauger	*Sander canadensis*	Native	Sensitive	Not Listed	Not Listed
Shorthead Redhorse	*Moxostoma macrolepidotum*	Native	Secure	Not Listed	Not Listed
White Sucker	*Catostomus commersoni*	Native	Secure	Not Listed	Not Listed

***Table 2** - Fish Species Documented in the Red Deer River*

Common Name	Scientific Name	Occurrence	Alberta Status[1]	COSEWIC Status[2]	SARA Status[3]
Burbot	*Lota lota*	Native	Secure	Not Listed	Not Listed
Emerald Shiner	*Notropis atherinoides*	Native	Secure	Not Listed	Not Listed
Flathead Chub	*Platygobio gracilis*	Native	Secure	Not listed	Not listed
Goldeye	*Hiodon alosoides*	Native	Secure	Not Listed	Not Listed
Lake Chub	*Couesius plumbeus*	Native	Secure	Not Listed	Not Listed
Longnose Dace	*Rhinichthys cataractae*	Native	Secure	Not listed	Not listed
Longnose Sucker	*Catostomus catostomus*	Native	Secure	Not Listed	Not Listed
Mooneye	*Hiodon tergisus*	Native	Secure	Not Listed	Not Listed
Northern Pike	*Esox lucius*	Native	Secure	Not Listed	Not Listed
Prussian Carp	*Carassius gibbelio*	Invasive	Exotic/Alien	Not Listed	Not Listed
Quillback	*Carpiodes cyprinus*	Native	Undetermined	Not Listed	Not Listed
River Shiner	*Notropis blennius*	Native	Undetermined	Not Listed	Not Listed
Sauger	*Sander canadensis*	Native	Sensitive	Not Listed	Not Listed
Shorthead Redhorse	*Moxostoma macrolepidotum*	Native	Secure	Not Listed	Not Listed
Walleye	*Stizostedion vitreum*	Native	Secure	Not Listed	Not Listed
White Sucker	*Catostomus commersoni*	Native	Secure	Not Listed	Not Listed

1. Alberta Wild Species Status Search (Alberta Environment and Parks 2023)
2. COSEWIC Species Database (Government of Canada 2021)
3. Species at Risk Public Registry (Government of Canada 2021)

4.1.4 Applied Aquatics - Fall Riverine Habitat Inventory

The assessment completed by Applied Aquatics Research Ltd. on the Rosebud River in fall 2021 encompasses approximately 1.5 km of the Rosebud River upstream of the project area. Water temperature was 1.2°C, with conductivity of 1080 µs, pH of 8.11, and saturated dissolved oxygen (DO). Applied Aquatics noted the potential for Sauger and Mountain Whitefish spawning habitat through their survey reach; this was not noted within the study reach of this report.

4.1.5 Site Visit Results

A summary of physical channel characteristics from all transects are presented in **Table 3** below with site photographs in **Appendix E**. Within the assessment area, the Rosebud River was sinuous, and frequently confined. Downstream of the Highway 56 bridge, the Rosebud River is within the flood plain of the Red Deer River and was only confined by constructed berms.

Water temperature was measured at 7.6°C, with conductivity of 1057 µs, pH of 8.46, and DO of 9 mg/L on October 18, 2023, like conditions observed by Applied Aquatic (2021) and were within suitable ranges to support aquatic life (CCME 2023). No barriers to fish migration were identified in the assessed area, with potential for fish to access the project area from the Red Deer River. The Rosebud River was considered to provide moderate habitat for juvenile fish rearing, fish spawning, and overwintering. The study reach provided adequate cover for fish, with habitat features such as:

- overhead vegetation
- undercut banks

- emergent vegetation
- sufficient flow
- presence of gravel and cobble

Streambank vegetation cover was noted to include mostly native grass, forb, shrub, and tree species.

Within the footprint of the berms, the banks of the Rosebud River exhibited extensive slumping and erosion through the project area, indicating low bank stability. Both river left and river right banks appeared to be altered, and despite having high vegetation cover, these banks were considered a potential source of sediment into this section of the watercourse. Improvements to bank stability will likely reduce downstream suspended sediment to the benefit of the aquatic ecosystem.

***Table** 3 – Physical Channel Characteristics of Rosebud River*

Transect Location		T1: 0 m d/s	T2: 30 m d/s	T3: 50 m d/s	T4: 100 m d/s	T5: 150 m d/s
Dominant Habitat Type		Run	Riffle	Run	Run	Run
Channel Morphology	Rooted Width (m)	14.82	17	17.9	14.0	13.5
	Wetted Width (m)	14.25	16.6	8.22	14.0	13.5
	Max. Depth (m)	0.30	0.15	0.55	0.50	0.50
Substrate	Dominant	Fines <2mm	Fines <2mm	Fines <2mm	Fines <2mm	Fines <2mm
	Co-Dominant	Gravels 17-64mm	Gravels 17-64mm	Gravels 17-64mm	Gravels 17-64mm	Gravels 17-64mm
	Embeddedness	Moderate	Moderate	Moderate	Moderate	Moderate
Left Bank Shape	Height (m)	3	3	3	3	3
	Slope	Vertical	Vertical to Sloping	Vertical	Moderately Sloping	Mild Sloping
	Stability	Low	Low	Low	Moderate to High	High
	Vegetation (%)	80	80	80	90	90
Right Bank Shape	Height (m)	4	4	4	4	3
	Slope	Sloping - steep	Undercut	Sloping	Steeply Sloping	Moderately Sloping
	Stability	Low	Low	Low	Moderate to High	Moderate to High
	Vegetation (%)	80	80	80	100	100

4.2 Fish Habitat Assessment

4.2.1 Spawning Habitat

4.2.1.1 Sportfish

Sauger and Walleye utilize tributaries to large prairie rivers for spawning, preferring flowing riffle or run habitat, with gravel or cobble substrates (Joynt and Sullivan 2003). The riffle and run habitat present through the Scarlett Berm project reach was shallow with embedded gravels and cobbles, which provided low quality spawning habitat for Sauger and Walleye. Northern Pike spawn in heavily vegetated, slow-moving waters, which were not present.

4.2.1.2 Large-bodied and Forage fish

Riffle and run habitat found along the project reach provide a variety of depths and velocities that would provide suitable spawning habitat for several forage fish species found within the Rosebud River. Substrates consisted of fines and gravels with moderate embeddedness, which may limit large-bodied fish spawning potential. Cover elements were minimal due to a lack of instream structure (i.e., coarse substrates, woody debris, etc.); however, shoreline cover was abundant via overhanging grasses and shrubs.

4.2.2 Rearing Habitat

4.2.2.1 Sportfish

Juvenile Sauger and Walleye utilize slow moving waters for rearing as they are poor swimmers at birth. The stream reach adjacent to the project was a riffle-run system that would not contain substantial low velocity habitat during high flow stages. Northern Pike rear in slow moving water with dense emergent vegetation, which was also not present. As such, this survey reach provided low quality rearing habitat for the sportfish found in the area.

4.2.2.2 Large-bodied and Forage fish

The riffle-run habitat found throughout the project area provided low quality rearing habitat for juvenile and adult large-bodied and forage fish.

4.2.3 Migration and Movement Potential

4.2.3.1 Sportfish, Large-bodied and Forage Fish

The reach of the Rosebud River within the project area appeared to be at low to moderate discharge at the time of the October 2023 site visit. At this flow stage, the watercourse did not have any permanent barriers to fish passage. One beaver impoundment (0.4-0.5 m high) was present approximately 50 m downstream of the train bridge (between T4 and T5) at the time of the site visit. This impoundment was not considered to be a barrier to large-bodied fish. While visible during the higher flows observed in August 2024, forage fish may be impeded by this beaver impoundment, but this barrier is not expected to impede the ability to complete all life stages within this stream reach.

4.2.4 Overwintering Habitat

4.2.4.1 Sportfish

Water depths associated with fish overwintering habitat (greater than 0.50 m) were present within the project area. Upstream of the train bridge the channel formed a run with water depths of 0.5 - 1.0 m, fine substrate, low overhead vegetation cover, and minimal structure such as boulders or undercut banks. Due to the lack of cover and moderate depth of this stream reach, it was deemed as low to moderate overwintering habitat for local sportfish. Downstream of the train bridge, depths were <0.5 m and overwintering potential was minimal; however, due to the proximity to the Red Deer River, this section may see some overwintering fish present.

4.2.4.2 Large-bodied and Forage Fish

Forage fish may utilize this stream reach as overwintering habitat; however, as described above, overall structure was absent and overwintering habitat was deemed low to moderate.

5. Project Effects and Mitigation

A review of project activities and associated pathways of effects (PoE; DFO 2018) that may affect fish and habitat include:

- use of industrial equipment
- vegetation clearing
- grading
- excavation
- placement of material or structures in water

Each pathway was reviewed to determine potential changes to fish and fish habitat. Potential changes include:

- Potential mortality of fish/eggs/ova from equipment
- Sediment concentrations
- Contaminant concentrations
- Water temperature
- Habitat structure and cover
- Food supply

Potential changes to fish and fish habitat are described below including mitigation measures and a summary of remaining effects (if applicable).

5.1 Potential mortality of fish/eggs/ova from equipment

Potential causes of fish mortalities associated with construction activities include deposition of sediment on spawning areas that could have a negative impact on egg development and survival. Mortalities of fish at all life stages could arise from direct placement of bank protection material.

5.1.1 Mitigation Measures

Fish will likely avoid the Project areas when machinery begins operating on or near the riverbank; however, the following mitigations will be implemented to avoid and reduce the potential for mortalities of fish:

- work is scheduled to occur outside of the RAP.
- block nets can be installed along the perimeter of the project footprints prior to work and a fish rescue will be completed before rock is placed instream.

5.1.2 Residual Effects

Fish are not likely to be spawning in the Project footprints during the construction period and, as a result, eggs or fry will not be present in the project footprint or in the zone of impact. Additionally, fish will be excluded or removed from the footprint prior to rock placement instream, precluding the occurrence of a HADD.

5.2 Change in Sediment Concentrations

Sediment has numerous deleterious effects to fish, both when suspended in the water column and when deposited on the substrate and is considered a deleterious substance under the *Fisheries Act*. Impacts to fish include reduced embryo survival, reduced visibility, gill damage, and avoidance behaviour, which can impact fish feeding behaviour (Robertson *et al.* 2006). Installation and removal of isolations and diverting the watercourse into the completed construction areas after isolation removal are likely to resuspend sediment.

Suspended sediment may affect fish and fish habitat present in the river by filling interstitial spaces in favorable spawning substrates, suffocating developing fish embryos, altering a primary food source (*i.e.,* increased drift of benthic invertebrate community), inhibiting respiration and filter feeding, irritating the gills of aquatic organisms, and reducing visibility for feeding of local fish. Suspended sediment does not only affect habitat and fish populations adjacent to the Project footprint, but it can also be mobilized and affect downstream habitat and populations.

Change in sediment concentrations (or general sedimentation) may occur due to erosion of exposed soil surfaces during vegetation clearing and exposure or destabilization of beds and bank material during excavation. Heavy machinery working in the area may weaken or dislodge portions of the bank, releasing sediment into the watercourse.

5.2.1 Mitigation Measures

All cleared access locations will have erosion control measures installed and maintained throughout the duration of the Project. All instream works will occur in isolation to avoid resuspension of bed and bank sediment during all phases of Project construction. Some instream disturbance is expected during the initial placement of the isolation measures and will be documented through turbidity monitoring. The potential downstream Zone of Impact from suspended sediment will be monitored (*i.e.,* turbidity monitoring) to verify that mitigations are effective. The Zone of Impact is the area where approximately 90% of the disturbed sediments are expected to deposit but this transportation of sediment is dependent on watercourse velocity and particle size. Turbidity will be monitored downstream of the project activities to document effectiveness of mitigation measures. If planned measures are ineffective at mitigating suspended sediment entering downstream habitat, construction methods will be altered (*e.g.,* slowing pace and upgrading isolating structures). Sediment and other fines will be removed from the construction area prior to the removal of isolation.

Prior to in-water work, a water quality monitoring program (i.e., installation of isolation methods, working within isolation and removal of isolation) will be developed by a QAES to reflect Alberta's *Turbidity Monitoring for In-Stream Construction Activities* (GoA 2022).

Duration of soil exposure will be limited, and adequate soil stabilization measures will be installed as soon as possible until vegetation is established. Erosion and sediment control measures will be installed to manage periodic runoff events during construction, prior to significant precipitation events. Stockpiled erodible material will be stabilized to prevent erosion and run-off while slopes will be protected from erosion using appropriate measures. Channelized flow of run-off will be avoided, and measures will be in place to prevent downstream sedimentation until construction is complete and vegetation is established. All work will be undertaken and completed in such a manner as to prevent the release of sediment laden water to any ditch or waterbody.

5.2.2 Residual Effects

Any exposed soils within the Project footprint area related to access and vegetation stripping, are expected to have short term (weeks) potential effects, of low magnitude (silt fencing to be installed) and localized. Thus, residual effects are not predicted for these pathways.

For potential disturbance of sediment associated with instream placement of material, effects are expected to be short term (hours) and of low magnitude (sediment transport and turbidity within natural range). Thus, residual effects are not predicted for these pathways and a HADD is not predicted due to a change in sediment concentrations.

5.3 Change in Contaminant Concentration

Introduction of contaminants could occur in several ways and may result in negative effects on fish and fish habitat. Hydrocarbon-based fuels, hydraulic fluids, and lubricants are used in construction machinery operating adjacent to and in the Rosebud River, and spills or leaks have the potential to occur.

Vehicles and construction equipment, particularly tracked machinery, may also transport biological contaminants to the site. These could include noxious or invasive terrestrial or aquatic vegetation or diseases.

5.3.1 Mitigations to avoid changes in contaminant concentration:

- All machinery working in or near water will be decontaminated as per the Decontamination Protocol for working in or near water (GoA, 2020a), and cleaned and free of debris and organic matter before entering the construction site;
- All machinery and vehicles will be refuelled a minimum of 30 m away from the watercourse. If fueling occurs within 100 m of the watercourse, fuelling will occur over a drip tray and be attended to by fuelling personnel at all times;
- If immobile machinery is required to be stationed within 100 m of the channel (*e.g.,* pumps), then it will be placed in an isolated area within secondary containment capable of containing all fluids in said machinery;
- All machinery working in and around water will be inspected before each shift and periodically throughout the day to ensure all hoses and fittings are in good repair;
- Every effort will be made to prevent deleterious substances from entering a waterbody; and
- Spill kits will be present on all equipment working in the Project footprint.

5.3.2 Whirling Disease Risk

The Project is located within the White Zone of the Province, which is considered low risk (GoA 2020b). As such the project will follow the Alberta Decontamination Protocol for Work in or Near Water (**Appendix F**). Any machinery, equipment or gear used in the Rosebud River must be decontaminated according to the decontamination protocol prior to use instream.

5.3.3 Prussian Carp

Prussian Carp (*Carassius gibbelio)* is an invasive species found within the Rosebud River and Red Deer River. Should Prussian Carp be captured as part of the fish salvage effort, the fish will be destroyed and disposed of properly as per the directions specified in the Fish Research License (FRL) issued by GoA to the on-site QAES.

5.3.4 Residual Effects

A HADD due to change in contaminant concentrations is not predicted.

5.4 Change in water temperature

Water temperature directly affects many of the physical, biological, and chemical characteristics of a waterway. In elevated temperatures, many cold-water fish, such as trout and salmon, could experience reduced reproductive activity or direct mortality, including egg mortality. High temperatures also encourage the microbial breakdown of organic matter, leading to a depletion of dissolved oxygen in the water body.

5.4.1. Residual Effects

Existing trails, roads, and access points will be used wherever possible and vegetation removal, pruning, and grubbing will be minimized. Alteration or clearing of riparian vegetation may result in a loss of shade provided by the existing shrubs and trees; however, the aspect of the vegetation in relation to the angle

of the sun determines how much shade is present throughout the day. At the proposed site, the Rosebud River flows north and vegetation along the proposed project bank provides minimal shading, restricted to the fringes of the immediate shoreline. Few large trees occur along the proposed section and there is minimal to no canopy cover or projection over the river in this reach. Changes to riparian vegetation in this reach are not expected to result in changes in water temperature.

5.5 Changes to Habitat Structure and Cover

A change in habitat structure and cover is considered along the shoreline protection footprint, where the bank protection will be placed instream. Channel habitat changes consist of an increase in local bed and bank structure, as the shoreline protection is expected to provide an increase in available instream cover for fish from the interstitial spaces within the rip-rap. The left bank along the Scarlett Berm was steeply sloped, contained bare soil in places and exhibited evidence of slumping. The placement of rip-rap and willow plantings are expected to reduce the potential sediment input to the Rosebud River at this location. The Rosedale Berm project area exhibited a slightly milder slope, abundant vegetation and minimal slumping; however, instream structure was considered lacking. The placement of rip-rap is expected to provide additional instream structure and cover elements lacking in this reach, while the willow plantings will replace any loss of cleared vegetation.

5.5.1 Mitigations Measures

Construction access to the Rosebud River should be built in a way that limits disturbance to riparian vegetation and minimize width of grading, building the access point within the extent of rip-rap armouring. The project will be designed to limit erosion of the armoured areas and adjacent banks.

5.5.2 Residual Effects

The alteration of the habitat structure and cover adjacent to the berm locations are not expected to result in long term negative effects, as revegetation is expected to occur within the following growing season.

5.6 Change in food supply

The aquatic food supply must be plentiful and diverse to sustain the productivity of a watershed. An increase or decrease in the quantity or composition of the food supply, beginning with plants and organic debris that fall into a waterway, can alter the structure of the aquatic community.

5.6.1 Mitigations Measures

The entirety of the existing streambank structure and riparian vegetation within the footprint of the berm will be replaced with the berm structure. Existing streambank conditions adjacent to the Scarlett Berm project consisted of steep (approximately 1:1) eroded soil with less than 75% vegetation coverage. Vegetation included shrubs, grasses and trees. Despite vegetation coverage, the streambank is currently unstable and heavily eroded, exhibiting signs of slumping throughout. Due to the eroded nature of the streambank, vegetation directly along the streambank was limited and provided minimal overhead cover. In addition, the extensive erosion and slumping on the site indicated that the site is likely a source of sediment to the Rosebud River during periods of rainfall and/or snowmelt. The

5.6.2 Residual Effects

Vegetated rip-rap should substantially reduce streambank erosion, while having minimal long-term effects on the riparian habitat of the Rosebud River. As such, bank stabilization measures may reduce sedimentation in the long-term. The temporary reduction of riparian vegetation through the project

footprint is not expected to have significant long-term effects on the fish and fish habitat in the Rosebud River.

5.7 Discussion

The installation of the Scarlett Berm is expected to alter approximately 175 m^2 of habitat within the high-water mark of the Rosebud River, over a length of 50 m, with the Rosebud berm expected to alter 359 m^2 over a length of 70 m. Total impact for both berms will be approximately 534 m^2 over a length of 120 m. The fish habitat found within this portion of the river is deemed as low to moderate adjacent to the project footprints.

The change in substrate to class 1 and 2 rip-rap is not expected to significantly change habitat suitability for local fish species, as the project footprint does not contain suitable spawning habitat and rearing habitat potential was limited. Fish habitat within the berm footprints lacked depth and structure such as overhead vegetation, woody debris, or boulders that would create high quality rearing habitat for local fish species. Though habitat below the high-water mark will be reduced, installation of vegetated rip-rap is not expected to alter productive capacity of this section of the Rosebud River and is expected to increase instream structure via additional interstitial spaces and velocity breaks. In addition, scouring along rip-rap toes can increase water depth, increasing suitability for sportfish and large-bodied fish. The use of vegetated rip-rap for the berm should minimize impacts of berm installation on fish and fish habitat adjacent to the project.

6. Regulatory Considerations

6.1 Water Act

A *Water Act* approval will be required prior to commencement of construction.

6.2 Fisheries Act & Species at Risk Act

Fisheries And Oceans Canada (DFO) states that projects should implement Measures to protect fish and fish habitat and apply suitable standards and codes of practice to avoid harmful alteration, disruption, and destruction (HADD) of fish and fish habitat (DFO 2019). Measures to protect fish and fish habitat have been described above and include:

- Prevent the death of fish by respecting timing windows to avoid sensitive life stages;
- Maintain riparian vegetation;
- Carry out works, undertakings and activities on land;
- Maintain fish passage;
- Ensure proper sediment control; and
- Prevent entry of deleterious substances in water.

To implement the Project works, riparian vegetation clearing, and instream work will be required; the measures “maintaining riparian vegetation and carrying out works, undertakings and activities on land” cannot be met. As such, a DFO Request for Review (RFR) of each project will need to be submitted, which may result in DFO issuing a Letter of Advice for each project or requiring an application for authorization.

6.3 Navigable Waters Protection

The Rosebud River is not listed within the *Canadian Navigable Water Act’s* scheduled waters; however, there is public access by land or water, there are more than two waterfront owners, and the watercourse has the potential to be used for transport or travel in the future. Any work, in, on, over, under, through, or across any navigable water in Canada is subject to approval through the Navigation

Protection Program. The *Canadian Navigable Water Act* requires approval for 'major works,' and registry and public notice for 'minor works.' Erosion-protection works that meet specific criteria are considered minor works (Canadian Navigable Waters Act subsection 28 (2)) require owners to register on the Government of Canada public registry and publish a public notice on the NPP external submission site (GoC 1985). This project meets the criteria for a minor work under the Act.

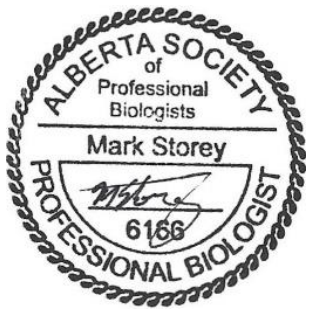
6.3.1 Navigable Waters Mitigation Measures

- Deposit information describing the activity on the registry;
- Publish a public notice on the NPP external submission site; and
- Implement appropriate on-site mitigations including upstream and downstream signage along the Rosebud River to ensure river users are aware of works ongoing in and around the waterway.

7. Closure

We trust this report meets your needs. If you have any questions, please do not hesitate to contact Kelsey Morin at 403-836-5582.

Written by:



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8. References

Alberta Environment and Parks. 2021. Fish and Wildlife Management Internet Mapping Tool. https://maps.alberta.ca/FWIMT_Pub/Viewer/?Viewer=FWIMT_Pub Accessed June 2023.

Alberta Environment and Parks. 2018. Species Accessed by Alberta Endangered Species Conservation Committee. http://aep.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx Accessed June 2023.

Applied Aquatic Research Ltd. 2021. Fall Riverine Habitat Inventory of the Red Deer & Rosebud Rivers in 08/09/10/11-29-20 W4M and 20/29-28-19 W4M Resiliency and Flood Mitigation Program.

Canadian Council of Ministers of the Environment. 2023. CCME Resource Browser. https://ccme.ca/en/resources# Accessed November 2023.

DFO Department of Fisheries and Oceans Canada. 2019. Measures to Avoid Causing Harm to Fish and Fish Habitat. www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html. Accessed June 2023.

Government of Alberta. 2006. Code of Practice Brooks Management Area Map.

Government of Canada, 2018. Species at Risk Public Registry. www.registrelep-sararegistry.gc.ca/sar/index/default_e.cfm. Accessed June 2023

Government of Alberta. 2020a. Alberta Decontamination Protocol for Work In or Near Water.

Government of Alberta. 2020b. Whirling Disease Decontamination Risk Zone Map.

Government of Alberta. 2023. Wild Species Status Search. https://www.alberta.ca/lookup/wild-species-status-search.aspx. Accessed November 2023.

Government of Canada. 1985a. Canadian Navigable Waters Act. R.S., 1985, c. N-22, s. 12012, c. 31, s. 316; 2019, c. 28, s. 46

Government of Canada. 2019a. Fisheries Act. R.S., c. F-14, s. 1. Hawkins, C.P., J.L. Kershner, P.A. Bison, M.D. Bryant, L.M. Decker, S.V. Gregory, D.A McCullough, C.K. Overton, G.H. Reeves, R.J. Steedman and M.K. Young. 1993. A Hierarchical Approach to Classifying Stream Habitat Features. Fisheries. 18(6):3-12.

Joynt, A. and M.G. Sullivan. 2003. Fish of Alberta. Lone Pine Publishing. Edmonton, AB. Pp 176.

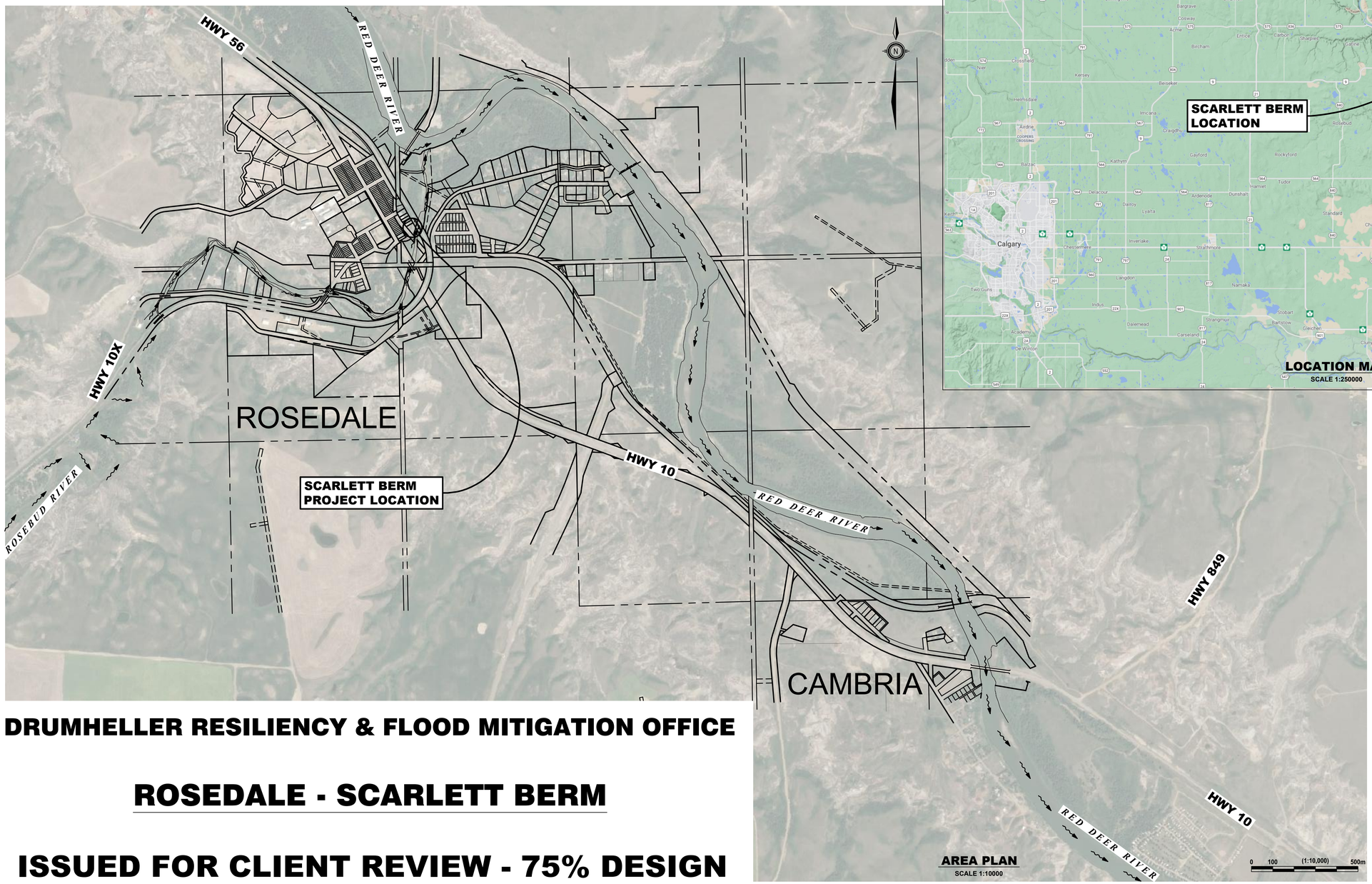
Langhorn, A.L., Neufeld, M., Hoar, G. Bouthis, V., Fernet, D.A., Minss, C.K. 2001. Life History Characteristics of Freshwater Fishes Occurring in Manitoba, Saskatchewan, and Alberta, with Major Emphasis on Lake Habitat Requirements. Canada Manuscript Report of Fisheries and Aquatic Sciences 2579. 182 pp.

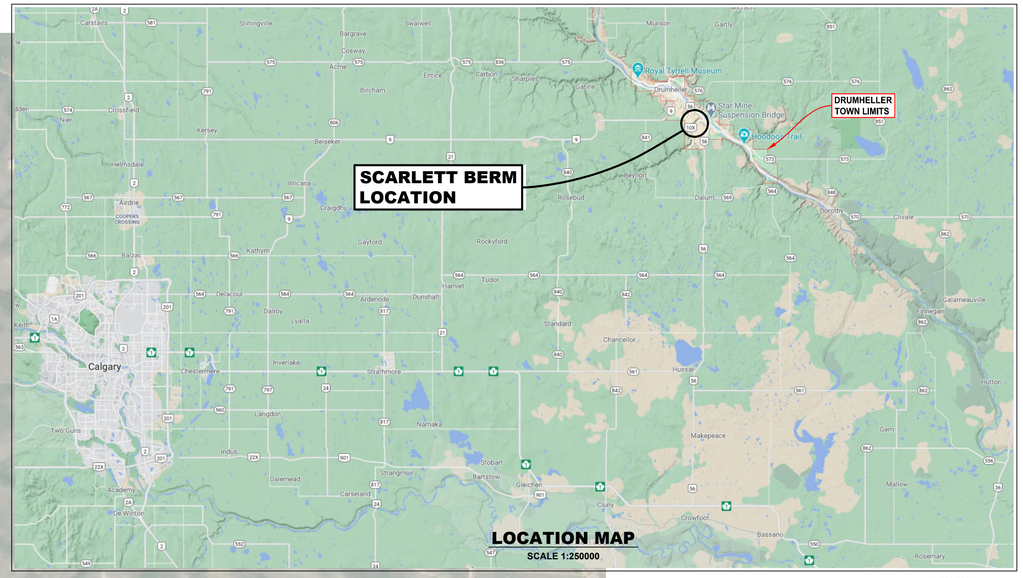
Nelson, J.S. and M.J. Paetz, 1992. The Fishes of Alberta. The University of Alberta Press. Edmonton, AB. Pp 437.

Robertson, M.J., Scruton, D.A., Gregory, R.S., Clarke, K.D. 2006. Effect of Suspended Sediment on Freshwater Fish and Fish Habitat. Canadian Technical Report of Fisheries and Aquatic Sciences 2644.

APPENDIX A

Scarlett Berm Project – Project Drawing Set





DRAWING INDEX LIST	
DWG No.	DRAWING TITLE
G-001	LOCATION MAP, AREA PLAN AND INDEX TO DRAWINGS
G-002	KEY PLAN, LEGEND, GENERAL NOTES AND SURVEY CONTROL
C-001	EXISTING CONDITIONS PLAN AND SEDIMENT CONTROL MEASURES
C-002	SCARLETT BERM DESIGN SITE PLAN
C-100	VEGETATED RIPRAP EMBANKMENT PROTECTION PLAN & PROFILE
C-101	SCARLETT BERM WITH ACCESS PATH PLAN & PROFILE
C-301	SCARLETT BERM CROSS SECTIONS
C-302	SCARLETT BERM CROSS SECTIONS
C-501	SCARLETT BERM DETAILS - SHEET 1
C-502	SCARLETT BERM DETAILS - SHEET 2
C-503	SCARLETT BERM DETAILS - SHEET 3
C-504	SCARLETT BERM DETAILS - SHEET 4

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE

ROSEDALE - SCARLETT BERM

ISSUED FOR CLIENT REVIEW - 75% DESIGN

JANUARY 31, 2024 - REVISION A

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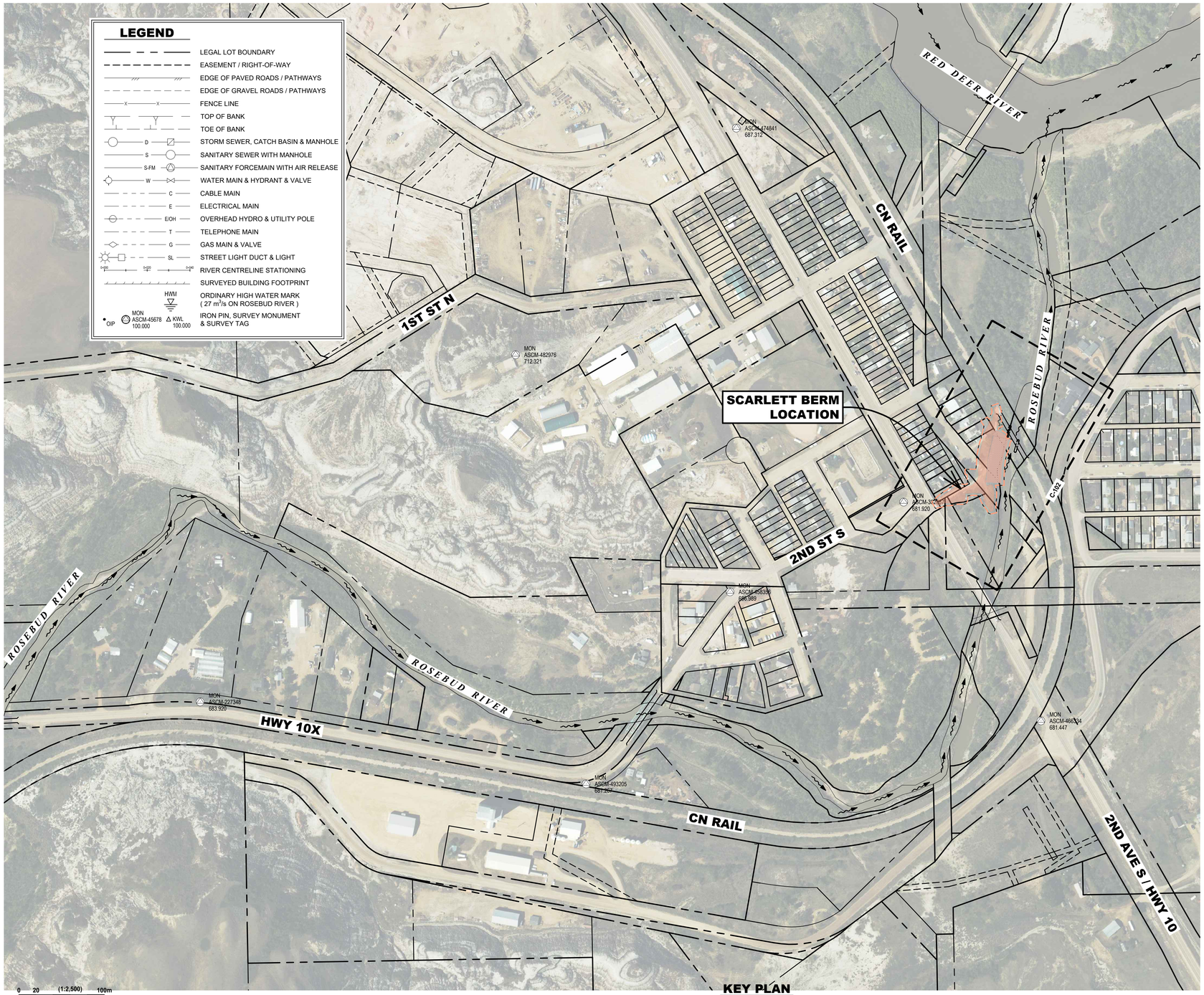
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
LOCATION MAP, AREA PLAN AND INDEX TO DRAWINGS

Project No.	Drawing No.	Rev.
3446-005	G-001	A
Group: GENERAL		



CONSTRUCTION NOTES

GENERAL:

1. ALL CONSTRUCTION AND MATERIALS SHALL CONFORM TO ALBERTA TRANSPORTATION CIVIL WORKS MASTER SPECIFICATIONS, DRUMHELLER RESILIENCY AND FLOOD MITIGATION OFFICE STANDARD SPECIFICATIONS & DRAWINGS, UNLESS NOTED OTHERWISE. WHEN A CONFLICT BETWEEN SPECIFICATION ARISES, THE MOST STRINGENT SHALL APPLY.
2. ALL AFFECTED RESIDENTS AND BUSINESSES SHALL BE NOTIFIED IN WRITING A MINIMUM OF 7 BUSINESS DAYS PRIOR TO ANY SCHEDULED ACCESS AND/OR SERVICE DISRUPTIONS.
3. CONTRACTOR SHALL PREPARE A TRAFFIC MANAGEMENT PLAN TO ADDRESS CONSTRUCTION DISRUPTIONS.
4. DURING CONSTRUCTION, ENSURE ALL OH&S REGULATIONS ARE FOLLOWED. CONTRACTOR SHALL PROVIDE THE CONTRACT ADMINISTRATOR WITH ALBERTA OCCUPATIONAL HEALTH AND SAFETY REPORTS, IF APPLICABLE.
5. ENSURE THE CURRENT MUNICIPAL OH&S GROUND DISTURBANCE PRACTICE AND PROCEDURES ARE FOLLOWED. CONTACT UTILITY SAFETY PARTNERS ONE CALL FOR EXTERNAL UTILITY LOCATES AT LEAST 72 HRS PRIOR TO THE START OF CONSTRUCTION.
6. CONFIRM ALL EXISTING SERVICES, CONNECTIONS AND CROSSING POINTS AT LEAST 48 HRS PRIOR TO START OF CONSTRUCTION ON ANY SUCH ITEM. NOTIFY THE CONTRACT ADMINISTRATOR SHOULD CONFLICTS BE FOUND.
7. CLEARING AND GRUBBING TO OCCUR UNDER THE BERM, BANK PROTECTION, AND DITCH FOOTPRINTS.
8. CONTRACTOR TO MAINTAIN FLOW IN THE ROSEBUD RIVER UPSTREAM AND DOWNSTREAM OF THE CONSTRUCTION AREA AT ALL TIMES. CONTRACTOR RESPONSIBLE FOR FLOW ISOLATIONS OF THE CONSTRUCTION AREAS AND FLOW DIVERSIONS AROUND THE CONSTRUCTION AREA OF THE ROSEBUD RIVER IF FLOW IS PRESENT DURING CONSTRUCTION.
9. ADJUST ALL EXISTING AND NEW APPURTENANCES TO MEET THE FINAL DESIGN GRADES.
10. RESTORE ALL AREAS AFFECTED BY CONSTRUCTION WORKS TO THEIR ORIGINAL CONDITION OR BETTER.
11. ENSURE THAT ALL OPERATIONAL SERVICES TO EXISTING BUILDINGS REMAIN FUNCTIONAL DURING CONSTRUCTION AND OPERATIONAL POST-CONSTRUCTION.
12. REPAIR AND/OR REPLACE ALL INFRASTRUCTURE (INCLUDING PRIVATE PROPERTY & BOULEVARDS) DAMAGED OR REMOVED DURING CONSTRUCTION TO BETTER THAN OR EQUAL TO PRE-CONSTRUCTION CONDITION.
13. CONTRACTOR SHALL CONSTRUCT OR RESTORE LANDSCAPE TO ORIGINAL CONDITIONS OR BETTER OUTSIDE THE TEMPORARY WORKING AREA UNLESS OTHERWISE STATED
14. ALL ELEVATIONS AND DIMENSIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

ENVIRONMENTAL:

1. USE BEST MANAGEMENT PRACTICES (BMP), IN ACCORDANCE WITH ALBERTA BMP GUIDELINES AND REGULATIONS, DURING CONSTRUCTION. ADJUST WORK ACTIVITIES DURING PERIODS OF PRECIPITATION AND/OR SNOWMELT TO MITIGATE AGAINST SEDIMENT RELEASE TO THE STORM DRAIN SYSTEM OR ROSEBUD RIVER. SOME BMP'S TO CONSIDER ARE:
   - INSPECT ALL EQUIPMENT DAILY FOR FLUID LEAKS
   - ENSURE SPILL PROTECTION MEASURES ARE IN PLACE DURING RE-FUELING OF EQUIPMENT
   - KEEP A SPILL KIT ON SITE AT ALL TIMES
   - CONTRACTOR SHALL PREPARE AND SUBMIT AN ECO PLAN FOR APPROVAL PRIOR TO CONSTRUCTION.
   - CONTRACTOR SHALL PROTECT ALL TREES TO REMAIN FROM DAMAGE DURING CONSTRUCTION. NOTIFY THE CONTRACT ADMINISTRATOR IMMEDIATELY IF A POSSIBLE CONFLICT IS FOUND.
   - CONTRACTOR TO COOPERATE WITH OWNER TO ENSURE NEST SWEEP IS COMPLETED PRIOR TO REMOVING ANY TREES ON SITE, IF WORK IS TO BE COMPLETED DURING FEDERALLY REGULATED MIGRATORY BIRD NESTING PERIOD.
2. CONTRACTOR TO COMPLETE A CONSTRUCTION ISOLATION PLAN FOR THE ROSEBUD RIVER AND SUBMIT TO THE OWNER FOR APPROVAL PRIOR TO CONSTRUCTION.
3. CONTRACTOR TO COMPLETE A FLOW DIVERSION PLAN FOR THE ROSEBUD RIVER AND SUBMIT TO OWNER FOR APPROVAL PRIOR TO CONSTRUCTION.
4. PERFORM INSTREAM WORK UNDER THE DIRECTION OF A QUALIFIED AQUATIC ENVIRONMENT SPECIALIST (QAES). WORK MAY BE HALTED OR SLOWED DOWN AT THE DISCRETION OF THE QAES IF SEDIMENT LEVELS IN THE WATERCOURSE INCREASE ABOVE ACCEPTABLE LIMITS. HALTED WORK MAY PROCEED UPON APPROVAL BY THE QAES.
5. PERFORM A FISH RESCUE WITHIN ISOLATED AREAS UNDER THE DIRECTION OF A QAES PRIOR TO THE START OF IN-STREAM CONSTRICTION WORK.

UTILITIES:

1. LOCATION AND ELEVATION OF EXISTING UTILITIES SHOWN ON DRAWINGS ARE APPROXIMATE ONLY. CONTRACTOR IS RESPONSIBLE TO DETERMINE EXACT LOCATION AND ELEVATION PRIOR TO CONSTRUCTION.
2. ENSURE ALL EXISTING WATER SYSTEMS REMAIN FUNCTIONAL DURING CONSTRUCTION.
3. IF GAS MAINS ARE PRESENT WITHIN THE PROJECT AREA, ALTAGAS AND OH&S REGULATIONS SHALL BE FOLLOWED. ALTAGAS REPRESENTATIVE MY BE REQUIRED TO BE PRESENT WHEN WORKING ADJACENT TO GAS MAINS (ESPECIALLY HIGH PRESSURE).
4. IF ATCO ELECTRIC UTILITIES ARE FOUND WITHIN THE PROJECT AREA, THE CONTRACTOR SHALL PROVIDE 72 HRS NOTICE PRIOR TO EXCAVATION. A REPRESENTATIVE FROM ATCO WILL BE SCHEDULED TO BE PRESENT DURING EXCAVATION.
5. WHERE HEAVY WORK IS REQUIRED WITHIN THE EXCAVATION ZONE SURROUNDING UTILITY POLES, AND A POLE HOLD IS REQUIRED, THE CONTRACTOR MUST BE AUTHORIZED AND BE ABLE TO PULL A LIVE LINE PERMIT.

REFERENCES:

1. ORTHOPHOTOS WERE TAKEN ON MAY 27, 2019 AND PROVIDED BY THE TOWN OF DRUMHELLER.
2. BASE DATA, INCLUDING LEGAL BOUNDARIES, PLANIMETRIC FEATURES AND EXISTING UTILITIES WERE PROVIDED BY THE TOWN OF DRUMHELLER.
3. EXISTING TOPOGRAPHY CONTOURS GENERATED FROM MAY 2018 LIDAR WITH VERTICAL ACCURACY OF +/- 0.15 M AT 95% ON HARD, FLAT, OPEN SURFACES. LIDAR PROVIDED BY THE TOWN OF DRUMHELLER AND RECEIVED SURVEY DATA FROM HUNTER WALLACE SURVEYS LTD. ON OCT 26, 2023.
4. WATER LEVELS WERE OBTAINED FROM THE RED DEER RIVER AND TRIBUTARIES MODEL DEVELOPED BY NHC (2019).

SURVEY CONTROL INFORMATION

COORDINATES ARE TO NAD83(CSRS) / ALBERTA 3TM REFERENCE MERIDIAN 114W DATUM, (CODE CANA83-3TM114) GRID ELEVATIONS ARE GEODETIC TO CGVD28 W/ GSD95 GEOID.

PNT #	NORTHING	EASTING	ELEV	DESC.
227348	5698579.258	94423.288	683.920	ASCM
382887	5698812.840	95245.463	681.920	ASCM
458356	5698707.823	95042.588	686.989	ASCM
474841	5699250.079	95049.949	687.312	ASCM
466334	5698557.026	95405.847	681.447	ASCM
482976	5698985.079	94791.925	712.321	ASCM
493205	5698483.362	94874.360	681.267	ASCM

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DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
KEY PLAN, LEGEND, GENERAL NOTES AND SURVEY CONTROL

Project No. 3446-005
Group GENERAL
Drawing No. G-002
Rev. A

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2ND STREET SOUTH

2ND AVENUE SOUTH / HIGHWAY 10/56

1ST AVENUE SOUTH

CN RAIL

CN RAIL BRIDGE

RAILWAY AVENUE

ROSEBUD RIVER

EX GARAGE CONTRACTOR TO PROTECT IN PLACE DURING CONSTRUCTION

EX POWER POLE, CONTRACTOR TO PROTECT IN PLACE DURING CONSTRUCTION

EX STRUCTURE TO BE REMOVED BY LAND OWNER PRIOR TO CONSTRUCTION

PROPOSED SCARLETT BERM LOCATION

INSTALL GRAVEL ACCESS PAD (15.0 m LONG x 0.2 m DEEP CLEAN GRAVEL) PRIOR TO CONSTRUCTION TO MITIGATE MUD TRACKING (SEE DWG C-504)

EX. DRAINAGE COURSE

3 m TEMPORARY CONSTRUCTION BOUNDARY

EX. CONCRETE BRIDGE ABUTMENT

EX SHEET PILING (APPROX. LOCATION) CONTRACTOR TO REMOVE AND DISPOSE AS APPROVED BY OWNERS ONSITE REPRESENTATIVE

EX. SANITARY MANHOLES

EX. ABANDONED PIPE STUB

EX. BOREHOLE BH20-19 LOCATION

PROPOSED ACCESS PATH LOCATION

EX. TOP OF DIKE

EX. BOREHOLE BH20-18 LOCATION

EX. CONCRETE BRIDGE PIER

EX. SANITARY MANHOLE

EX. BANK EROSION AREA

INSTALL SILT FENCE OR STRAW WATTLES PRIOR TO BEGINNING CONSTRUCTION TO MITIGATE SEDIMENT RELEASE TO ROSEBUD RIVER (SEE DWG C-504)

EX. SANITARY LIFT STATION

0 5 (1:500) 25m

PLAN
SCALE 1:500

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DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
EXISTING CONDITIONS PLAN AND
EROSION & SEDIMENT CONTROL MEASURES

Project No. 3446-005
Group CIVIL
Drawing No. C-001
Rev. A

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0 10 50 100 millimeters

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2ND AVENUE SOUTH / HIGHWAY 10/56

1ST AVENUE SOUTH

CN RAIL

CN RAIL BRIDGE

ROSEBUD RIVER

PROPOSED SCARLETT BERM
4 m TOP GRAVEL SURFACE WITH GRASSED SIDE SLOPES. REFER TO TYPICAL SECTION ON C-501 FOR DETAILS.

PROPOSED 3.0 m BERM CONSTRUCTION BUFFER

OPTION A
CULVERT NO.1 INLET FLARED END C/W TRASH GATE

OPTION B
CULVERT NO.1 INLET FLARED END C/W TRASH GATE

DRAINAGE SWALE TO PROVIDE POSITIVE DRAINAGE TO CULVERT INELT

OPTION B
PR. 525 Ø CONCRETE CULVERT (CULVERT No. 1 REPLACEMENT) FITTED WITH OUTLET BACKFLOW PREVENTION (SEE DWG C-502)

EX. SANITARY MANHOLE - RAISE STRUCTURE TO RIM EL. 680.63 m

CULVERT NO.2 INLET FLARED END C/W TRASH GATE

REPLACE AND REALIGN EX. CULVERT No. 2 WITH 675 Ø CONCRETE CULVERT FITTED WITH BACKFLOW PREVENTION (SEE DWG C-502)

PROPOSED DRAINAGE SWALE INLET DEPRESSION. 3:1 SIDESLOPES

TIE SWALE CL TO EXISTING DRAINAGE COURSE

TYPICAL 3 m TEMPORARY CONSTRUCTION BOUNDARY

REDUCED TEMP CONSTRUCTION BOUNDARY (APPROX. 2 m)

PROPOSED VISUAL BARRIER. STAINLESS STEEL HANDRAIL TO BE INSTALLED ON TOP OF EXISTING CONCRETE BERM WITH FLANGE CONNECTION. SEE DWG C-503 FOR DETAILS.

EX SHEET PILING (APPROX. LOCATION) CONTRACTOR TO REMOVE AND DISPOSE AS APPROVED BY OWNERS ONSITE REPRESENTATIVE

EX. CONCRETE ABUTMENT

EX. TOP OF BANK

EX. CONCRETE BRIDGE PIER

FIELD FIT RIPRAP AROUND PR. HEADWALL AND TIE TO EXISTING GROUND AS PER DIRECTION AND APPROVAL FROM OWNERS ONSITE REPRESENTATIVE.
EXTENTS OF RIPRAP TO BE APPROVED.
MAINTAIN POSITIVE DRAINAGE FROM OUTLET TO ROSEBUD RIVER WITH A BUFFER OF 1 m AWAY FROM EX BRIDGE PIER.

OPTION A
PR. 525 Ø CONCRETE CULVERT FITTED WITH OUTLET BACKFLOW PREVENTION (SEE DWG C-502)

OPTION A
CULVERT NO.1 OUTLET SEE DWG C-502 FOR DETAILS

EX. 600 Ø CMP CULVERT No. 1 REMOVE AND DISPOSE. FILL AND COMPACT TO EX GROUND SURFACE CONDITIONS

PROPOSED ACCESS AND MAINTENANCE VEHICLE PATH TO EX. SAN MH AND RIVERSIDE BENCH.
4 m TOP GRAVEL SURFACE WITH GRASSED SIDE SLOPES. REFER TO TYPICAL SECTION ON C-501 FOR DETAILS.

OPTION B
CULVERT NO.1 OUTLET SEE DWG C-502 FOR DETAILS

MITIGATION OF EX. BANK EROSION WITH CLASS 1 RIPRAP VEGETATED RIPRAP BANK PROTECTION

INITIAL 1.0 m TIE IN RIPRAP SCOUR PROTECTION, SEE TYPICAL ON DRAWING C-501

RAISE RIM OF EX. SAN MH TO EL. 680.22 m - REPLACE LID WITH FLOODPROOF LID (SEE DETAIL ON DWG C-504)

0 5 (1:500) 25m

PLAN
SCALE 1:300

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DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
SCARLETT BERM DESIGN
SITE PLAN

Project No.	Drawing No.	Rev.
3446-005	C-002	A
Group: CIVIL		

OPTION A
CULVERT NO.1 INLET
FLARED END C/W
TRASH GATE

OPTION B
CULVERT NO.1 INLET
FLARED END C/W
TRASH GATE

EX. SANITARY MANHOLE - RAISE
STRUCTURE TO RIM EL. 680.63 m

DRAINAGE SWALE TO
PROVIDE POSITIVE DRAINAGE
TO CULVERT INLET

OPTION B
PR. 525 Ø CONCRETE CULVERT
(CULVERT No. 1 REPLACEMENT)
FITTED WITH OUTLET BACKFLOW
PREVENTION (SEE DWG C-502)

1ST AVENUE S

PROPOSED SCARLETT BERM
4 m TOP GRAVEL SURFACE WITH
GRASSED SIDE SLOPES.
REFER TO PROFILE FOR DESIGN
ON C-101 AND TYPICAL SECTION
ON C-501 FOR DETAILS.

CULVERT NO.2 INLET
FLARED END C/W
TRASH GATE

OPTION A
PR. 525 Ø CONCRETE CULVERT
FITTED WITH OUTLET BACKFLOW
PREVENTION (SEE DWG C-502)

TIE SWALE CL TO EXISTING DRAINAGE
COURSE.
DO NOT CROSS PL FOR ADJACENT LOT

REGRADE EX. DRAINAGE
SWALE TO PROPOSED
CULVERT No. 2 REPLACEMENT

OPTION A
CULVERT NO.1 OUTLET
SEE DWG C-502 FOR
DETAILS

PROPOSED DRAINAGE SWALE INLET DEPRESSION.
300 mm WIDE BOTTOM WITH 3:1 SIDESLOPES

TIE TO PROPOSED FLARED INLET FOR POSITIVE
DRAINAGE

EX. 600 Ø CMP CULVERT No. 1
REMOVE AND DISPOSE

SCARLETT BERM

PROPOSED TOP OF EMBANKMENT

REPLACE AND REALIGN EX. CULVERT
No. 2 WITH 675 Ø CONCRETE CULVERT
FITTED WITH BACKFLOW PREVENTION
(SEE DWG C-502)

PROPOSED ACCESS AND MAINTENANCE
VEHICLE PATH TO EX. SAN MH AND
RIVERSIDE BENCH.

4 m TOP GRAVEL SURFACE WITH GRASSED
SIDE SLOPES.
REFER TO PROFILE FOR DESIGN ON C-101
AND TYPICAL SECTION ON C-501 FOR
DETAILS.

PROPOSED VISUAL BARRIER.
STAINLESS STEEL HANDRAIL TO BE
INSTALLED ON TOP OF EXISTING
CONCRETE BERM WITH FLANGE
CONNECTION.
SEE DWG C-504 FOR DETAILS.

EX. CONCRETE
ABUTMENT

ACCESS RAMP

CULVERT No.2 OUTLET
SEE DWG C-503 FOR
DETAILS

FIELD FIT RIPRAP AROUND PR. HEADWALL AND TIE
TO EXISTING GROUND AS PER DIRECTION AND
APPROVAL FROM OWNERS ONSITE
REPRESENTATIVE.
EXTENTS OF RIPRAP TO BE APPROVED.
MAINTAIN POSITIVE DRAINAGE FROM OUTLET TO
ROSEBUD RIVER WITH A BUFFER OF 1 m AWAY FROM
EX. BRIDGE PIER.

RAISE RIM OF EX. SAN MH
TO EL. 680.22 m - REPLACE
LID WITH FLOODPROOF LID
(SEE DETAIL ON DWG C-504)

PROPOSED CL
TOE OF BANK

EX. CONCRETE BRIDGE PIER

CN RAIL
BRIDGE

PROPOSED 3.0 m BERM
CONSTRUCTION BUFFER
(TYP)

INITIAL 1.0 m TIE IN RIPRAP
SCOUR PROTECTION.
SEE TYPICAL ON DRAWING C-501

EX SHEET PILING (APPROX.
LOCATION)
CONTRACTOR TO REMOVE
AND DISPOSE AS APPROVED
BY OWNERS ONSITE
REPRESENTATIVE

ROSEBUD RIVER

ROSEBUD RIVER

EX. CONCRETE BRIDGE PIER

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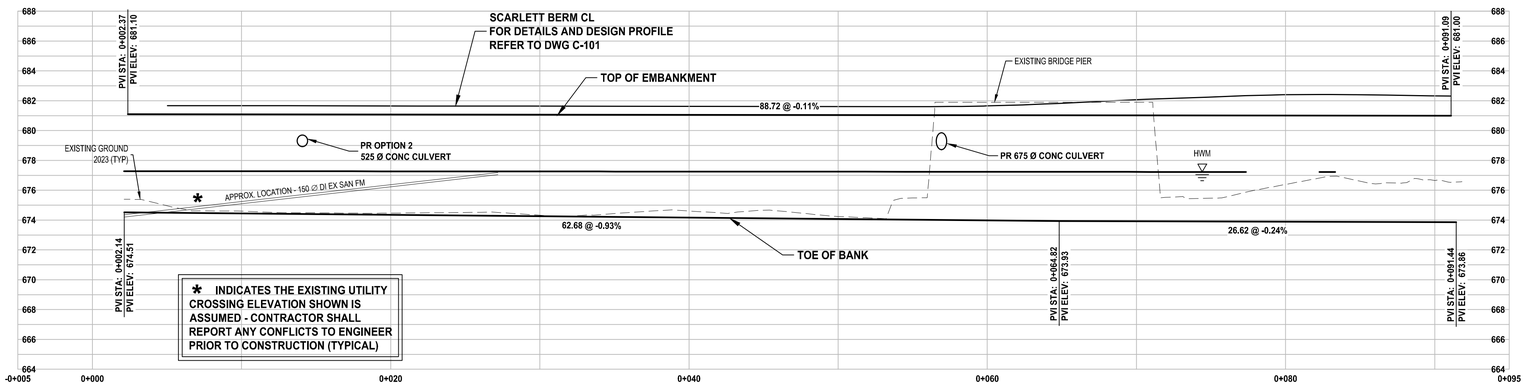
PLAN
SCALE 1:200



EMBANKMENT PROTECTION PROFILE
SCALE: H 1:200 V 1:50

0 2 (H 1:200) 8m
0 0.5 (V 1:50) 2m

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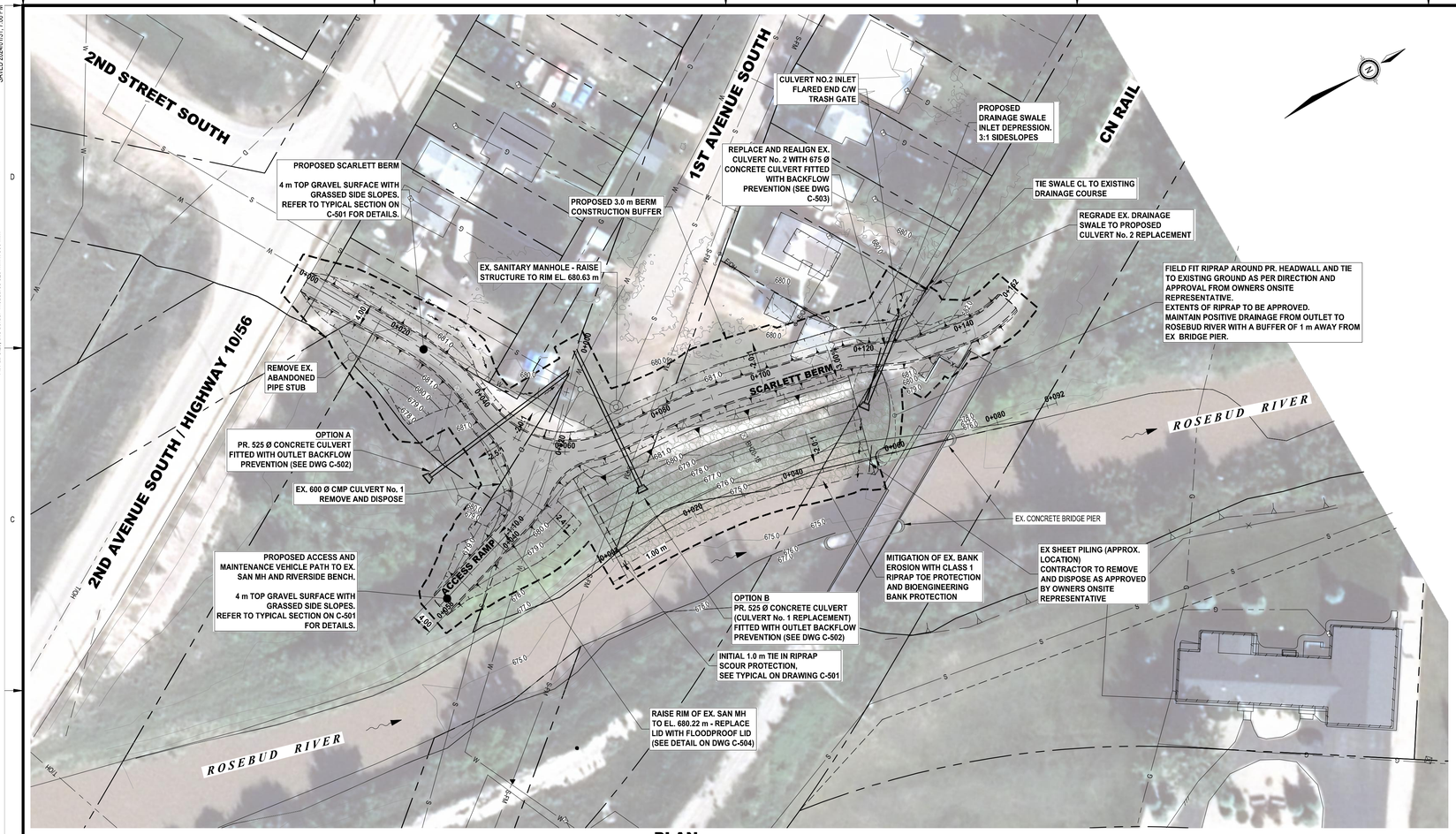
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
VEGETATED RIPRAP EMBANKMENT PROTECTION
PLAN AND PROFILE

Project No. 3446-005
Group CIVIL
Drawing No. C-100
Rev. A



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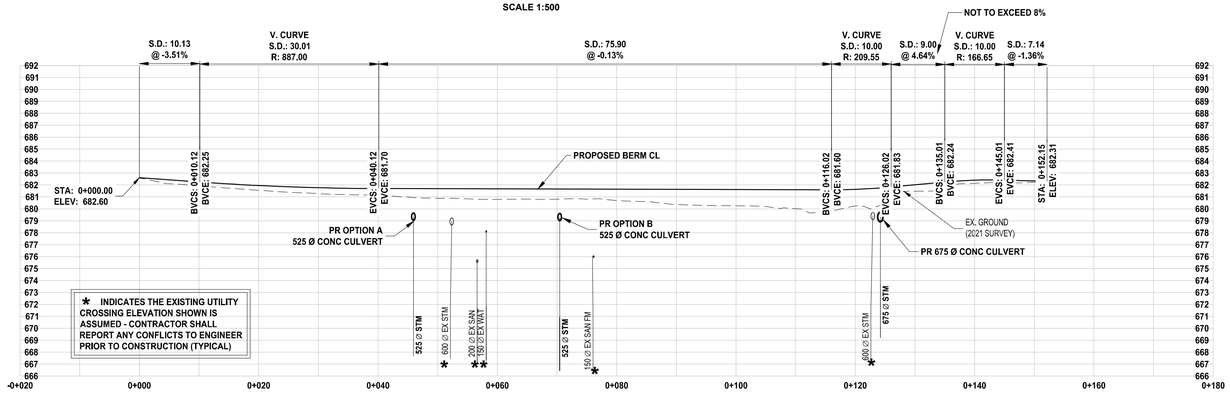
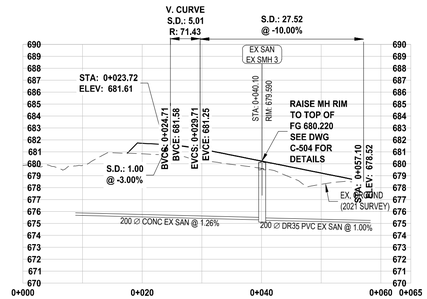


SCARLETT BERM PROFILE
SCALE: H 1:500 V 1:100



ACCESS PATH PROFILE
SCALE: H 1:500 V 1:100

0 5 (H 1:500) 25m
0 1 (V 1:100) 5m

DRUMHELLER VALLEY

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2024-01-31 10:51:27 PM

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Seal:

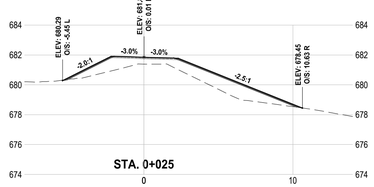
Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2/CS	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN

Issued for Review
2024-01-31

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
SCARLETT BERM AND ACCESS PATH

Project No.	Drawing No.	Rev.
3446-005	C-101	A
Group: CIVIL		



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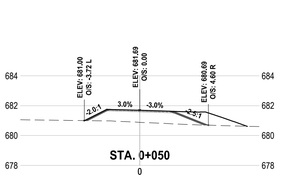

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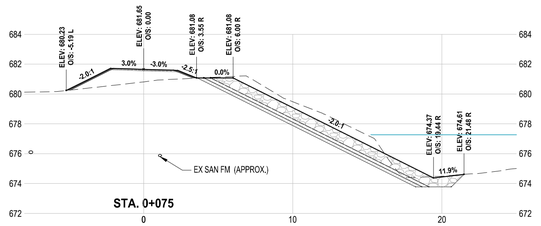

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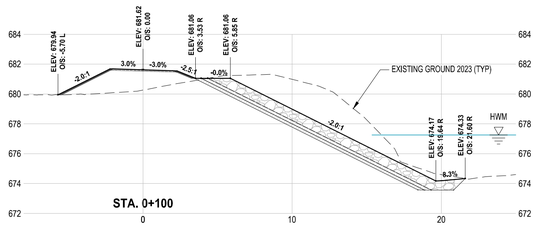

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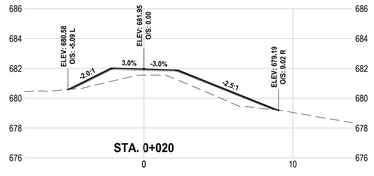

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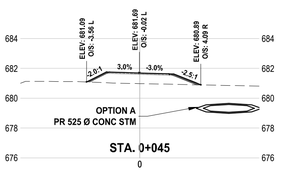

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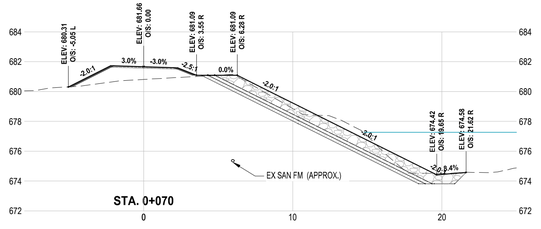

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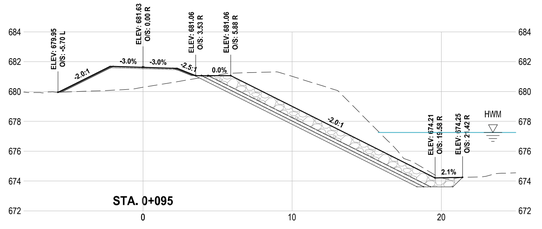

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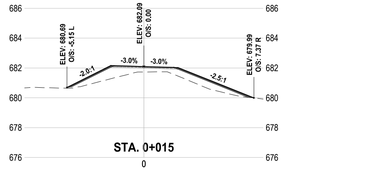

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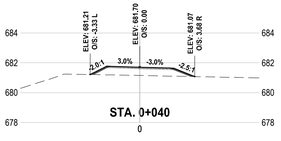

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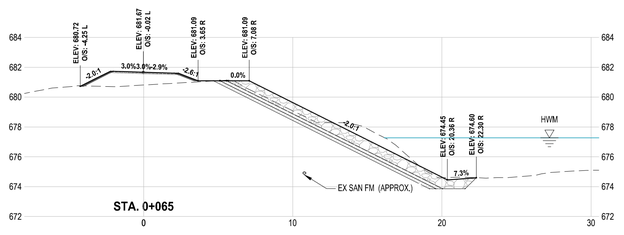

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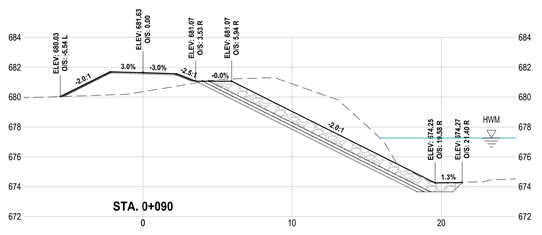

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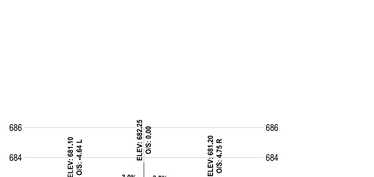

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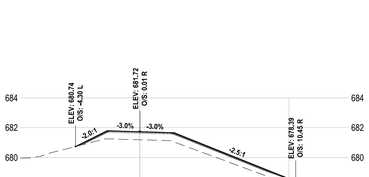

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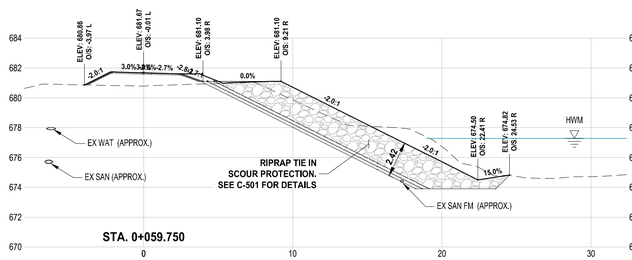

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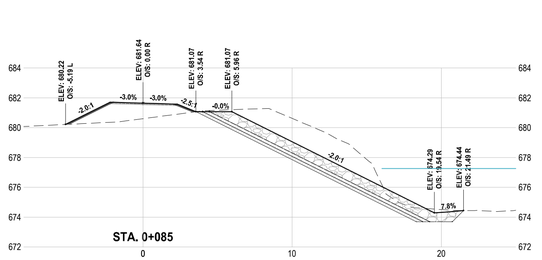

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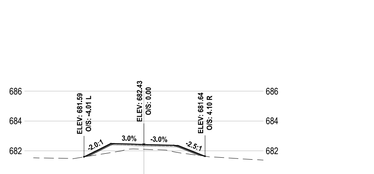

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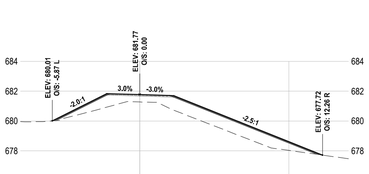

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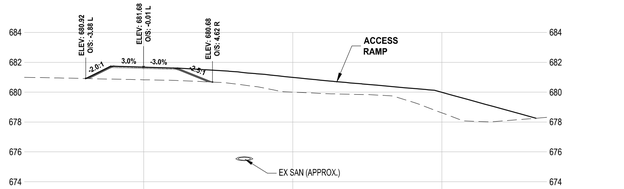

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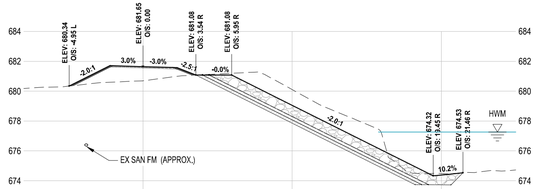

STA. 0+080

NOTE: SEE DWG C-501 FOR TYPICAL SCARLETT BERM SECTION

BERM CROSS SECTIONS

Scale 1:200

0 2 (1:200) 10m

NOTE:
1. BERM AND ACCESS RAMP SURFACES ARE A FINISHED GRADE SURFACE AND INCLUDES 100mm THICK CLASS 4-40 GRAVEL SURFACE
2. 100 mm OF TOPSOIL TO BE PLACED ON ALL SIDE SLOPES.

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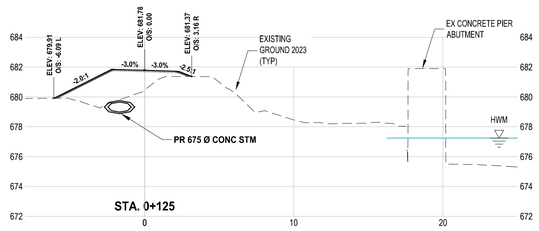
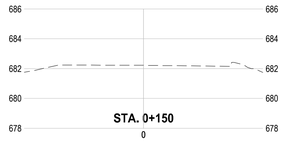
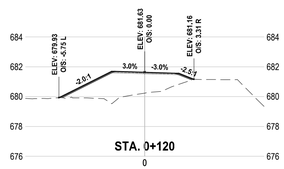
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

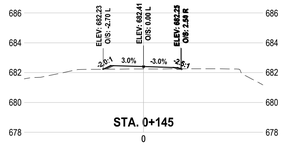
BERM IMPROVEMENTS
SCARLETT BERM CROSS SECTIONS

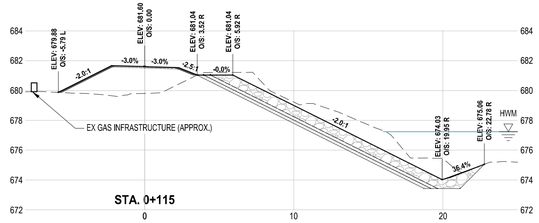
Project No.	Drawing No.	Rev.
3446-005	C-301	A
Group: CIVIL		

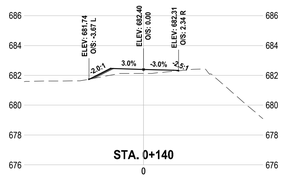


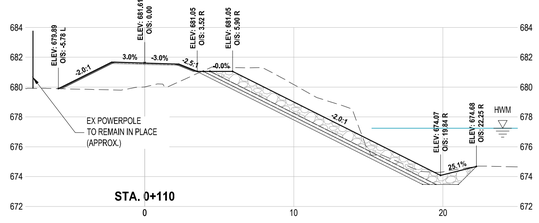


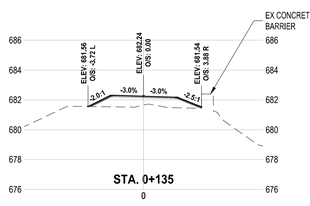


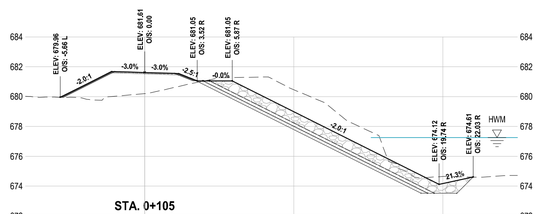


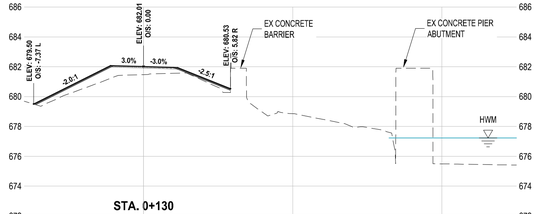




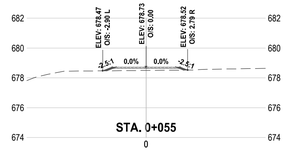


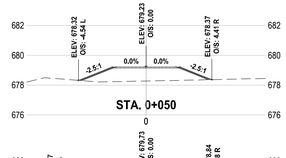


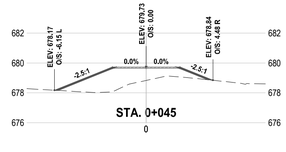


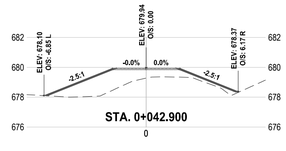


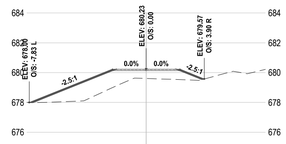
BERM CROSS SECTIONS
Scale 1:200

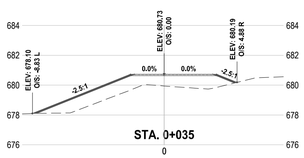


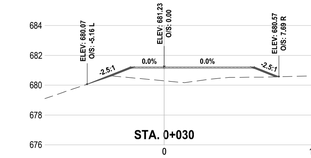


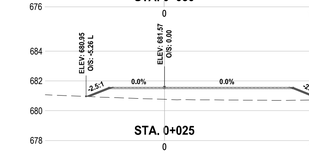












RAMP CROSS SECTIONS
Scale 1:200

NOTE: SEE DWG C-501 FOR TYPICAL SCARLETT BERM SECTION

NOTE:
1. BERM AND ACCESS RAMP SURFACES ARE A FINISHED GRADE SURFACE AND INCLUDES 100mm THICK CLASS 4-40 GRAVEL SURFACE
2. 100 mm OF TOPSOIL TO BE PLACED ON ALL SIDE SLOPES.

0 2 (1:200) 10m

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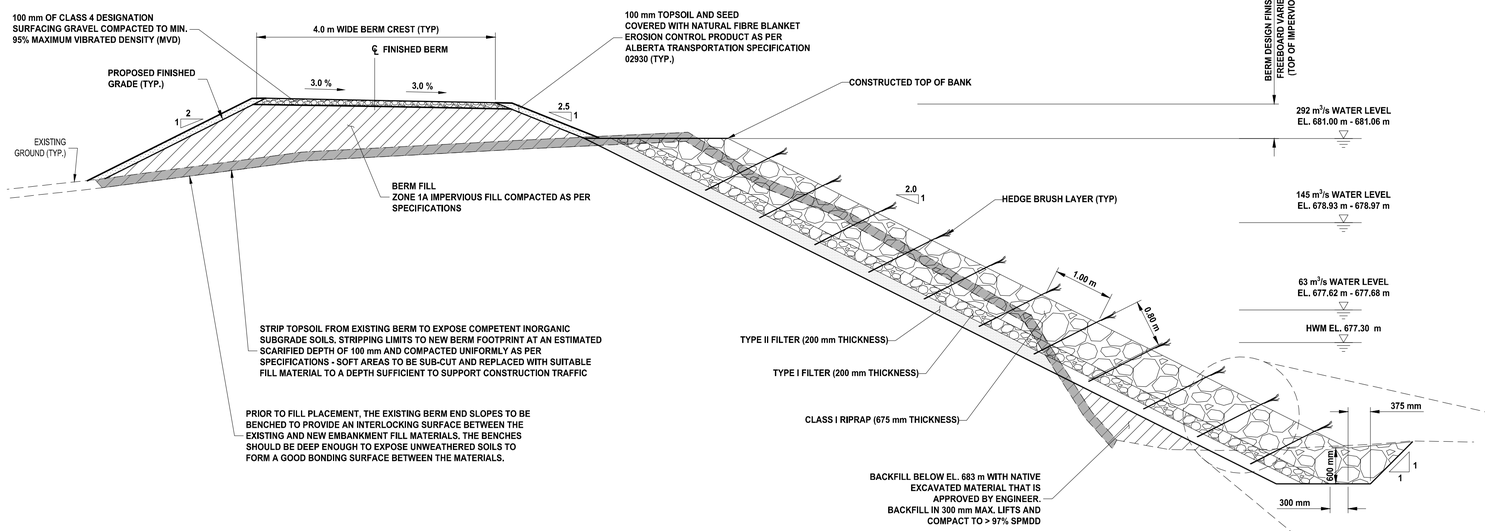
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

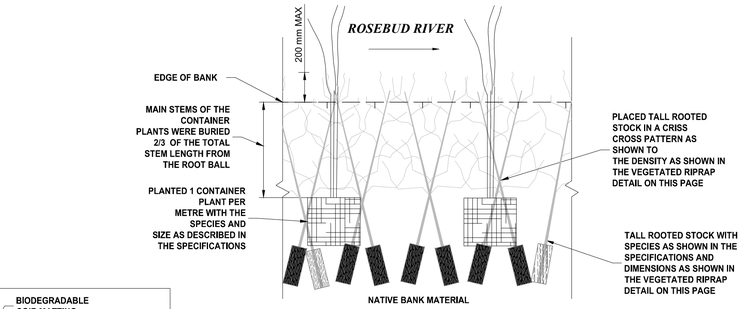
BERM IMPROVEMENTS
SCARLETT BERM CROSS SECTIONS

Project No.	3446-005	Drawing No.	C-302	Rev.	A
Group	CIVIL				



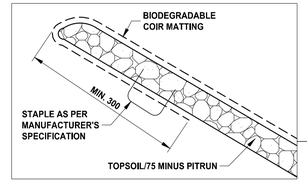
TYPICAL SCARLETT BERM SECTION

SCALE NTS



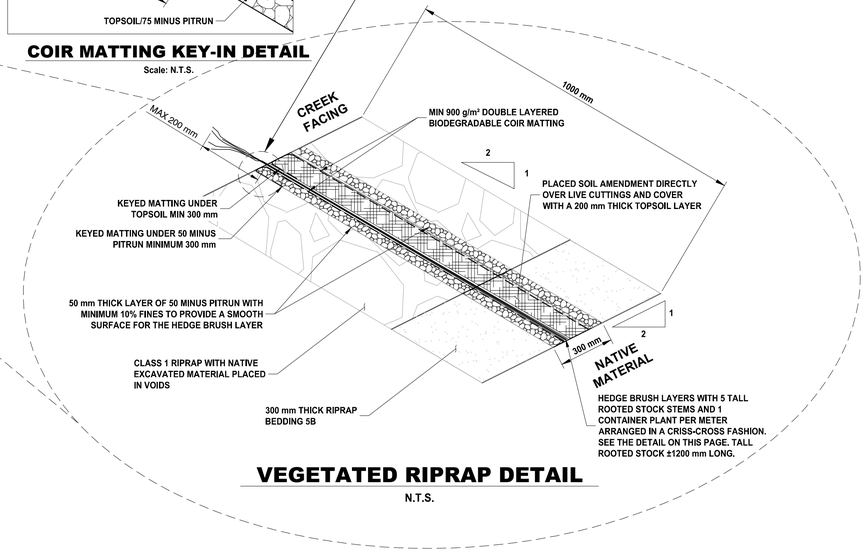
HEDGE BRUSH LAYER DETAIL

Scale: N.T.S.



COIR MATTING KEY-IN DETAIL

Scale: N.T.S.



VEGETATED RIPRAP DETAIL

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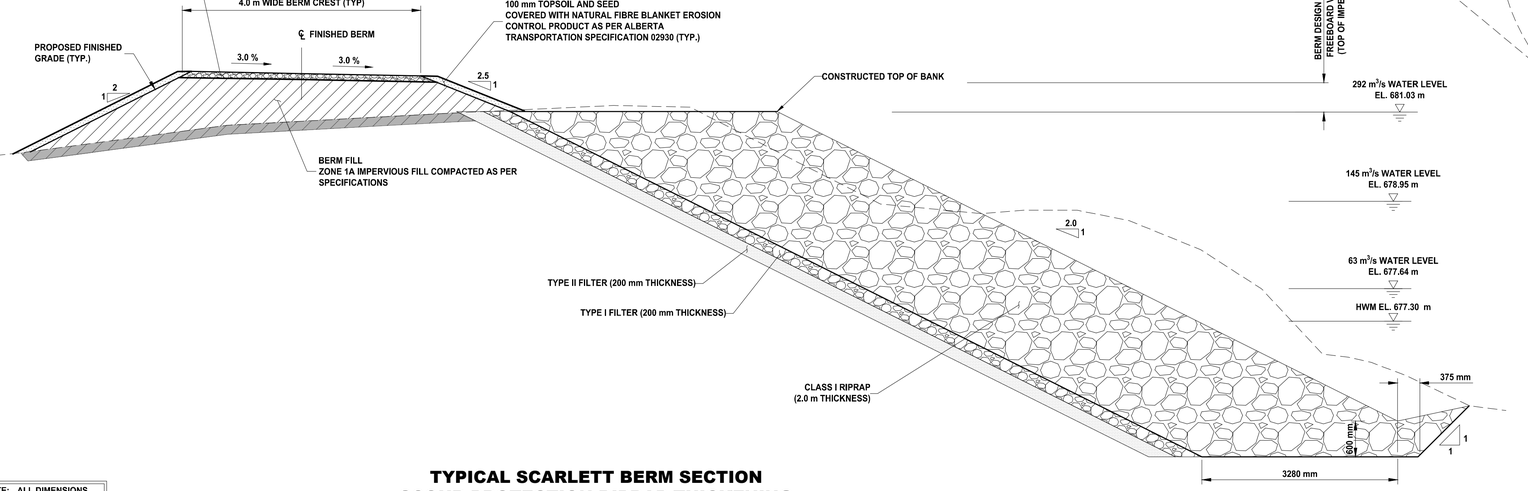
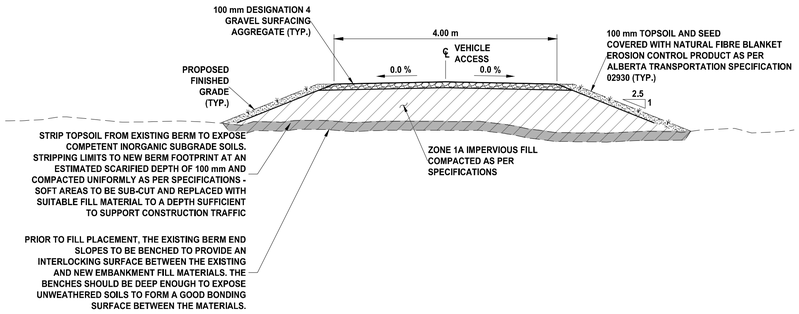


TYPICAL SCARLETT BERM SECTION SCOUR PROTECTION RIPRAP THICKENING

SCALE NTS



TYPICAL ACCESS RAMP SECTION

SCALE 1:50

NOTE: ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED

NOTES:
1. 292 m³/s WATER LEVEL CORRESPONDS TO 100-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND THE RED DEER RIVER
2. 145 m³/s WATER LEVEL CORRESPONDS TO 20-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND 2-YEAR RETURN FLOW IN THE RED DEER RIVER.
3. 63 m³/s WATER LEVEL CORRESPONDS TO 5-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND 2-YEAR RETURN FLOW IN THE RED DEER RIVER.

DRUMHELLER VALLEY

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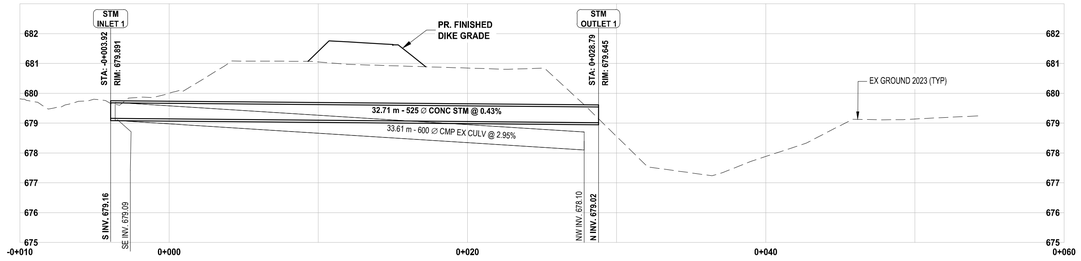
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
SCARLETT BERM TYPICAL DETAILS - SHEET 1

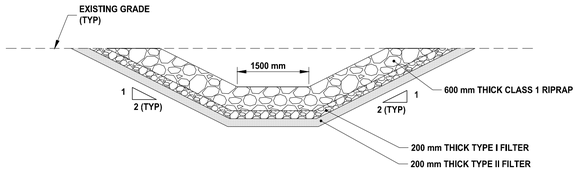
Project No.	Drawing No.	Rev.
3446-005	C-501	A
Group: CIVIL		



OPTION A
EXISTING CULVERT No. 1 TO BE REMOVED - PROFILE

SCALE HOR. 1:200, VER. 1:100

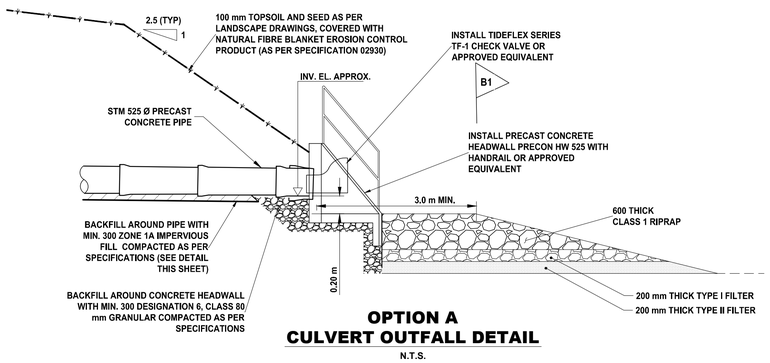
(SCARLETT BERM STA. 0+045.800)



OPTION A
OUTFALL OUTLET CHANNEL DETAIL

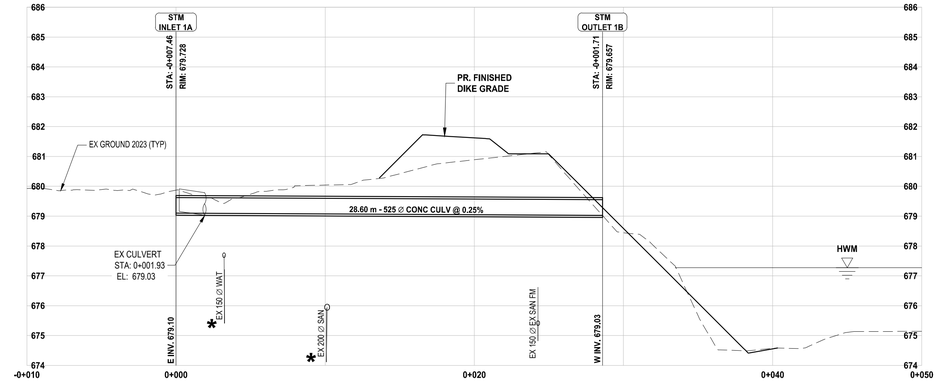
B1
-

Scale NTS



OPTION A
CULVERT OUTFALL DETAIL

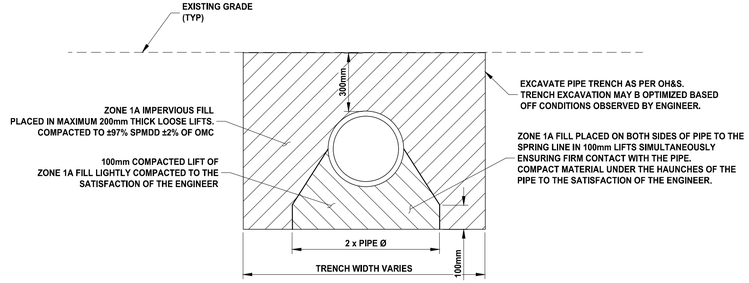
N.T.S.



OPTION B
PROPOSED CULVERT No. 1 REPLACEMENT - PROFILE

SCALE HOR. 1:200, VER. 1:100

(SCARLETT BERM STA. 0+052.400)



PIPE BEDDING & BACKFILL DETAIL
ZONE 1A BEDDING, ZONE 1A BACKFILL

Scale NTS

NOTE: ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED

0 2 (H 1:200) 8m
0 1 (V 1:100) 4m

DRUMHELLER VALLEY

Draft
2024-01-31 10:51:28 PM

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Seal:

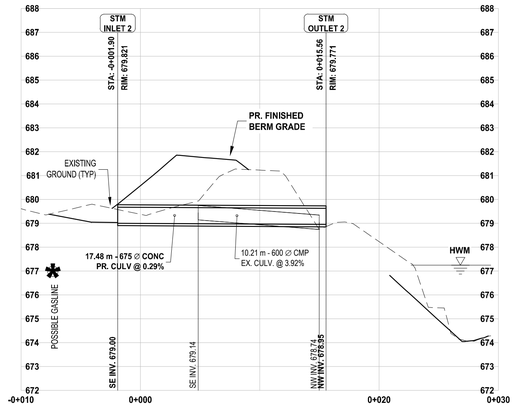
Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN

Issued for
Review
2024-01-31

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
SCARLETT BERM DETAILS - SHEET 2

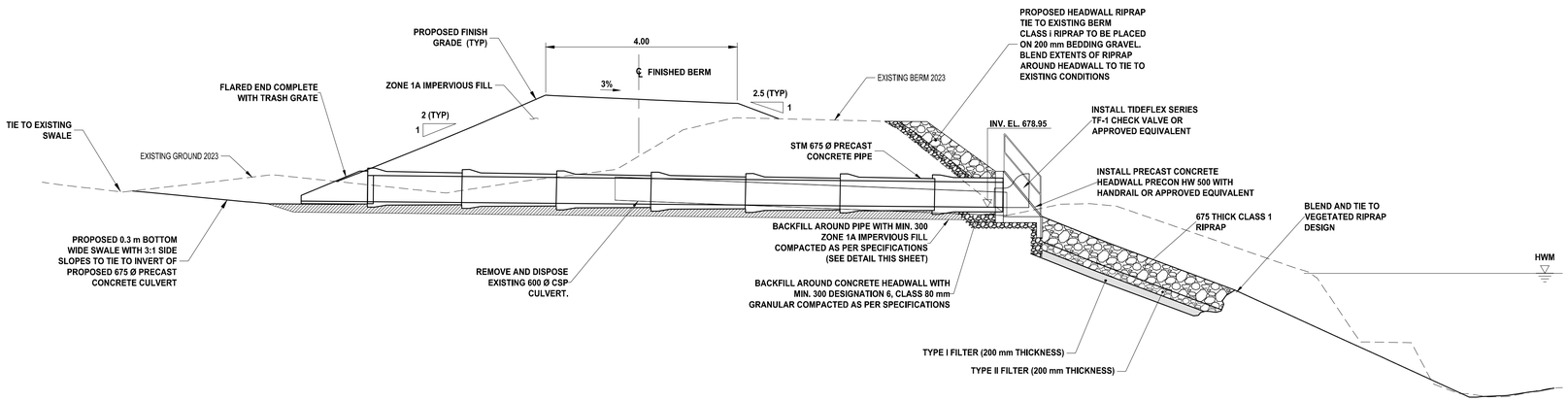
Project No. 3446-005
Group CIVIL
Drawing No. C-502
Rev. A



EXISTING CULVERT No. 2 REPLACEMENT - PROFILE

SCALE HOR. 1:250, VER. 1:50

(SCARLETT BERM STA. 0+124.400)



ROSEBUD RIVER OUTFALL No. 2 REPLACEMENT AROUND STA 0+124.400

SCALE 1:75

NOTE: ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED

DRUMHELLER VALLEY

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2024-01-31 10:51:28 PM

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Seal:

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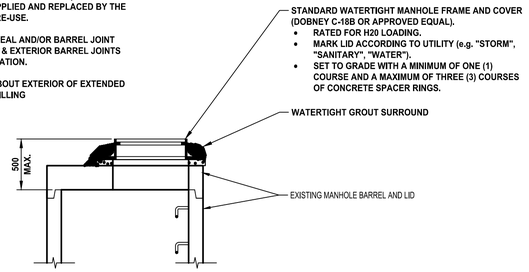
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
SCARLETT BERM DETAILS - SHEET 3

Project No. 3446-005 | Drawing No. C-503 | Rev. A
Group CIVIL

NOTES: (FOR THE EXISTING MANHOLE THAT NEEDS TO BE "RAISED" AT APPROX. RAMP STA. 0+040)

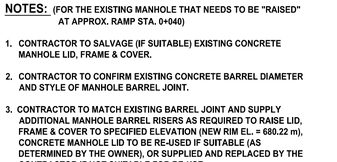
1. CONTRACTOR TO SALVAGE (IF SUITABLE) EXISTING CONCRETE MANHOLE LID, FRAME & COVER.
2. CONTRACTOR TO CONFIRM EXISTING CONCRETE BARREL DIAMETER AND STYLE OF MANHOLE BARREL JOINT.
3. CONTRACTOR TO MATCH EXISTING BARREL JOINT AND SUPPLY ADDITIONAL MANHOLE BARREL RISERS AS REQUIRED TO RAISE LID, FRAME & COVER TO SPECIFIED ELEVATION (NEW RIM EL. = 680.22 m), CONCRETE MANHOLE LID TO BE RE-USED IF SUITABLE (AS DETERMINED BY THE OWNER), OR SUPPLIED AND REPLACED BY THE CONTRACTOR IF NOT SUITABLE FOR RE-USE.
4. CONTRACTOR TO USE MASTIC JOINT SEAL AND/OR BARREL JOINT GASKET(S) AND GROUT ALL INTERIOR & EXTERIOR BARREL JOINTS AND ENSURE A WATERTIGHT INSTALLATION.
5. CONTRACTOR TO WRAP 6 MIL POLY ABOUT EXTERIOR OF EXTENDED MANHOLE BARRELS PRIOR TO BACKFILLING



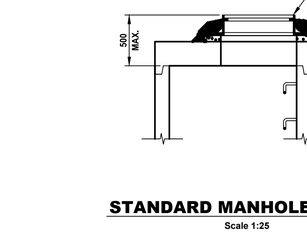
STANDARD MANHOLE DETAIL
Scale 1:25

GENERAL NOTES:

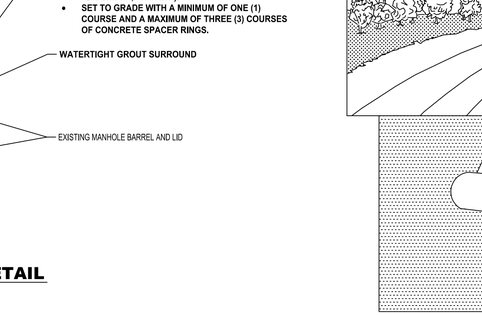
1. ALL WORK MUST BE UNDERTAKEN AND COMPLETED IN SUCH A MANNER AS TO PREVENT THE RELEASE OF SILT, RAW CONCRETE LEACHATE OR OTHER DELETERIOUS SUBSTANCES INTO ANY DITCH, WATERCOURSE, RAVINE AND STORM SEWER SYSTEM.
2. MAINTAIN ALL SEDIMENT CONTROL FACILITIES SHOWN ON THIS DRAWING UNTIL 90% OF THE LANDSCAPING IS COMPLETED.
3. SILT FENCE/FILTER FABRIC TO BE NILEX 2130 AND NILEX 4535 (C-10) RESPECTIVELY OR ENGINEER APPROVED EQUIVALENT.
4. REDUCED DUST BY USE OF WATER SPRAYED ON THE EXPOSED SOURCE OF THE DUST AS REQUIRED.
5. TEMPORARY EXPOSED SLOPES AND SPOIL STOCK PILES SHALL BE COVERED WITH ONE LAYER OF 6 mil POLY WEIGHTED OR STAPLED INTO PLACE.
6. SEDIMENT TO BE REMOVED FROM THE SEDIMENT CONTROL SYSTEM AFTER EACH STORM EVENT OR WHEN SEDIMENT HAS EXCEEDED 33% OF DESIGN SEDIMENT STORAGE VOLUME.



FABRIC SPLICE DETAIL
N.T.S.



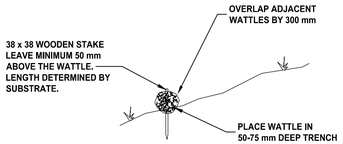
SECTION



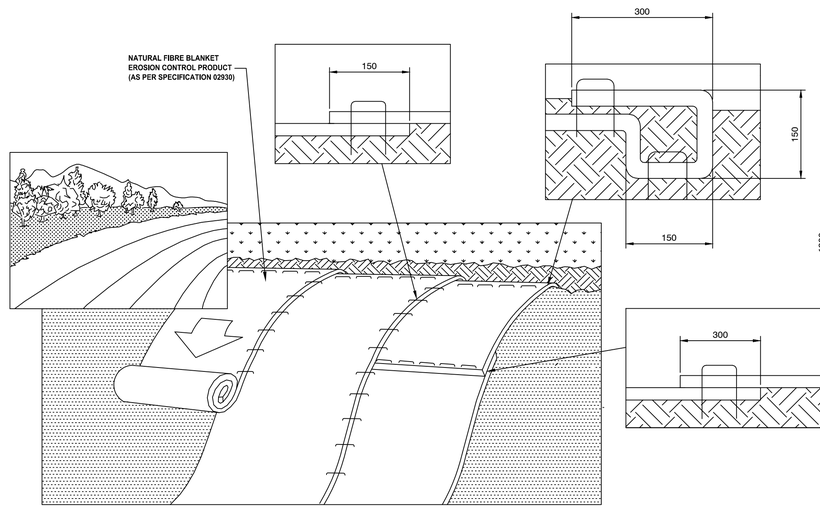
ELEVATION

NOTE: ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED

SILT FENCE DETAIL
SCALE 1:25



WATTLE ROLL DETAIL
N.T.S.



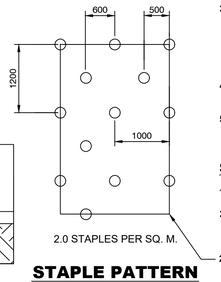
EROSION CONTROL BLANKET INSTALLATION
Scale 1:25

INSTALLATION NOTES:

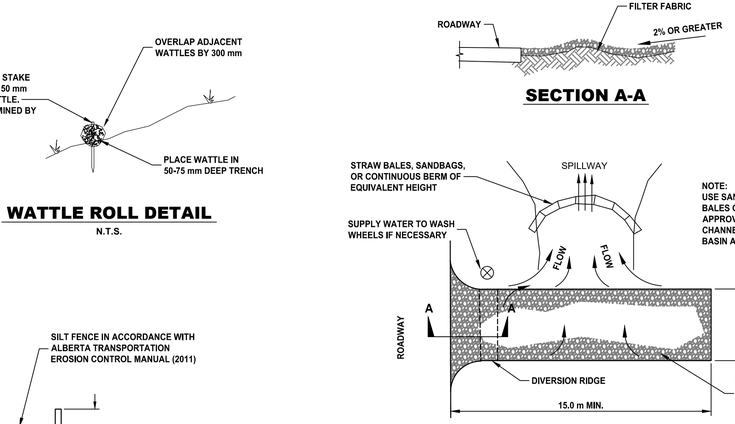
1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. BEGIN AT THE TOP OF THE SLOPES BY ANCHORING THE RECP's IN A 0.15m DEEP X 0.15m WIDE TRENCH WITH APPROXIMATELY 0.30m OF RECP's EXTENDED BEYOND THE UPSLOPE PORTION OF THE TRENCH. ANCHOR THE RECP"s WITH A ROW OF STAPLES/STAKES APPROXIMATELY 0.30m APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND APPLY REMAINING 0.30m PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 0.20m APART ACROSS THE WIDTH OF THE RECP's
3. ROLL THE RECP's (A.) DOWN THE SLOPE. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OIF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGE OF PARALLEL RECP's MUST BE STAPLED WITH APPROXIMATELY 0.15m OVERLAP DEPENDING ON RECP's WIDTH.
5. CONSECUTIVE RECP's SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 0.30m OVERLAP. STAPLE THROUGH OVERLAPPED AREA. APPROXIMATELY 0.30m APART ACROSS ENTIRE RECP's WIDTH.

SEED NOTES:

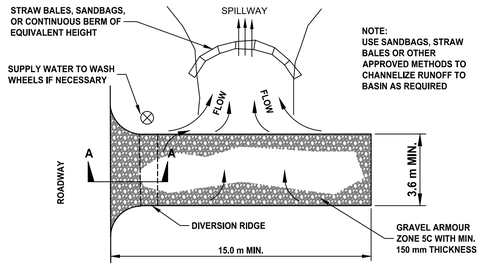
1. SEED MIX SHALL AS PER SPECIFICATION 02924 HYDROSEEDING.
2. APPLY SEED AT A RATE SPECIFIED IN 02924 HYDROSEEDING.



STAPLE PATTERN
N.T.S.



SECTION A-A

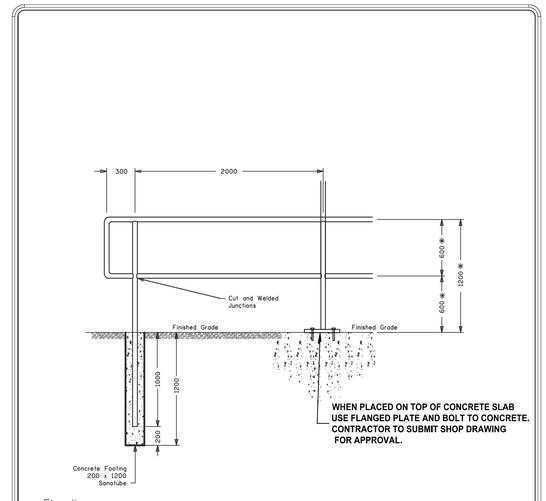


PLAN

NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. FOR HIGHWAY CONSTRUCTION, 300 mm THICKNESS OF GRAVEL IS PREFERRED.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY, AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER / ENGINEER.

GRAVEL ACCESS PAD DETAIL
N.T.S.



Elevation

NOTE: – All dimensions are in millimetres unless otherwise noted.
– Posts – Schedule 40, 48mm OD
– Rails – .083 to .100 wall thickness, 48mm OD
– Post and Rails to be steel pipe, continuous weld, all joints.
– * Total railing height increases to 1400mm when required on a bridge.

HANDRAIL DETAIL
MODIFIED CALGARY PARKS 2020 SPECIFICATION
Scale 1:25

PROJECT TITLE: SPECIFICATIONS	DRAWN BY: W.E./M.M./I.S.	SCALE: N.T.S.
SHEET TITLE: PATHWAY HANDRAIL	DATE: 2010 03 24	SHEET NO.: 30
	DESIGN BY: G.S.	FILE NO.
	DATE: 1997 06	

The City of Calgary Parks

DRUMHELLER VALLEY

Draft
2024-01-31 10:51:28 PM

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Seal:

Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2/CS	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN

Issued for **Review** 2024-01-31

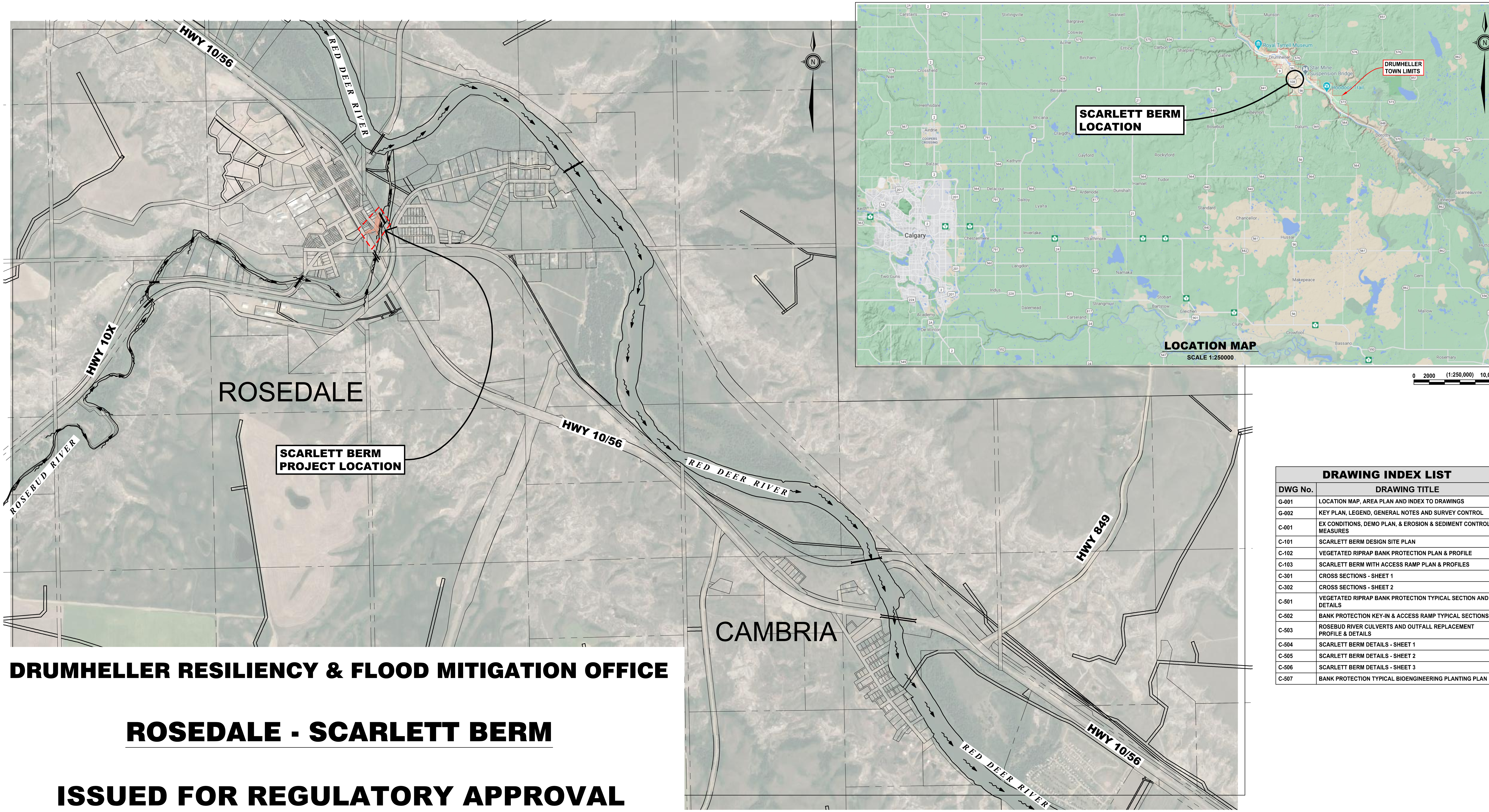
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
SCARLETT BERM DETAILS - SHEET 4

Project No.	Drawing No.	Rev.
3446-005	C-504	A
Group: CIVIL		

APPENDIX B

Rosedale Berm Project – Project Drawing Set



LOCATION MAP
SCALE 1:250000

0 2000 (1:250,000) 10,000m

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE

ROSEDALE - SCARLETT BERM

ISSUED FOR REGULATORY APPROVAL
JUNE 5, 2024

AREA PLAN
SCALE 1:10000

0 100 (1:10,000) 500m

DRAWING INDEX LIST

DWG No.	DRAWING TITLE
G-001	LOCATION MAP, AREA PLAN AND INDEX TO DRAWINGS
G-002	KEY PLAN, LEGEND, GENERAL NOTES AND SURVEY CONTROL
C-001	EX CONDITIONS, DEMO PLAN, & EROSION & SEDIMENT CONTROL MEASURES
C-101	SCARLETT BERM DESIGN SITE PLAN
C-102	VEGETATED RIPRAP BANK PROTECTION PLAN & PROFILE
C-103	SCARLETT BERM WITH ACCESS RAMP PLAN & PROFILES
C-301	CROSS SECTIONS - SHEET 1
C-302	CROSS SECTIONS - SHEET 2
C-501	VEGETATED RIPRAP BANK PROTECTION TYPICAL SECTION AND DETAILS
C-502	BANK PROTECTION KEY-IN & ACCESS RAMP TYPICAL SECTIONS
C-503	ROSEBUD RIVER CULVERTS AND OUTFALL REPLACEMENT PROFILE & DETAILS
C-504	SCARLETT BERM DETAILS - SHEET 1
C-505	SCARLETT BERM DETAILS - SHEET 2
C-506	SCARLETT BERM DETAILS - SHEET 3
C-507	BANK PROTECTION TYPICAL BIOENGINEERING PLANTING PLAN

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SULLIVAN ALBERTA 194899 2024-Jun-05

Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN
B	2024-03-08	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 90% DESIGN
C	2024-04-12	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 100% DESIGN
D	2024-06-05	CSUL	T2	MG	ISSUED FOR REGULATORY APPROVAL

NOT FOR CONSTRUCTION
2024-06-05

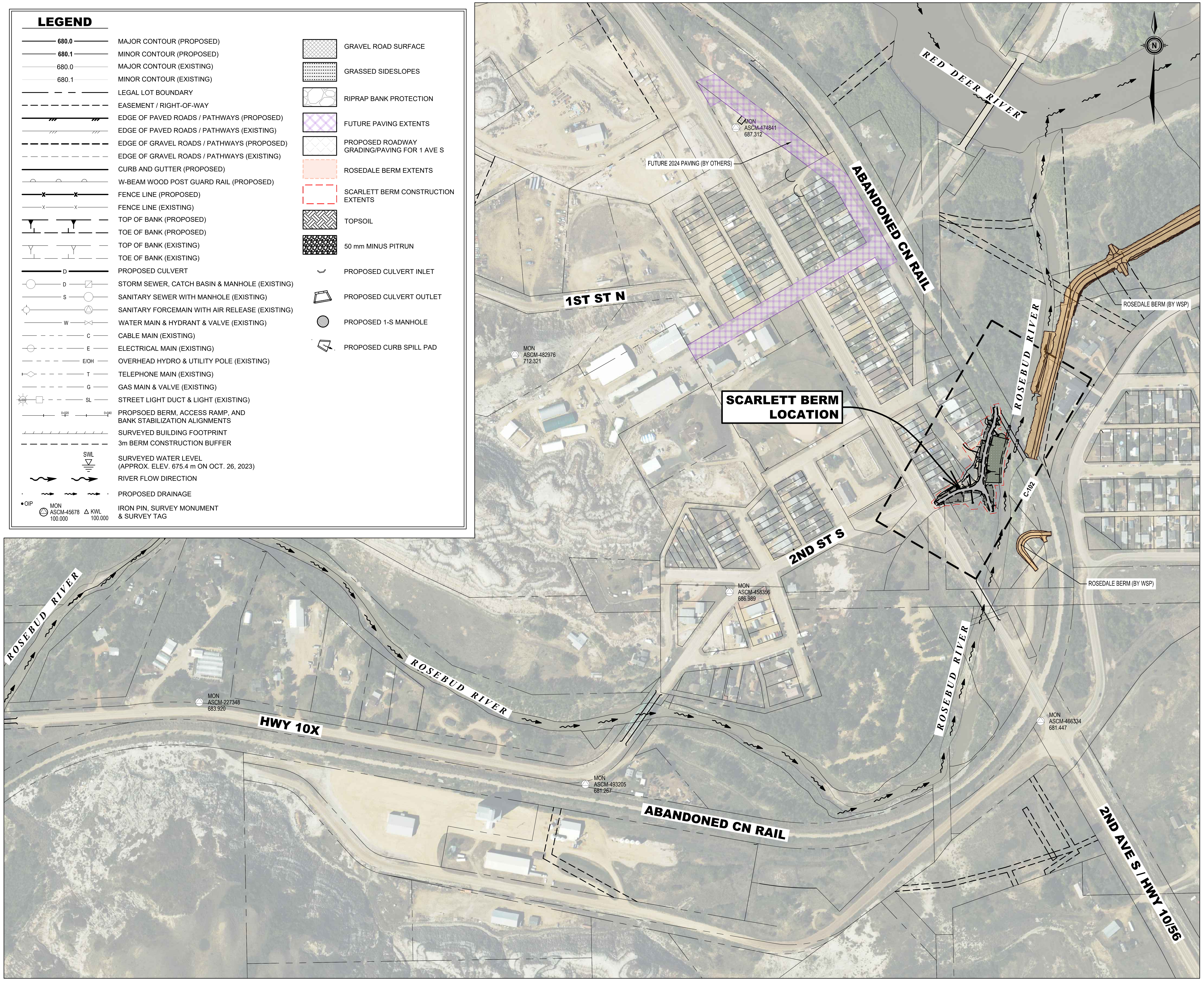
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
LOCATION MAP, AREA PLAN AND INDEX TO DRAWINGS

Project No. 3446-005
Group GENERAL
Drawing No. G-001
Rev. D

LEGEND

- 680.0 — MAJOR CONTOUR (PROPOSED)
- 680.1 — MINOR CONTOUR (PROPOSED)
- 680.0 — MAJOR CONTOUR (EXISTING)
- 680.1 — MINOR CONTOUR (EXISTING)
- LEGAL LOT BOUNDARY
- EASEMENT / RIGHT-OF-WAY
- EDGE OF PAVED ROADS / PATHWAYS (PROPOSED)
- EDGE OF PAVED ROADS / PATHWAYS (EXISTING)
- EDGE OF GRAVEL ROADS / PATHWAYS (PROPOSED)
- EDGE OF GRAVEL ROADS / PATHWAYS (EXISTING)
- CURB AND GUTTER (PROPOSED)
- W-BEAM WOOD POST GUARD RAIL (PROPOSED)
- FENCE LINE (PROPOSED)
- FENCE LINE (EXISTING)
- TOP OF BANK (PROPOSED)
- TOE OF BANK (PROPOSED)
- TOP OF BANK (EXISTING)
- TOE OF BANK (EXISTING)
- D — PROPOSED CULVERT
- D — STORM SEWER, CATCH BASIN & MANHOLE (EXISTING)
- S — SANITARY SEWER WITH MANHOLE (EXISTING)
- SANITARY FORCEMAIN WITH AIR RELEASE (EXISTING)
- W — WATER MAIN & HYDRANT & VALVE (EXISTING)
- C — CABLE MAIN (EXISTING)
- E — ELECTRICAL MAIN (EXISTING)
- E/OH — OVERHEAD HYDRO & UTILITY POLE (EXISTING)
- T — TELEPHONE MAIN (EXISTING)
- G — GAS MAIN & VALVE (EXISTING)
- SL — STREET LIGHT DUCT & LIGHT (EXISTING)
- PROPSOED BERM, ACCESS RAMP, AND BANK STABILIZATION ALIGNMENTS
- SURVEYED BUILDING FOOTPRINT
- 3m BERM CONSTRUCTION BUFFER
- SWL — SURVEYED WATER LEVEL (APPROX. ELEV. 675.4 m ON OCT. 26, 2023)
- RIVER FLOW DIRECTION
- PROPOSED DRAINAGE
- OIP / MON ASCM-45678 100.000 / KWL 100.000 — IRON PIN, SURVEY MONUMENT & SURVEY TAG
- GRAVEL ROAD SURFACE
- GRASSED SIDESLOPES
- RIPRAP BANK PROTECTION
- FUTURE PAVING EXTENTS
- PROPOSED ROADWAY GRADING/PAVING FOR 1 AVE S
- ROSEDALE BERM EXTENTS
- SCARLETT BERM CONSTRUCTION EXTENTS
- TOPSOIL
- 50 mm MINUS PITRUN
- PROPOSED CULVERT INLET
- PROPOSED CULVERT OUTLET
- PROPOSED 1-S MANHOLE
- PROPOSED CURB SPILL PAD



0 20 (1:2,500) 100m

KEY PLAN

SCALE 1:2500

CONSTRUCTION NOTES

GENERAL:

1. ALL CONSTRUCTION AND MATERIALS SHALL CONFORM TO ALBERTA TRANSPORTATION CIVIL WORKS MASTER SPECIFICATIONS, DRUMHELLER RESILIENCY AND FLOOD MITIGATION OFFICE STANDARD SPECIFICATIONS & DRAWINGS, UNLESS NOTED OTHERWISE. WHEN A CONFLICT BETWEEN SPECIFICATION ARISES, THE MOST STRINGENT SHALL APPLY.
2. ALL AFFECTED RESIDENTS AND BUSINESSES SHALL BE NOTIFIED IN WRITING A MINIMUM OF 7 BUSINESS DAYS PRIOR TO ANY SCHEDULED ACCESS AND/OR SERVICE DISRUPTIONS.
3. CONTRACTOR SHALL PREPARE A TRAFFIC MANAGEMENT PLAN TO ADDRESS CONSTRUCTION DISRUPTIONS.
4. DURING CONSTRUCTION, ENSURE ALL OH&S REGULATIONS ARE FOLLOWED. CONTRACTOR SHALL PROVIDE THE CONTRACT ADMINISTRATOR WITH ALBERTA OCCUPATIONAL HEALTH AND SAFETY REPORTS, IF APPLICABLE.
5. ENSURE THE CURRENT MUNICIPAL OH&S GROUND DISTURBANCE PRACTICE AND PROCEDURES ARE FOLLOWED. CONTACT UTILITY SAFETY PARTNERS ONE CALL FOR EXTERNAL UTILITY LOCATES AT LEAST 120 HRS PRIOR TO THE START OF CONSTRUCTION. UTILITY SAFETY PARTNERS ONE CALL TO BE COMPLETED PRIOR TO ANY GROUND DISTURBANCE
6. CONFIRM ALL EXISTING SERVICES, CONNECTIONS AND CROSSING POINTS AT LEAST 48 HRS PRIOR TO START OF CONSTRUCTION ON ANY SUCH ITEM. NOTIFY THE CONTRACT ADMINISTRATOR SHOULD CONFLICTS BE FOUND.
7. CLEARING AND GRUBBING TO OCCUR UNDER THE BERM, BANK PROTECTION, AND DITCH FOOTPRINTS.
8. ADJUST ALL EXISTING AND NEW APPURTENANCES TO MEET THE FINAL DESIGN GRADES AND NOTIFY THE CONTRACT ADMINISTRATION REGARDING ANY CHANGES.
9. RESTORE ALL AREAS AFFECTED BY CONSTRUCTION WORKS TO THEIR ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.
10. ENSURE THAT ALL OPERATIONAL SERVICES TO EXISTING BUILDINGS REMAIN FUNCTIONAL DURING CONSTRUCTION AND OPERATIONAL POST-CONSTRUCTION TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.
11. REPAIR AND/OR REPLACE ALL INFRASTRUCTURE (INCLUDING PRIVATE PROPERTY & BOULEVARDS) DAMAGED OR REMOVED DURING CONSTRUCTION TO BETTER THAN OR EQUAL TO PRE-CONSTRUCTION CONDITION TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.
12. CONTRACTOR SHALL CONSTRUCT OR RESTORE LANDSCAPE TO ORIGINAL CONDITIONS OR BETTER OUTSIDE THE TEMPORARY WORKING AREA TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR UNLESS OTHERWISE STATED
13. ALL ELEVATIONS AND DIMENSIONS ARE IN MILLIMETERS, UNLESS NOTED OTHERWISE.

ENVIRONMENTAL:

1. USE BEST MANAGEMENT PRACTICES (BMP), IN ACCORDANCE WITH ALBERTA TRANSPORTATION EROSION AND SEDIMENT CONTROL MANUAL (2011), DURING CONSTRUCTION. ADJUST WORK ACTIVITIES DURING PERIODS OF PRECIPITATION AND/OR SNOWMELT TO MITIGATE AGAINST SEDIMENT RELEASE TO THE STORM DRAIN SYSTEM OR ROSEBUD RIVER. SOME BMP'S TO CONSIDER ARE:
   - INSPECT ALL EQUIPMENT DAILY FOR FLUID LEAKS
   - ENSURE SPILL PROTECTION MEASURES ARE IN PLACE DURING RE-FUELING OF EQUIPMENT
   - KEEP A SPILL KIT ON SITE AT ALL TIMES
   - CONTRACTOR SHALL PROTECT ALL TREES TO REMAIN FROM DAMAGE DURING CONSTRUCTION. NOTIFY THE CONTRACT ADMINISTRATOR IMMEDIATELY IF A POSSIBLE CONFLICT IS FOUND.
   - CONTRACTOR TO COOPERATE WITH OWNER TO ENSURE NEST SWEEP IS COMPLETED PRIOR TO REMOVING ANY TREES ON SITE, IF WORK IS TO BE COMPLETED DURING FEDERALLY REGULATED MIGRATORY BIRD NESTING PERIOD.
2. CONTRACTOR TO COMPLETE A CONSTRUCTION ISOLATION OR FLOW DIVERSION PLAN FOR THE ROSEBUD RIVER AND SUBMIT TO THE OWNER FOR APPROVAL PRIOR TO CONSTRUCTION.
3. CONTRACTOR TO MAINTAIN FLOW IN THE ROSEBUD RIVER UPSTREAM AND DOWNSTREAM OF THE CONSTRUCTION AREA AT ALL TIMES. CONTRACTOR RESPONSIBLE FOR FLOW ISOLATIONS OF THE CONSTRUCTION AREAS AND FLOW DIVERSIONS AROUND THE CONSTRUCTION AREA OF THE ROSEBUD RIVER IF FLOW IS PRESENT DURING CONSTRUCTION.
4. CONTRACTOR SHALL PREPARE AND SUBMIT AN ECO PLAN FOR APPROVAL PRIOR TO CONSTRUCTION. THE ECO PLAN IS TO INCLUDE SECTIONS FOR EROSION AND SEDIMENT CONTROL (ESC) MEASURES AND CARE OF WATER. THE CONTRACTOR SHALL UPDATED THE ECO PLAN AS NEEDED FOR CHANGES IN SITE CONDITIONS OR CONSTRUCTION ACTIVITY CHANGES AND RECEIVE APPROVAL FROM THE CONTRACT ADMINISTRATOR BEFORE IMPLEMENTING ANY CHANGES
5. PERFORM INSTREAM WORK UNDER THE DIRECTION OF A QUALIFIED AQUATIC ENVIRONMENT SPECIALIST (QAES). WORK MAY BE HALTED OR SLOWED DOWN AT THE DISCRETION OF THE QAES IF SEDIMENT LEVELS IN THE WATERCOURSE INCREASE ABOVE ACCEPTABLE LIMITS. HALTED WORK MAY PROCEED UPON APPROVAL BY THE QAES.
6. PERFORM A FISH RESCUE WITHIN ANY ISOLATED AREAS UNDER THE DIRECTION OF A QAES PRIOR TO THE START OF IN-STREAM CONSTRUCTION WORK.

UTILITIES:

1. LOCATION AND ELEVATION OF EXISTING UTILITIES SHOWN ON DRAWINGS ARE APPROXIMATE ONLY. CONTRACTOR IS RESPONSIBLE TO DETERMINE EXACT LOCATION AND ELEVATION PRIOR TO CONSTRUCTION AND NOTIFY THE CONTRACT ADMINISTRATION REGARDING ANY DISCREPANCIES.
2. ENSURE ALL EXISTING WATER SYSTEMS REMAIN FUNCTIONAL DURING CONSTRUCTION.
3. IF GAS MAINS ARE PRESENT WITHIN THE PROJECT AREA, APEX AND OH&S REGULATIONS SHALL BE FOLLOWED. APEX REPRESENTATIVE MAY BE REQUIRED TO BE PRESENT WHEN WORKING ADJACENT TO GAS MAINS (ESPECIALLY HIGH PRESSURE).
4. IF ATCO ELECTRIC UTILITIES ARE FOUND WITHIN THE PROJECT AREA, THE CONTRACTOR SHALL PROVIDE 72 HRS NOTICE PRIOR TO EXCAVATION. A REPRESENTATIVE FROM ATCO WILL BE SCHEDULED TO BE PRESENT DURING EXCAVATION.
5. WHERE HEAVY WORK IS REQUIRED WITHIN THE EXCAVATION ZONE SURROUNDING UTILITY POLES, AND A POLE HOLE IS REQUIRED, THE CONTRACTOR MUST BE AUTHORIZED AND BE ABLE TO PULL A LIVE LINE PERMIT.

REFERENCES:

1. ORTHOPHOTOS WERE TAKEN ON MAY 27, 2019 AND PROVIDED BY THE TOWN OF DRUMHELLER.
2. BASE DATA, INCLUDING LEGAL BOUNDARIES, PLANIMETRIC FEATURES AND EXISTING UTILITIES WERE PROVIDED BY THE TOWN OF DRUMHELLER.
3. EXISTING TOPOGRAPHY CONTOURS GENERATED FROM MAY 2018 LIDAR PROVIDED BY THE TOWN OF DRUMHELLER HAS VERTICAL ACCURACY OF +/- 0.15 M AT 95% ON HARD, FLAT, OPEN SURFACES.
4. GROUND SURVEY DATA RECEIVED FROM HUNTER WALLACE SURVEYS LTD. ON OCT 26, 2023.
5. WATER LEVELS WERE OBTAINED FROM "HYDROTECHNICAL ASSESSMENT OF THE SCARLETT AND ROSEDALE BERMS REV. 1" (NHC, 2024) AND "HYDROTECHNICAL ASSESSMENT OF THE SCARLETT BERM" (NHC, 2024)

SURVEY CONTROL INFORMATION

COORDINATES ARE TO NAD83(CSRS) / ALBERTA 3TM REFERENCE MERIDIAN 114W DATUM, (CODE CANA83-3TM114) GRID ELEVATIONS ARE GEODETIC TO CGVD28 W/ GSD95 GEOID.

PNT #	NORTHING	EASTING	ELEV	DESC.
227348	5698579.258	94423.288	683.920	ASCM
458356	5698707.823	95042.588	686.989	ASCM
474841	5699250.079	95049.949	687.312	ASCM
466334	5698557.026	95405.847	681.447	ASCM
482976	5698985.079	94791.925	712.321	ASCM
493205	5698483.362	94874.360	681.267	ASCM

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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Seal: PROFESSIONAL ENGINEER ALBERTA — CHRISTOPHER SULLIVAN — 194899 — 2024-Jun-05

Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN
B	2024-03-08	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 90% DESIGN
C	2024-04-12	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 100% DESIGN
D	2024-06-05	CSUL	T2	MG	ISSUED FOR REGULATORY APPROVAL

NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
KEY PLAN, LEGEND, GENERAL NOTES AND SURVEY CONTROL

Project No. 3446-005
Group GENERAL
Drawing No. G-002
Rev. D

SAVED 2024/06/03, 10:49 AM

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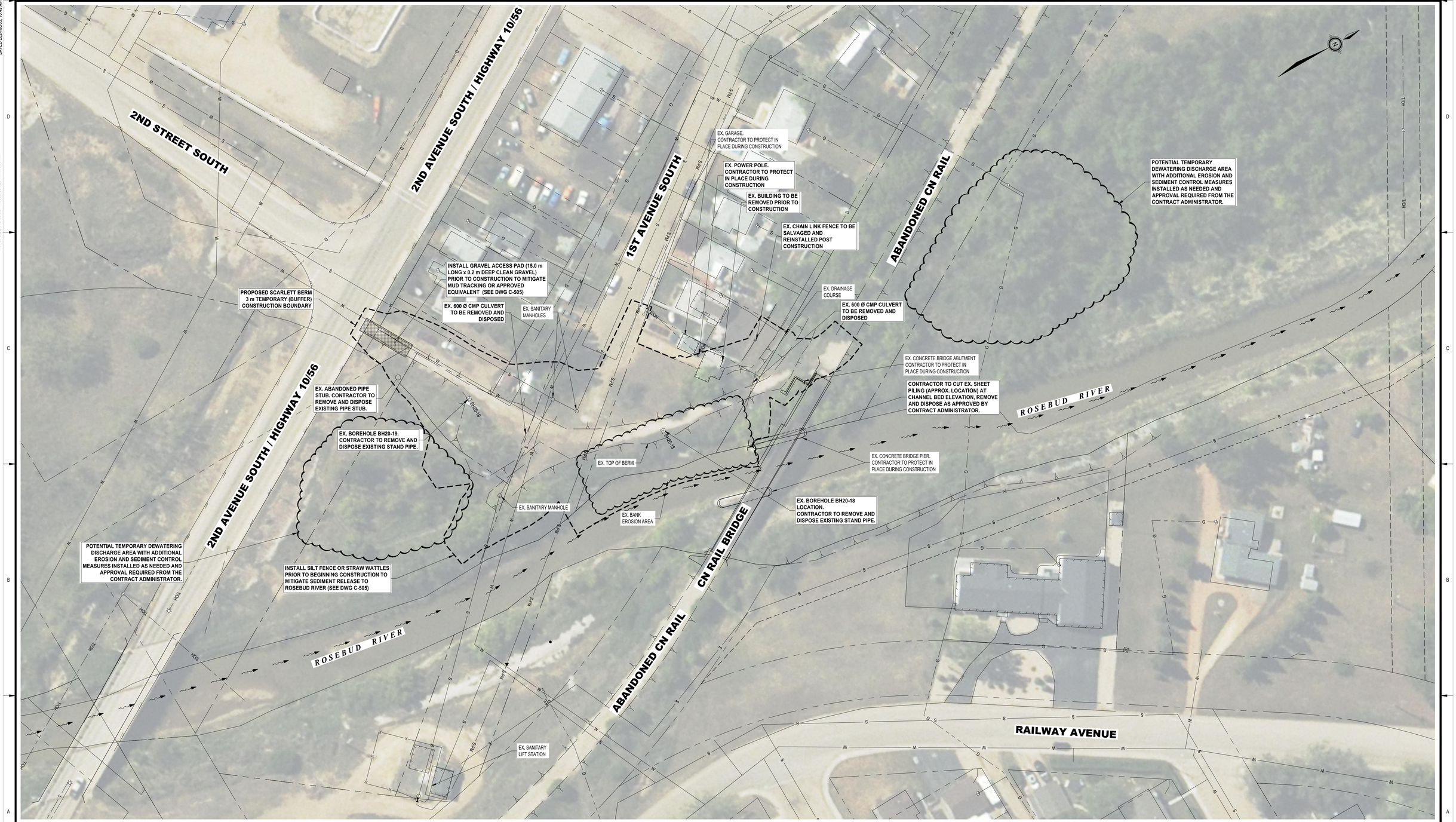
millimeters 0 10 50 100



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PLAN
SCALE 1:500

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SELMAN ALBERTA 194890
2024-Jun-05

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D	2024-06-05	CSUL	T2	MG	ISSUED FOR REGULATORY APPROVAL

Rev	Date	Des	Dwn	Chk	Description

NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
EXISTING CONDITIONS, DEMOLITION PLAN, & EROSION AND SEDIMENT CONTROL MEASURES

Project No. 3446-005
Group CIVIL
Drawing No. C-001
Rev. D

SAVED 2024/06/05, 12:48 AM

Paper Size = ANSI D
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millimeters 0 10 50 100

2ND STREET SOUTH

2ND AVENUE SOUTH / HIGHWAY 10/56

1ST AVENUE SOUTH

ABANDONED CN RAIL

CN RAIL BRIDGE

ROSEBUD RIVER

PROPOSED V-DITCH. TIE TO CULVERT No.1 INLET — K C-504

PROPOSED ROADWAY GRADING AND PAVING AS NEEDED TO TIE TO EX. DRIVEWAYS AND PROPOSED CONCRETE CURB AND V-DITCH

PROPOSED V-DITCH (TYP) TIE TO CULVERT No.1 INLET — K C-504

TIE PROPOSED CONCRETE LOW PROFILE ROLLED CURB TO EX. CURB AND GUTTER. L=15m @ 1.5% — 15 C-504

EX. CURB & GUTTER (EAST SIDE OF ROAD)

EX. SWALE

EX. EDGE OF ASPHALT

TIE PROPOSED CONCRETE SPASH PAD TO V-DITCH. — L C-504

PROPOSED CULVERT NO.2 INLET FLARED END C/W TRASH GATE — H C-503

EX. SANITARY MANHOLE - RAISE STRUCTURE TO RIM ELEV. 680.63 m
REPACE EX. SANITARY MANHOLE WITH A FLOOD PROOF LID. — M C-505

REPACE EX. SANITARY MANHOLE COVER WITH A FLOOD PROOF LID — M C-505

PROPOSED SCARLETT BERM SEE DWG C-103 FOR DETAILS

CL V-DITCH
N: 5698819.32
E: 95285.92
EL: 681.32

CL V-DITCH
N: 5698834.32
E: 95309.58
EL: 679.65

CL V-DITCH
N: 5698845.16
E: 95322.53
EL: 679.29

CL V-DITCH
N: 5698865.78
E: 95331.99
EL: 679.59

CL V-DITCH
N: 5698885.45
E: 95337.61
EL: 679.87

CL V-DITCH
N: 5698905.76
E: 95344.47
EL: 697.04

EX. CHAIN LINK FENCE TO BE SALVAGED.
SEE DWG C-001 FOR DETAILS.

PROPOSED V-DITCH.
TIE TO CULVERT No. 2 INLET.
MAINTAIN POSITIVE DRAINAGE. — K C-504

TIE V-DITCH CENTRELINE TO EXISTING DRAINAGE COURSE

REDUCED TEMP CONSTRUCTION BOUNDARY (APPROX. 2 m OFFSET FROM BERM TOE)

PROPOSED 'T' BOLLARD — V C-506

PROPOSED 1.2 m 1-S MANHOLE C/W 750 x 750 TYPE M HATCH ACCESS & FALL ARREST. — G C-503, U C-506

PROPOSED 675 Ø CONCRETE CULVERT No. 1 FITTED WITH BACKFLOW PREVENTION. — G C-503

PROPOSED CULVERT NO.1 OUTLET — G C-503

EX. 600 Ø CMP CULVERT, SEE DWG C-001 FOR DETAILS.

RAISE RIM OF EX. SAN MANHOLE TO ELEV. 680.3 m AND REPLACE LID WITH FLOODPROOF LID — M C-505

PROPOSED ACCESS AND MAINTENANCE VEHICLE RAMP TO EX. SANITARY MANHOLE AND RIVERSIDE BENCH.
FOR PROFILE SEE DWG C-103

PROPOSED SCARLETT BERM 3 m TEMPORARY (BUFFER) CONSTRUCTION BOUNDARY

PROPOSED STAINLESS STEEL HANDRAIL (AS A VISUAL BARRIER) INSTALLED ON TOP OF EXISTING CONCRETE ABUTMENT. — 30 C-506

EX. CONCRETE ABUTMENT. CONTRACTOR TO PROTECT IN PLACE DURING CONSTRUCTION.

EX. TOP OF BANK

EX. 600 Ø CMP CULVERT. SEE DWG C-001 FOR DETAILS.

EX. CONCRETE BRIDGE PIER.. CONTRACTOR TO PROTECT IN PLACE DURING CONSTRUCTION.

PROPOSED 675 Ø CONCRETE CULVERT No. 2. FITTED WITH BACKFLOW PREVENTION — H C-503

PROPOSED RIPRAP FROM CULVERT No.2 OUTLET TO EX. CONCRETE BRIDGE PIER. SEE DWG C-102 FOR DETAILS.

PROPOSED CULVERT No.2 OUTLET — H C-503

EX. CONCRETE BRIDGE PIER. CONTRACTOR TO PROTECT IN PLACE DURING CONSTRUCTION.

PROPOSED CLASS 1 VEGETATED RIPRAP BANK PROTECTION. REFER TO DWG C-102 FOR DETAILS.

PROPOSED W-BEAM WOOD POST GUARD RAIL AS PER ALBERTA TRANSPORTATION STANDARD DRAWINGS TEB 3.01, TEB 3.02, TEB 3.03, TEB 3.06, & TEB 3.09. POST TO BE INSTALLED TO AVOID EX. UNDERGROUND UTILITIES. L = 22.6 m.

PROPOSED 750 mm X 750 mm WA-8 "CHECKERBOARD DEAD END" AND 300mm X 300 mm RB-51 "NO PARKING" SIGNS C/W 100 mm X 150 mm BREAKAWAY POST AS PER ALBERTA TRANSPORTATION STANDARD DRAWINGS TEB 1.81, TCS-A-110, & TCS-A4-330.

1.0 m WIDE UPSTREAM RIPRAP KEY-IN. REFER TO DWG C-102 FOR DETAILS.

ROSEDALE BERM (BY WSP)

0 5 (1:500) 25m

PLAN
SCALE 1:300

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SULLIVAN ALBERTA
2024-Jun-05

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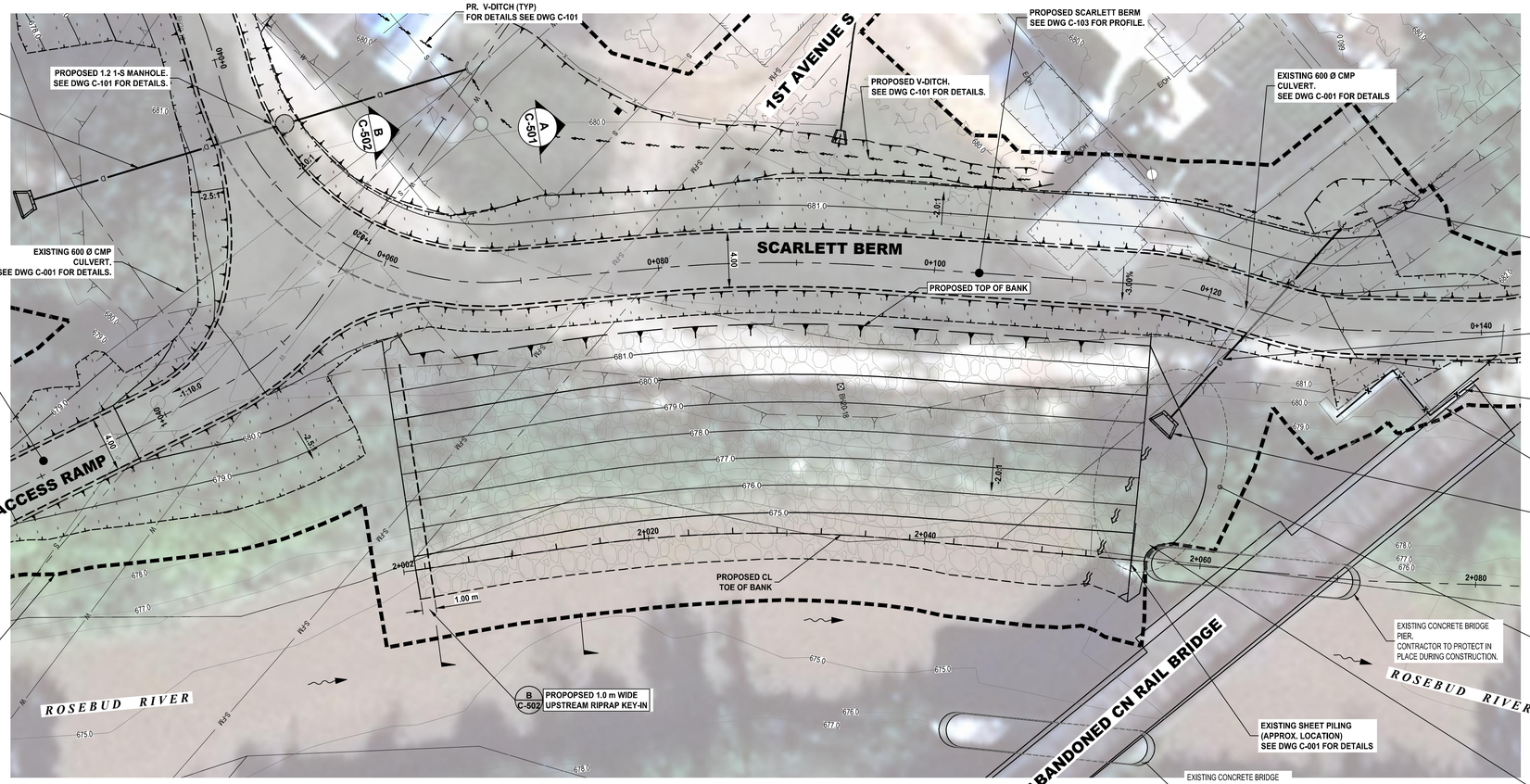
Rev	Date	Des	Dwn	Chk	Description

NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
SCARLETT BERM DESIGN
SITE PLAN

Project No. 3446-005
Group CIVIL
Drawing No. C-101
Rev. D



PLAN
SCALE 1:200

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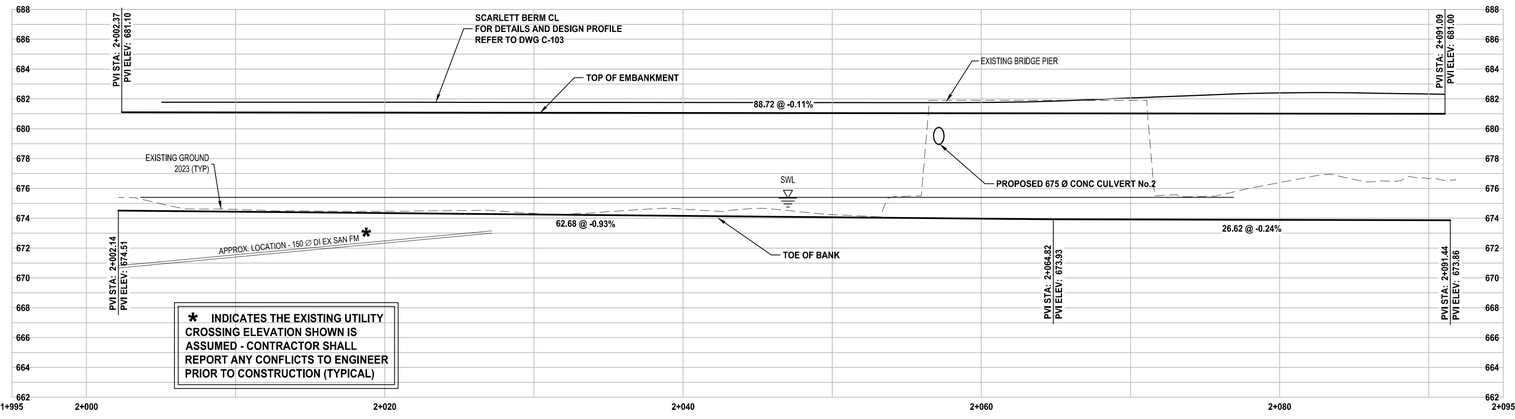

BANK PROTECTION - PROFILE
SCALE: H 1:200 V 1:50

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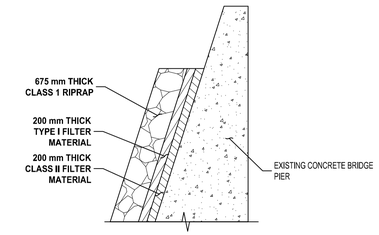
0 0.5 (V 1:50) 2m



RIPRAP REPLACEMENT AT CONCRETE PIER
SCALE: 1:75
F C-102

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SULLIVAN ALBERTA
2024-Jun-05

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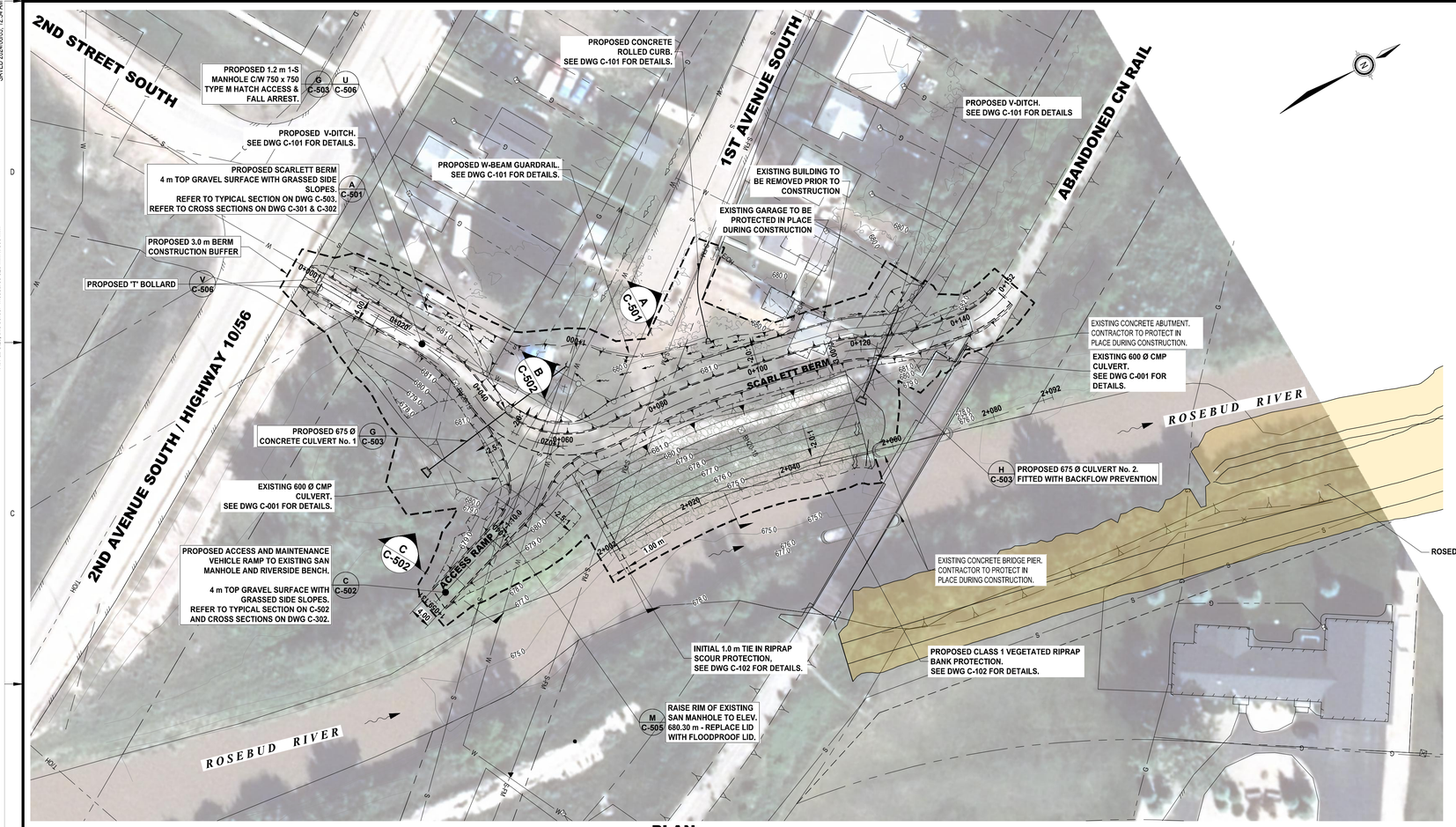
Rev	Date	Des	Dwn	Chk	Description

NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
VEGETATED RIPRAP BANK PROTECTION
PLAN & PROFILE

Project No. 3446-005
Group CIVIL
Drawing No. C-102
Rev. D



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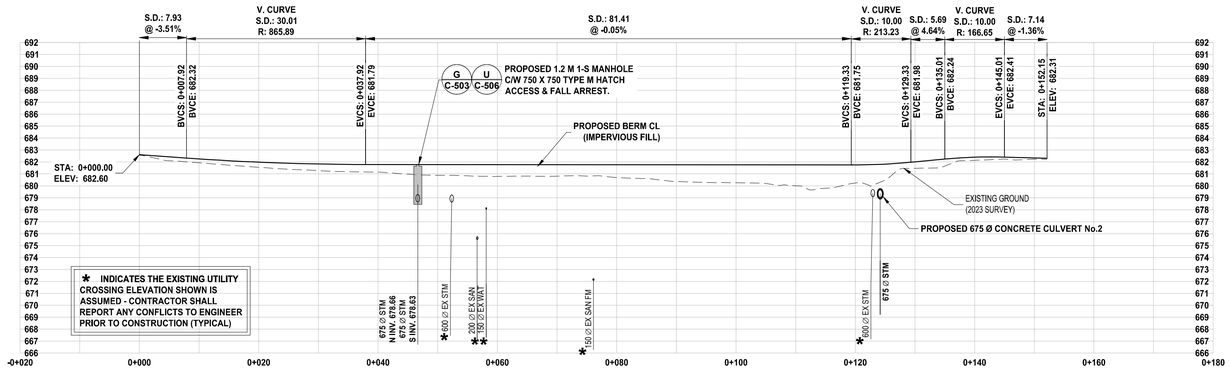
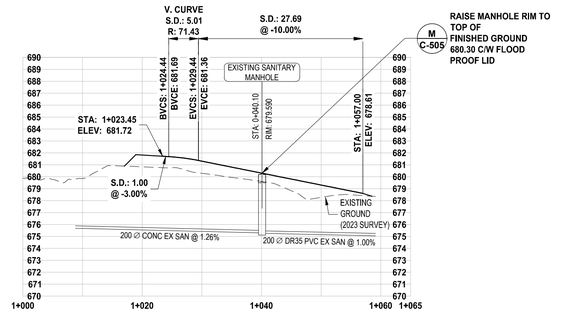
PLAN
SCALE 1:500



0 5 (H 1:500) 25m
0 1 (V 1:100) 5m

SCARLETT BERM PROFILE
SCALE: H 1:500 V 1:100



ACCESS RAMP PROFILE
SCALE: H 1:500 V 1:100

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SALVATERRA 104850 PROVINCE OF ALBERTA
2024-Jun-05

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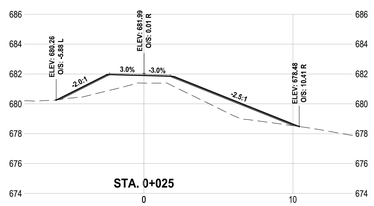
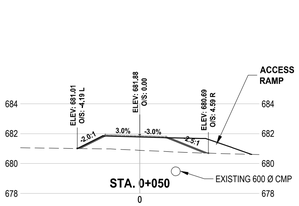
NOT FOR CONSTRUCTION
2024-06-05

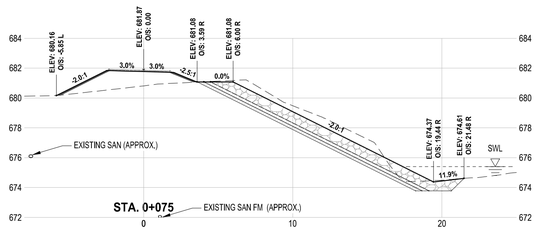
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

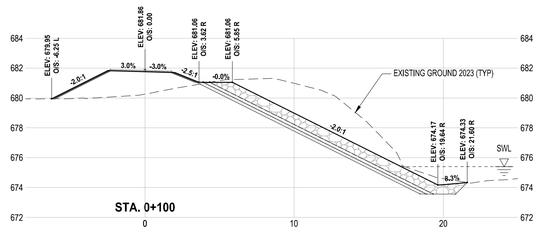
BERM IMPROVEMENTS
SCARLETT BERM WITH ACCESS RAMP
PLAN & PROFILES

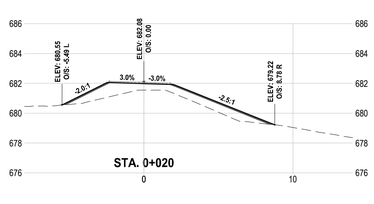
Project No. 3446-005
Group CIVIL
Drawing No. C-103
Rev. D

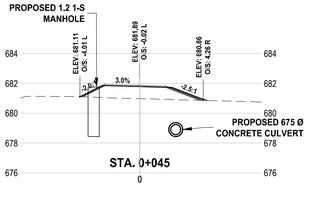


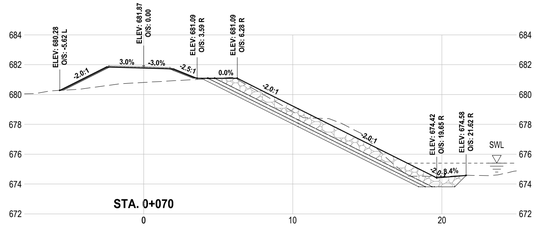


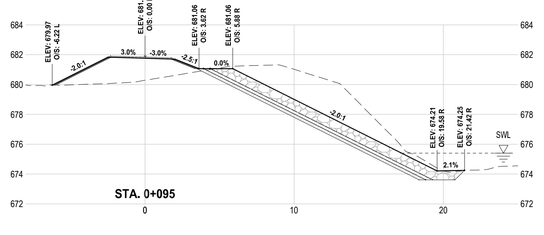


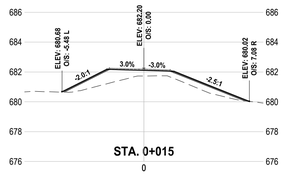


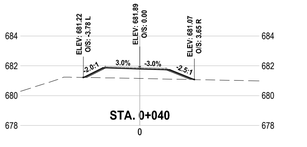


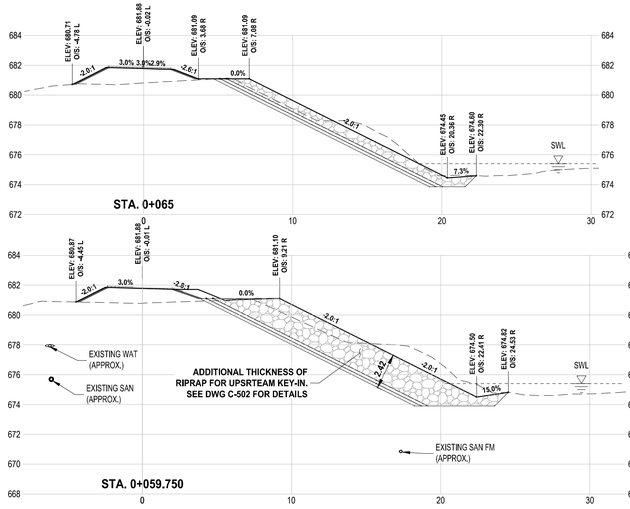


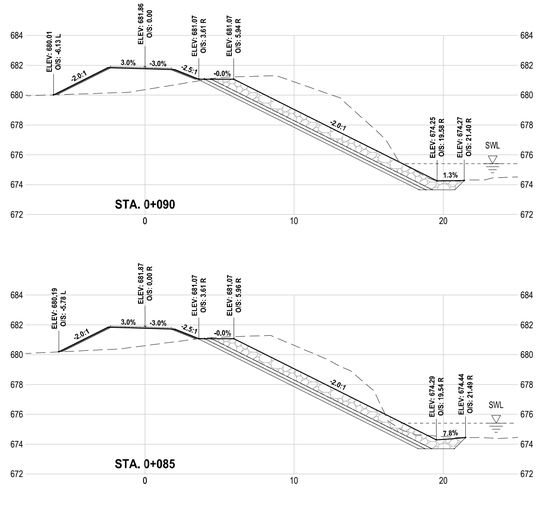


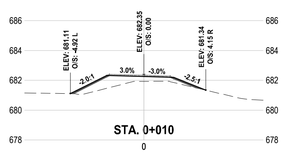


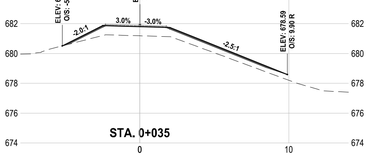


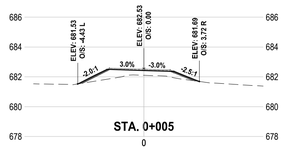


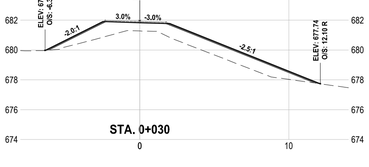


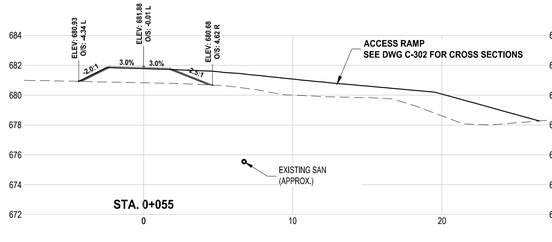


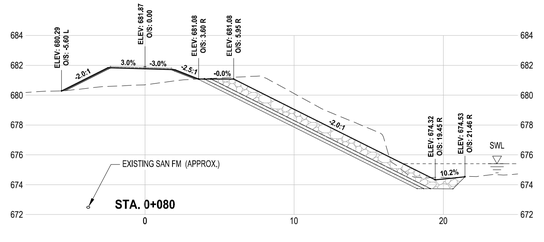












NOTE:
1. BERM, ACCESS RAMP, AND BANK PROTECTION ARE SHOWN AS A FINISHED GRADE SURFACE.
2. SEE DWG C-501 AND C-502 FOR TYPICAL SECTIONS.
3. SWL REPRESENTS ESTIMATED SURVEY WATER LEVEL FROM OCTOBER 2023.

SCARLETT BERM AND BANK PROTECTION CROSS SECTIONS

Scale 1:200

0 2 (1:200) 10m

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

KERR WOOD LEIDAL
consulting engineers
100 - 239 10th Avenue SE
Calgary, AB T2G 0V9
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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SCOTT LEIDAL 154495 PROVINCE OF ALBERTA
2024-Jun-05

Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2/CS	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN
B	2024-03-08	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 90% DESIGN
C	2024-04-12	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 100% DESIGN
D	2024-06-05	CSUL	T2	MG	ISSUED FOR REGULATORY APPROVAL

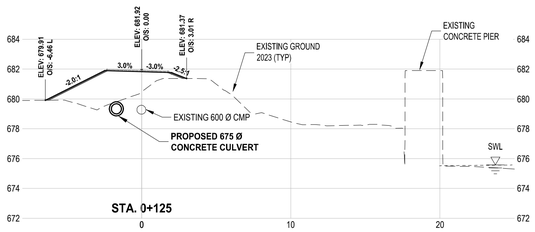
Rev	Date	Des	Dwn	Chk	Description

NOT FOR CONSTRUCTION
2024-06-05

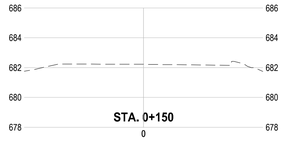
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
CROSS SECTIONS
SHEET 1

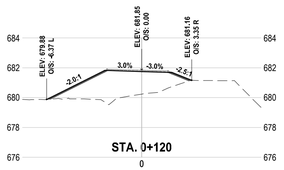
Project No. 3446-005
Group CIVIL
Drawing No. C-301
Rev. D



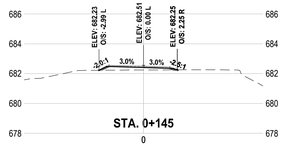
STA. 0+125



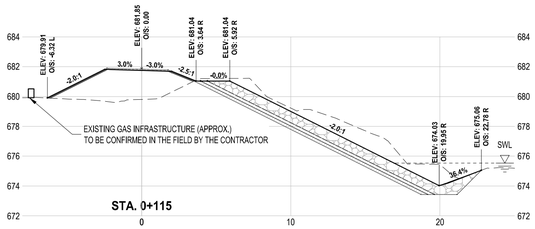
STA. 0+150



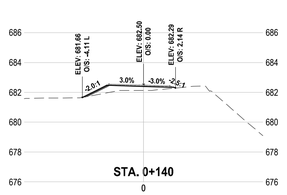
STA. 0+120



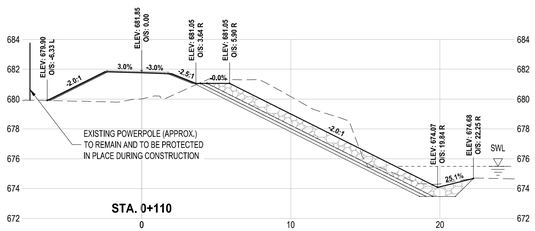
STA. 0+145



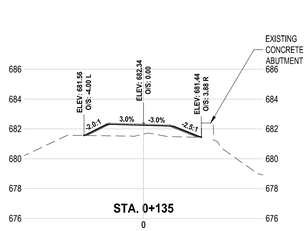
STA. 0+115



STA. 0+140



STA. 0+110



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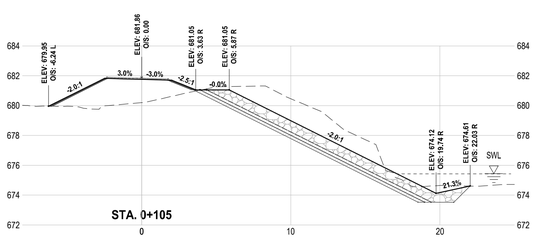
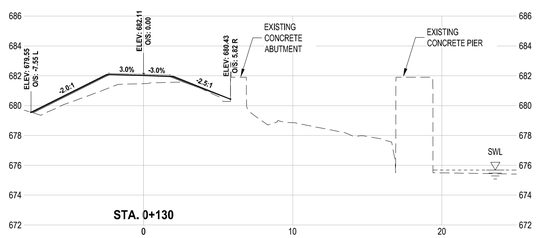
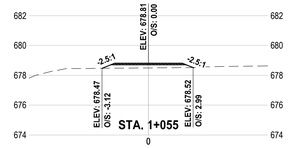


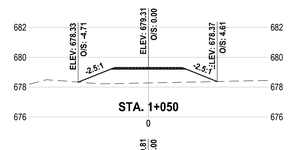
STA. 0+105



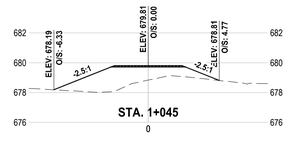
STA. 0+130



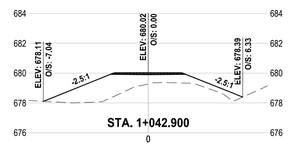
STA. 1+055



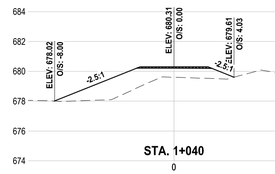
STA. 1+050



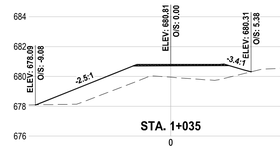
STA. 1+045



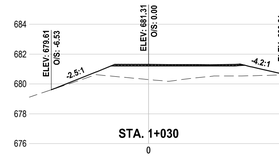
STA. 1+042.900



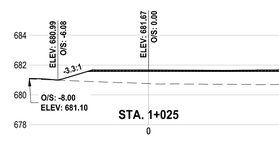
STA. 1+040



STA. 1+035



STA. 1+030



STA. 1+025

SCARLETT BERM AND BANK PROTECTION CROSS SECTIONS

Scale 1:200

ACCESS RAMP CROSS SECTIONS

Scale 1:200

0 2 (1:200) 10m

NOTE:
1. BERM, ACCESS RAMP, AND BANK PROTECTION ARE SHOWN AS A FINISHED GRADE SURFACE.
2. SEE DWG C-501 AND C-502 FOR TYPICAL SECTIONS.
3. SWL REPRESENTS ESTIMATED SURVEY WATER LEVEL FROM OCTOBER 2023.

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SUTHERLAND 134859 ALBERTA
2024-Jun-05

Rev	Date	Des	Dwn	Chk	Description
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Rev	Date	Des	Dwn	Chk	Description

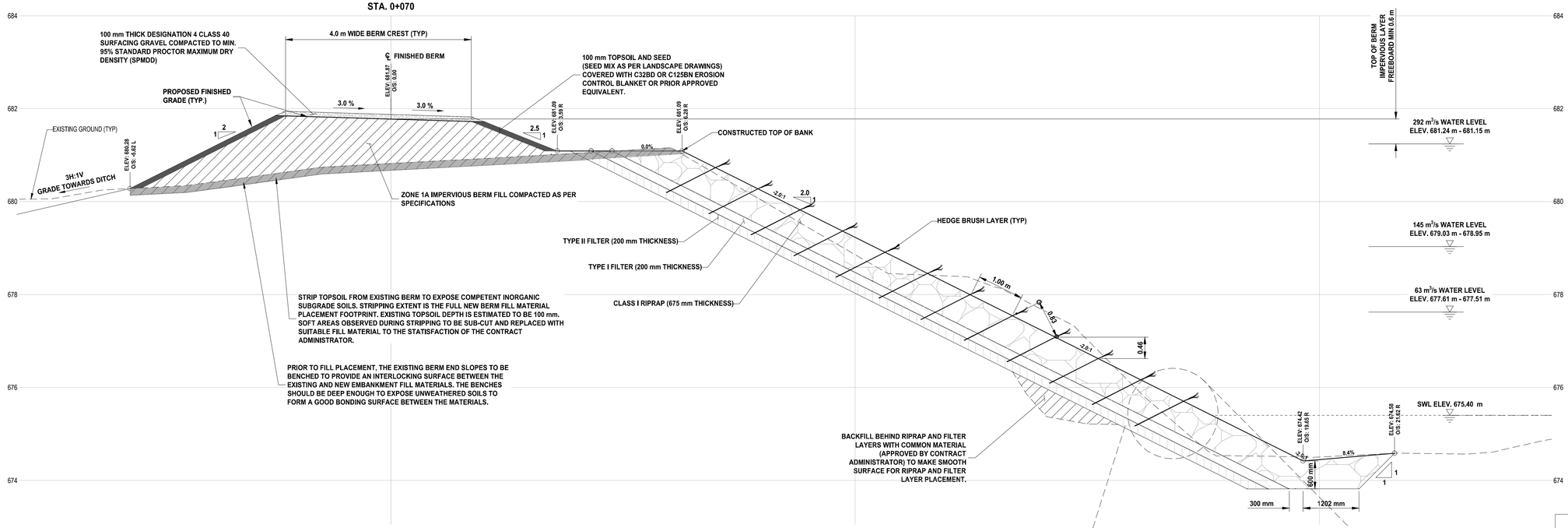
NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
CROSS SECTIONS
SHEET 2

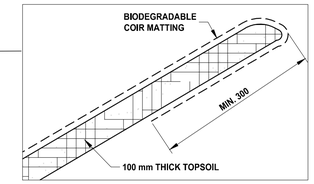
Project No.	3446-005	Drawing No.	C-302	Rev.	D
Group	CIVIL				

STA. 0+070



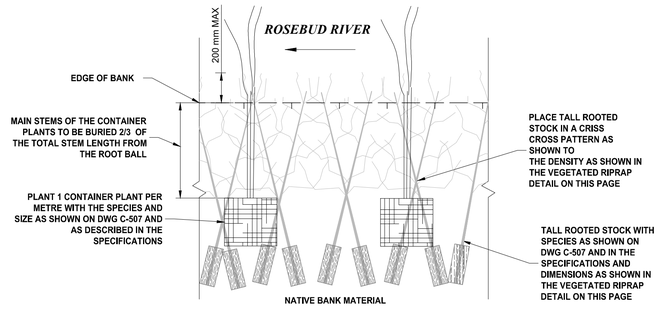
TYPICAL SCARLETT BERM AND BANK PROTECTION SECTION (A / C-103)

SCALE 1:50



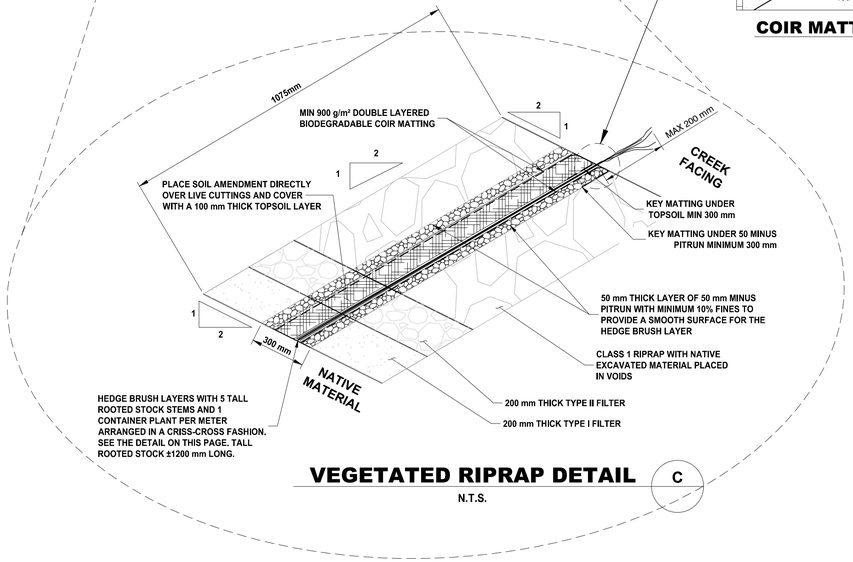
COIR MATTING KEY-IN DETAIL (D)

Scale: N.T.S.



HEDGE BRUSH LAYER DETAIL (B)

Scale: N.T.S.



VEGETATED RIPRAP DETAIL (C)

N.T.S.

NOTES:

1. 292 m^3/s WATER LEVEL CORRESPONDS TO 100-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND THE RED DEER RIVER
2. 145 m^3/s WATER LEVEL CORRESPONDS TO 20-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND 2-YEAR RETURN FLOW IN THE RED DEER RIVER.
3. 63 m^3/s WATER LEVEL CORRESPONDS TO 5-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND 2-YEAR RETURN FLOW IN THE RED DEER RIVER.
4. 600 mm FREEBOARD INCLUDED TOWN STANDARD 500 mm FREEBOARD PLUS 100 mm FOR MATERIAL SETTLEMENT.
5. SWL 675.4 m HUNTER WALLACE ESTIMATED SURVEY WATER LEVEL OCTOBER 26, 2023.

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SUTTON ALBERTA 144859
2024-Jun-05

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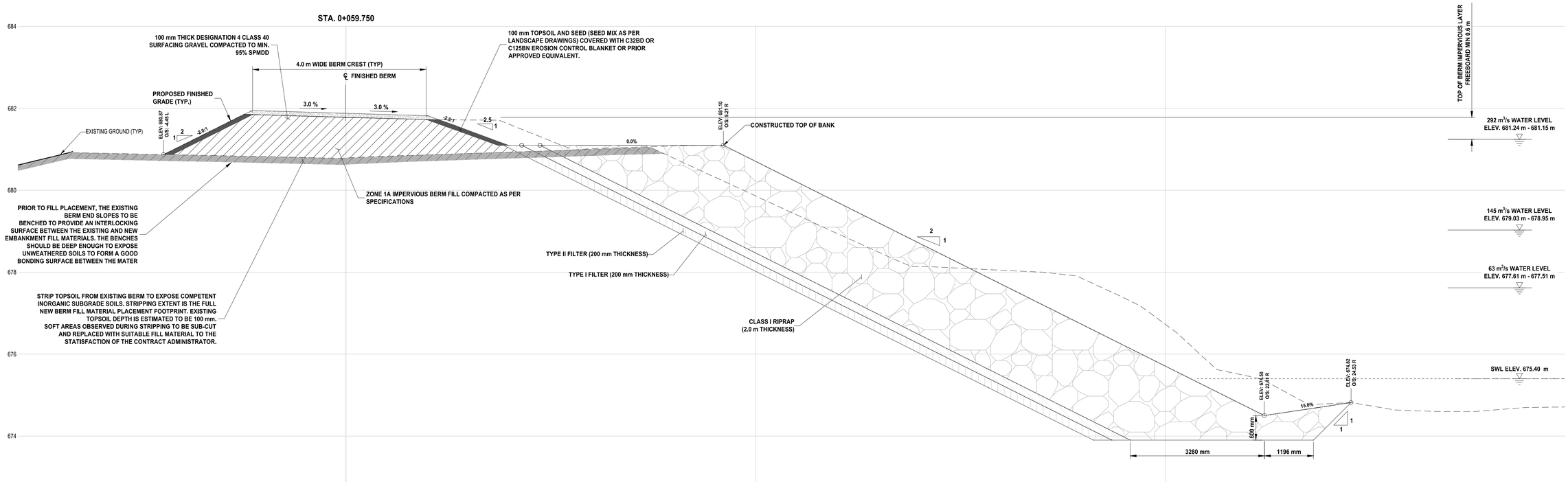
NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
VEGETATED RIPRAP BANK PROTECTION
TYPICAL SECTION & DETAILS

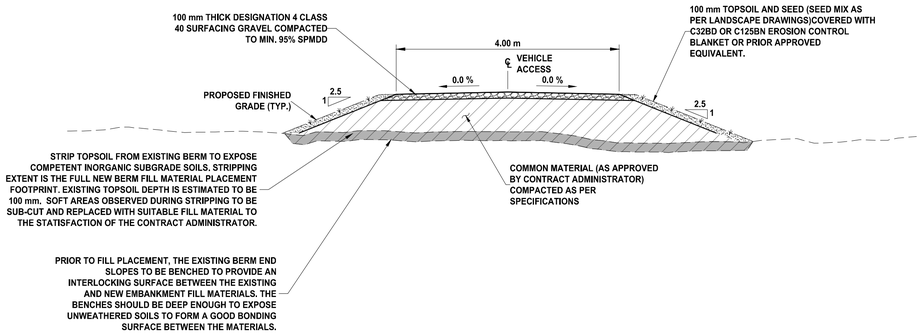
Project No.	Drawing No.	Rev.
3446-005	C-501	C
Group: CIVIL		



TYPICAL SCARLETT BERM BANK PROTECTION KEY-IN SECTION

SCALE 1:50

B C-103



TYPICAL ACCESS RAMP SECTION

SCALE 1:50

C C-103

NOTES:

1. 292 m^3/s WATER LEVEL CORRESPONDS TO 100-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND THE RED DEER RIVER
2. 145 m^3/s WATER LEVEL CORRESPONDS TO 20-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND 2-YEAR RETURN FLOW IN THE RED DEER RIVER.
3. 63 m^3/s WATER LEVEL CORRESPONDS TO 5-YEAR RETURN FLOW IN THE ROSEBUD RIVER AND 2-YEAR RETURN FLOW IN THE RED DEER RIVER.
4. 600 mm FREEBOARD INCLUDED TOWN STANDARD 500 mm FREEBOARD PLUS 100 mm FOR MATERIAL SETTLEMENT.
5. SWL 675.4 m HUNTER WALLACE ESTIMATED SURVEY WATER LEVEL OCTOBER 26, 2023.

DRUMHELLER VALLEY

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KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SCOTT ALLEN ALBERTA
2024-Jun-05

Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN
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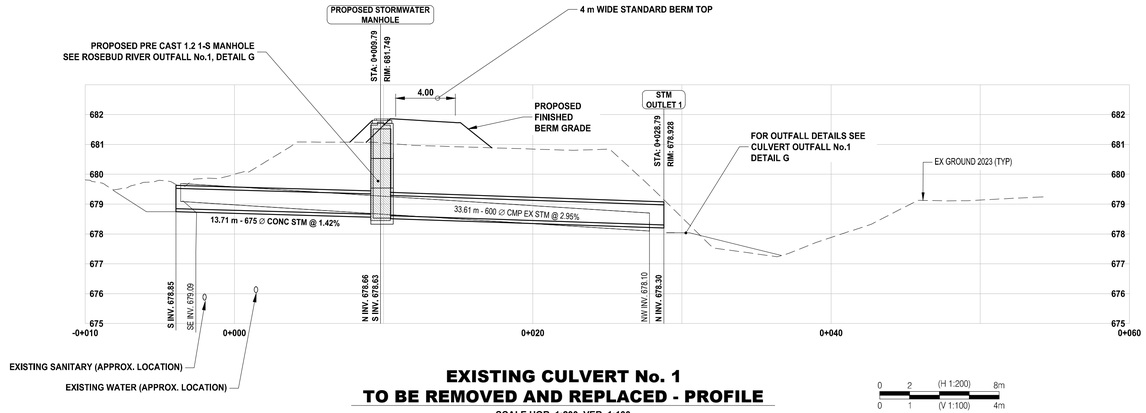
C	2024-06-05	CSUL	T2	MG	ISSUED FOR REGULATORY APPROVAL

NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
BANK PROTECTION KEY-IN & ACCESS RAMP
TYPICAL SECTIONS

Project No. 3446-005
Group CIVIL
Drawing No. C-502
Rev. C

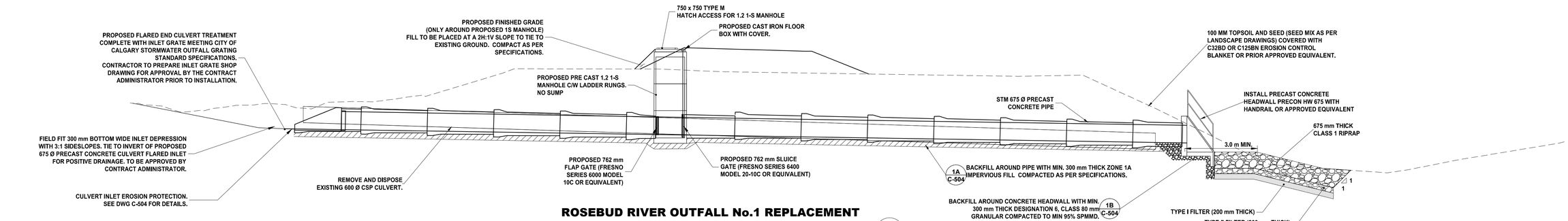


EXISTING CULVERT No. 1
TO BE REMOVED AND REPLACED - PROFILE

SCALE HOR. 1:200, VER. 1:100

(SCARLETT BERM STA. 0+045.800)

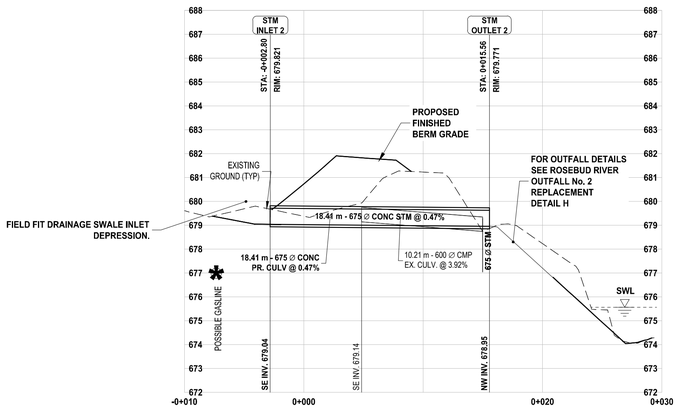
0 2 (H 1:200) 8m
0 1 (V 1:100) 4m



ROSEBUD RIVER OUTFALL No.1 REPLACEMENT
AROUND STA 0+045.800

SCALE 1:75

G
-

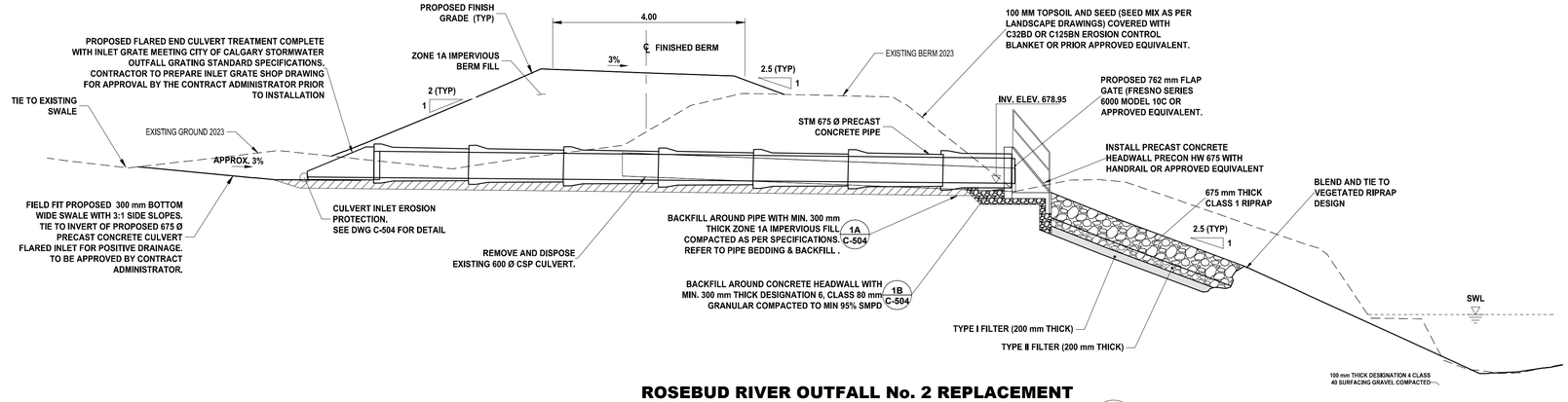


EXISTING CULVERT No. 2
TO BE REMOVED AND REPLACED - PROFILE

SCALE HOR. 1:250, VER. 1:50

(SCARLETT BERM STA. 0+124.400)

0 2 (H 1:250) 10m
0 0.5 (V 1:50) 2m



ROSEBUD RIVER OUTFALL No. 2 REPLACEMENT
AROUND STA 0+124.400

SCALE 1:75

H
-

0 1 (1:75) 4m

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
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Seal: PROFESSIONAL ENGINEER CHRISTOPHER SCOTT LEIDAL 154495 PROVINCE OF ALBERTA
2024-Jun-05

Rev	Date	Des	Dwn	Chk	Description
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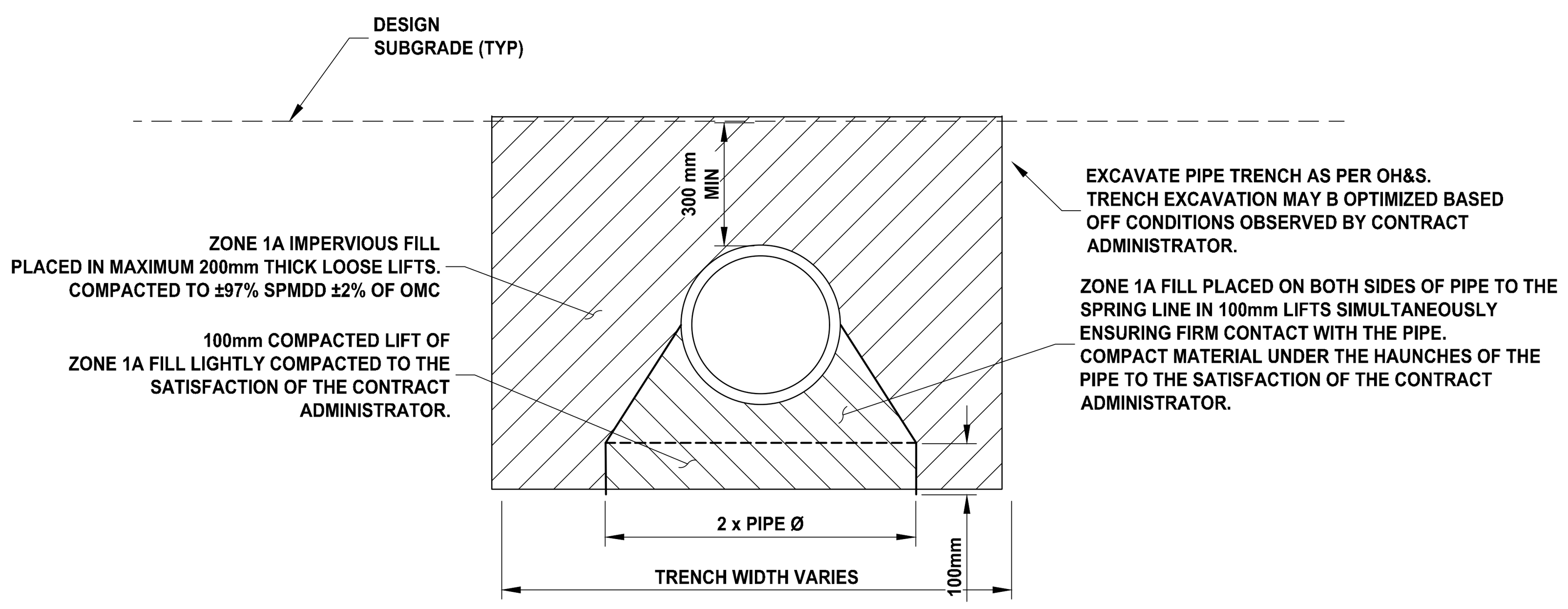
Rev	Date	Des	Dwn	Chk	Description

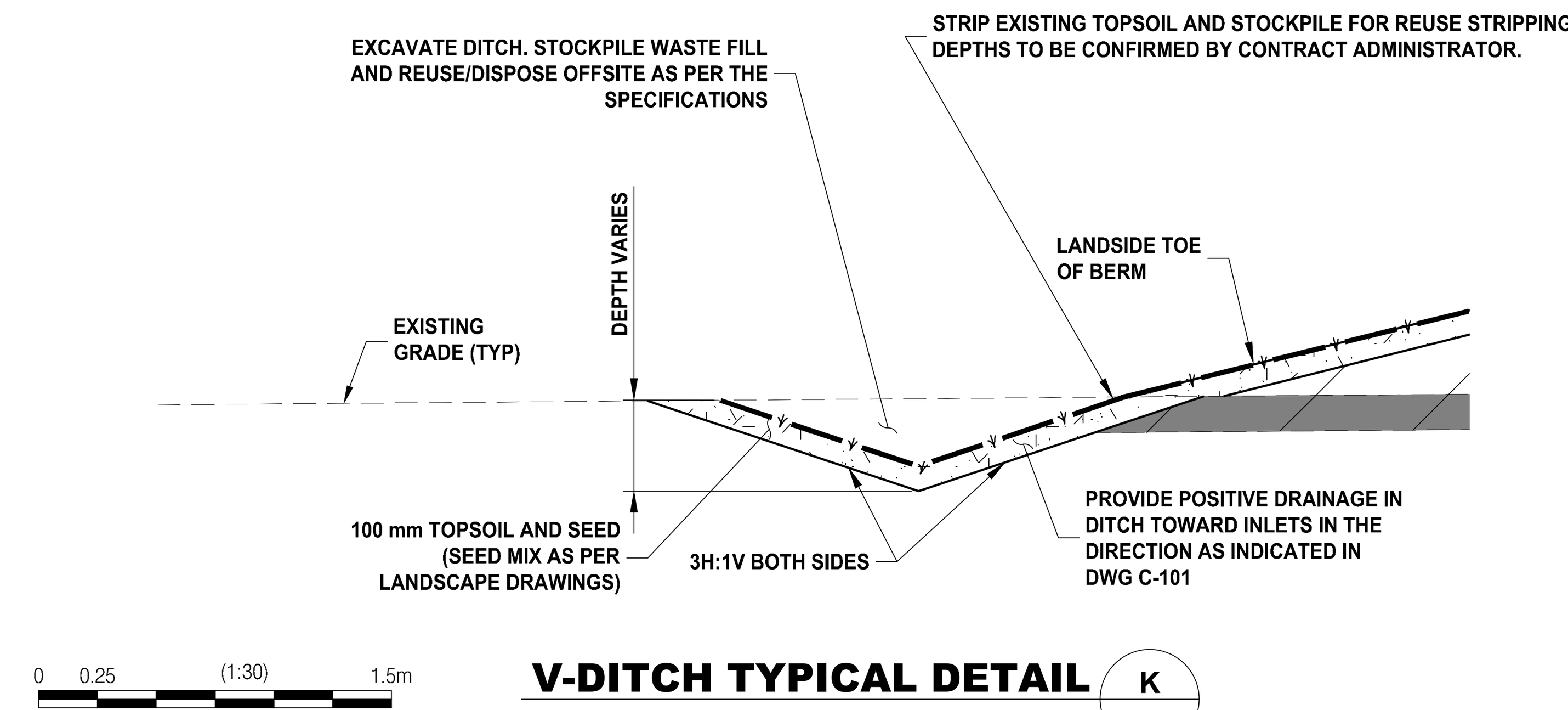
NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
ROSEBUD RIVER CULVERTS & OUTFALL REPLACEMENT
PROFILE & SECTION DETAILS

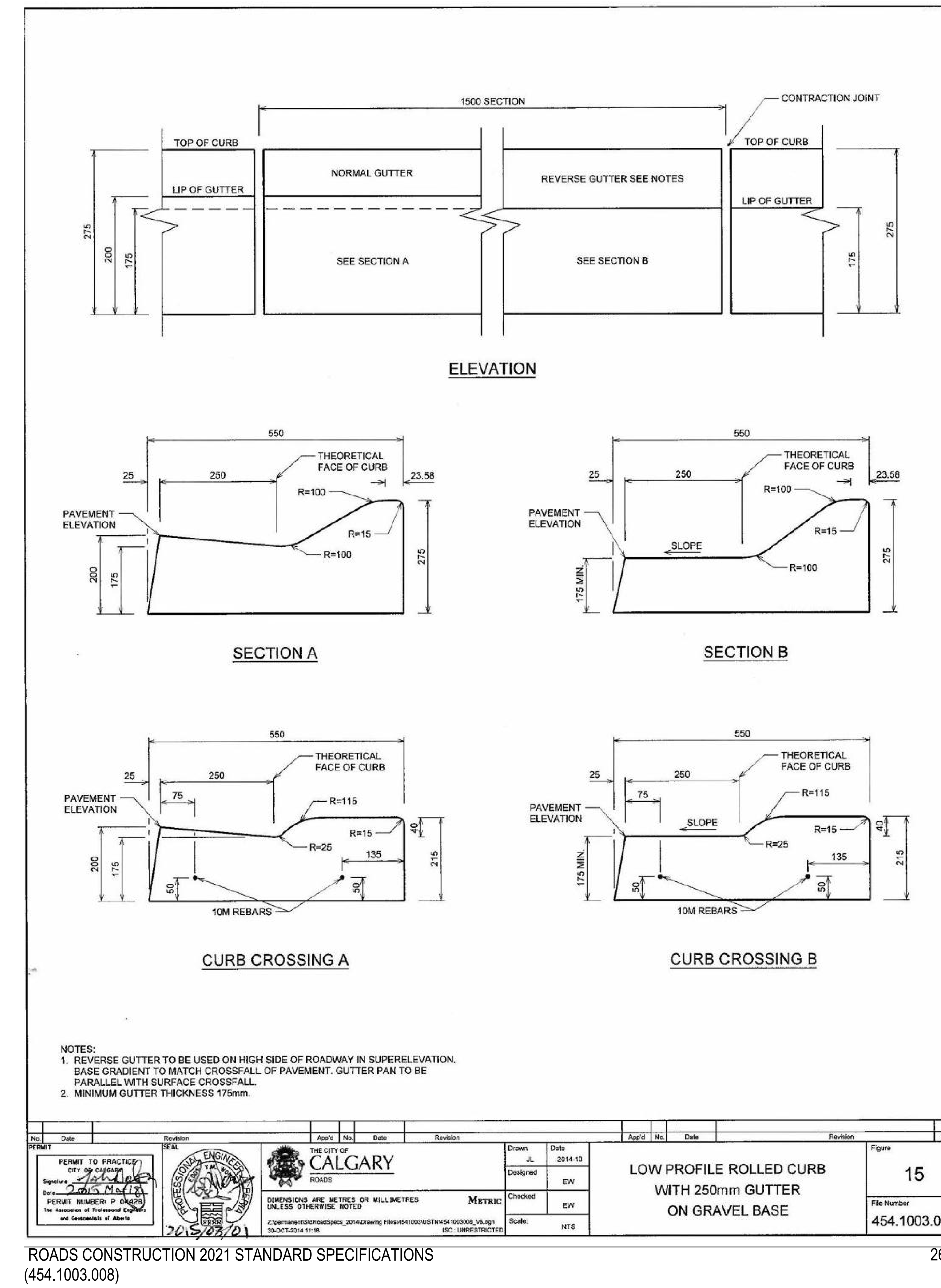
Project No.	Drawing No.	Rev.
3446-005	C-503	C
Group: CIVIL		



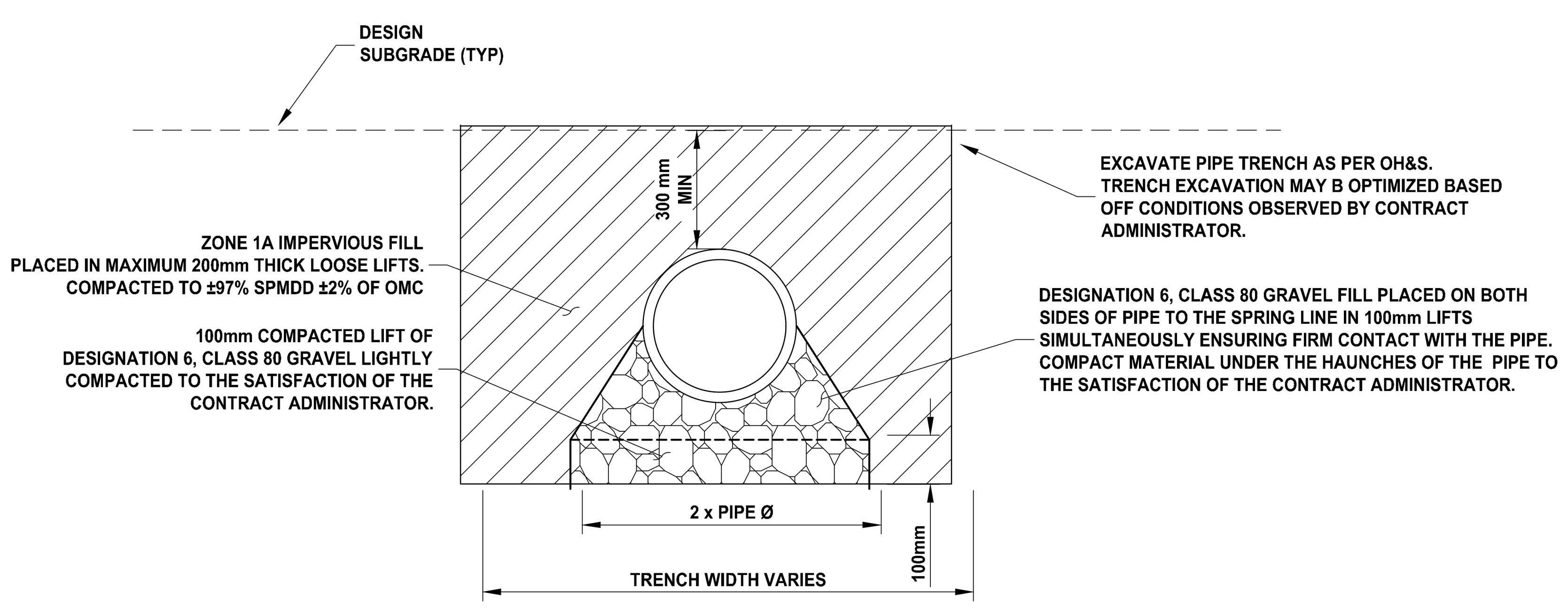
PIPE BEDDING & BACKFILL DETAIL
ZONE 1A BEDDING, ZONE 1A BACKFILL (IA)
Scale NTS



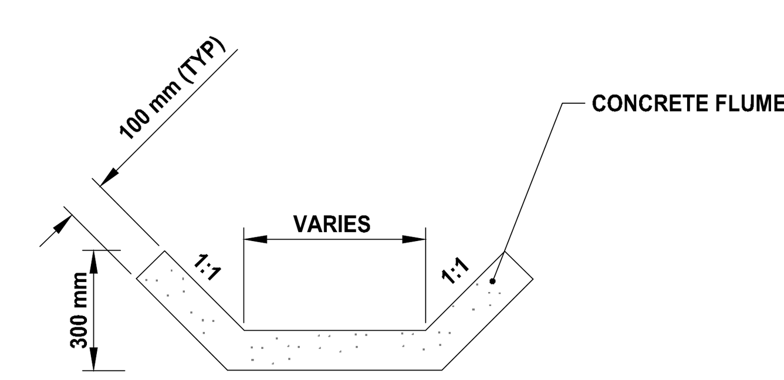
V-DITCH TYPICAL DETAIL (K)
Scale 1:30



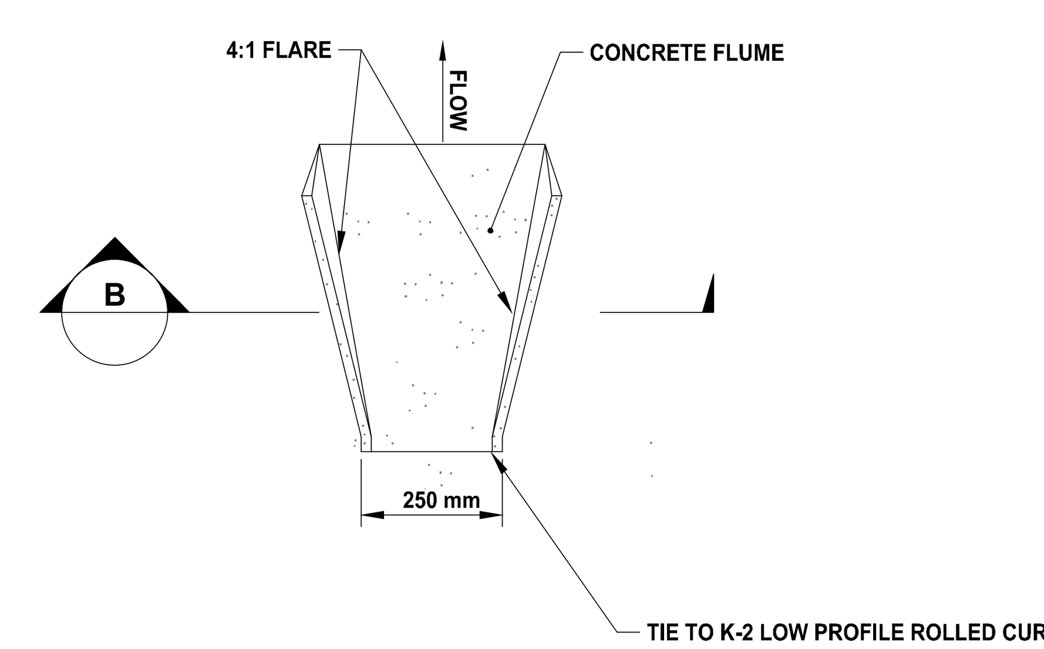
250 mm LOW PROFILE ROLLED GUTTER
ON GRAVEL BASE DETAIL
Scale NTS



PIPE BEDDING & BACKFILL DETAIL
GRAVEL BEDDING, ZONE 1A BACKFILL (IB)
Scale NTS

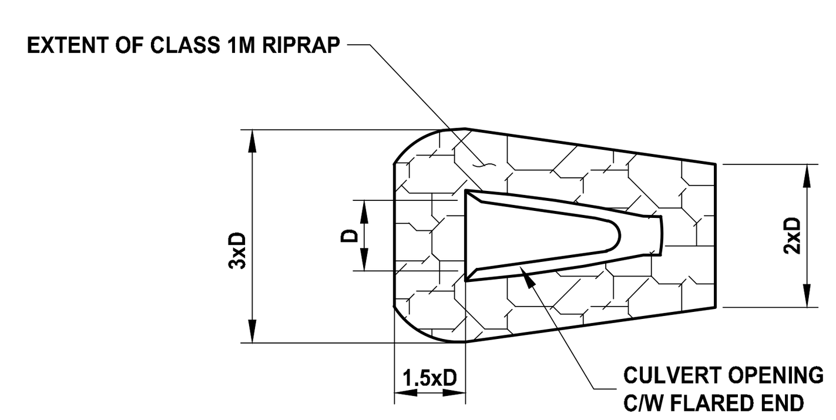


B - B



PLAN

1ST AVENUE S
SPLASH PAD TYPICAL DETAIL (L)
Scale NTS



TYPICAL CULVERT INLET TREATMENT (J)
SCALE N.T.S

NOTE: ALL DIMENSIONS
ARE MILLIMETERS (mm)
UNLESS OTHERWISE NOTED

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
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The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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Seal: 2024-Jun-05

Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN
B	2024-03-08	CSUL	T2	DRS	ISSUED FOR CLIENT REVIEW - 90% DESIGN
C	2024-06-05	CSUL	T2	MG	ISSUED FOR REGULATORY APPROVAL

NOT FOR CONSTRUCTION
2024-06-05

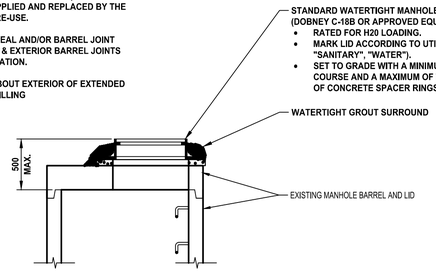
DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
SCARLETT BERM DETAILS - SHEET 1

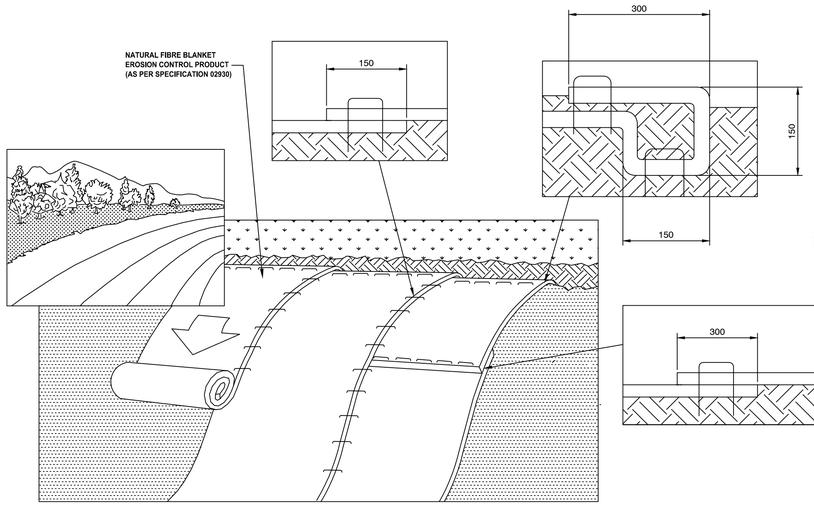
Project No. 3446-005
Group CIVIL
Drawing No. C-504
Rev. C

NOTES: (FOR THE EXISTING SANITARY MANHOLES THAT NEED TO HAVE A FLOODPROOF LID)

1. CONTRACTOR TO SALVAGE (IF SUITABLE) EXISTING CONCRETE MANHOLE LID, FRAME & COVER.
2. CONTRACTOR TO CONFIRM EXISTING CONCRETE BARREL DIAMETER AND STYLE OF MANHOLE BARREL JOINT.
3. CONTRACTOR TO MATCH EXISTING BARREL JOINT AND SUPPLY ADDITIONAL MANHOLE BARREL RISERS AS REQUIRED TO RAISE LID, FRAME & COVER TO SPECIFIED ELEVATION (NOTED ON DWG C-101), CONCRETE MANHOLE LID TO BE RE-USED IF SUITABLE (AS DETERMINED BY THE OWNER), OR SUPPLIED AND REPLACED BY THE CONTRACTOR IF NOT SUITABLE FOR RE-USE.
4. CONTRACTOR TO USE MASTIC JOINT SEAL AND/OR BARREL JOINT GASKET(S) AND GROUT ALL INTERIOR & EXTERIOR BARREL JOINTS AND ENSURE A WATERTIGHT INSTALLATION.
5. CONTRACTOR TO WRAP 6 MIL POLY ABOUT EXTERIOR OF EXTENDED MANHOLE BARRELS PRIOR TO BACKFILLING



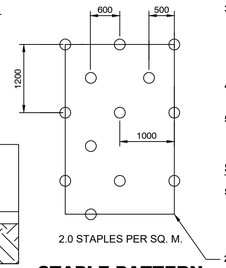
FLOODPROOF LID DETAIL (M)
Scale 1:25



EROSION CONTROL BLANKET INSTALLATION DETAIL (N)
Scale 1:25

INSTALLATION NOTES:

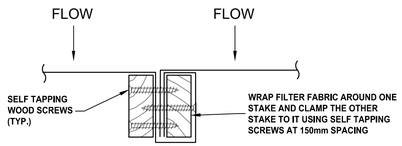
1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. BEGIN AT THE TOP OF THE SLOPES BY ANCHORING THE RECP's IN A 0.15m DEEP X 0.15m WIDE TRENCH WITH APPROXIMATELY 0.30m OF RECP's EXTENDED BEYOND THE UPSLOPE PORTION OF THE TRENCH. ANCHOR THE RECP"s WITH A ROW OF STAPLES/STAKES APPROXIMATELY 0.30m APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND APPLY REMAINING 0.30m PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 0.20m APART ACROSS THE WIDTH OF THE RECP's
3. ROLL THE RECP's (A.) DOWN THE SLOPE. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OIF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGE OF PARALLEL RECP's MUST BE STAPLED WITH APPROXIMATELY 0.15m OVERLAP DEPENDING ON RECP's WIDTH.
5. CONSECUTIVE RECP's SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 0.30m OVERLAP. STAPLE THROUGH OVERLAPPED AREA. APPROXIMATELY 0.30m APART ACROSS ENTIRE RECP's WIDTH.



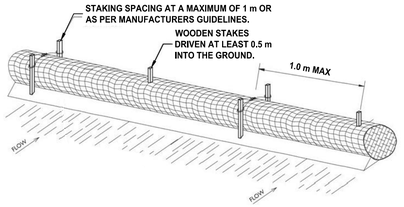
STAPLE PATTERN
N.T.S.

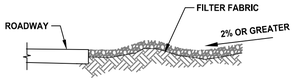
SEED NOTES:

SEED MIX SHALL FOLLOW LANDSCAPE DRAWINGS.

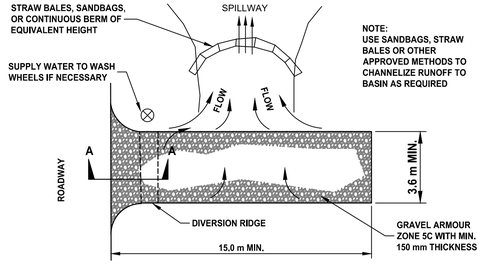


FABRIC SPLICE DETAIL (P)
N.T.S.





SECTION A-A

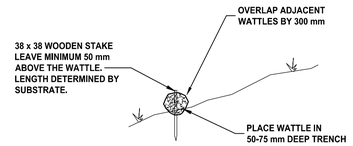


PLAN

NOTES:

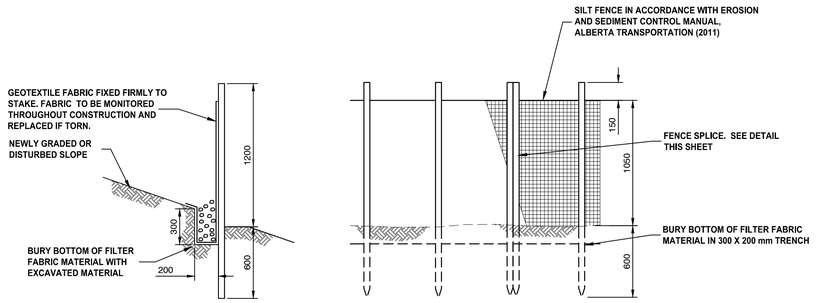
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. FOR HIGHWAY CONSTRUCTION, 300 mm THICKNESS OF GRAVEL IS PREFERRED.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY, AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER / ENGINEER.

GRAVEL ACCESS PAD DETAIL (T)
N.T.S.



SECTION

WATTLE ROLL DETAIL (Q)
N.T.S.



SECTION ELEVATION

SILT FENCE DETAIL (S)
SCALE 1:25

GENERAL NOTES:

1. ALL WORK MUST BE UNDERTAKEN AND COMPLETED IN SUCH A MANNER AS TO PREVENT THE RELEASE OF SILT, RAW CONCRETE LEACHATE OR OTHER DELETERIOUS SUBSTANCES INTO ANY DITCH, WATERCOURSE, RAVINE AND STORM SEWER SYSTEM.
2. MAINTAIN ALL SEDIMENT CONTROL FACILITIES SHOWN ON THIS DRAWING UNTIL 90% OF THE LANDSCAPING IS COMPLETED.
3. SILT FENCE/FILTER FABRIC TO BE NILEX 2130 AND NILEX 4535 (C-10) RESPECTIVELY OR ENGINEER APPROVED EQUIVALENT.
4. REDUCED DUST BY USE OF WATER SPRAYED ON THE EXPOSED SOURCE OF THE DUST AS REQUIRED.
5. TEMPORARY EXPOSED SLOPES AND SPOIL STOCK PILES SHALL BE COVERED WITH ONE LAYER OF 6 mil POLY WEIGHTED OR STAPLED INTO PLACE.
6. SEDIMENT TO BE REMOVED FROM THE SEDIMENT CONTROL SYSTEM AFTER EACH STORM EVENT OR WHEN SEDIMENT HAS EXCEEDED 33% OF DESIGN SEDIMENT STORAGE VOLUME.

NOTE: ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED

DRUMHELLER VALLEY

PERMIT TO PRACTICE
KERR WOOD LEIDAL ASSOCIATES LTD
RM SIGNATURE:
RM APEGA ID #: 90096
DATE: 2024-06-05
PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

KERR WOOD LEIDAL
consulting engineers
100 - 239 10th Avenue SE
Calgary, AB T2G 0V9
T (403) 262-4241
E calgary@kwl.ca

Seal: PROFESSIONAL ENGINEER CHRISTOPHER SUTTON ALBERTA
2024-Jun-05

Rev	Date	Des	Dwn	Chk	Description
A	2024-01-31	CSUL	T2/CS	DRS	ISSUED FOR CLIENT REVIEW - 75% DESIGN
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C	2024-06-05	CSUL	T2	MG	ISSUED FOR REGULATORY APPROVAL

NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
SCARLETT BERM DETAILS - SHEET 2

Project No. 3446-005
Group CIVIL
Drawing No. C-505
Rev. C

Page Size = ANSI D
At Full Size, this border measures 520 mm x 800 mm
0 10 50 100 millimeters

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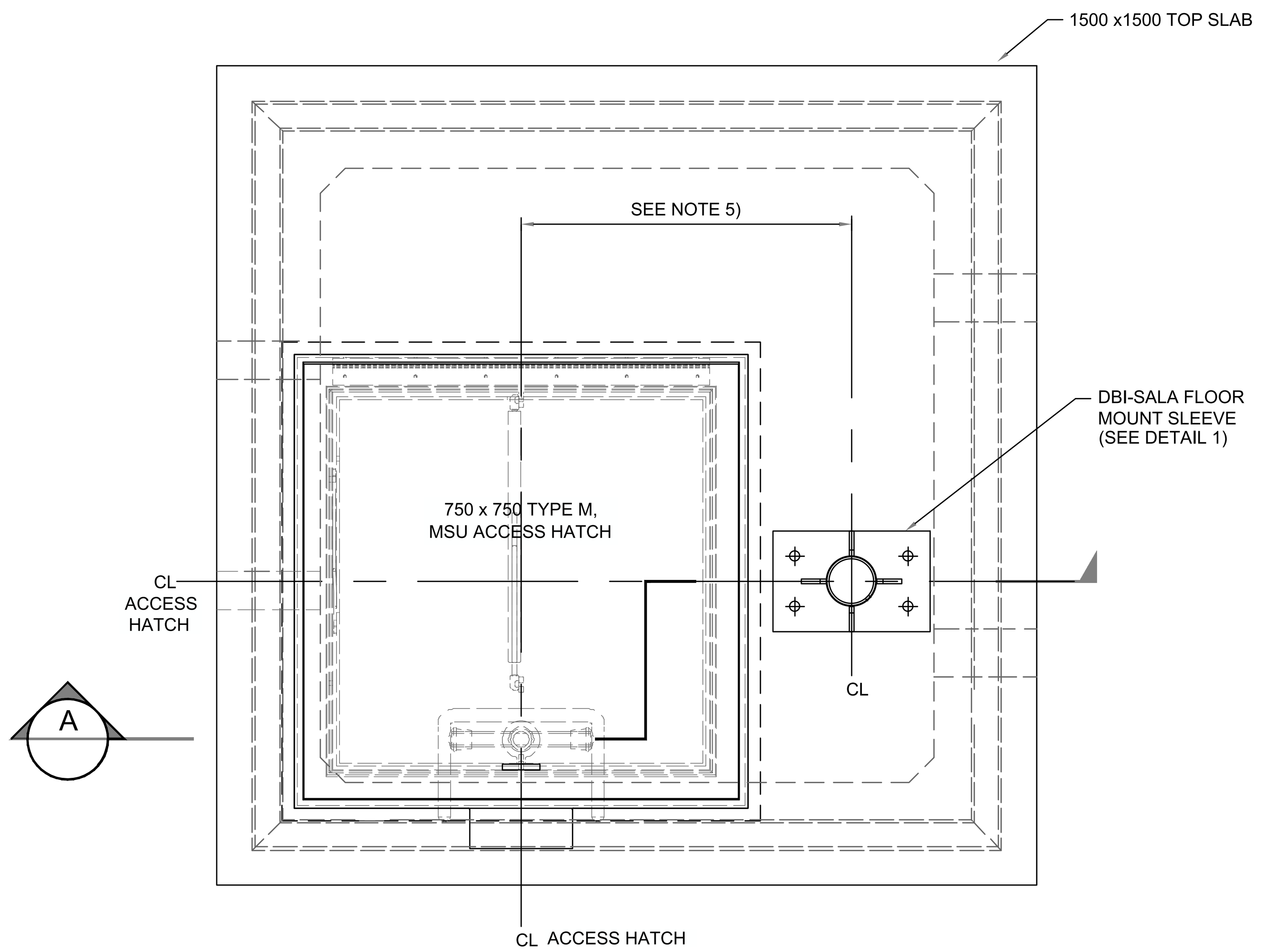
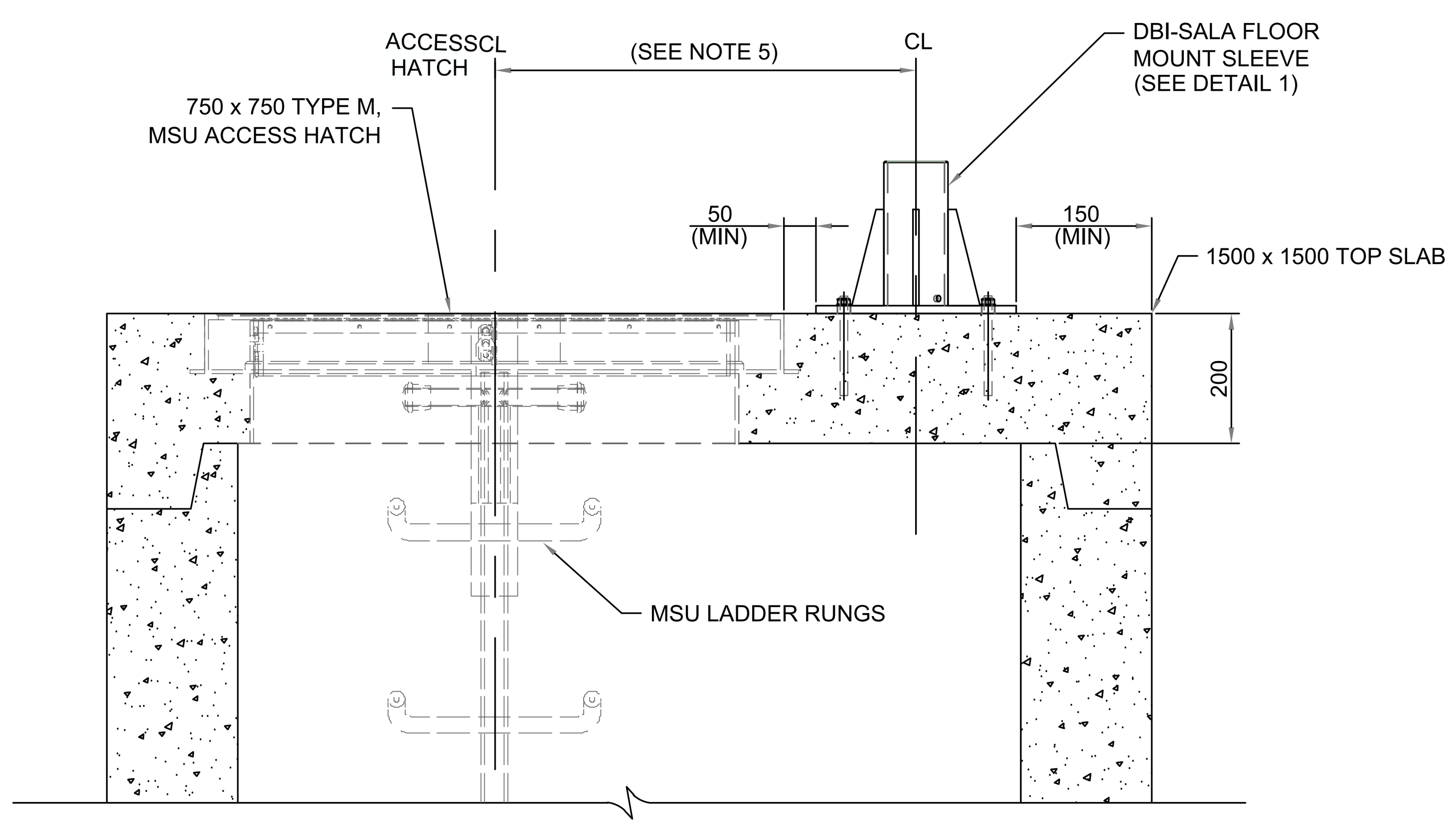
NOTES:

1. FLOOR MOUNT SLEEVE SHALL BE MOUNTED SUCH THAT ACCESS HATCH DOES NOT OPEN TOWARDS DAVIT ARM.
2. EDGE OF FLOOR MOUNT SLEEVE SHALL BE AT LEAST 150 mm FROM ANY OUTSIDE FACE OF MANHOLE.
3. ORIENT FLOOR MOUNT SLEEVE SUCH THAT LONG EDGE IS PERPENDICULAR TO THE NEAR SIDE OF ACCESS HATCH.
4. CONTRACT ADMINISTRATOR SHALL CONFIRM FLOOR MOUNT SLEEVE LOCATION IN THE FIELD PRIOR TO INSTALLATION.
5. ACCESS HATCH TO FLOOR MOUNT SLEEVE (CENTRE TO CENTRE) SHALL BE 600 mm UNLESS OTHERWISE REQUIRED BY MINIMUM DIMENSIONS SHOWN.
6. ACCESS HATCH AND MANHOLE COVER DIMENSIONS MAY VARY FROM THIS DRAWING. ENSURE MINIMUM REQUIREMENTS ARE MET.



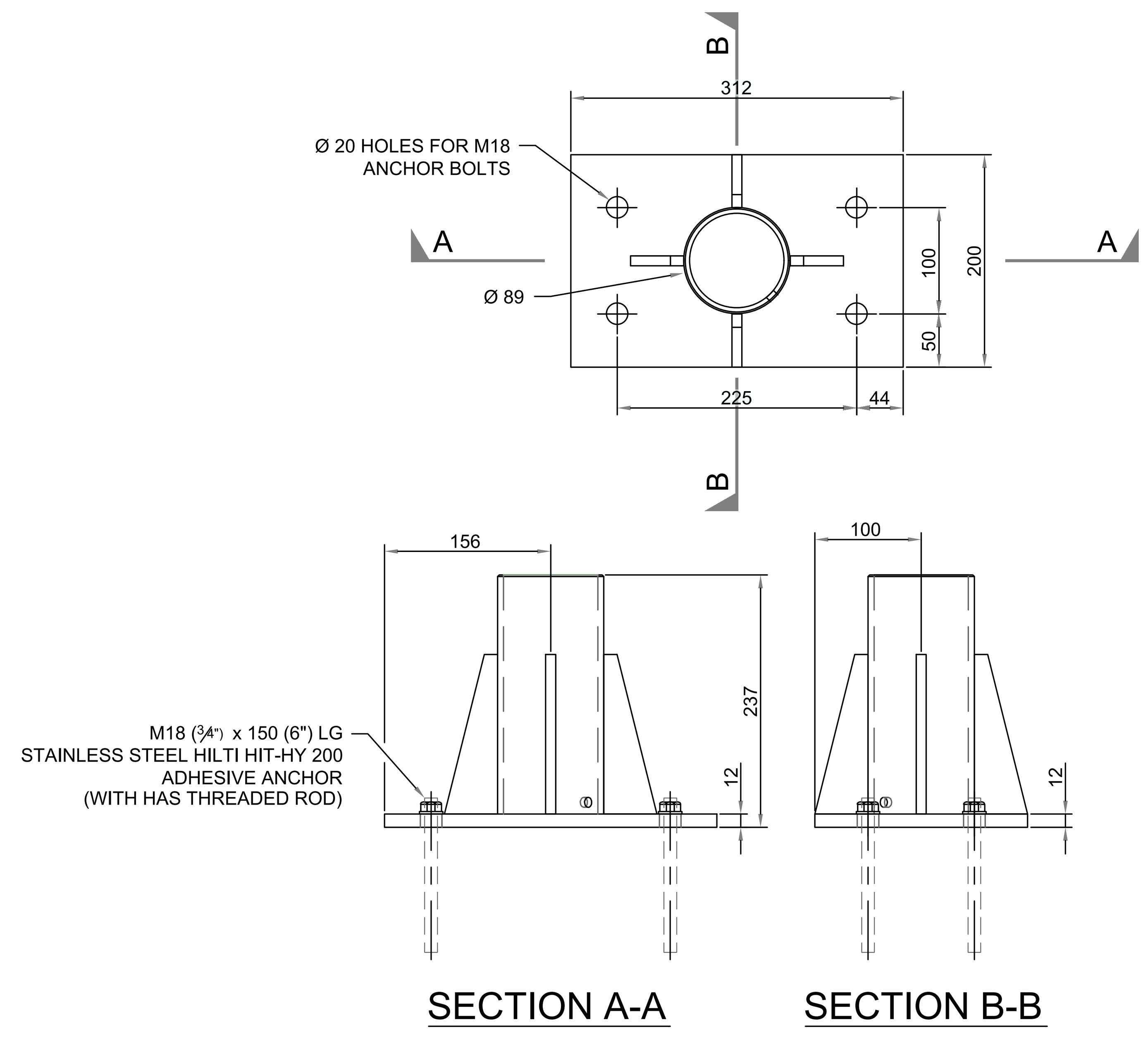
PLAN
MANHOLE Scale 1:10



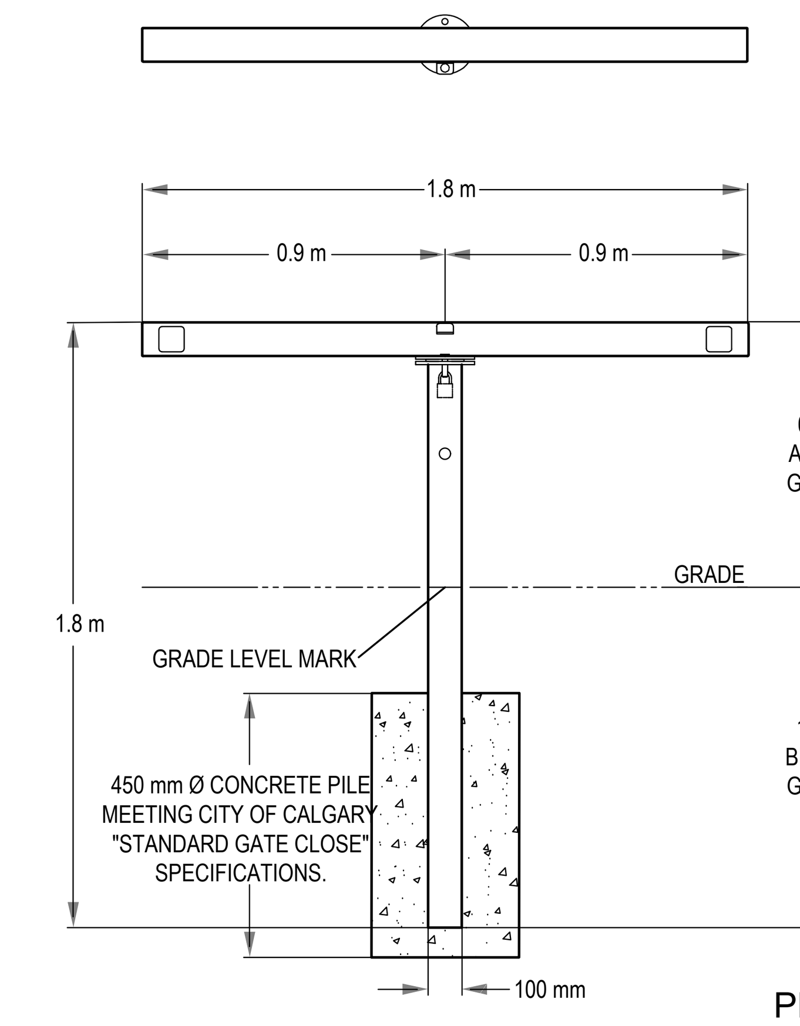
(A) SECTION
Scale 1:10

0 0.1 (1:10) 0.5m

TYPICAL MANHOLE FALL ARREST FLOOR MOUNT SLEEVE DETAIL (U / -)
Scale AS NOTED
(PROVIDED BY DRFMO)

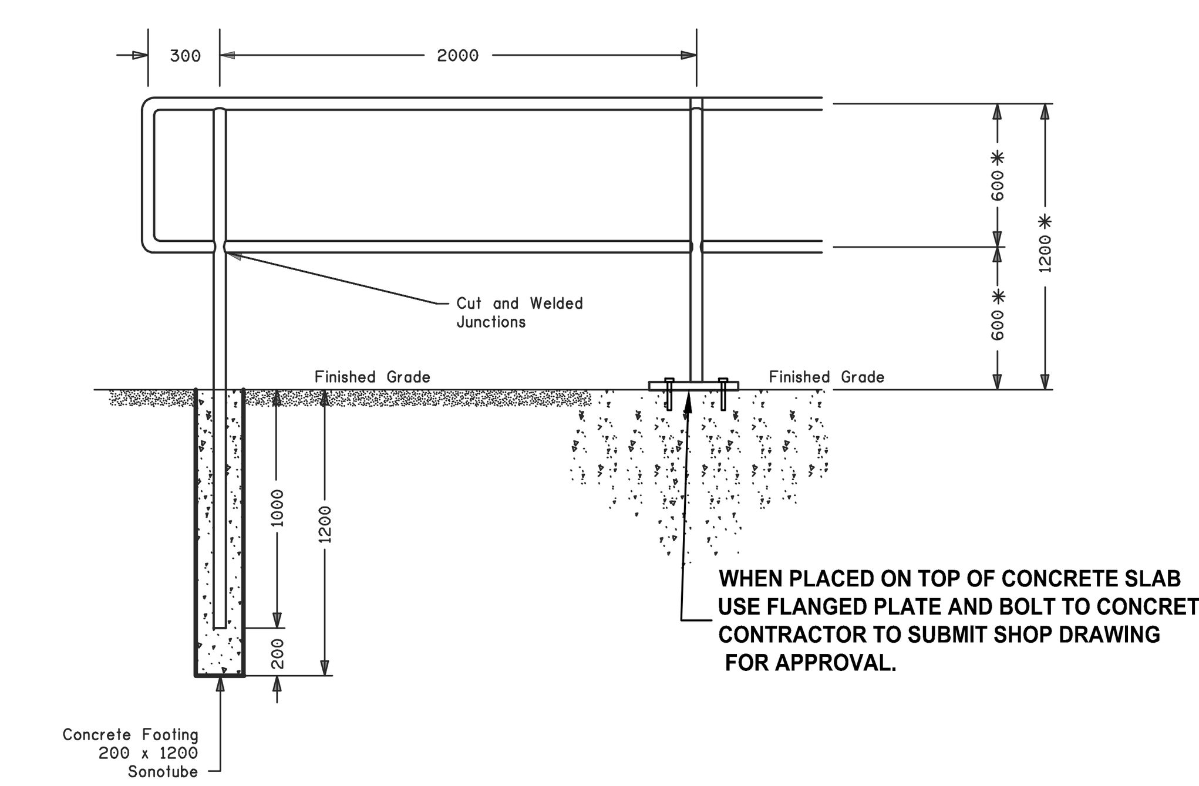


(1) DETAIL
DIB-SALA FLOOR MOUNTING SLEEVE Scale NTS



PROVIDED BY BELSON OUTDOORS
www.belson.com

MODIFIED 'T' BOLLARD DETAIL
MODEL# TBIG-72-36-36 (V / -)
Scale NTS



Elevation

NOTE: - All dimensions are in millimetres unless otherwise noted.
- Posts - Schedule 40, 48mm OD
- Rails - .083 to .100 wall thickness, 48mm OD
- Post and Rails to be steel pipe, continuous weld, all joints.
- ✱ Total railing height increases to 1400mm when required on a bridge.

THE CITY OF CALGARY PARKS	PROJECT TITLE: SPECIFICATIONS	DRAWN BY: W.B./M.M.H.S.	SCALE: N.T.S.
		DATE: 2010 03 24	SHEET NO.: 30
	SHEET TITLE: PATHWAY HANDRAIL	DESIGN BY: G.S.	FILE NO.
		DATE: 1997 06	

PEDESTRIAN HANDRAIL DETAIL
MODIFIED CALGARY PARKS 2020 SPECIFICATION
Scale NTS

Paper Size = ANSI D
At Full Size, this border measures 520 mm x 800 mm
0 10 50 100 millimeters

DRUMHELLER VALLEY

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PERMIT NUMBER: P007929
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

KERR WOOD LEIDAL
consulting engineers
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Seal: PROFESSIONAL ENGINEER, ALBERTA, 2024-Jun-05

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A	2024-06-05	CSUL	T2	MG	ISSUED FOR REGULATORY APPROVAL

NOT FOR CONSTRUCTION
2024-06-05

DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM

BERM IMPROVEMENTS
SCARLETT BERM DETAILS - SHEET 3

Project No. 3446-005
Group CIVIL
Drawing No. C-506
Rev. A

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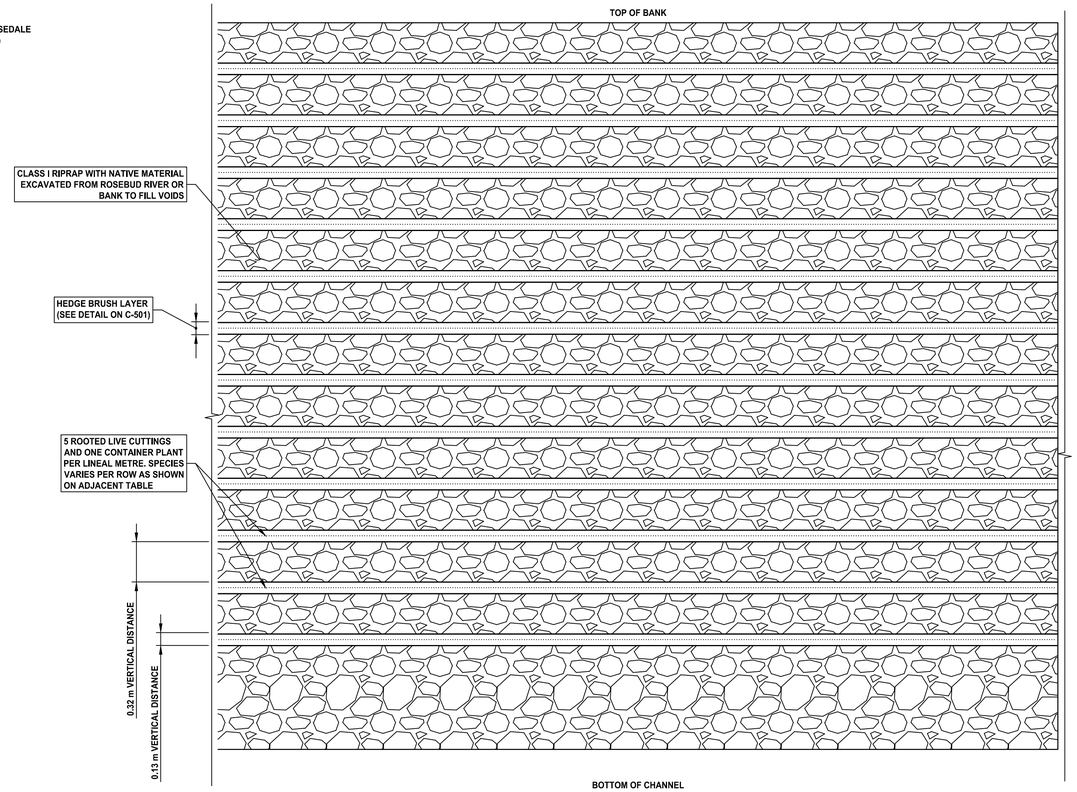
PLAN
Scale 1:300



TYPICAL SECTION-BANK FACING VIEW (V / -)
Scale N.T.S

							Q2	Q5			Q20					Q100
TALL ROOTED STAKES[1] - HEDGE BRUSH LAYER (5 STEMS PER LINEAR METER)				**ROW 1**	**ROW 2**	**ROW 3**	**ROW 4**	**ROW 5**	**ROW 6**	**ROW 7**	**ROW 8**	**ROW 9**	**ROW 10**	**ROW 11**	**ROW 12**
SPECIES NAME	**LATIN NAME**	**OVERALL QUANTITY**	**LIVE CUTTING LENGTH (mm)**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**	**STEMS/M**
SANDBAR WILLOW	SALIX INTERIOR	995	1200	5	5	4	3	2							
HUNGRY WILLOW[2]	SALIX FAMELICA[2]	1177	1200			1	2	3	4	2	2	2	2	2	2
BEBB'S WILLOW	SALIX BEBBIANA	701	1200						1	2	2	2	2	2	2
BALSAM POPLAR	POPULUS BALSAMIFERA	324	1200							1	1	1	1	1	1
	TOTAL	**3196**		**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
CONTAINER PLANTS - HEDGE BRUSH LAYER (1 STEM PER LINEAR METER)															
SPECIES NAME	**LATIN NAME**	**OVERALL QUANTITY**	**STOCK TYPE**												
RED OSIER DOGWOOD	CORNUS SERICEA	139	2 gal	1	1	0.33	0.33								
NORTHERN GOOSEBERRY	RIBES OXYACANTHOIDES	101	2 gal			0.33	0.33	0.5	0.5	0.25					
SASKATOON	AMELANCHIER ALNIFOLIA	114	2 gal			0.33	0.33	0.5	0.5	0.5					
CHOKE CHERRY	PRUNUS VIRGINIANA	94	2 gal							0.25	0.5	0.5	0.5		
COMMON WILD ROSE	ROSA WOODSII	190	2 gal								0.5	0.5	0.5	1	1
	TOTAL	**638**		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

NOTES:
1 TALL ROOTED STAKES PLANTING CONSTRUCTION SCHEDULE IS FROM JULY TO SEPTEMBER. DORMANT LIVE CUTTINGS SHOULD BE USED FOR CONSTRUCTION FROM OCTOBER TO THE THIRD WEEK OF JUNE.
2 SYNONYM FOR HUNGRY WILLOW (SALIX FAMELICA) IS YELLOW WILLOW (SALIX LUTEA)
3 VEGETATED TRIM LINE (VTL) PROVIDED BY HUNTER WALLACE SURVEYS APRIL 30, 2024

DRUMHELLER VALLEY

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Seal: PROFESSIONAL ENGINEER ALBERTA CHRISTOPHER SUTTON 144899
2024-Jun-05

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DRUMHELLER RESILIENCY & FLOOD MITIGATION OFFICE
ROSEDALE - SCARLETT BERM
BERM IMPROVEMENTS
SCARLETT BERM BANK PROTECTION
TYPICAL BIOENGINEERING PLANTING PLAN

Project No. 3446-005
Group CIVIL
Drawing No. C-507
Rev. B

Paper Size = ANSI D
At Full Size, this border measures 520 mm x 800 mm
0 10 50 100 millimeters

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APPENDIX C

Fish and Wildlife Internet Mapping Tool – Species Summary Report

Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Date: 18-Oct-2023 16:30

Species present within the current extent

Fish Inventory

- BURBOT
- EMERALD SHINER
- FLATHEAD CHUB
- GOLDEYE
- LAKE CHUB
- LONGNOSE DACE
- LONGNOSE SUCKER
- MINNOW FAMILY
- MOONEYE
- NORTHERN PIKE
- PRUSSIAN CARP
- QUILLBACK
- RIVER SHINER
- SAUGER
- SHORTHEAD REDHORSE
- SUCKER FAMILY
- WALLEYE
- WHITE SUCKER

Wildlife Inventory

- BALD EAGLE
- BULL SNAKE
- EARED GREBE
- LITTLE BROWN BAT
- NORTHERN GOSHAWK
- PRAIRIE RATTLESNAKE
- WESTERN SMALL-FOOTED BAT

Stocked Inventory

No Species Found in Search Extent

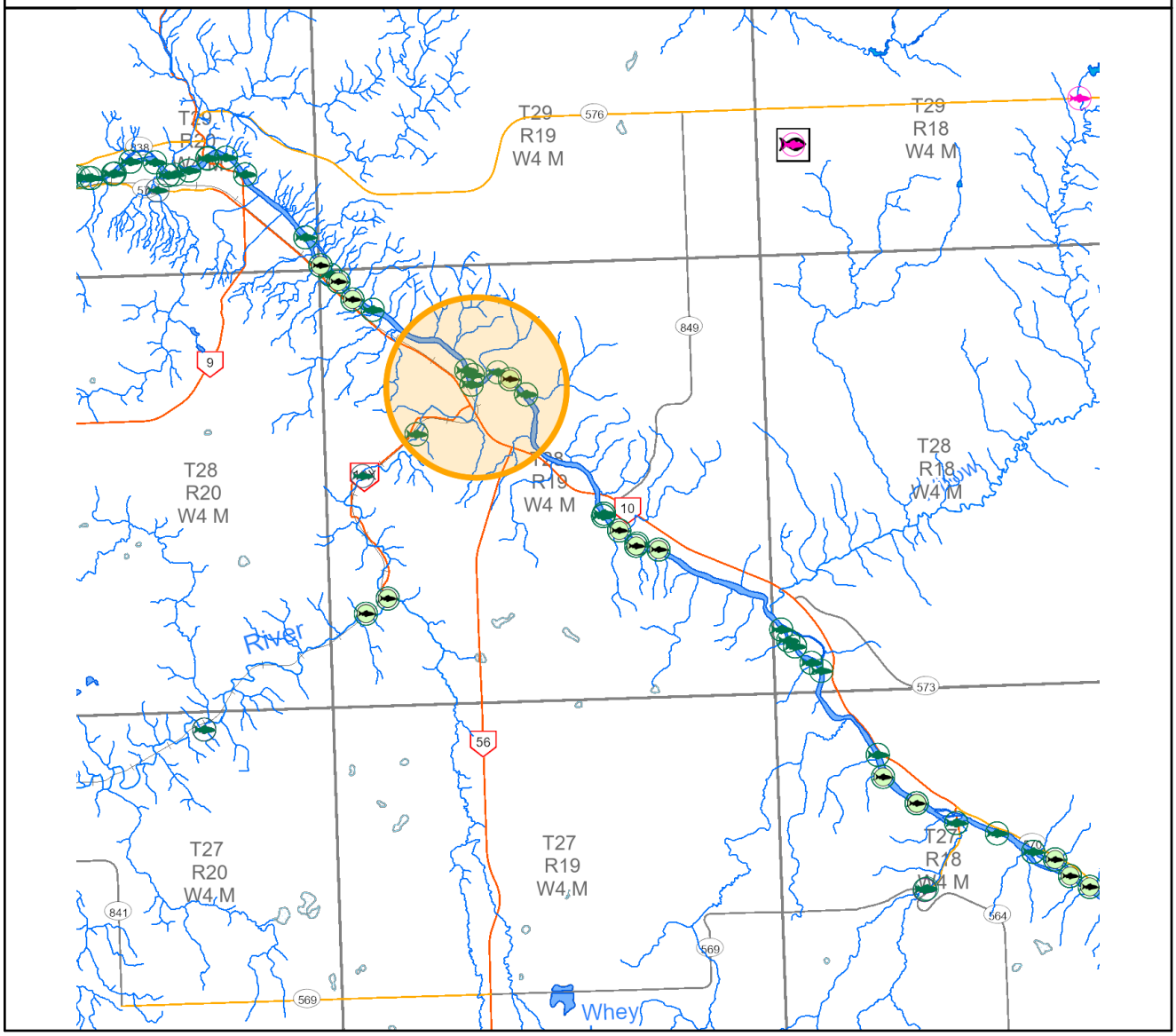
Buffer Extent

Centroid (X,Y)	Projection	Centroid (Qtr Sec Twp Rng Mer)	Radius or Dimensions
664836, 5696995	10-TM AEP Forest	SW 28 28 19 4	2 kilometers

Contact Information

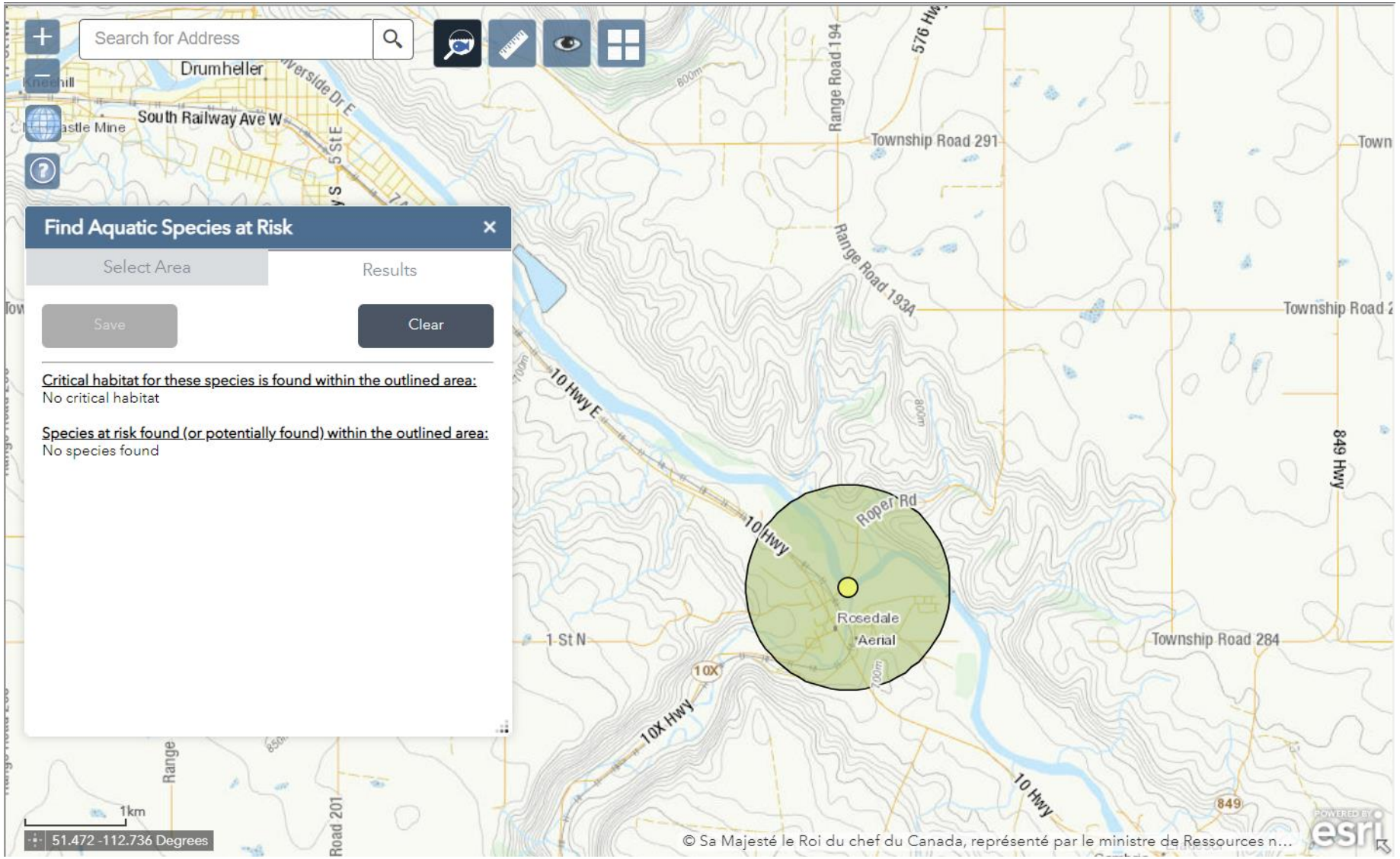
For contact information, please visit:
https://www.alberta.ca/fisheries-and-wildlife-management-contacts.aspx

18-Oct-2023 16:30 **Map Results**



APPENDIX D

Fisheries and Oceans Canada - Aquatic Species at Risk Map Search Results


Search for Address
Drumheller
South Railway Ave W
Range Road 194
Township Road 291
Range Road 193A
Township Road 2
10 Hwy E
10 Hwy
Roper Rd
Rosedale
Aerial
1 St N
10X
10X Hwy
Township Road 284
849 Hwy
849
Range
Road 201
1km
51.472 -112.736 Degrees
© Sa Majesté le Roi du chef du Canada, représenté par le ministre de Ressources n...
esri
Find Aquatic Species at Risk
Select Area
Results
Save
Clear
Critical habitat for these species is found within the outlined area:
No critical habitat
Species at risk found (or potentially found) within the outlined area:
No species found

APPENDIX E

Scarlett and Rosedale Berms - Site Photographs

Site Photographs

Photo 1 - View of the Rosebud River at Scarlett Berm project area, looking NW and upstream.

Photo 2 - View of the Rosebud River at Scarlett Berm project area, looking N and downstream.

Photo 3a – Viewing downstream from decommissioned train bridge at Rosedale Berm area.

Photo 3b – Viewing downstream from train bridge at Rosedale Berm (updated August 2024).

Photo 4 – Collapsed bank along upstream extent of Scarlett Berm project footprint.

Photo 5 – Viewing right downstream bank at Hwy 56 and gravel bar, upstream of projects.

Photo 6 – View of right bank upstream of decommissioned train bridge, showing general riparian vegetation and vertical slope.

Photo 7 – Left bank of Rosebud River, showing riparian vegetation and river channel.

Photo 8 – Instream vegetation providing rearing habitat for juvenile fish.

Photo 9 – Upstream of Hwy 56, viewing upstream at channel split/islands.

Photo 10 – View of gravel bar and sloping bank, downstream of Hwy 56.

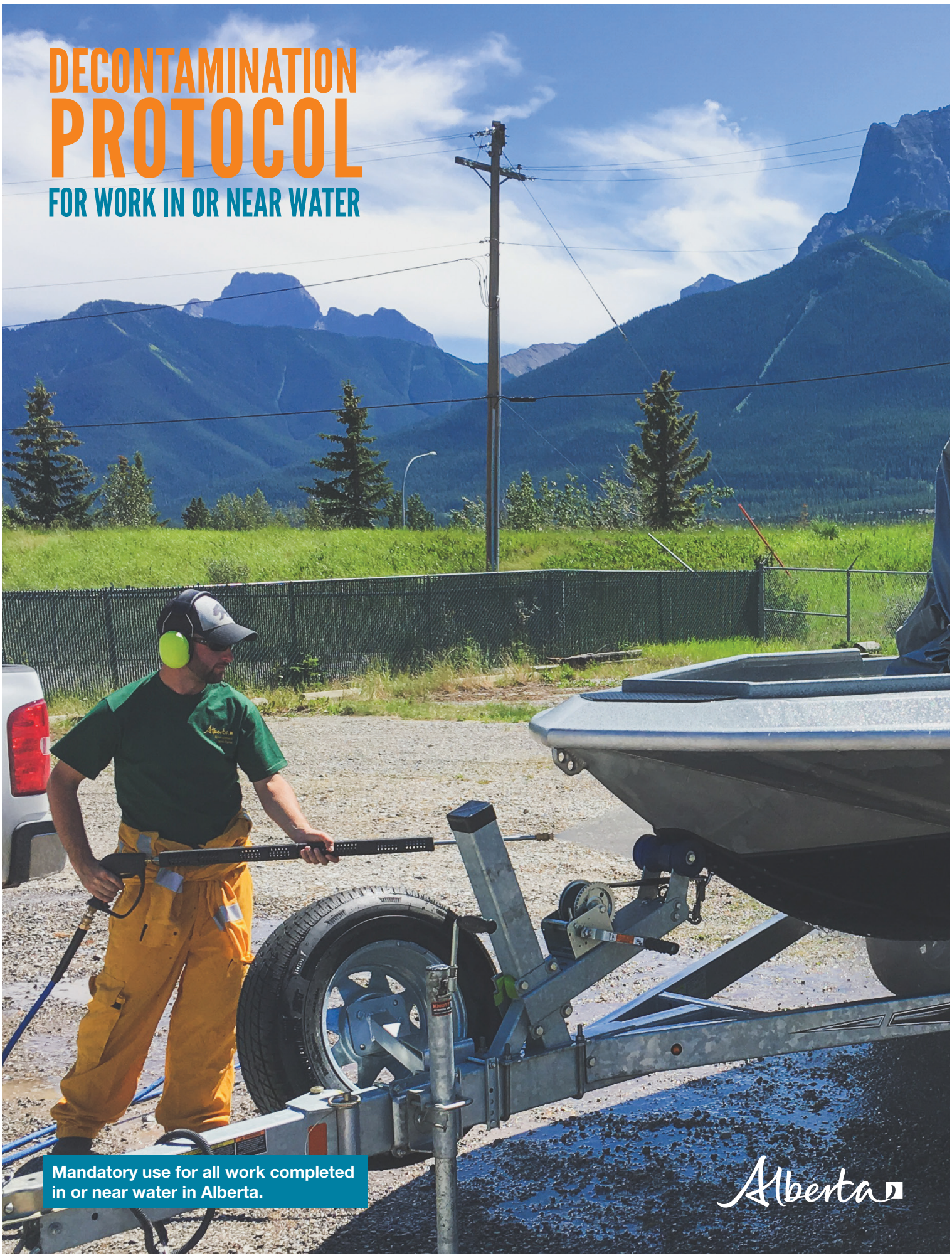
Photo 11 – View of Rosebud River at confluence with Red Deer River from Rosedale Bridge (Google image capture: May 2024).

APPENDIX F

Government of Alberta - Decontamination Protocol for Work In or Near Water

DECONTAMINATION PROTOCOL

FOR WORK IN OR NEAR WATER



Mandatory use for all work completed in or near water in Alberta.

Alberta

Alberta Decontamination Protocol, August 2017,
updated July 2020

ISBN 978-1-4601-4820-4 (PDF Online)

CONTENT

SECTION 1: INTRODUCTION

Aquatic Invasive Species (AIS) and fish disease (including parasites, bacteria and viruses) pose significant risks to the conservation and sustainability of our native species and their habitat. These threats pose both ecological and economic impacts to fisheries (particularly to species at risk), water management infrastructure, tourism, and local communities. Aquatic invasive species such as quagga and zebra mussels, non-native carp, flowering rush, and invasive Phragmites will adversely affect our environment, economy, and society. The introduction and spread of fish diseases has the potential to decimate fish stocks in affected waters. Vigilance on behalf of all Albertan's working with water is required to minimize the chance of introductions and help prevent the spread of AIS and fish disease.

One of the most important aspects of any invasive species or disease detection response is to implement 'Early Detection, Rapid Response' activities to reduce the risk of further spread. This protocol was developed to address the detection of whirling disease in the province, but is also intended to minimize the risk of aquatic invasive species of concern.

In August 2016, whirling disease was detected within Banff National Park; this was the first time the disease had been detected in Canada. Whirling disease is a fish disease that affects salmonids (family of ray-finned fish), including trout and mountain whitefish. The disease is caused by a parasite (*Myxobolus cerebralis*) that has two hosts: a tubifex worm (endemic to Alberta and found in sediment in most waterbodies) and salmonid fish. Once inside a fish, the parasite affects cartilage of the head, spine and/or gills. Whirling disease can cause high levels of mortality to fish populations. The federal Canadian Food Inspection Agency (CFIA) is responsible for reportable diseases in Canada, which includes whirling disease. For this reason, they have issued 'declarations' for infected areas within Alberta. Permits are required from CFIA to move fish or fish parts from the declared zone.

Figure 1: *Whirling Disease Technician cleaning waders between sampling sites.*

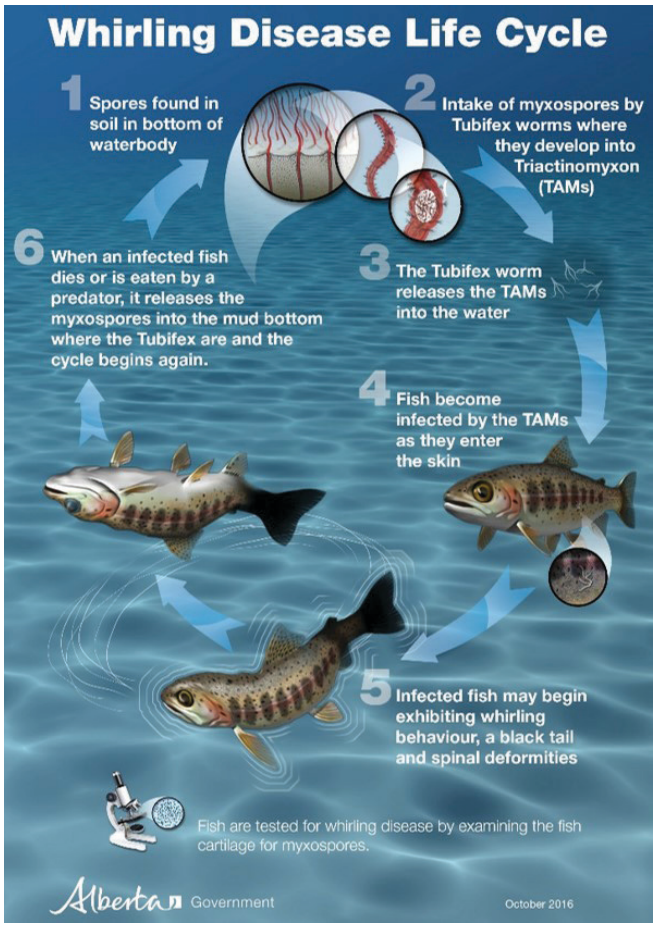


Figure 2: *Whirling Disease Life Cycle*

The CFIA declared infected zones (defined in Appendix A) are different than the decontamination risk map. The Decontamination Risk Map is intended to more accurately portray the specific locations where whirling disease has been detected at watershed level.

It is imperative that all work conducted in, or near water take the necessary measures to ensure that there is not inadvertent spread of AIS and fish disease in any provincial waters.

This protocol is mandatory for all Government of Alberta staff and any activities when conditioned under government issued contracts or approvals (including but not limited to Government of Alberta contractors, Fish Research Licenses, Public Lands Act Approvals, and Water Act Approvals) when working in or near a watercourse or waterbody (defined in Appendix A) across Alberta. Exceptions are provided only to emergency services, which have Best Management Practices instead of a mandatory protocol due to the time sensitivity of their work.

This protocol provides consistent methods for the inspection and cleaning of equipment, vehicles and machinery which will help prevent the spread of fish disease and AIS during all field activities.

The primary targets are equipment inspection and decontamination, if necessary. Preventative actions curb the introduction of pests, fish diseases, and invasive species into uninfected locations.

The general public and those engaging in recreational activities are not required to follow the Decontamination Protocol but are encouraged to use the Clean, Drain, Dry methods that are described in the Level 1 Decontamination section to protect the water resources they use.

SECTION 2: KEY OBJECTIVES OF THE DECONTAMINATION PROTOCOL

1. To provide decontamination requirements for work being completed in or near water, using best available technologies, information and feedback from field staff and other jurisdictions.
2. To provide techniques that can be safely, effectively and efficiently administered in the field or dedicated location, which is effective against whirling disease and AIS.
3. To provide decontamination techniques that minimizes harm to the aquatic environment as a direct, or indirect result of implementation of the protocol.
4. To provide a decontamination process which is economically viable, sustainable, and practical. This will include both the immediate short-term application of the protocol, as well as future use.

5. To minimize the deleterious effects on equipment thereby reducing the necessity of replacing assets and reducing the potential for equipment failures.
6. To update as needed based on user feedback or as new research and decontamination methods become available or to address new aquatic threats.
7. To provide techniques that recognize that different activities carry different risks of AIS and fish disease transfer, and, as such may have different treatment requirements.

SECTION 3: TRAINING, QUALITY ASSURANCE AND TRACKING

- All individuals involved in work in or near water must understand and be able to implement the application of the mandatory protocols before initiating work.
- Training may be provided through formal training workshops lead by designated decontamination staff. Alternately, staff who have been trained can familiarize staff new to the protocol. In these cases, a trained staff member should be clearly identified as the decontamination field lead, who is responsible for ensuring all decontamination protocols are implemented appropriately and effectively.
- All individuals completing the decontamination of equipment, vehicles and machinery must be familiar with and be able to demonstrate proper use of prescribed personal protective equipment (PPE) to complete the decontamination.

Figure 3: *Decontamination workshop held in Lethbridge for GOA staff*

- Decontamination efforts should be documented and tracked. A "Decontamination Record" template is available in Appendix I and on the Stop the Spread website.
- A "Decontamination Record" may be requested as part of a Contract, Approval or License.

SECTION 4: DECONTAMINATION RISK ZONE MAP

> **NOTE:** Only Whirling Disease is reflected in the Decontamination Risk Zone Map. However other aquatic invasive species can be added to risk zone map as required to prevent introduction or spread in the future. If other AIS are detected in the province, alternate disinfection methods may be required and the protocol will be modified to reflect mitigation measures. Other AIS of concern, present in Alberta, are currently all prevented through compliance to Clean, Drain, Dry (Level 1) recommendations.

A 'Whirling Disease Risk Map' has been developed to ensure the correct decontamination effort is used while working in the field based on the level of risk. This map is not included in this protocol as it is subject to change depending on whirling disease monitoring results. The current protocol and Decontamination Risk Zone Map can be found at the AEP Stop the Spread website at: https://www.alberta.ca/stop-whirling-disease.aspx

The map reflects the current status of whirling disease in Alberta. All workers should have access to detailed maps in both digital and print forms to ensure compliance.

The definitions of terms in the Decontamination Protocol can be found in: Appendix A: “Definition of Terms”.

The three risk zones in the province are as follows:

1. **Red Zone** – zone tested positive for whirling disease;
2. **Yellow Zone** – zone that represents high risk waters for introduction/spread of whirling disease due to one or more of the following criteria: susceptible species present, high use and access to water;
3. **White Zone** – zone that has a low population of whirling disease susceptible species, has no confirmed case of whirling disease and represents lower risk due to less activity/use.

The Decontamination Protocol requirements are directly tied to the Decontamination Risk Zone Map, which may include recent detections of ‘suspect positives’ from monitoring efforts not yet confirmed by the Canadian Food Inspection Agency (CFIA).

Given the intent of this Decontamination Protocol, Hydrologic Unit Code (HUC – Defined in Appendix A) watersheds were determined to be the most appropriate mapping system for developing the Risk Map. HUC Watersheds of Alberta define hydrologic units that form a standardized baseline across Alberta. HUCs represent a collection of nested hierarchically structured drainage basins and consist of successively smaller hydrologic units that nest within larger hydrologic units. The risk map is defined by a HUC 6 in Yellow and White Risk Zones and a detailed HUC 10 in the Red Risk Zone.

SECTION 5: OVERVIEW OF THE DECONTAMINATION PROTOCOL

GENERAL PRINCIPLES

- Level 1 Decontamination: “Clean, Drain, and Dry” applies to all zones, regardless of activity or movement.
- It is recommended to use dedicated equipment and gear in the Red Zone whenever possible to avoid decontamination issues and/or concerns especially when working with sensitive equipment or gear. Red Zone dedicated equipment or gear requires a Level 2 decontamination when being moved between HUC or is moving from a downstream location to an upstream location. A Level 3 decontamination is not necessary if equipment is dedicated to the Red Zone.
- When working in a particular zone, please refer to that zone’s decontamination instructions for a detailed description on how to proceed (as summarized in Table 1). Note that different decontamination instructions and/or level of decontamination by risk zone apply for Wildfire, Water Pumping and Industrial and Construction Operations (found in the appendices B, C and D).
- Items that cannot be decontaminated should not be used or should be dedicated for use in particular zones or HUCs.
- Items, or parts of items, that were not contaminated by water, sediment, organics or vegetation do not need to be decontaminated. Isolating small contaminated items in a large container will reduce the amount of decontamination necessary.
- Workers should avoid using leather, felt, wood, Styrofoam, Velcro or rope, as they cannot be easily decontaminated.
- Review equipment before heading into the field and remove any equipment or gear from vehicles, machinery or watercraft that is not required for the work or for decontamination. Any equipment that is exposed to

potentially contaminated water, sediment or vegetation must be decontaminated. Do not take what will not be needed.

- Equipment that cannot or will not be decontaminated must be handled and disposed of in a bio secure manner (Appendix F: Disposal of Disinfectant Solutions and Single-use Products).
- Any essential non-disposable equipment that cannot be decontaminated without compromising its functionality should be protected from contamination (i.e., covered with disposable material, such as a zippered bag).
- Vehicles or equipment not required for the work should be located on high, dry ground whenever possible prior to unloading equipment in order to limit exposure to water or soil.

Table 1: Summary of decontamination levels by risk zone for activities other than wildfire, water pumping, and industrial and construction operations*

WHITE ZONE**	YELLOW ZONE**	RED ZONE**
Level 1: Clean, Drain, Dry Location: On site	**Level 1: Clean, Drain, Dry** Location: On site	**Level 1: Clean, Drain, Dry** Location: On site
	Level 2: Disinfection Treatment Location: On site or at dedicated location	**Level 2: Disinfection Treatment** Location: On site or at dedicated location
		Level 3: Temperature Treatment Location: Decontamination Hub

* Decontamination levels and procedures for Wildfire, Water Pumping and Industrial and Construction Operations are found in the appendices B, C and D
** See associated 'Decontamination Risk Zone Map' as outlined in previous section of this document to determine Zone

> **Note:** At time of publication (2020) approved disinfectants are Quaternary Ammonium Compounds (QAC's) or Bleach. QAC's are common cleaning agents used in homes and hospitals and are safe for MOST equipment, vehicles and machinery when used at the recommended concentrations and followed by a thorough rinse (See Appendix E: Disinfection Treatments). The label and MSDS of any chemical product must be followed at all times.

SECTION 6: LEVELS OF DECONTAMINATION

This section outlines the methods to complete a Level 1, Level 2 or Level 3 decontamination. Levels of decontamination required are dependent upon activity type and zone. Use Table 1 and Section 7 in this document to determine the level of decontamination required in each zone.

SECTION 6.1: LEVEL 1 - CLEAN, DRAIN, DRY!

While on land, but before leaving any body of water, properly follow these instructions every time equipment, vehicles or machinery is used in or near water, regardless of the zone. It is not only mandatory, but critical in prevention efforts. Clean, Drain, and Dry all equipment, vehicles and machinery that came in contact with water. This is a 'Level 1' decontamination.

CLEAN

- Visibly inspect equipment, vehicles and gear after each use. Remove any visible plant fragments, as well as mud and other organic debris. Aquatic plants and mud routinely contain AIS and/or fish disease. Check in and around all the items, including tires as well as items on or inside a vehicle or machine that might have been exposed to water, sediment or vegetation.
- Take extra care to look in tight dark places, or where there are angles or edges for plants or mud to get caught.
- Do not forget to check off-highway vehicles, trailers and towing vehicles.
- Gear must be cleaned and rinsed with on-site water from the waterbody or by using clean water brought to site. For small items, a small nylon bristle-scrub brush (no wood), can be used to aid in the removal of organic debris or fish slime. All small items that were in contact with stream or lake water, that can be immersed, must be thoroughly cleaned by hand washing on-site. Large equipment vehicles and machinery must be cleaned with a long handled nylon scrub brush or pressurized water system on site to prevent transfer.

Figure 4: *Cleaning waders by manually removing organic debris*

DRAIN

- Drain all spaces or items that can hold water. At the conclusion of your work, drain all containers or depressions in equipment that were filled with water from a waterbody. Water should be drained on-site.
- WATERCRAFT: Follow factory guidelines for eliminating water from engines. All engines hold water, but jet drives on personal watercraft and other specialized boats can hold extra water. Lower the motor prior to leaving the body of water to properly ensure all water is drained after each use. Remove the drain plug from boats (the fine for not removing the drain plug while in transport is $172 as of June 2018). Empty water out of kayaks, canoes, rafts, buckets, tanks, etc. and towel dry or use a wet/dry vacuum if necessary.

DRY

- Whenever possible, allow everything to completely dry before working in another body of water. A minimum of 24 hours is recommended, but the longer the dry time, the better between each use. Drying time can be reduced by using towels, wet/dry vacuums, pressurized air, mechanical drying or drying during transport.

SECTION 6.2: LEVEL 2 – DISINFECTION TREATMENT

- After thorough cleaning, a three-step treatment procedure must be used to disinfect wetable items. Items do not need to be dry when moving from Level 1 to Level 2. Ideally a Level 2 decontamination will occur before leaving the field site, however if this is not feasible items can be transported to a decontamination hub, or alternate location provided they are contained and do not contaminate clean items or transport vehicle.

Figure 5: *Disinfecting submersible items in a QAC bath for a Level 2 Decon.*

FIRST TREATMENT (QAC OR ALTERNATIVE):

Prior to working with any disinfectant, refer to the MSDS sheet and use appropriate Personal Protective Equipment (PPE). The disinfectants approved and the appropriate concentrations can be found in Table 2: Disinfectant Treatments.

Submersible Items

- Use a rigid plastic tub/tote (or if field work does not allow, an alternative product that serves the same purpose effectively, such as a dry bag) to make a disinfection solution in which items can be submerged. Care should be taken to locate this container on high ground.

  > **Note:** The concentration of the disinfection solution is dependent on the type being use. Please refer to Table 2: Disinfectant Treatments and Appendix B: Disinfectant Concentration and Dilution.

- Submersible items must be immersed such that all surfaces which were in contact with potentially contaminated water, mud, or fish, are submerged for 10 minutes (quantity of equipment in the treatment is discretionary as it is concentration based). Care must be taken to ensure that any porous materials which may have absorbed potentially contaminated water are thoroughly soaked and physically agitated while submerged. Save this solution for later use on larger equipment (and check concentration level for efficacy).

Non–Submersible Items

- Non-submersible items, sensitive, non-waterproof or large equipment. Personal floatation device's, floater jackets and life jackets that were not submerged in the waterbody should be thoroughly wiped or sprayed rather than submerged in disinfectant to reduce drying time. Surface disinfection can be accomplished by

Figure 6: *QAC application using a pump-up style sprayer.*

wiping wetted surfaces with a heavy-duty type shop towel which has been soaked in a disinfectant or by spraying the surfaces with a disinfectant that is double concentrated to ensure effective coverage of the surfaces.

- Surfaces must be kept damp with disinfectant for 10 minutes. Any disposable items (i.e., shop towels, disposable gloves) used for this purpose must be bagged until able to dispose of these materials in a safe location (i.e., garbage cans with lids) away from water.
- The disinfectant solution can be applied using garden variety pump-up style sprayers which are labelled specifically for use with chlorine or other disinfectants. The disinfectant solution from the submersible tub/tote can be used for this purpose. The solution should be liberally sprayed on both the outside and the inside of the equipment, vehicles or machinery, keeping surfaces moist for 10 minutes. Avoid letting the disinfectant to dry on items as it is harder to rinse off once dry. Care should be taken to avoid electronic components that are not water resistant.

> **Note:** When using watercraft, it is important to target the trailer “bunks” to ensure they are cleaned of organics and then thoroughly wetted with a disinfectant. Workers should consider upgrading bunks to polyethylene plastic from the traditional wooden/carpeted options.

> **Note:** Small quantities of disinfectant [i.e., residual volume from a containment mat (defined in Appendix A) or both] can be reused but should be monitored using testing strips for effective concentration. They can be disposed through a sanitary sewer but should be diluted with an equal volume of water (See Appendix F: Disposal of Disinfectant Solutions and Single-use Products). Local authorities responsible for operating municipal wastewater treatment facilities should be consulted before disposing of larger volumes of disinfectant down sanitary sewers.

Table 2: Disinfectant Treatments

	CONCENTRATION	EXPOSURE TIME	PROS	CONS	EFFECTIVE AGAINST
Chlorine Bleach	▪ Soaking = 5000 ppm ▪ Wiping and spraying = 5000 ppm	15 minutes	▪ Can be neutralized by adding sodium thiosulphate prior to disposal	▪ Can cause corrosion to fabrics, plastics, rubber and metal	▪ Multiple fish viruses and diseases including whirling disease ▪ Quagga and zebra mussels ▪ Didymo ▪ Spiny water flea
Quaternary Ammonium Compounds (QAC's) including: **QUAT Plus**	▪ Soaking = 1500 ppm ▪ Wiping and spraying = 3000 ppm	10 minutes	▪ Common cleaning agent used in home, restaurant and hospital settings ▪ Immobile in soil	▪ Can cause corrosion on aluminum	▪ Whirling disease
Virkon (not approved for decontamination for Whirling Disease at time of publication)	▪ Soaking = 2:100 ▪ Wiping and spraying = 2:100	20 minutes			▪ Many fish viruses and diseases but only the TAM stage of whirling disease ▪ Didymo, ▪ New Zealand mud snail ▪ Quagga mussels ▪ Asian clam ▪ Spiny water flea

Second Treatment: Rinse

- For rinse, use a clean hard plastic tub/tote to contain "clean" water (Defined in Appendix A); this is typically obtained off-site prior to sampling or from a potable water source on-site if available. It must not be water from the waterbody. Small disinfected items, following the 10 minute submersion, should be rinsed in this tub/tote. Make sure to thoroughly rinse the items to prevent the build up of disinfectant residue. In some cases, the addition of a soap (such as Simple Green) helps prevent the disinfectant build-up. Large or sensitive equipment, vehicles or machinery that were wiped or sprayed with disinfectant should be wiped down with clean water to remove any residue.

> **Note:** If "clean" rinse water is not available, disinfected items should be secured in a designated container (i.e., hard tub/totes preferred, dry bags, etc.) for transport back to a location with clean water.

Third Treatment: Dry

- Once treatment and rinse is completed, allow items to dry as long as possible (24 hours minimum recommended). Items that require a Level 3 decontamination do not need to be dry prior. If there is not enough time to allow items to dry before next use, ensure they were thoroughly rinsed prior to next use.

Figure 7: *Rinsing and drying field gear using potable water that was brought to the worksite.*

SECTION 6.3: LEVEL 3 – TEMPERATURE TREATMENT

All equipment, vehicles and machinery leaving a Red Zone HUC requires Level 3 decontamination in addition to Levels 1 and 2. Once Level 2 decontamination has been completed, equipment and gear can be transported to a designated location (decontamination hub) for a final Level 3 decontamination. This three-step treatment process must be completed before items go back into the field for use at another work site unless it is staying in the same Red Zone HUC. Items do not need to be dry when moving from Level 2 to Level 3. If equipment, vehicles and machinery are able to be contained or transported without contaminating other items a Level 2 decontamination can be skipped if going directly to a decontamination hub.

FIRST TREATMENT: TEMPERATURE TREATMENT

- Care must be taken to ensure that any items inside a vehicle, watercraft or equipment that were contaminated with water, sediment or organics are removed, and decontaminated separately. Some equipment, vehicles or machinery, particularly watercraft may have compartments that are not easily accessible. Refer and follow the user manual to gain access to these compartments for decontamination.
- Items to be decontaminated should be evaluated for tolerance to hot and cold temperatures, by contacting the distributor or manufacturer prior to treatment. Inflatable items should not be subjected to more than warm water to ensure that heat and glue welded seams on the pontoons do not rupture.

Temperature Tolerant Items:

- The temperature treatment can be completed using hot or cold temperatures.

Table 3: Level 3 Treatments

TREATMENT	TEMPERATURE	EXPOSURE TIME	PROS	CONS
Hot water or steam applied using: ▪ pressure washer with heat and/or steam capabilities ▪ hot water soaking tub	▪ 90 °C ▪ 60 °C for engine flush	10 minutes of continuous contact	▪ Effective decontamination of all AIS and fish disease, including whirling disease	▪ Failing to understand temperature tolerance of items could cause damage ▪ Cannot be used on items with glued seals or sensitive electronics

Cold temperatures by: ▪ Using freezer units ▪ Leaving items outside during winter months	▪ -20 °C	7 continuous days	▪ Does not produce waste ▪ Passive method of decontamination during winter months	▪ Difficult to maintain the continuous temperature ▪ May be difficult to achieve during summer
Drying time: Items need to be dried to descant any organisms		Out of water for 1 year	▪ Passive method of decontamination	▪ Limits use of equipment due to length of time
Disinfectants – **double** Disinfectant Treatment: ▪ Use should be limited to items that are sensitive or cannot tolerate 90 °C or -20 °C temperatures	See Table 2: Disinfectant Treatments for concentration	See Table 2: Disinfectant Treatments for exposure time	▪ Can be used on items that cannot tolerate high heat or cold temperatures	▪ Is not as effective at killing all AIS and fish diseases as extreme heat

SECOND TREATMENT: DISINFECTANT

- Following temperature treatment, all equipment, vehicles and machinery must receive a secondary decontamination using a disinfectant treatment, see Table 2: Disinfectant Treatments. This is particularly important where temperatures have not been maintained at 90°C because of manufacturer's recommendations or where there is no assurance that internal or difficult to reach areas were subjected to the hot water decontamination. Ensure all items are thoroughly rinsed following the disinfectant treatment.

THIRD TREATMENT: DRY

- Once treatment and rinse are completed, allow items to dry as long as possible (24 hours minimum recommended). Drying time can be reduced by using towels, wet/dry vacuums, pressurized air, mechanical drying or drying during transport.

Figure 8: *Level 3 Temperature Treatment using Steam*

Figure 9: *Drying out recently decontaminated field gear*

GUIDELINES FOR DECONTAMINATION HUBS

A Level 3 decontamination hub can be established subject to meeting the following criteria:

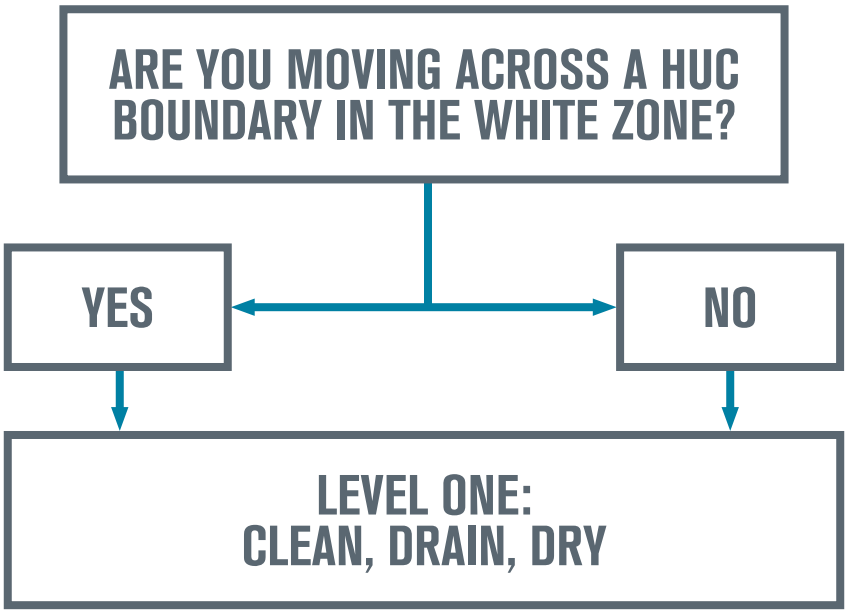
- Enough space to safely turn around necessary equipment, and preferably with exposure to natural sunlight. Asphalt or concrete surfaces are preferred, as water will evaporate following decontamination of equipment due to direct or reflected sunlight.
- Vegetated or graveled areas that allow for filtration are sufficient as well. Dirt surfaces should be avoided for decontamination hubs as they are prone to collecting water or becoming muddy.
- No conveyed drainage to surface waterbodies, wetlands, or adjacent flowing water can be permitted; similarly, no potential for overland drainage to surface waterbodies in the event of large rain events is permissible.
- Controlled, secure access to the site (i.e., no access to vehicles other than those dedicated to the decontamination protocol) is highly desirable. Multi-purpose sites should only be used when other suitable isolated locations cannot be found. If site does not meet all requirements, containment mats must be used.
- If using containment mats, contained water must be treated as required to ensure safe disposal (See Appendix F: Disposal of Disinfectant Solutions and Single-use Products). In the event of contaminated water, consider allowing dumping of water in a safe location (i.e., vegetated area, on gravel, etc. as it allows for slow percolation and/or evaporation of wastewater).

SECTION 7: GENERAL PRINCIPLES FOR DETERMINING LEVEL OF DECONTAMINATION WITHIN EACH ZONE

This section outlines how to determine when a Level 1, Level 2 or Level 3 decontamination is required. Note that this section applies to all activities other than Wildfire, Water Pumping and Industrial and Construction Operation. To determine when a Level 1, Level 2, or Level 3 decontamination is required for Wildfire, Water Pumping and Industrial and Construction Operation, reference the appendices B, C and D.

SECTION 7.1: WHITE ZONE – GENERAL PRINCIPLES

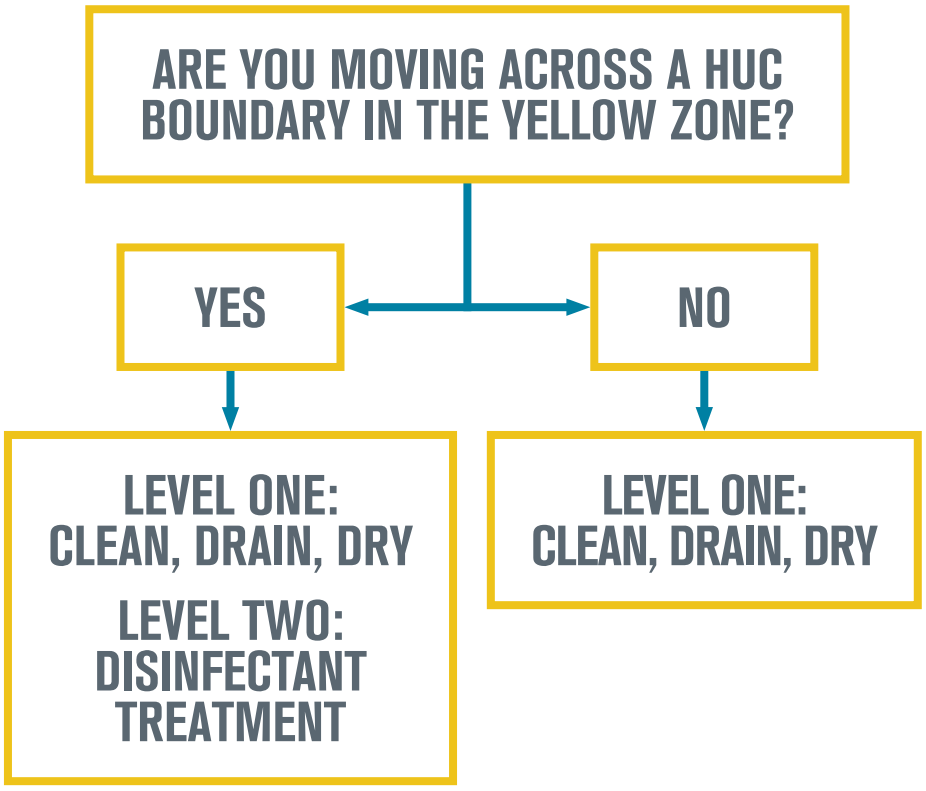
WHITE ZONE = REDUCED RISK OF INTRODUCTION: ZONE THAT DOES NOT HAVE WHIRLING DISEASE SUSCEPTIBLE SPECIES.



- Level 1 (Clean, Drain, Dry instructions) are to be followed when leaving a field site, whether or not you are crossing a HUC boundary.

SECTION 7.2: YELLOW ZONE – GENERAL PRINCIPLES

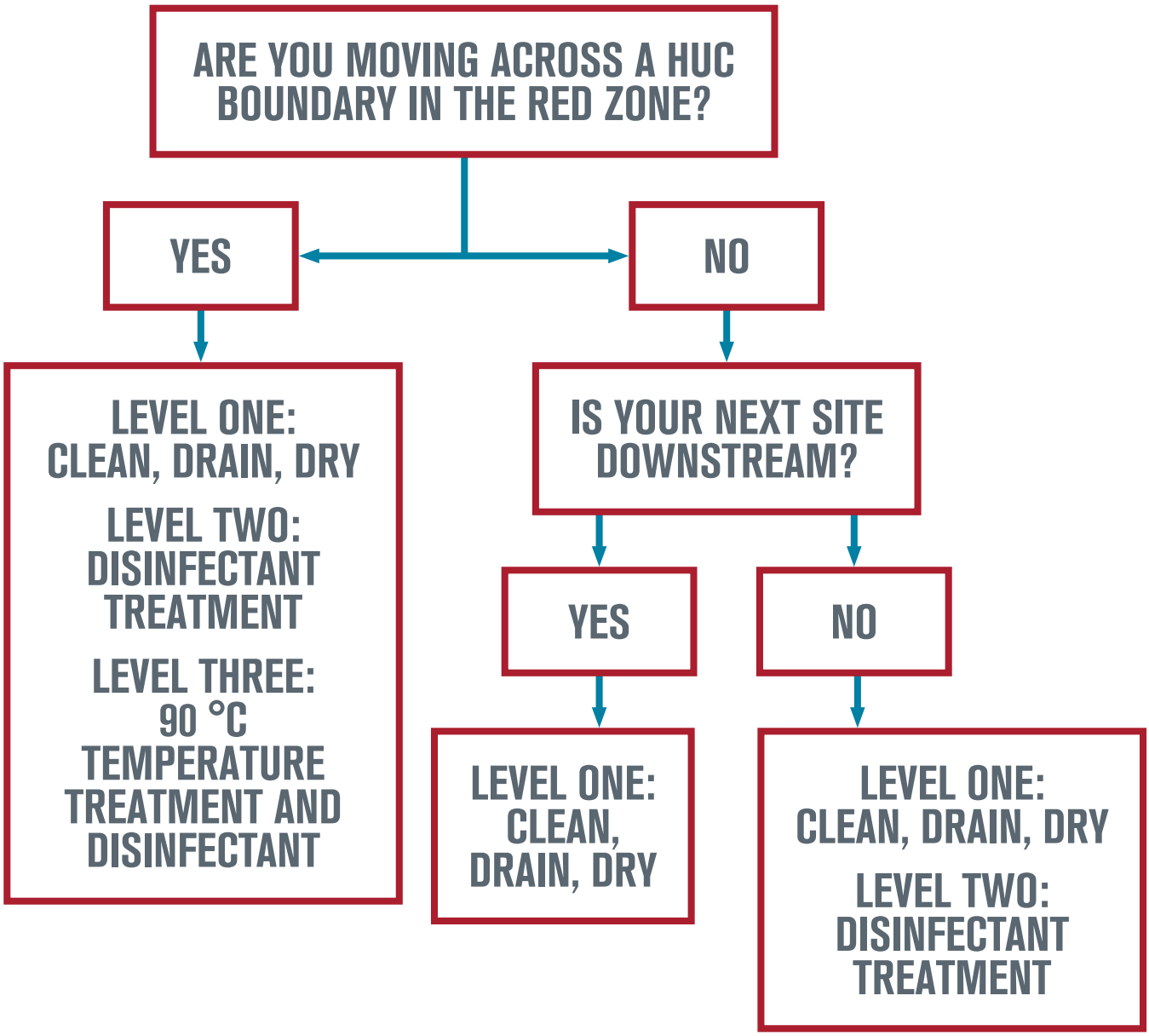
YELLOW ZONE = MODERATE TO HIGH RISK: WITHIN THE SALMONID ZONE HIGH RECREATIONAL ACITIVITY AND HIGH POPULATION BASE.



- When moving outside one Yellow Zone HUC boundary (or at the completion of the field season if staying in one HUC boundary), Level 1 and 2 decontamination must be completed.
- If you are not moving outside of a single Yellow Zone HUC boundary, only Level 1 protocols are required.

SECTION 7.3: RED ZONE – GENERAL PRINCIPLES

RED ZONE = HIGH RISK: WHIRLING DISEASE DETECTED



- Have dedicated equipment for use in the Red Zone whenever possible.
- If equipment or gear is dedicated to a single Red Zone HUC, and is properly labeled and stored, a Level 3 decontamination is not required, only a Level 2 between uses.

> **Note:** Felt-soled waders are not to be used anywhere in the province, unless the soles are removable and able to be properly decontaminated OR if dedicated to a single Red Zone HUC.

Note: When working within a Red Zone, always select sites from upstream to downstream. If this cannot be accomplished, Level 1 and 2 decontamination is required between each site.

- The decontamination risk map denotes irrigation systems that are sourced from infected waters; Red Zone principles apply in the Irrigation District only when working in canals and leaving the district; the rest of the waterbodies within the delineated Irrigation District area may be considered the Yellow Zone.
- Avoid working in, or drawing water from the Red Zone whenever possible.

SECTION 8: CONSIDERATIONS FOR DECONTAMINATION BY ACTIVITY TYPE

The following considerations are in addition to requirements outlined in Section 6 and 7 with the goal of providing additional recommendations by activity type. Also in this section are considerations for recreational activities including ATV's and Float Planes that are not regulated for decontamination requirements but compliance to these considerations reduces the risk of AIS and/or fish disease transfer. Note that activities associated with Wildlife, Water Pumping and Industrial Construction Activities have separate and specific decontamination procedures that can be found in the Appendix B, C and D.

SECTION 8.1: FISH RESEARCH LICENSE ACTIVITIES

Anyone (person, agency or institution) whose work involves collecting, holding or sampling fish for inventory, research, educational or promotional purposes in Alberta must obtain a Fish Research License (FRL). FRL is also required for conducting any fish toxicant work in controlling AIS like goldfish.

General Prevention

- Handling/movement of fish (i.e., live, dead, parts) is the greatest risk for spreading fish disease, so this work generally is higher risk than most activities.
- Avoid transferring water between watersheds or between unconnected waters within the same drainage. Do not dump water from one watercourse or waterbody (i.e., stream, lake, reservoir) into another watercourse or waterbody (defined in Appendix A.). Dispose of excess water over uplands.
- Always err on the side of caution as one can never be certain that AIS are not present, so make sure that your activities are not going to spread what may be there.
- Watercraft and trailers can be a primary source of spread of AIS and fish disease. They must be washed according to the protocols outlined in this guide, and where they were used according to the most up-to-date risk maps between each use (unless using in same waterbody, river drainage, or HUC according to the protocols of that particular zone).
- When working within a Red Zone, always sample from upstream to downstream, and from unaffected zones to infected zones. If this cannot be accomplished, Level 1 and 2 decontamination is required between each site.

Figure 10: *GOA staff and partners completing a fish salvage at Rocky Creek*

- When working in the Red Zone, a Level 1, 2, and 3 decontamination is required, unless you are working only in a single Red Zone HUC, in which case only a Level 1 decontamination is needed. **THIS IS VERY IMPORTANT**. Movement of any fish, fish parts, sediment, and water from the Red Zone to other zones constitutes the highest risk of spread.
- When working in the Yellow Zone a Level 1 and 2 decontamination is required when moving between HUC 6 boundaries.
- If you are working within one Yellow Zone HUC 6 boundary, you may conduct the Level 2 decontamination at the end of your field season at the warehouse (instead of on site), so long as care is taken to avoid potential cross-contamination and the (warehouse) site is appropriate for decontamination activities.

Notes on fish sampling in Red Zone

- All fish must be processed (i.e., weighed and bagged on site), unless specific procedures are in place to quarantine these fish.
- Fish must be processed on non-porous surfaces that can be hot water washed and disinfected.
- Fish samples should be double bagged to reduce potential leakage of contaminated fluids.
- The outside of sample bags must be cleaned to remove any blood or organic matter with a 3000 ppm QAC solution (a higher concentration is specified for these materials given the potential for contamination from direct contact with potentially infected fish) before placing samples on ice within a clean and disinfected cooler.
- The outside of fish aren't likely any more 'infectious' than is the water they've been taken out of. If TAMs are on the outside of the fish, they are in the water too.
- The biggest risk is if workers are cutting off heads in the field with potential for myxospore release from bones/cartilage lesions and subsequent contamination of equipment and cross-over from one sample to another.
- Unless you have been in contact with the lab to ship fresh fish, transfer samples to -80ºC freezer and disinfect coolers. Coolers should be hot water cleaned, sprayed with a 3000 ppm QAC solution and dried completely.
- All surface water and QAC solution should be collected in the cooler and disposed of in accordance with approved procedures (Appendix F).

Disposal of Fish within the Red Zone

When disposing of fish in the Red Zone (re: fish toxicant and fish salvage operations) the appropriate disposal method for potentially infected fish includes:

- Non-salmonids may be disposed of in landfill (no risk of spreading whirling disease).
- Salmonids must be disposed of in a secure manner, either by making special arrangements with the landfill (deep burial) or incineration.
- Landfill considerations: Per the Waste Control Regulation (AR 192/96), fish are not biomedical waste and there is no limitation to Class II Landfill disposal, unless the EPEA approval specifically limits pathogenic animal waste or bio-hazardous or infectious waste. These limitations are generally not listed in the landfill approvals; however, this stresses the need to make arrangements with the landfills prior to disposal. The landfill run-off control system should be isolated so there is no run-off from the disposal areas at the time of disposal. Isolation burial is required to ensure the risk remains with the landfill. A pre-arranged haul into the landfill for all special waste is advised; working with the landfill owner/operator is key to the successful burial.
- Transport Considerations: If there is risk of transmission to organisms other than fish, the infected fish may be considered a risk to animals, but not to humans. The waste material could be classified under the transportation of dangerous goods as an infectious substance (UN2900, INFECTIOUS SUBSTANCE, AFFECTING ANIMALS). CFIA should be able to provide more clarity here.
- Salmonid (including parts) should not be used for bear bait in the Red Zone, as the range of bears is too great not to produce a risk of spreading whirling disease. However, this can still be conducted in the Yellow Zone.

SECTION 8.2: MONITORING/RESEARCH/FLOOD & DROUGHT MITIGATION

Workers monitoring, managing, and/or researching surface water.

General Prevention

- While the movement of water is not considered the highest risk activity for whirling disease, standing water can be a host to a number of fish diseases and AIS. Care must be taken to avoid inadvertently spreading non-native species in water or on equipment.
- Avoid transferring water between watersheds or between unconnected waters within the same drainage. Do not dump water from one watercourse or waterbody (i.e., stream, lake and reservoir) into another watercourse or waterbody. Dispose of excess water over uplands.
- Watercraft and trailers can be a primary source of spread of AIS and fish disease. They must be decontaminated between each use (unless using in the same waterbody or river drainage).
- When working within a Red Zone, always sample from upstream to downstream and from unaffected zones to infected zones. If this cannot be accomplished, Level 1 and 2 decontamination is required in between each site (to avoid spreading whirling disease from an infected downstream area to a unaffected upstream area).
- When working in the Red Zone, a Level 1, 2, and 3 decontamination is required, unless you are working only in a single Red Zone HUC, in which case only a Level 1 decontamination is required. THIS IS VERY IMPORTANT. Movement of fish, fish parts, sediment and water from the Red Zone to other Zones constitutes the highest risk of spread.
- Isolate water samples within separate bags until sampling is complete, then place in a single cooler.
- Sonde probes and calibration cups should be treated with disinfectant and carefully cleaned using a brush and triple-rinsed with clean water.
- Teflon coated sensors in the M9, FlowTracker, StreamPro and ADCP are able to receive the disinfectant (QAC or bleach) spray.

Figure 11: *Example of irrigation equipment that may require decontamination*

SAMPLING OF IRRIGATION DISTRICTS

- Portions of the Western Irrigation District (WID) fall within the Risk Map.
- When sampling within an irrigation district always sample from upstream to downstream, and from unaffected zones to infected zones (if known).
- Irrigation districts have canals that routinely cross watershed lines and as such require special zones for decontamination. Decontamination zones are to be defined based upon shared source water, returning river basins, and susceptible reservoirs (See Table 4 below).
- For specific zone boundaries, please consult irrigation infrastructure schematics and flow patterns.
- Level 1 and 2 decontamination should be completed when leaving one zone for work in another. Level 3 decontamination should be completed when leaving a Red Zone and prior to working elsewhere.

Table 4: Irrigation District Decontamination Zones

ZONE	RETURNING RIVER BASIN	DESCRIPTION
Bow River Irrigation District (BRID)		
1	Bow River	All infrastructure sourcing from the Little Bow Reservoir and returning to the Bow River
2	Oldman River	All infrastructure sourcing from the Little Bow Reservoir and returning to the Oldman River
Eastern Irrigation District (EID)		
3	Headworks/Bow River	All infrastructure sourcing from the Bassano Dam and returning to Crawling Valley Reservoir
4	Red Deer River	All infrastructure sourcing from Crawling Valley Reservoir and returning to the Red Deer River.
5	Red Deer River	All infrastructure sourcing from the Bassano Dam and returning to the Red Deer River
6	Bow River	All infrastructure sourcing from the Bassano Dam and returning to the Bow River
7	Lake Newell/Rolling Hills Reservoir	Any infrastructure within Lake Newell or Rolling Hills Reservoir
8	Bow River	All infrastructure sourcing from Lake Newell or Rolling Hills Reservoir and returning to the Bow River
Lethbridge North Irrigation District (LNID)		
9	Oldman River	All LNID infrastructure
Magrath Irrigation District (MID)		
10	St. Mary River	All MID infrastructure
Mountain View, Leavitt, and Aetna Irrigation Districts		
11	Belly/St. Mary River	All infrastructure within these districts
Raymond Irrigation District (RID)		
12	St. Mary River	All RID infrastructure

Ross Creek Irrigation District		
13	Ross Creek	All Ross Creek Irrigation District infrastructure
St. Mary River Irrigation District (SMRID)		
14	Oldman River	All SMRID infrastructure west of Taber Irrigation District
15	Oldman River	All SMRID infrastructure east of Taber Irrigation District to Sauder (Rattlesnake) Reservoir
16	South Saskatchewan River	All SMRID infrastructure east of Sauder (Rattlesnake) Reservoir
Taber Irrigation District (TID)		
17	Oldman River	All TID Infrastructure
United Irrigation District (UID)		
18	Waterton River/Belly River	All UID Infrastructure
Western Irrigation District (WID)		
19	Headworks/Bow River	AEP main canal from Harvey Passage to Chestermere Lake
20	Red Deer River	All infrastructure sourcing from Chestermere Lake and returning to the Red Deer River
21	Bow River	All infrastructure sourcing from Chestermere Lake and returning to the Bow River
Other Infrastructure		
22	McGregor Lake	AEP main canal sourcing from the Bow River and returning to McGregor Lake
23	McGregor Lake/Travers Reservoir/Little Bow Reservoir	Any infrastructure within and connecting McGregor Lake, Travers Reservoir, and Little Bow Reservoir
24	Little Bow River	Any infrastructure within the Mosquito Creek or Little Bow River Basins

*To be updated as monitoring results become available, as needed.

Disposal of Water Samples from Red Zone

For water quality monitoring, analytical labs should be directed to treat the water with QAC or bleach prior to disposal.

- Decontamination: use a QAC compound like “QUAT Plus” at a concentration of 1500 mg/L (active ingredient) for a minimum of 10 minutes. The alkalinity of the solution can be neutralized prior to disposal.
- Heating: 90ºC for a minimum of 10 minutes
- Freezing: -20ºC for a minimum of 1 week
- Chlorine Bleach: added to sample to achieve a final concentration of 5000 ppm of available chlorine (= 1:10 dilution of household bleach) held for a minimum of 15 min. before disposal. Bleach can be neutralized by adding sodium thiosulphate prior to release.

SECTION 8.3: OFF HIGHWAY VEHICLES

Human activity is a known vector for transferring AIS and fish disease. While it is difficult to demonstrate the specific potential of Off-Highway-Vehicles (OHV) for introducing and spreading AIS and fish disease, these vehicles are a cause for concern if they are crossing bodies of water (particularly between water courses). Whirling disease can be spread through contact with water, mud, and organic debris, particularly if OHV are travelling through multiple watercourses.

OHV use in watercourses has been an issue for public lands management in the province, and as such, it is important that workers set a positive example for the public and reduce their risk of spreading AIS and fish disease. Under the Public Lands Act, it is against the law to use OHV in public waters. It is recommended that the following actions be taken each time workers use OHV for fieldwork.

Figure 12: *OHV's used to complete fieldwork*

General Prevention

- Keep Wheels out of Water! Avoid contact with water when possible and clean OHV as best as possible before transporting them from the field site.
- Plan before you go. Avoid crossing watercourses where there is no infrastructure or measures in place to mitigate the impact to the waterbodies. Use bridges or built-up crossings whenever possible.
- If contact with water is unavoidable, remove mud and organic debris from the OHV between watercourses.
- Know where your work is occurring within the 'Decontamination Risk Map,' and avoid OHV contact with water in the Red Zone.
- Avoid taking an OHV from the Red Zone to any other zone.
- Use a high pressure wash unit to clean all mud and organic debris from OHV when returning from field activities.

Notes on OHV Use in the Red Zone

- In Red Zones, contact with water should be avoided at all times unless it is critical and the OHV is dedicated for use in the whirling disease positive zone (see Risk Map).
- Use Red Zone dedicated equipment where possible as OHV are difficult to decontaminate (particularly in the field).
- Disinfectant (QAC or bleach) can be applied via sprayer as part of the decontamination procedures, but all mud and organic debris must be removed prior to application to ensure efficacy.

SECTION 8.4: FLOAT PLANES AND AVIATION

Fish disease and AIS such as invasive mussels and Eurasian watermilfoil, can be unintentionally transported from one waterbody to another on the floats of float planes. Therefore, it is always important to clean aircraft of any organic debris, mud and standing water before traveling rather than after landing at new locations and incorporate these procedures into the operation of the float plane.

Recommended Actions

BEFORE ENTERING THE AIRCRAFT:

- Inspect and remove aquatic plants from the floats, wires or cables, and water rudders;
- Pump floats (which may contain infested water);
- If moored in a waterbody known to have AIS or fish disease for extended periods: check the transom, chine, bottom, wheel wells, and the step area of floats. Use the following options to remove or kill any potential fish disease or AIS that may be attached to the floats:
  - wash with hot water; or
  - spray with high-pressure water; and/or
  - dry all parts of the floats in the sun for at least 5 days
  - Hand clean the submerged portion of floats with a scrub brush and physically remove any organic debris and organisms

Figure 13: *Underside of a float plane*

PRE TAKE-OFF CHECK:

- Avoid taxing through heavy surface growths of aquatic plants before takeoff;
- Raise and lower water rudders several times to clear off plants;

AFTER TAKE-OFF:

- Raise and lower water rudders several times to free aquatic plant fragments;
- If aquatic plants are visible on floats or water rudders, return to the lake you left and remove plant fragments

STORAGE/MOORING:

- Remove aircraft from the water (as is often done at float plane bases) and allow all parts of the floats to dry. During hot summer temperatures, a few days will kill most AIS (longer drying times are required to kill AIS during cool, humid weather);

SECTION 9: INFORMATION SOURCES

Alberta Environment and Parks, September 2016. *Interim Guidelines for the Disinfection of Fisheries Equipment to Reduce the Spread of Whirling Disease in Southern Alberta*, Version 1.3.

Alberta Environment and Parks, October 2016. *Environmental Monitoring and Science Division. Interim Whirling Disease Decontamination Protocol*, Monitoring Section (modified).

Bureau of Reclamation Technical Memorandum No. 86-68220-07-05, 2012. *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species*.

Canada-Ontario Invasive Species Centre/Ontario Ministry of Natural Resources, April 2013. *Clean Equipment Protocol for Industry: Inspecting and Cleaning Equipment for the Purposes of Invasive Species Prevention*.

Cockman, Joneen S., A. Gibbons and S. Kelly, 2012. *Decontamination for Whirling Disease on the Seely Fire in Utah 2012: Sharing an Important Process with our Fellow Teams*. Wildland Fire Lessons Learned Centre.

Code of Practice for Small Incinerators. Alberta Queen's Printer, September 2005. http://www.qp.alberta.ca/documents/Codes/INCINERATORS.pdf

Colorado Department of Natural Resources, 2012. *Quaternary Ammonia Compound Disinfection Protocols*.

Fernandez, T. 2012. Guide to the Code of Practice for Small Incinerators. Alberta Environment and Sustainable Resource Development. Air, Land and Waste Policy Branch. 31 pp. (https://extranet.gov.ab.ca/env/infocentre/info/library/8782.pdf)

Government of Alberta. *Hydrologic Unit Code Watersheds of Alberta*. Accessed from: https://geodiscover.alberta.ca/geoportal/catalog/search/resource/fullMetadata.page?uuid=%7B657AA2A1-2914-422A-B914-5DC1E87CF1F0%7D

Hemmera Envirochem Inc., September 2016. *Whirling Disease Jurisdictional Review* (for Decontamination Protocols).

Hedrick RP, T., McDowell, K. Mukkatira, E. MacConnell, and B. Petri, 2008. *Effects of freezing, drying, ultraviolet irradiation, chlorine, and QUATernary ammonium treatments on the infectivity of myxospores of Myxobolus cerebralis for Tubifex tubifex*. Journal of Aquatic Animal Health, 20(2):116-125. View article at: http://afsjournals.org/doi/abs/10.1577/H07-042.1

Ontario Ministry of Natural Resources. 2013. *Best Management Practices for Preventing the Spread of Invasive Species When Working Around Water*. Queen's Printer for Ontario.

Ontario Ministry of Natural Resources. *Float Planes: Precautions to Avoid Spreading Aquatic Nuisance Species by Float Planes*. Accessed from: http://www.invadingspecies.com/stop-the-spread/float-planes/

State of Oklahoma Technical Report 05-157, July 2005. *Decontamination Protocol for Aquatic Nuisance Species*.

United States Forest Service Intermountain Region, October 2016. *INTERIM Operational Guidance: Preventing Spread of Aquatic Invasive Organisms Common to the Intermountain Region*. Interim Operational Guidelines for 2016 Fire Activities.

United States Forest Service, Technology & Development Project, February 2013. *Testing QUATernary Ammonium Products (aquatic invasive species decontaminants) for Corrosive Effects to Fire Equipment*.

United States Forest Service – Tables compiled by Cynthia Tate and Beth MacConnel.

Wagner, E.J., 2002. *Whirling Disease Prevention, Control, and Management: A Review*. American Fisheries Society Symposium 29:217-225

Wagner, EJ, Mark Smith, Ronney Arndt, Donald W. Roberts. 2003. *Physical and chemical effects on viability of the Myxobolus cerebralis triactinomyxon. Diseases of Aquatic Organisms. 53:133- 142*.

Wagner, Jim, W. Giamberardino, and D. DePape, September 2016. *Personal correspondence*. Alberta Environment and Parks.

APPENDIX A: DEFINITION OF TERMS

1. **Infected Zone:** Zone that immediately surrounds a location that has tested positive for whirling disease.
2. **HUC:** Hydrologic Unit Code (HUC) Watersheds of Alberta define hydrologic units that form a standardized baseline across Alberta. HUCs represent a collection of nested hierarchically structured drainage basins and consist of successively smaller hydrologic units that nest within larger hydrologic units. There are currently individual feature classes for HUC 2 (coarsest level), HUC 4, HUC 6, HUC 8 and HUC 10 (finest level). The HUC 6 Watersheds of Alberta represent a seamless basin-wide coverage that falls completely within the Hydrologic Unit Code 4 Watersheds of Alberta.
3. **Clean water:** Water not likely to be contaminated with whirling disease, which has typically been obtained off-site from a potable water supply.
4. **Hot water:** Water being used for decontamination purposes which is 90°C or hotter.
5. **Containment Mat:** A waterproof, chemically resistant ground cover that is designed to hold the hot water and disinfectant solutions used to disinfect equipment, vehicles and machinery. Mats are usually portable, leak proof, one piece systems large enough to accommodate a trailer with self-supporting sides to capture treatment water. Typically, two containment mats are utilized during decontamination: one mat for temperature treatment and a second mat for disinfectant treatment. A two mat system provides for the separation of hot wash water from disinfectant solutions for ease of containment and eventual disposal. Specifications: impervious containment mat material with lip height appropriate to items being decontaminated on mat (i.e., drive on/off ability for vehicles and trailers), drain protector – impervious (urethane) drain protector/seal, impervious dykes/pads (not filter socks)
6. **Watercourse or Waterbody:** Waterbody: Any location where water is present, whether or not the presence of water is continuous, intermittent or occurs only during a flood, and includes but is not limited to wetlands and aquifers. Watercourse: A river, brook, stream or other natural water channel (includes ephemeral draws), and the bed along which water flows continuously or intermittently. See Alberta Public Lands Glossary of Terms for definitions by following this link https://open.alberta.ca/publications/alberta-public-lands-glossary-of-terms

APPENDIX B: BEST MANAGEMENT PRACTICES FOR WILDFIRE MANAGEMENT EQUIPMENT DECONTAMINATION

Activities associated with workers preventing and managing wildfire is a possible source of aquatic invasive species (AIS) and fish disease introductions and spread. Firefighter and public safety is still the number one priority, but AIS and fish disease pose a significant risk to the environment. Avoidance and decontamination can prevent the spread of these organisms. Given that wildfire management and mitigation are considered emergency activities, the non-traditional types of equipment used for wildfire management, as well as the complexity and scope of the work, it was deemed most appropriate to adopt them as Best Management Practices, to be implemented whenever possible, instead of including them in the mandatory protocols for other GOA field staff. Mud and standing water are known vectors of spread for AIS and fish disease, so care should be taken during each use to minimize the risk of transfer.

The Risk Map shows the distribution of known whirling disease positive watersheds in Alberta (Red Zone), as well as those that are considered high risk or susceptible to AIS or fish disease (Yellow Zone). While the White Zone captures watersheds that are considered a lower risk than other locations in Alberta, care should always be taken to prevent the spread of AIS and fish diseases by ensuring equipment is CLEAN, DRAINED and DRY after each use.

PREVENTION PROTOCOLS

GROUND OPERATIONS

ALL ZONES

- CLEAN (remove organic material and mud as best as you can), DRAIN (drain all lake/river/ stream standing water from tanks and equipment after each use), and DRY (a minimum of 24 hours is ideal) all equipment that came into contact with water between each use.
- Avoid transferring water between watersheds or between unconnected waters within the same drainage. Do not dump water from one waterbody (i.e., stream, lake and reservoir) into another waterbody. Dispose of excess water over uplands.
- Use proper drafting and water handling procedures:
  - When possible, fill engines from a municipal hydrant, a water tender, or from a pump assigned to a single drafting source
  - To minimize the potential for engine water leakage through the foot valve, prime with water from the drafting source rather than water from the engine tank. Unit should carry a spare foot valve in case one leaks.
  - When priming by filling the drafting hose with a bucket, first make sure that the bucket is clean so that it does not transfer AIS or fish disease.
  - During drafting and water tending operations, do not leave draft hose full with foot valve engaged and submerged in water source when not pumping.
  - When filling the engine tank, avoid tank overflow into the water source.
- Use proper pumping and water handling procedures:
  - Elevate foot valves above the bottom of the waterbody for clean, sediment-free operation—for example, duct tape foot valve to a shovel or place the valve in a hardhat or bucket.

  - Remove water drain plug/s from self-priming pumps (i.e., trash pumps) to empty pump housing before moving to a new waterbody.
  - When done using pump, remove all mud and organic debris before subsequent use. This may be done by entering deeper water and cleaning mud off pump and foot valve. In particular, mud should be removed from equipment before it is used at any other site.
- When spraying water to suppress a fire, avoid application of untreated water into local water bodies (ponds, lakes, rivers, streams, wetlands, seeps or springs), especially if the hose water came from a different watershed.
- Avoid drafting from known whirling disease/AIS positive waterbodies.
- Avoid training (pump, engine, airtanker/helitanker practices) in whirling disease/AIS positive waterbodies.

RED ZONE

- If collapsible tanks can be filled with municipal water, draft from those tanks instead of untreated water sources.
- Avoid obtaining water from multiple sources during a single operational period unless drafting/ dipping equipment is decontaminated or changed out with clean equipment between sources.
- Use green 'Aquatic Invasive Species Risk' flagging tape to mark any ground equipment used in the 'Red Zone.'

YELLOW/WHITE ZONE

- "CLEAN, DRAIN, DRY" principles are strongly encouraged in both Yellow and White Zones.

AIR OPERATIONS

ALL ZONES

- Whenever possible, avoid operating from whirling disease/AIS positive waterbodies.

RED ZONE

- If possible, avoid dipping or scooping water from multiple water sources minimize cross-contamination of water sources.
- Whenever possible, use water dipped from the same watershed that it will be dropped.
- Use deeper (blue) water whenever possible. Avoid areas that will intake mud or plants.
- Switch out a contaminated helicopter bucket with a clean bucket before moving to a new water source. Alternating used (possibly contaminated) helicopter buckets with spare (clean) buckets can save time and increase efficiency, as the first bucket can be decontaminated while the second bucket is being used.
- Snorkel ends and foot valves that encounter untreated water must be decontaminated.
- Pumps, suction hoses, and foot valves must be decontaminated prior to being used outside of the Red Zone.

YELLOW/WHITE ZONE

- "CLEAN, DRAIN, DRY" principles are strongly encouraged in both Yellow and White Zones.

DECONTAMINATION PROTOCOLS

GROUND OPERATIONS

RED ZONE

- At the end of operations within the Red Zone, decontaminate all equipment (i.e., foot valves, suction hose, hand tools etc.). Three options are:
  - Dry the gear until dry to the touch (sunlight accelerates the process).
  - Use hot water (90°C), allow spray to contact surface for 5 to 10 seconds (up to 5 minutes preferred).
  - Use a disinfectant solution (Quaternary Ammonium Compounds (QAC). Surfaces can be decontaminated by submerging in a bucket for ten minutes filled with disinfectant.
- Consider carrying spare, clean dry draft hoses and foot valves to switch out with used ones when moving to a new water source.
- Hose gets melon rolled, flagged with green flagging tape and sent to the Provincial Warehouse

YELLOW/WHITE ZONE

- “CLEAN, DRAIN, DRY” principles are strongly encouraged in both Yellow and White Zones.

AVIATION

Out of province import aircraft

- When importing helitankers, helicopters with buckets, or skimmer airtankers, from out of province, or when these aircraft are returning to Alberta, they must be thoroughly decontaminated (temperature treated) and dried prior to being utilized in Alberta waterbodies.
- Decontamination of these aircraft is not required for quick strikes into neighboring jurisdictions unless directed by the provincial aircraft coordinator.
- For skimmer airtankers, the Forest Area Duty Officer, with guidance from the Provincial Aircraft Coordinator, will arrange for a steam truck to be on-site upon the aircraft’s arrival.
- Helicopter companies are responsible for decontaminating their tanks and buckets prior to being utilized in Alberta waterbodies.

Figure 14: *Decontaminating a float plane*

RED ZONE

- Disinfectants such as bleach and Quaternary Ammonium Compounds (QAC) do not meet corrosion requirements for aluminum and **shall not be used on aircraft fuselages or water delivery components such as helicopter buckets and foot valves**.
- When contact with untreated water has occurred or is suspected, decontamination is needed.
  - Flush with uncontaminated water and dry the gear until dry to the touch (sunlight accelerates the process).
  - Use hot water (90°C), allow spray to contact surface for 5 to 10 seconds (up to 5 minutes preferred).
- Decontaminate internal tanks by spraying the internal surface with hot water (90°C). Allow spray to contact surface for 5 to 10 seconds (up to 5 minutes preferred). This method is recommended for scooper and Fire Boss aircraft. Tanked helicopters have tank doors that open widely from below for easy tank access and draining. Hot water spray or thoroughly dry these surfaces. A steam truck may also be used.

YELLOW/WHITE ZONE

- “CLEAN, DRAIN, DRY” principles are strongly encouraged in both Yellow and White Zones.

APPENDIX C: BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND FORESTRY WATER PUMPING PROGRAM EQUIPMENT DECONTAMINATION

Water pumping activities associated with drought mitigation and emergency response (flood, fire, drought, etc.) is a possible source of AIS and fish disease introduction and spread. Emergency response personnel and public safety is still the number one priority, but whirling disease and AIS pose a significant risk to the environment. Avoidance and decontamination can prevent the spread of these organisms. Given that water pumping equipment is often used in emergency situations, the large-scale equipment used, as well as the scope of the work, it was deemed most appropriate to adopt them as Best Management Practices, to be implemented whenever possible, instead of including them in the mandatory protocols for workers. Mud and standing water are known vectors of spread for AIS and fish disease, so care should be taken during each use to minimize the risk of transfer.

The Risk Map shows the distribution of known whirling disease positive watersheds in Alberta (Red Zone), as well as those that are considered high risk or susceptible to whirling disease (Yellow Zone). While the White Zone captures watersheds that are considered a lower risk than other locations in Alberta, care should always be taken to prevent the spread of AIS and fish diseases by ensuring equipment is CLEAN, DRAINED and DRY after each use.

PREVENTION PROTOCOLS

NON-EMERGENCY OPERATIONS (INCLUDES FILLING OF DUGOUTS FOR AGRICULTURAL USE)

ALL ZONES

- CLEAN (remove organic material and mud as best as you can), DRAIN (drain all lake/river/ stream/dugout standing water from pump, pipe and equipment after each use), and DRY (a minimum of 24 hours is ideal) all equipment that came into contact with water between each use.
- Avoid transferring water between watersheds or between unconnected waters within the same drainage. Do not transfer water from one natural waterbody (i.e., stream, lake, and reservoir) or irrigation canal into another natural waterbody or irrigation canal.
- Dispose of excess water over uplands where the runoff doesn't directly drain into a waterbody; it either evaporates or seeps into the ground.
- When transferring water between natural waterbodies or irrigation canals and dugouts/ reservoirs containing fish, ensure all equipment (intake, hose, pump, pipe, etc.) has not been used in a Red Zone
  - If equipment has been used in a Red Zone, it must be decontaminated before use
  - Use proper pumping and water handling procedures:
  - Drain water from primer and drain pump housing before moving to a new waterbody.

When done using equipment, remove all mud and organic debris before subsequent use. This may be done by entering deeper water and cleaning mud off intake screen and intake pipe. In particular mud should be removed from equipment before it is used at any other site.

Figure 15: *Example of a set up that may require decontamination after drawing water*

Figure 16: *Example of irrigation equipment that may require decontamination*

RED ZONE

- Avoid obtaining water from multiple sources during a single operational period unless intake pipe and hose is decontaminated or changed out with clean equipment between sources.
- All equipment must be decontaminated prior to being used outside of the Red Zone.
  - Consider segregating equipment that has been used in the Red Zone to only be used in Red Zone areas for the remainder of the season

YELLOW/WHITE ZONE

- "CLEAN, DRAIN, DRY" principles are strongly encouraged in both Yellow and White Zones.

EMERGENCY OPERATIONS (FLOOD, FIRE, DROUGHT)

ALL ZONES

- Whenever possible, avoid operating from whirling disease/AIS positive waterbodies.
- Change footwear, waders, etc. on high ground
- Use proper pumping and water handling procedures:
  - Drain water from primer and drain pump housing before moving to a new waterbody.
  - When done using equipment, remove all mud and organic debris before subsequent use. This may be done by entering deeper water and cleaning mud off intake screen and intake pipe. In particular mud should be removed from equipment before it is used at any other site.

RED ZONE

- If possible, avoid pumping water from multiple water sources to minimize cross-contamination of water sources.
- Use deeper water whenever possible. Avoid areas that will intake mud or plants.
- If possible, switch out a contaminated intake pipe and hose with a clean intake before moving to a new water source. Alternating used (possibly contaminated) intakes with spare (clean) intakes can save time and increase efficiency, as the first intake can be decontaminated while the second intake is being used.

YELLOW/WHITE ZONE

- "CLEAN, DRAIN, DRY" principles are strongly encouraged in both Yellow and White Zones.

DECONTAMINATION PROTOCOLS

NON-EMERGENCY OPERATIONS (INCLUDES FILLING OF DUGOUTS FOR AGRICULTURAL USE)

RED ZONE

- At the end of a pump job within the Red Zone, before leaving the site:
  - Clean off all mud and debris and drain all equipment (pumping and personal)
  - Spray down any surfaces that were in contact with mud or water (intake pipe, hose, pump,) from contaminated waterbody with QAC solution using a hand pump/backpack sprayer
  - Surfaces of small equipment (boots, etc.) can be decontaminated by submerging in a bucket/ container filled with QAC solution for ten minutes.
- After completion of a pump job, decontaminate all equipment (either at site or after transferring to regional storage location)
  - For pumping equipment (i.e., intake pipe, hose, pump, pipe etc.), leave out until dry to the touch (sunlight accelerates the process.).
  - Launder all clothing that was in contact with contaminated water in hot water
- Consider keeping spare, clean dry intake pipe and hose on hand to switch out with used ones when moving to a new water source.
- Consider segregating equipment that has been used in the Red Zone to only be used in Red Zone areas for the remainder of the season.
- After pumping season is complete (fall/winter), all pumping equipment must be decontaminated by completely drying and exposed to freezing (i.e., outside winter storage)
- Before leaving Red Zone (and entering Yellow/White):
  - Remove gaskets to allow for decontamination either by submerging in a bucket/container filled with QAC solution for ten minutes, or
  - Complete drying (sunlight accelerates the process).

YELLOW/WHITE ZONE

- "CLEAN, DRAIN, DRY" principles are strongly encouraged in both Yellow and White Zones.
- After pumping season is complete (fall/winter), all pumping equipment must be decontaminated by completely drying and exposed to freezing (i.e., outside winter storage)

EMERGENCY OPERATIONS (FLOOD, FIRE, DROUGHT)

RED ZONE

- If possible, clean off all mud and debris and drain all equipment before leaving the site.
- If possible, dry all equipment (sunlight accelerates the process) before moving to another site.

YELLOW/WHITE ZONE

- "CLEAN, DRAIN, DRY" principles are strongly encouraged in both Yellow and White Zones.

APPENDIX D: DECONTAMINATION INSTRUCTIONS FOR INDUSTRIAL AND CONSTRUCTION OPERATIONS

The Decontamination Protocol for Watercraft and Equipment supports the provincial **Fish Conservation and Management Strategy**. Fisheries are a crown resource and the Government of Alberta's primary goal is to ensure the conservation of healthy, productive fish habitats and sustainable fish populations. By following the protocol when working in or near water, we are taking some of the most effective steps to reduce the spread of whirling disease and other aquatic threats.

Note: These instructions are intended to reduce the risk of Aquatic Invasive Species (AIS) and whirling disease both of which have potential detrimental impacts on Alberta's wildlife, infrastructure and recreational opportunities.

Prevention

1. Be aware of the risk of whirling disease in the watercourse or waterbody[1]. The Whirling Disease Risk Zone Map (https://www.alberta.ca/stop-whirling-disease.aspx) illustrates the areas of high (Red[1]), medium (Yellow[1]) and low (White[1]) risk.
2. Avoid entering the bed and the banks of a watercourse or waterbody[1] whenever possible, if you do not enter the bed and banks, decontamination is not necessary. Use equipment, vehicles and machinery on dry ground as much as possible to minimize work in water. Reach into the waterbody with as few parts of the equipment as possible.
    a. **Note:** the use of mats/temporary bridges could create additional mechanisms for AIS and whirling disease to be transferred and will need to be decontaminated after use.
3. Proper disposal of contaminated items and decontamination products: Appendix F.
4. When working in the Red zone, complete work from upstream to downstream to reduce the risk of transferring whirling disease or AIS upstream.
5. If work involves moving between a Red zone (infected zone[1]) and a non-Red zone (yellow or white), attempt to complete work in the non-Red zone first to reduce the risk of spread.
6. Use dedicated footwear for work in water and never wear this contaminated footwear inside a vehicle, or machine. Change footwear on dry ground and keep it isolated until it is decontaminated.
7. Sediment, vegetation or water originating from a waterbody in the Red zone should not be transported outside the Red zone.
8. Do not transfer/dump water between watersheds or between unconnected waterbodies. Disposal or use of water should be done upland in an area that has been isolated to prevent drainage to any surface waterbodies, wetlands, or sewer or storm drainage.

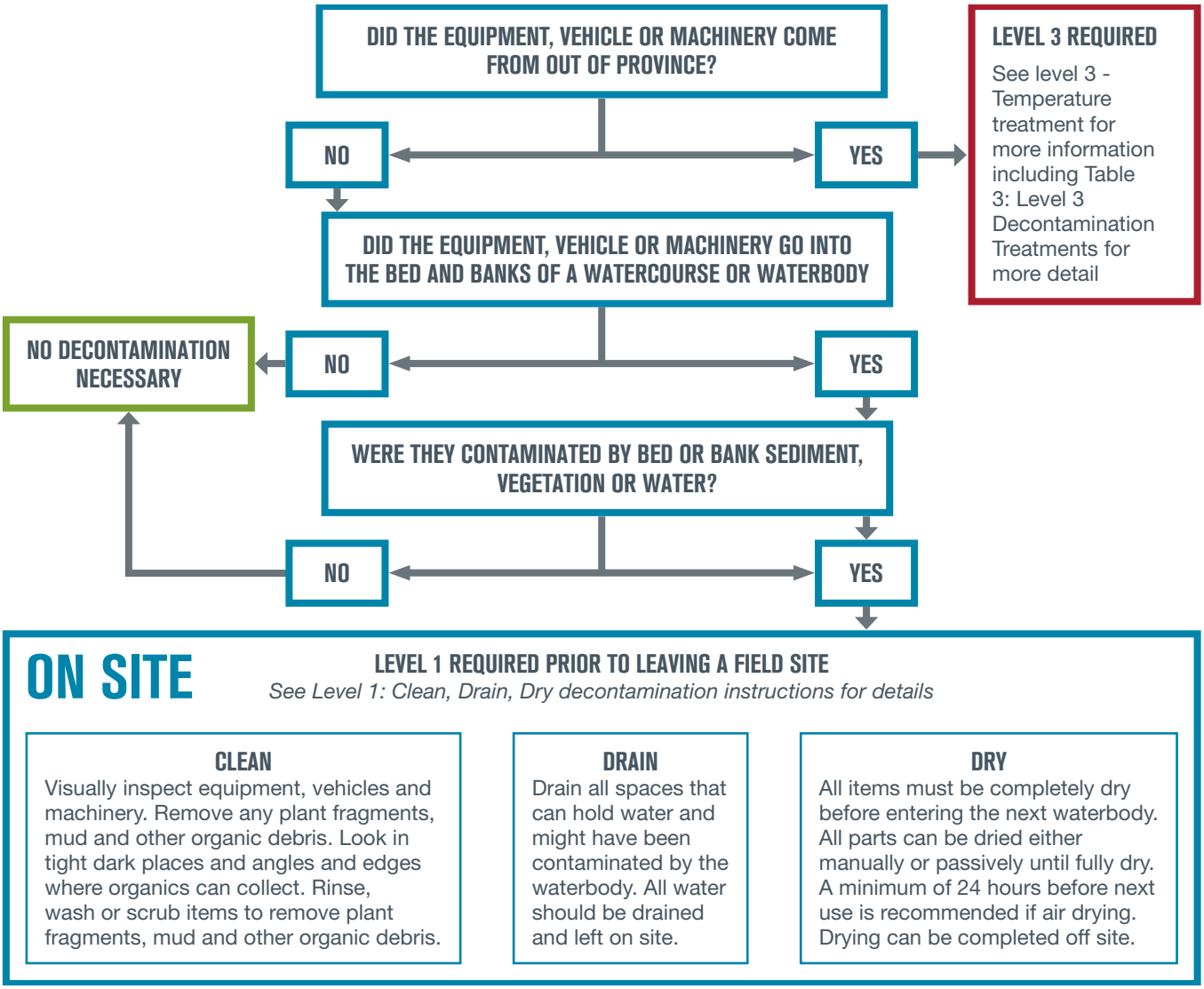
Decontamination

1. Follow the Decontamination Flow Chart for instructions on when and how to decontaminate.
    a. For detailed descriptions on methods see the appropriate sections in the Decontamination Protocol that are referenced in the flow chart:
2. For a sample list of equipment, vehicles and machinery, review the Decontamination Equipment List on the Stop the Spread website.
3. A template of a "Decontamination Record" form can be found in Appendix I. The intent of the form is for tracking decontamination efforts.

1. The definitions can be found in Appendix A

Figure 17: *Decon technician cleaning a piece of heavy equipment to complete a level 1 decontamination*

Decontamination Flow Chart for Industrial and Construction Users



APPENDIX E: CHEMICAL TREATMENTS

- Quaternary Ammonium Compounds (QAC) are common cleaning agents used in homes and hospitals, and are safe for MOST gear and equipment when used at recommended concentrations and rinsed.

  NOTE: QAC products can cause corrosion when used on aluminum. Alternative cleaning methods should be utilized for aluminum equipment.

- Chlorine products are not recommended for use in these protocols because of their corrosiveness to fabrics, plastics, rubber, and metal and their limited effectiveness against snails.

Approved Products

- Of the Quaternary Ammonium Compounds (QAC) available, 'QUAT Plus' (Dustbane) has been found to be most effective against whirling disease and AIS, at concentrations no lower than 1500 ppm. This is the product recommended for use in Alberta for activities however; there are other options as listed in the table.
- QAC compounds are toxic to aquatic organisms but are immobile in soil.
- Keep effluent containing this product at least 30 m from lakes, ponds, streams or other waters.

Table 5: Available QAC's and Manufacturer's Concentrations

BRAND NAME	MANUFACTURER	QAC ACTIVE INGREDIENT(S)	QAC CONCENTRATION (AS SUPPLIED)
QUAT Plus*	Dustbane	n,n-dialkyl –n, n-dimethyl ammonium chloride	4.8%
QUAT Plus M5	Dustbane	n,n-dialkyl –n, n-dimethyl ammonium chloride	7.7%
Vanguard	Dustbane	Didecyl dimethyl ammonium chloride n-alkyl; dimethyl benzyl ammonium chloride	2.88% 1.92%
Pinosan	Dustbane	Didecyl dimethyl ammonium chloride n-alkyl; dimethyl benzyl ammonium chloride	1.44% 0.96%
QUAT 128	Sanicare	Didecyl dimethyl ammonium chloride Dimethyl benzyl ammonium chloride	5.07% 3.38%
SparQUAT 256	Spartan Chemical	Dialkyl dimethyl ammonium chloride Alkyl dimethyl benzyl ammonium chloride	5-10% 5-10%

*Recommended Product (AEP)

Recommended Concentration and Dilutions

The recommended concentration of active ingredient for QAC compounds (listed above) is 1500 ppm. The dilution rate for QAC compounds will be specific to the brand name and the concentration of active ingredient in that product.

The dilution rate can be calculated by:

- Convert the percent active ingredient identified from the label or MSDS sheet for the product into ppm by multiplying the % times 10,000 (i.e., QUAT Plus: 4.8% active ingredient X 10,000 = 48,000 ppm).
- To determine the dilution rate to obtain the desired concentration of 1500 ppm of active ingredient, divide the ppm obtained above by 1500 ppm. Using QUAT Plus as the recommended product, this would result in a dilution rate of 32 (i.e., 48,000 divided by 1500 = 32). To make up a stock solution this would require diluting one liter of QUAT Plus with 31 liters of clean water to yield 32 liters of stock solution at a concentration of 1500 ppm.

> **Note:** These calculations assume no organics present and no interference(s) from other chemicals/minerals in the dilution water. Solutions should be tested with QAC test strips initially to confirm concentrations and dilution rates.

Table 6: Common dilution rates for use with QUAT Plus

QUAT PLUS 4.8 % (LITERS)	WATER (LITERS)	CONCENTRATION
2	62	1500 PPM
1	31	1500PPM
0.5	15.5	1500PPM
0.25	7.25	1500PPM
0.125	3.625	1500PPM
4	62	3000PPM
2	31	3000PPM
1	15.5	3000PPM
0.5	7.25	3000PPM
0.25	3.625	3000PPM

APPENDIX F: DISPOSAL OF PRODUCTS AND ITEMS

Disposal of Single-Use Items

A number of items that are used in these protocols are considered disposable either due to the difficulty in adequately disinfecting them or because of their insignificant purchase cost. These items include:

- Boot covers and single-use laboratory coveralls
- Wet wipes, or paper “shop towels”
- Bags for contaminated gear
- Single use gloves

This material must be secure and double bagged in heavy duty garbage bags (leak and tear resistant) and dispose of these materials in a safe location (i.e., municipal waste management) away from water.

Incineration is also an option for disposal.

Disposal of Disinfection Solutions

- Small quantities of diluted QAC products may be disposed of in a sanitary sewer if indicated on the product label or MSDS sheet.
- Always consult the product label in determining the appropriate Personal Protective Equipment (PPE) necessary for the mixing and use of these disinfectants, and for final direction on a given products use and disposal.
- Do NOT allow these products to enter storm drains, lakes, streams, or other waterbodies.
- Some products may be allowed to be disposed of into municipal waste systems in accordance to municipal, provincial, and federal regulations, please review and print applicable MSDS sheet for products.

On-Site Product Disposal (Level 2)

The disposal of QAC used for Level 2 for on-site decontaminations. Note that it is important to also check with legislative requirements for disposal of contaminated water to ensure that you are in compliance.

- Volume limitations: Follow label rate, mixing instructions and dilution rate of product (See Appendix E, Table 6: Dilution rates.) Use care in applying decontamination solution to minimize runoff.
- Large equipment decontamination runoff concerns: applied to equipment in the following areas over dry bare ground such as concrete or asphalt surfaces, or gravel or vegetated areas away from surface water, ditches, or storm drains. No containment mats are necessary if no surface drains are present.
  - Prevent off-site runoff using containment mats and surface drain protection, when the above criteria cannot be met.
  - Water body proximity buffers–decontamination not to be conducted on boat ramp or ramp approach/setup areas–flat, level area a minimum of 30 m from water and with no slope towards water.
  - Restricted/sensitive areas–Avoid decontamination activities in these areas: low-lying, non- level, surface drainage present to water body, standing water present, and sandy soils.
  - Containment mats – when using, collect water for transport back to warehouse for consolidation and disposal.
- Equipment decontamination soak – tubs/pails: not to be disposed of on-site.
  - Return to warehouse/operations facility for consolidation and disposal. These larger quantities must be disposed of properly.
  - Do not allow decontamination solution to enter storm water drains or floor drains.

- Contact local wastewater treatment facility for disposal authorization for used decontamination solution (volumes, concentrations, and point of disposal information likely required). Determine disposal for larger volumes of decontamination solution that must be determined on a site- by-site basis depending on location and wastewater treatment options.

Off-Site Product Disposal (Level 3)

It is the responsibility of the generator of the wastewater to ensure proper disposal of their wastewater. This would include receiving consent of the ultimate wastewater treatment provider. Individual wastewater treatment plants are responsible for ensuring that what gets discharged to their system can be appropriately treated – they can restrict what enters the wastewater system through municipal sewer bylaws. The wastewater treatment providers are also in better position to investigate and determine if a particular waste can be managed/treated by their system or not.

Regarding smaller municipalities who may not have the same wastewater expertise as a large municipality–the generator should err on the side of caution and should not assume that smaller municipal wastewater systems can treat their waste appropriately.

APPENDIX G: DECONTAMINATION KIT – RECOMMENDED CONTENTS

Cleaning And Disinfectant Supplies

1. Two plastic (no wooden components), nylon stiff bristle brushes (two sizes, one small hand scrub brush, a second larger, long handled brush for exterior/interior of watercraft, trailers and trucks);
2. Three 100 L rigid plastic totes with tight fitting lids (or equivalent) to be used as follows: (1) for cleaning of equipment, (1) for disinfectant bath, (1) clean water rinse of equipment. Alternatively, the tubs can be used as a secure container for transporting equipment to decontamination hub; note, do not use the third, clean water rinse tub for transporting contaminated gear.
3. Pump-style liquid sprayers–hand-pump and back-pack style sprayers work well (typically labelled as suitable for use with chlorine);
4. Zepp® instant hand sanitizer (or equivalent);
5. Test strips for measuring concentration of QAC in the field;
6. Measuring container marked out in liter increments for use with QAC;
7. Pail marked out in liter increments for filling plastic disinfecting containers. Alternatively, mark solution levels directly onto plastic totes.
8. 4L Jug of Quat Plus

Personal Protective Equipment

> **Note:** Please review and reference individual manufacturers MSDS and SDS sheets for appropriate safety equipment and precautions for use.

1. Shoulder length, chemical resistant gloves (disposable preferred): Neoprene, rubber, polyvinyl chloride, Vitron or nitrile;
2. Chemical resistant apron or Tyvek® suit, in case of spill;
3. Waterproof, chemical resistant foot wear (rubber boots);
4. Eye protection: safety glasses with side shields, which protect from splash.
5. Portable eyewash containers.

APPENDIX H: MSDS SHEET FOR QUAT

NOTE: Comprehensive Safety Data Sheet for QUAT PLUS can be found at: http://www.dustbane.ca/sds/Quat-Plus.pdf

Government of Alberta

Decontamination Record

This template can be used to document and track decontamination efforts. Organizations may adapt this template for their use, however; the information from this template is required.

TRACKING INFORMATION			
Date:		Tracking number:	
Company:			
Contact name, location and contact number:			
Project title:			
Activity description:			
HUC 6 or waterbody name(s):		Risk zone:	☐White ☐Yellow Red
Location (ATS, Lat/Long, Address):			

EQUIPMENT INFORMATION						
Mobilize (in) Date	**Demobilize (out) Date**	**Item (general) and unit number**	**Highest decontamination level***			**Initials**
			☐1	2	3	
			1	2	3	
			1	2	3	
			1	2	3	
			1	2	3	
			1	2	3	

	INITIALS & SIGNATURES	CLOSE OUT DATE
Contractor:		

* Highest decontamination level definitions are found in *Decontamination Instructions for Construction and Industrial Operations*

APPENDIX I: DECONTAMINATION RECORD TEMPLATE

EQUIPMENT INFORMATION						
Mobilize (in) Date	**Demobilize (out) Date**	**Item (general) and unit number**	**Highest decontamination level***			**Initials**
			☐1	2	3	
			☐1	2	3	
			☐1	2	3	
			1	2	3	
			☐1	2	3	
			☐1	2	3	
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			☐1	2	3	
			☐1	2	3	
			☐1	2	3	
			☐1	2	3	
			☐1	2	3	
			☐1	2	3	

COMMENTS OR NOTES

* Highest decontamination level definitions are found in *Decontamination Instructions for Construction and Industrial Operations*


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