Annex II

Conceptual Engineering Design

Contents

BIG EDDY HYDRO PROJECT
CONSTRUCTION MANAGEMENT PLAN
(CMP)

PART A – General Project Requirements
PART B – Big Eddy Hydro Projects Construction Details

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AUTHENTICATION

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PART A

GENERAL PROJECT REQUIREMENTS

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1 GENERAL CONSTRUCTION ENVIRONMENTAL CONSIDERATIONS

1.1 Wildlife

Construction may affect wildlife through sensory disturbance, movement restriction and habitat alteration. Some parts of the construction period will be busier than others and road upgrades for construction traffic may improve year-round access and alter existing wildlife habitat and behaviour. Some species may be temporarily displaced from their habitat for short periods during the construction phase.

Important habitats, including riparian areas, wetland complexes, unstable slopes, and protected tree species, have been avoided where possible. Activities will be scheduled to avoid sensitive nesting, rearing, mating, or staging periods wherever possible.

All food and food waste will be properly stored and disposed of to prevent attraction of wildlife to the site.

Equipment and vehicles will yield the right-of-way to wildlife. All Project personnel will use proper care and caution when operating vehicles to avoid collisions with wildlife. A log of wildlife sightings will be kept at the Project office to aid the construction personnel in determining more active wildlife areas. Using the sightings log, traffic measures such as crossing signage and reduced speed limits will be implemented.

1.2 Fish and Fish Habitat

All foreseeable adverse effects on fish and fish habitat are being considered in the EA phase of this Project. Adverse environmental effects on fish and fish habitat may include:

- Dewatering during construction (fish salvage);
- Reduction in water quality;
- Increased erosion and sedimentation in the watercourse;
- Disturbance of fish spawning and rearing habitat at sensitive times;
- Toxic contamination (from concrete, grout, fuel or hazardous material spills);
- Removal of riparian vegetation (effects on water temperature); and
- Physical disturbance of stream beds and habitat.

General environmental protection measures include:

- Construction planning to avoid or mitigate adverse environmental effects;
- Environmental monitoring to ensure that predicted conditions are, in fact, accurate;
- In-stream work constraints (work windows or other controls to limit the significance of adverse effects at sensitive times);
- Identification and relocation of fish stranded by dewatering;
- Following industry Best Management Practices (BMPs) for environmentally sensitive work (see need BMP reference);
- Adherence to legislation, regulation, and approval terms and conditions (compliance);

- Erosion and sedimentation controls in place, effective, and monitored;
- Fuel and hazardous materials management in place, effective, and monitored;
- Prompt and effective spill response; and
- Prompt and effective clean up and restoration once construction is complete.

The Project was designed to minimize the adverse effects, including maintenance of minimum in-stream flows. Compensation works will be built to improve fish habitat elsewhere to compensate for the project physically occupying a defined amount of habitat.

1.3 Heritage and Archaeological Sites

Archaeological sites and objects, such as buried structures, stone tools, graves, paintings, or surface features such as culturally modified trees may be encountered during construction activity. These features represent valuable cultural resources, and uncontrolled disturbance could result in loss or damage to these resources and the valuable information represented by them.

Inventory surveys completed during the planning and approvals phase of the Project may have indicated a low probability of the presence of any significant archaeological or heritage resources in the Project area, but these surveys do not preclude archaeologically significant resources from being found. If archaeological or heritage resources are discovered during clearing or construction, work will be stopped until an archaeologist has assessed the find and a course of action is determined. A step-by-step Discovery Protocol will be prepared and implemented for project construction.

1.3.1 Culturally Modified Trees (CMT)

Trees may be altered in several ways by humans; for example, by notching, felling, carving, cutting, or stripping bark. Trees modified by aboriginal people are known as “culturally modified trees.” They are protected under the Heritage Conservation Act.

There is no simple method for identifying a CMT. Most identification involves matching the observable characteristics of an altered tree suspected of being a CMT with those listed for the different types of CMTs already identified by First Nations or archaeologists.

Workers will be advised to follow the Discovery Protocol and to notify their supervisor immediately for instructions if they encounter any trees they suspect may have been culturally modified. It is an offence to cut down a CMT unless it is a danger tree liable to fall on its own. The local First Nations and the Ministry of Natural Resources (MNR) will provide assistance. The management of cultural heritage values in forestry operations, including the best management practices and applicable legislation, are discussed in the MNR publication “Forest Management Guide for Cultural Heritage Values”[1].

1.4 Public Access During Construction

Where there was public use of the project area for recreational purposes including kayaking, canoeing, fishing and hiking, a bypass portage route will be created and maintained to re-

[1] Ontario Ministry of Natural Resources, Forestry Branch. Forest Management Guide for Cultural Heritage Values. 2007.

establish continuity of access between the areas upstream and downstream of the project. The route will be properly signed to keep users on the trail. The portage will be sized for non-motorized traffic only.

Public access to the immediate project area will be controlled during construction for the safety of the public and project personnel. A combination of fencing and signage will be used to advise the public of areas that are under construction and not accessible.

1.5 Existing Site Conditions

The site may have been used for previous activities including guiding, outfitting, logging, mineral exploration, or mining which may have residual impacts on the land. Often, evidence of such activities will only be uncovered once clearing or grubbing starts, or field workers do a walk-through of the proposed Project areas. Abandoned or forgotten sites may be contaminated by materials hazardous to personnel and/or the environment, such as chemicals, asbestos, fuel, explosives, or human waste.

Before site preparation and construction activities commence, the Proponents site manager and contractors will conduct a site assessment to identify if any conditions exist that may present an environmental or safety concern. Assessments will continue routinely during construction activities.

1.6 Weather and Water

High flows and debris torrents can occur in the watershed. Project personnel will check weather forecasts and endeavour to anticipate approaching storms that may affect the Project. The Project areas site drainage will be designed to handle appropriate return-period flood events.

Should it become obvious that a storm is approaching, immediate plans should be made to adjust work schedules to protect personnel, re-schedule vulnerable tasks and facilities, manage adverse effects on the Project and the environment, and prepare for excess runoff.

During storms, sedimentation, debris, and in-stream flows will be naturally high in the watershed. Personnel, tools, equipment, and supplies will be made as safe and secure as possible before the storm arrives. Vulnerable sites will be protected with lock blocks or cofferdams. Exposed building sites will be protected with tarpaulins or temporary sheeting. During and/or immediately after any major storm all facilities and work sites will be inspected for damage and repairs will be conducted as required. Roads and work sites may require immediate repair or upgrading, such as culvert replacement or roadside ditching, during or immediately following a major storm. Such work will be done as soon as it is safe to do so.

1.6.1 In-Stream Work

In Ontario, the obligation of protecting streams and stream habitat during in-stream work is explained in the *Lakes and Rivers Improvement Act* of Ontario administered by the MNR. When working in or around a stream, Project personnel will ensure that:

- The timing window or the period of time in the year during which in-stream work can proceed with significantly reduced potential for harm to fish, wildlife, or habitat is respected;

- The minimum in-stream flow that must remain in the stream during the work is maintained;
- No substance, sediment, debris or material that could adversely impact the stream is allowed to enter into the stream from any construction activity, or is placed, used or stored within the stream channel;
- No standards or objectives published under the *Environment Management Act* of Ontario administered by the Ministry of Environment (MoE) for the protection of ambient water quality are exceeded or not attained now or in the future due to the work;
- There is no disturbance or removal of stable natural materials and vegetation in a stream that contribute to stream channel stability and habitat except as authorized under the regulations and in accordance with terms and conditions specified by the habitat officer;
- An approval for the work has been obtained from Federal Department of Fisheries and Oceans (DFO); and
- Fish or wildlife are relocated as required during the work and after the work has been completed.

Temporary diversion works will be constructed either around or through the work site to allow the construction of Project components such as the headworks, weir or powerhouse to proceed in dry conditions. Cofferdams will be designed by a Professional Engineer at a suitable flood return period and will be constructed in accordance with that design.

1.6.2 Drainage and Erosion Control

Activities associated with the construction phase of the proposed development that have the potential to adversely affect fish species and habitat include:

- Introduction of sediment into watercourses that supply known fish habitat downstream from the site;
- Introduction of sediment into the watercourse as a result of mass-wasting;
- Alteration or blockage of in-stream flow;
- Loss of riparian vegetation and bank cover, increasing the possibility of bank erosion; and
- Indirect disturbances of spawning activities or sites through careless water crossing, excavation, transportation, or installation of sediment control measures.

The following general principles will avoid, prevent, or limit the environmental effects of sedimentation:

- Clearing will take place as close as practical prior to excavation and earthworks to minimize the length of time that soils are exposed;
- Where vegetation is cleared in the year prior to excavation and earthworks, the forest litter and root cover will be left in place until the soil cover is stripped at the time of excavation;
- Grubbed soil and forest litter material will be stored either in small piles or windrows next to the earthwork area or in a central soil storage pile if one is designated for the site;
- Grubbed material will be used where possible and to the extent available to restore and top dress excavated areas where desirable, including ditches and site areas that are not required for vehicle access after construction;

- Riparian areas will be cleared as per the drawings and at the very minimum to enable work to proceed safely;
- Vehicles and equipment access will be restricted to the minimum area necessary;
- Vegetation in adjoining areas will not be disturbed;
- Temporary control measures such as silt fencing, drains, settling basins and pumping systems will be installed as needed;
- Erosion-prone slopes will be stabilized and re-vegetated if permanent. Temporary slopes will be cordoned off with silt fencing or covered with geotextiles and/or coco mats, especially when in close proximity to fish bearing streams;
- Vegetation identified for protection (e.g., mature trees and potential wildlife trees) will be left intact and root systems undisturbed wherever possible;
- Any piles of topsoil and silty material (rock and rip-rap excluded) formed due to construction will be placed a minimum of 20 m from any watercourse and in a location where erosion back into the watercourse cannot occur and will not impede any drainage; and,
- Excavation will be stopped during intense rainfall events or whenever surface erosion occurs affecting a fish-bearing watercourse. Silt fencing and/or other erosion protection measures will be implemented, checked, and/or repaired in anticipation of intense storm events.

1.7 Fuels, Oils and Lubricants

Storage and handling of petroleum products, fuels, oils and lubricants, many of which are flammable, will comply with industry best practices and regulatory requirements. The storage and handling of flammable substances must comply with:

- The Occupational Health and Safety Act, Part 4 – Toxic Substances, administered by the Ontario Ministry of Labour (MoL):
- Environmental Code of Good Practice for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products (CCME);
- Environmental Code of Practice for Above Ground Storage Tank Systems Containing Petroleum Products (CCME); and
- National Fire Code (National Research Council).

A stand alone Spill Response Plan will be prepared for the project and posted at the site construction office and fuel storage and handling locations.

All supervisory personnel will be trained in, and be aware of, the requirements of the Workplace Hazardous Materials Information System (WHMIS) program and specific requirements for transportation of dangerous goods.

Material Safety Data Sheets (MSDS) will be kept on site at all times for any hazardous substances and their location will be made known to all workers entering the site. All workers shall review the MSDS before working with any hazardous substances.

In addition to good housekeeping and material management methods, the following practices will be implemented for spill prevention and clean up:

- All hydrocarbon fuels, oils, and lubricants will be stored in a secondary containment area;
- All vehicle fuelling will occur in one location, a minimum of 30 m from a watercourse and where site grading and spill response equipment will be established to contain spillage;
- Drip pans will be installed on equipment to intercept minor leaks;
- Locations of spill prevention and clean up materials will be made known to all workers involved in these activities;
- Sumps will be installed including an oil trap to prevent contaminated water from being pumped into a water course; and
- Absorbent mats and other spill response equipment will be readily available for deployment.

All fuel or lubricant contaminated materials will be collected and trucked to an approved regional disposal facility, or will be treated with in situ bio-remediation techniques approved by the Proponent and Regulators.

Since impacts from spills can generally be minimized if appropriate actions are implemented promptly, all spills of fuel or noxious materials will be reported immediately to Project management and environmental monitors. Spills will be handled according to the following procedures:

- Construction activities will be suspended in the immediate vicinity of the spill;
- Appropriate methods will be determined for the removal or restoration of contaminated soils or other natural materials;
- Soils and vegetation heavily contaminated with petroleum products will be collected and disposed of at an approved facility;
- Spill site will be flagged or otherwise marked to enable post-construction monitoring; and
- Lightly contaminated areas where restoration is feasible will be fertilized and then cultivated to a depth below the depth of contamination. This process will be repeated as required.

1.8 Solid Waste

The construction activities will generate waste from various sources, such as packaging from delivered equipment, off-cuts from wood form construction, used formwork, packaging and remains from consumable materials, and organic waste from worker meals. This waste is generally referred to as solid waste and if not properly controlled, may be unsightly and potentially pose human health and safety concerns. In addition, some solid wastes may attract wildlife to the Project site, putting the health and safety of wildlife and humans at risk.

No trash, litter, or waste materials will be left on or around the work site. Appropriate disposal containers will be available for the prompt disposal of waste. Contractors will be responsible for cleaning up waste materials as soon as possible after they are created and full disposal containers will be removed to the appropriate waste disposal facility on a regular basis.

Organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards.

1.9 Fire

Fire, whether natural or caused by construction activity, could cause serious damage to the natural environment, the Project facilities, and/or threaten worker health and safety.

Construction or other activities could start a wildfire in the surrounding forest. Temporary construction facilities such as office trailers, construction material, petroleum, oil and lubricant stockpiles, other items and equipment could accidentally catch fire. Wildfires started elsewhere could approach the construction site.

Project personnel will prepare and will be familiar with the site Fire Preparedness Plan. Fire-fighting equipment will be available to all workers and the location of such equipment will be outlined in the Fire Preparedness Plan. Locations of equipment and muster points in case of fire will be advertised as necessary around the site. Project personnel will also be familiar with fire-fighting techniques and the use of the supplied equipment.

Un-controlled fires will be immediately reported to the nearest fire emergency service and to the MNR in the case of an un-controlled fire on Crown Land.

Smoking will only be permitted in designated smoking areas and disposal of all waste will be into proper waste containers to prevent fires. Fire extinguishers will be available at designated smoking areas and will be inspected on a regular basis.

1.10 Dust Control

Un-controlled dust reduces visibility and air quality, and thus may adversely affect worker health, fish habitat, and wildlife habitat.

Project personnel will control dust at work sites and on roadways when it is warranted by the conditions. A water truck or alternate method will be used to suppress dust on all Project roads and work sites when required during dry and dusty conditions. Efforts will be made to implement dust control techniques prior to reaching critical conditions. Trucks will be required to use dust covers when they are routed through populated areas.

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2 GENERAL CONSTRUCTION ACTIVITIES & PROTECTION MEASURES

2.1 Vegetation Clearing

Trees cut in the headpond area, inside the transmission line right-of-way and wherever else possible, will have their roots left intact. Merchantable timber will be decked for removal by the Sustainable Forest Licence (SFL) holder or other party as designated by the MNR. The environmental concerns associated with vegetation clearing include:

- Erosion of exposed soil by wind and/or water, and deposition of the resulting sediment in waterbodies;
- Disturbance, clearing, or accidental removal of trees used by wildlife or by nesting birds, especially during key life cycle periods such as mating, nesting, and/or rearing;
- Blow down or damage of newly exposed trees during high wind events;
- Forest fires associated with loss of control while burning of slash and debris; and
- Entry of cut materials (woody debris) into the waterway.

Vegetation clearing during bird breeding and nesting season should be avoided. If vegetation clearing is unavoidable during breeding and nesting season, nest surveys shall be undertaken. Tree and vegetation containing nests shall remain in place during the nesting season. Project work should avoid disturbance to the nested vegetation with a designated buffer area.

All trees with a diameter greater than 0.05 m located at or below the elevation corresponding to 0.5 m above the proposed Normal Operational Level will be cleared and removed from the headpond.

2.1.1 General Environmental Protection Measures

Project personnel will ensure that clearance techniques, silt/sediment control measures, and storm response protocols are understood and addressed:

- Vegetation removal (grubbing) will only take place where absolutely required and immediately prior to construction activities to minimize soil exposure;
- Clearing will comply with the requirements of all applicable permits and approvals;
- Clearing will be limited to the area of development set out in the project description; and
- All forest clearing operations will conform to the *Crown Forest Sustainability Act*, The Forest Operations and the Silviculture Manual.

During clearing, trees will be felled into the proposed site wherever possible. Trees cleared during headpond preparation will be not be felled into the water. Wildlife trees, Culturally Modified Trees and other significant trees will be marked for protection. Marked trees will only be removed if they are a safety concern that cannot be addressed in other practical ways.

Cut materials will be removed from the riparian zone daily to ensure they do not enter the river during high flow events. Slash and other construction material or debris will not be disposed of in or near a watercourse.

Brush will be disposed of by burning or chipping. When burning is carried out it will be under permit with the MNR and according to the *Forest Fires Prevention Act*.

2.2 Grubbing, Stripping, Grading and Soil Salvage

Root structures and ground mat material will only be removed where specifically required. Overburden will be stockpiled where practical for future reclamation work.

The principal environmental concerns associated with grubbing, stripping, grading, and soil salvage activities are the potential effects on freshwater habitat due to disturbed soil being washed or blown into a watercourse. The release of large quantities of accumulated surface water from the construction site into adjacent watercourses during high rainfall or runoff events is a further source of sediment loss during stripping. All grubbing, stripping, and debris disposal activities will comply with the Fisheries Act, which requires that no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substances may enter any such water.

2.2.1 General Environmental Protection Measures

Prior to grubbing activity, Project personnel will meet to discuss the prescribed strategy and responsibility for sediment and erosion control. The contractors will have prepared and will follow a Care of Water Plan.

Silt fences will be erected on the sides where there is potential for surface runoff leaving the disturbed area. Grubbing will not proceed prior to the installation of appropriate surface drainage controls.

Grubbing will be suspended during and immediately after intense rainstorms that have resulted in excessive runoff.

Mitigation measures will be implemented in anticipation of runoff of sediment-laden water during grubbing and stripping (e.g. settling ponds, ditch blocks, interception ditches, sediment screens, etc.). French drains, energy dissipaters, straw mats, geotextiles, and interception ditches will be used as needed on a site-specific basis to control erosion.

Where grubbed materials are stockpiled or re-spread during reclamation, stumps and roots will be left on the ground surface to maintain soil cohesion, to dissipate the energy of runoff, and promote natural revegetation. Erosion control measures will be implemented in areas prone to soil loss.

2.3 Excavation

Appropriate methods will be used for excavation. No excavation or borrowing will be done without the appropriate plans, surveys, permits, and approvals in place. Excavations conducted improperly or without proper planning have the potential to cause damage to the surrounding environment through slope failures, un-controlled sediment transport, un-controlled generation

of dust, uncovering and releasing contamination from pre-existing dumps or caches, and/or acting as a hazard to the mobility of wildlife.

2.3.1 General Environmental Protection Measures

Project personnel will review an area prior to the disturbance of a new site to ensure that environmental concerns are addressed, that contingency plans are in place, and that adequate resources, including personnel, are available on site to implement control, mitigation and protection measures. Reconnaissance may reveal old dumps, caches, spills, or other potential hazards that will be accommodated before the work is done.

Where practical, existing borrow sites and associated roads, trails or cut lines will be used instead of developing new sites. Borrow sites for aggregate will be located in upland locations and separated from streams and lakes by a minimum 30 m wide buffer of undisturbed terrain in order to minimize potential for siltation. The borrow area, stockpile area, and limits of clearing will be staked to prevent accidental over-extension of the affected area.

Where possible, topsoil will be placed in separate stockpiles for future use to re-contour and restore disturbed areas.

Erosion control berms and settling basins will be constructed where required and incorporated into the natural drainage where practicable.

Restoration, including appropriate drainage and erosion control measures, will be implemented as soon as possible following excavation or borrow site abandonment to prevent erosion and assist natural recovery of vegetation. Stockpiled overburden and soils will be re-contoured prior to seed application.

2.4 Rock Blasting

The principal concern about blasting activities is the potential for nitrogenous residues/seepage and/or rock debris to enter the water and affect fish populations. A secondary concern relates to Acid Rock Drainage (ARD). The environmental risk of ARD is directly related to the degree of sulphide mineralization in certain rock materials. Rock material that is highly mineralized poses a high risk for ARD. ARD results from metal being leached into the ecosystem from sulphide mineralized rock as a result of oxidation and weathering. The issue is primarily associated with the mining industry because the industry specifically searches for, develops and mines rock material that is high in metallic mineral content.

2.4.1 General Environmental Protection Measures

The potential for encountering ARD issues related to waterpower projects is rather small. Less than 1% of the landscape is underlain by rocks with a high degree of sulphide mineralization. Even where present, the mineralization often does not create a net acidic effect given the much higher proportion of non-mineralized rock excavated. However, a residual risk of encountering ARD due to rock excavation of a waterpower project does exist and needs to be mitigated.

ARD potential in rock can be readily tested by extracting and analysing representative rock samples. A drilling and testing program of the rock material will be completed prior to

construction to confirm if the rock mineralization and the potential for ARD exist at the site. The program will be carried out so that ARD testing result are available at an early enough stage to factor into final project design and permitting. Where the potential for ARD is confirmed, a management plan acceptable to the regulatory agencies will be prepared prior to commencing any rock excavation related to the project.

Rock removed from excavations may be used for embankments, riprap erosion protection, slope stabilization, cofferdam construction, fish habitat optimization, topping and rework of access roads, provided it is environmentally suitable (e.g. not acid generating and clean) and of proper grade.

2.5 Concrete Construction

Concrete may be produced on site for construction of the works. Wash water from concrete production may contain cement, chemical additives, and form oil. Some concrete additives pose potential human health and/or habitat hazards. The amount of concrete needed, and the number, timing and location of concrete pours, will be determined on site. The batch plant operator will be responsible for all concrete production permits, approvals, and operation.

2.5.1 General Environmental Protection Measures

Concrete pours will be conducted “in the dry” and efforts shall be made to prevent concrete from contacting the watercourse until it is properly cured.

Project personnel will be made aware of safe concrete handling procedures. Cementitious products in concrete mix are very alkali rich (high pH) and are deadly to aquatic life if sufficient quantity comes into contact with a habitable watercourse. Concrete handling will employ watertight forms, spill contingencies, and designated truck clean out pits. Clean out pits and washing areas will be established well away from a watercourse and will be subject to best industry practice and regulatory requirements.

CO_2 canisters and diffusers shall be on hand for immediate deployment in the watercourse should that be necessary.

2.6 Site Reclamation

Reclamation activities include cleanup, grading, and re-vegetation. All disturbed access roads and work sites will be reclaimed as soon as possible after disturbance. Failure to clean up, grade, and revegetate the work sites could lead to local surface instability and increased erosion.

During the initial site assessment prior to construction work, pictures will be taken and notes will be made regarding the original state of the site including native vegetation. Reclamation work will proceed in the interest of returning the site to its pre-project conditions where possible.

2.6.1 General Environmental Protection Measures

Appropriate silviculture treatments will be used to restore and revegetate the work sites. The Contractor shall stabilize all contours and disturbed slopes. Newly stabilized slopes will be

monitored by qualified personnel and unstable slopes will be repaired as soon as instability is discovered. Seed mixes and revegetation procedures will meet MNR standards.

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3 ENVIRONMENTAL PROTECTION BY PROJECT COMPONENT

3.1 Siteworks

3.1.1 Road/Trail Upgrading

Shutdown protocols are the primary control measures during road/trail upgrading. These protocols involve monitoring weather forecasts and planning the work accordingly, including stabilizing work areas in anticipation of forecasted storm events. The work activities will be modified or stopped during severe or prolonged precipitation until ground conditions improve.

Ditch and culvert upgrades will be carried out in the dry at all times by damming and pumping water flow around the work area if necessary. Any new, erodible soil cuts exposed during upgrade work will be re-seeded soon after the work is completed and before the end of a construction season.

Where a forest service road falls under the auspices of a Forest Management Plan and/or where the responsible forestry company is engaged in the road upgrading process, the applicable requirements of the Forest Management Plan will be observed related to any upgrading or extension of the road towards the project site. The Sustainable Forest License (SFL) holder will be contacted and consulted in regards to the most appropriate way to collaborate on the work.

3.1.2 New Access Roads

Cut and fill slopes along the road alignment will be constructed to stable angles for the material being used, followed by re-seeding before the end of the construction season. Sediment control fencing will be installed 1 m beyond the intended toe of the road fill to prevent sediment from the construction area migrating beyond the grubbed area, out of the access road right-of-way.

The control measures described in section 3.1.1 for ditch and culvert upgrades also apply for new ditch and culvert construction.

Extra caution shall be exercised where new access road construction is within 30 metres of a water course. The following additional control measures will be implemented:

- Prior to commencing work, the contractor will review the detailed work plan with the environmental monitor and Project management;
- A silt/sediment control fence will be installed between the water course and the proposed works;
- All loose clearing and grubbing materials will be removed from the area at the end of each work day;
- Ditching will be installed to direct any surface runoff from the exposed works into a sediment trap and sediment control structures;
- Earthworks will be scheduled to minimize duration of exposure; and
- Required erosion protection material and/or re-seeding will be installed as soon as practical following the work.

3.1.3 Bridges

Bridge installation will be in accordance with the Navigable Water Protection Act, DFO Operational Statements and MNR requirements. Copies of these approval documents will be made available on site. Key action items will be:

- The contractor responsible will be required to submit a detailed work plan for review and approval by Project management;
- Any in-stream works will be completed within the specified in-stream work window except for clear span bridges installed according to the applicable DFO Operational Statement;
- No construction material or debris will be delivered to the stream network directly or indirectly;
- Control measures as outlined above will be implemented for work within the riparian zone; and
- All creek banks will be restored to their original contour and the banks repaired and/or rip-rapped immediately after bridge/abutment installation.

3.1.4 Construction Camp

There are several unique issues associated with construction camps that are not present on other areas of the project. Housing and feeding people in a remote area requires water taking, sewage treatment and organic waste incineration. Camps can also affect wildlife due to the longer term presence of people at the site and by being attracted to the site through the smells of food preparation and disposal.

Required approvals will be obtained from the MOE and the Ministry of Health. The construction camp will be set up and operated according to the requirements of the *Health Protection and Promotion Act*.

The Proponent will prepare and implement an Attractant Management Policy to minimize the effect on wildlife from the storage, preparation and disposal of food products at the camp.

An electrified fence will be installed around the perimeter of the camp if the area is a known habitat for bears for the safety and security of Project personnel and the bears in the area. Bear awareness training will be provided to all Project personnel to provide information on minimizing human-bear interactions and appropriate response training if an interaction does occur.

3.2 Headworks

3.2.1 Construction Sequence

The majority of the headworks area may be cleared ahead of the main construction work, leaving stumps, forest litter and low vegetation in place.

Stage 1 cofferdam installation will follow, generally installed parallel to the water course for conduit/bypass projects, to keep the water flow in the natural channel and minimizing the chances of flooding of the intake structure construction site. Grubbing and excavation of the site will then proceed in the dry, followed by the intake and sluiceway structure construction. For close-coupled projects, the stage 1 cofferdam will be installed across the water course, isolating

one half of the river allowing construction of either the intake/powerhouse or weir structure to take place. Close-coupled projects will likely require a downstream cofferdam be employed as well to prevent back-water from flooding out the construction site.

Once the first phase of the in-stream structure is complete, the stage 1 cofferdam will be removed, allowing the flow to be diverted through the intake/powerhouse or sluiceway gate, rejoining the natural alignment downstream of the construction area. A stage 2 cofferdam will then be constructed across the natural flow channel downstream of the second phase in-stream construction area directing all remaining flow away from the construction area allowing the work to be completed in dry conditions. Once the structure is complete, the stage 2 cofferdam will be removed allowing water to flow through the intake channel or spillway.

Earth material for cofferdam work may come from various sources; including blasted rock generated on-site, imported clean fill or from earth borrow areas on-site where possible. Silt control methods will be used as described in other parts of this document to minimize the risk that excavation, storage and placement of cofferdam material could enter waterways.

3.2.2 General Environmental Protection Measures

The major construction activities that will occur in and around the water course, are the construction of the headworks, powerhouse tailrace and possibly bridges for facility access. The cofferdams and associated diversion works for these activities will be depicted on the construction drawings and will include the key conditions used in their design such as the month of construction and design flood return period.

Site conditions will be assessed immediately before implementation water diversion structures and the designer will be consulted prior to undertaking construction of these works. Some changes may be required due to changed site conditions or timing to ensure the diversion works can be implemented as intended.

The cofferdams will be designed by a Professional Engineer. They will be constructed of clean fill with impermeable rubber liner or 1 m^3 sand filled nylon mesh cargo bags (approximately 1600 kg dry) with smaller synthetic sand bags (22.5 kg dry) and a polyethylene plastic sheet liner. The smaller bags will be used to fill irregularities in the ground surface and gaps between the larger bags. The crest elevation of the cofferdams and the resulting flow channel will be designed to manage up to a 1 in 20 year maximum daily flow event for the intended period of construction.

If necessary, a sump and pump shall be set up immediately downstream of the cofferdams to catch seepage passing through the cofferdam before it reaches the work area. Eliminating surface water flow and creating an effective isolation of the work area will be the primary method of controlling sediment production. Silty water created in the work area through mixing groundwater or precipitation with excavated material will be pumped to a vegetated bench inside forested land or a sufficiently latent pond or passive drainage channel to allow the sediment to settle without deposition to the local watercourses. The environmental monitor will be consulted regarding the pumping discharge location and will approve the location before this activity commences.

A containment dike will be constructed downstream of the structure during construction to ensure that any potential concrete spills will be intercepted. A CO_2 diffusion system and non-

allum based flocculent will be available as required. Water discharged from these locations will be tested before release to ensure Total Suspended Solids (TSS) and pH are within acceptable limits.

A diversion and headpond filling plan will be developed and agreed upon with the environmental monitor prior to the work being carried out. In general, the filling will be carried out slowly and incrementally with upstream and downstream sampling of turbidity to ensure the work is not increasing suspended solids or pH in the water beyond acceptable levels. If acceptable levels are close to being exceeded, the work will be suspended until turbidity levels drop. The work will then continue with modifications if necessary.

3.3 Penstocks & Open Cut Channels

3.3.1 General Environmental Protection Measures

Clearing of penstock and/or open cut channel right-of-ways will be done within flagged limits to prevent any excess clearing. In critical or sensitive areas, orange HDPE safety fencing will be erected to prevent access to these areas. Silt/sediment control fencing will be installed between the work area and the water course.

Before construction proceeds at any creek or culvert crossings, environmental control measures will be installed and made functional to isolate the work area from flowing water before the water crossing work proceeds. Depending on the specific crossing, the water flow will be diverted from an upstream location to the road ditch downstream of the site, if this was its original path, or pumped around the construction site and back into the natural flow channel below the site. The intent is to minimize disturbance to natural drainage patterns.

The right-of-way for the penstock and/or open cut channel will only be grubbed where necessary, from the top of cut to the toe of the access bench fill slope. Before the end of the initial construction season, final cut slopes will be seeded as soon as possible. Temporary erosion protection will be applied to slopes if they are left exposed at the end of the initial construction season and need to be re-worked with the final penstock or channel work. A silt/sediment control fence will be installed along the toe of the fill slope along the entire length of the works in order to prevent sediment migration from the right-of-way.

Excavated earth material that is placed into permanent backfills, berms or dykes will be stabilized prior to removing the temporary silt control fencing as provided for in the design.

3.4 Powerhouse

3.4.1 General Environmental Protection Measures

Surface and seepage water from the site will be directed into a sediment trap at one location with enough storage time to allow suspended sediment to settle before the water is pumped out to an approved discharge location.

Tailrace excavation at the intersection with the river will be completed within the in-stream work window. The excavation will be carried out from the powerhouse working towards the water course so that flowing water does not infiltrate the cut until the final phase of excavation. Turbidity will be monitored upstream and downstream of the powerhouse to confirm the work is

not increasing the suspended solids in the water beyond acceptable levels. A silt curtain will be used in the water course adjacent to the excavation, if it is practical, to minimize siltation of the water course. If acceptable turbidity levels are close to being exceeded the work will be suspended under direction of the environmental monitor until levels drop. The work will then be re-started with modifications if necessary.

3.5 Changes During Construction

Conditions encountered during construction can be different from what was expected in the planning and design phase. For this reason, there must be an opportunity to make changes to the actual control measures used or the manner in which control measures are used for care of water on the project during construction. Except for the case where there is an immediate need to correct a situation where any delay for receiving approval could cause significant harm to the environment or to wildlife, any modifications to the measures described in this document will be discussed with the environmental monitor for approval prior to implementing those modifications on site.

3.6 Inspection and Maintenance

Measures installed during construction will be inspected regularly. Any damage or defect will be recorded and repaired. Additional inspections will be carried out prior to forecast storm events, if possible during such events and especially after the storm event has passed to ensure the control measures are still effective.

Upon completion of construction, all temporary control measures will be removed as appropriate. Some measures may be left until such time that new vegetation has properly established itself. Any sediment behind silt fences will be dug out and disposed of at a suitable location, and if necessary minor grading and seeding will be done. All materials removed will be disposed in designated waste areas or hauled off site for proper disposal.

3.7 Substation and Transmission Line

Clearing of the transmission line right-of-ways will proceed as outlined in Section 2.1. Clearing width will generally be 20 m, except where the transmission line is situated on a relatively steep side-slope which would require additional clearing on the upslope side. As per Section 1.3, any heritage or archaeological findings will be brought to the attention of Project management. At water crossings, clearing will proceed with the proper erosion and water protection techniques implemented (i.e. silt fencing, felling of trees away from the watercourse, etc.). A vegetated buffer will be maintained at all significant water crossings. The right-of-way will not be grubbed in any case, and extra attention will be given to maintaining low level bushes and vegetation that will not cause a safety hazard with the line. Where necessary, temporary bridges will be installed to completely isolate the watercourse from vehicles required for the transmission line works.

Clearing, grubbing, stripping, grading and soil salvaging of the area used for the substation will proceed as outlined in Sections 2.1 and 2.2. The footprint of the substation will be flagged to prevent unnecessary over-clearing. Erosion protection measures will be implemented to prevent

sediments from moving overland. Reclamation work will involve reseeding and will be completed on all areas not directly in the footprint of the substation.

4 CONSTRUCTION MONITORING

The Project will be subject to a detailed Monitoring Program that starts during the planning and design phase, well before construction, and will carry on after commissioning. The monitoring program is developed and carried out in accordance with regulatory approvals and requirements. The Construction Monitoring Plan is one component of the overall Monitoring Program that also includes a number of other items listed below.

4.1 Stream Water Quality Control

Water quality in the stream may be affected by sediment accidentally introduced during the construction phase, and best industry practice erosion control procedures will limit the adverse effects of sedimentation. To ensure these procedures are implemented and effective, water quality will be monitored on a regular basis as defined by the Monitoring Program.

4.2 Construction Dewatering Water Quality Monitoring

Water quality will be monitored daily at the settlement pond discharges for pH, temperature, turbidity and TSS. TSS can be monitored weekly once a correlation is established between TSS and turbidity, and is approved by the MNR.

Opportunistic samples may also be taken as designated by the environmental monitor to ensure compliance during sensitive works. Sediment traps and screens will be checked as required to ensure they are working properly. All sediment control measures will be maintained as part of routine site management practices, but will receive additional attention after high rainfall events.

4.3 Water Flow Monitoring

Water flow will be monitored on the stream before and during construction. Water flow monitoring will continue at those stations and also through the plants once they are operational.

4.4 Habitat Monitoring

Inventory, monitoring, and assessment efforts may identify potentially sensitive habitats and specific sites that require construction monitoring, including:

- Benthic Habitat;
- Riparian Areas;
- Old Growth Forest;
- Wetlands;
- Headpond;
- Bypassed Reaches;
- Bird Nesting Areas;
- Species at Risk/Endangered Species; and
- Fish and Fish Habitat.

The Monitoring Program will specify all monitoring requirements.

5 POST CONSTRUCTION MONITORING

Inspection of equipment shall be done in accordance with schedules and instructions from equipment manufacturers. Operation, maintenance and inspection plans will be developed and referred to for each piece of equipment for complete inspection requirements.

Equipment testing will be done during the formal annual inspection. Copies of the completed checklists will be maintained for future reference.

Turbine inspections shall be done in accordance with the turbine supplier manual.

Access to the substation shall be by properly trained personnel.

5.1 Routine Visual Inspection

To ensure integrity of the headworks and prevent problems, conduct routine Weekly Inspections.

Inspect the hydraulic equipment weekly to detect any leaks. Accumulators shall be fully charged when plant is in operation.

Inspect regularly in winter, all heaters to ensure all areas of the powerhouse are kept above freezing. Inspect regularly in summer the operation of the exhaust fans and motorized louvers to ensure the ventilation system can operate at capacity if required.

Inspect oil-water separators regularly for signs of oil. Remove any oil using an appropriate removal and disposal service.

5.2 Scheduled Inspection

Conduct a more thorough Annual Inspection each year. The Annual Inspection should be completed by the plant operator and one other person, and shall include at least the following key items:

- Inspect river channel shape and integrity downstream of the tailrace and spillway.
- Check concrete structures for signs of new cracking, movement, backfill settlement.
- Monitor and define seepage paths under or beside structures.
- Inspect gate and bulkhead seals and estimate any change in leakage over last inspection.
- Inspect equipment for sign of leakage, corrosion, or wear.
- Inspect building structure and roof for signs of water infiltration or deterioration of siding or insulation.
- Monitor and define seepage and drainage paths on the slopes and in the yard and substation.
- Inspect tailrace channel shape and integrity.

Conduct a Dam Safety Review (DSR) every 5 years, or as prescribed by the Dam Safety Review Best Management Practices by MNR. The dam safety review should be carried out by a professional engineer or multidisciplinary team qualified in design, construction, performance

analysis and operation of dams. The inspection should be documented in a formal report. The DSR should follow the Best Management Practices by MNR and the Annual Inspection requirements, as well as but not limited to the following items:

- Inspection of the trashrack structure, the intake entrance and intake gate and guides by lowering the headpond water level and closing the intake gate.
- Inspection of the spillway structure upstream side by dewatering the headpond.
- Inspection of the turbine and draft tube by installing the tailrace gate and dewatering the turbine and draft tube.
- The headpond, intake and tailrace channel depths by sounding for sediment accumulation.

Annual Inspection and Dam Safety Review should be conducted during the low-flow period (late August to early November) for several reasons:

- Ability to draw down the headpond to below the weir crest to inspect the water retaining structures and still operate the plant.
- Avoids completing inspection with ice build-up.
- Shutting down the plant to inspect the intake gate will not result in significant revenue loss.

Access road inspection shall include road conditions, uphill and downhill slope conditions, guardrail conditions, signs of movement and erosion, and culvert status.

During headworks inspections, special attention should be given to the followings items:

- Abutments for slope stability.
- Retaining walls for any sign of structural problems such as fissures or major concrete degradation.
- Ditches for signs of vegetation growth or soil movement preventing drainage.
- Fence and gates for damage or intrusion.
- Warning signs for proper visibility, damage, or missing signs.
- Electrical system for abnormal breaker opening, loss of power to equipment, or water leakage.
- Water leakage on equipment.
- Gates for signs of damage, corrosion or oil leakage.

During yard inspections, special attention should be given to the followings items:

- Drainage for signs of water accumulation.
- Ditches and drainage along the road and around the powerhouse for debris or growth restricting drainage of the yard.
- Slopes for signs of instability.
- Culverts for deflections due to traffic or blockage from debris.

During substation inspections, special attention should be given to the followings items:

- Warning signs for proper visibility, damage, or missing signs. Signs shall be on all sides of the substation.
- Fence and gates for damage or intrusion.
- Gate locks for proper operation and locking capability.
- Exposed ground connections for loose ends, corrosion, etc.
- Transformer for oil level or leaks.
- Circuit-switcher/interrupters for proper gas pressure.
- Circuit-switcher/disconnect power train for damage, excessive corrosion, wear, tightness of fasters.
- Sump for high water level or presence of oil in the water.
- Duct bank from the powerhouse for shallow overburden material or signs of movement.
- Oil spills should be dealt with immediately in accordance with established environmental procedures.

During transmission line inspections, special attention should be given to the followings items:

- ROW for tree clearance and vegetation overgrown.
- Poles for degradation or damage.
- Guy wires for loose or broken wires.
- Conductors for over sagging, mainly at road crossings.
- Disconnect switch for proper operation or signs of corrosion.

5.3 Special Inspection

Following every flood event, a complete inspection of all structures and headworks equipment should be performed. All major damage would be repaired without delay.

Conduct informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from water.

The transmission line should be inspected after major storms for potential trees falling on the line and to ensure proper condition of the line, poles, and support structures.

Dam Safety Inspections (DSI) shall be conducted as recommended by the Ontario Ministry of Natural Resources (MNR) in the Dam Safety Reviews Best Management Practices. It is recommended that a dam safety inspection occur after any significant change that may affect the dam such as;

- Construction modifications to the dam design.
- Discovery of unusual conditions.
- New dams on the river system.
- New developments downstream of the dam.
- New knowledge of safety analysis.

- New standards of safety.
- Extreme hydrologic or seismic events.

PART B

BIG EDDY HYDRO PROJECT CONSTRUCTION DETAILS

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TABLE OF CONTENTS

APPENDICES

1 CONSTRUCTION DETAILS

The construction details and sequence described below are proposed based on the information currently available and could change in part or in whole depending on conclusions from the EA process, modifications to the final Project location and final design. Refer to the appropriate sections in this report for a description of the environmental protection and mitigation measures that will be employed for each of these construction activities.

1.1 Design Options

Two design options are currently being contemplated for the project weir. Option 1 (Drawing 151) includes a fixed, stepped spillway where the Option 2 (Drawing 152) includes an Obermeyer variable height spillway. Both options cover the same general footprint, require the same construction sequencing and temporary structures, so the discussion below is intended to be read from the perspective of either option.

1.2 Access

Access to the site will be constructed using existing residential roads and a small amount of new construction. From Gerald Avenue, approximately 150 m of existing road will be upgraded and 200 m of new road will be constructed to provide temporary access to the weir on the south bank of the river. Permanent access to the powerhouse from Paquette Road will follow one of two route options. The primary option is to construct the access road on the existing rail bed, as this section of track is no longer in use. The secondary option, which will only be utilized if the primary option becomes unavailable, is to construct the access road adjacent to the existing pedestrian trail. Both options would utilize approximately 500 m of new road constructed parallel to the intake canal to provide permanent access to the powerhouse. Total length of project access will be approximately 1,400 m.

It is planned that the majority of this construction will be conducted using excavators, haul trucks, and other earth moving equipment. Some drilling and blasting may be required, depending on the bedrock elevation. Upgrades to existing water crossings and the traveling surface will not be required along these roads.

1.3 Temporary Siteworks

1.3.1 Borrow and Laydown Areas

The Project construction will require use of granular material for the construction of roads, embankments, yards, cofferdams, and concrete structure backfill. The total volume of borrow materials required is not known at this time, as it will depend on the final Project design. Useable materials excavated from the conveyance channel and powerhouse areas will be re-used on site for other construction requirements. Overburden materials in the area are mostly sand and gravel and will likely be suitable for use during construction. Some on-site processing of materials may be required (screening or crushing) to improve the engineering characteristics of the in-situ rock and soils. Additional borrow material, as required, will be sourced from existing licenced aggregate sites.

The site will require a 2,000 m^2 temporary laydown area close to the powerhouse. This area will be used for construction materials and equipment storage, construction offices, parking, etc. This area can be reduced post-construction with some area remaining for operations purposes or will be completely reclaimed. An additional 1,000 m^2 may be required for stockpiling topsoil, excavated soil material that is unsuitable for construction use, and extra blast rock material.

The weir structure and fishway will consist of a combination of concrete and earthfill. The relative amount of earthfill to concrete will depend on the final Project design, and may vary significantly from the design represented here. Earthfill will be sourced to the extent available on site.

1.3.2 Construction Camp

It is anticipated that accommodations for workers can be made available in Petawawa to support the Project construction. These accommodations will be a combination of house rentals, hotel space, and worker camper trailer use at local campgrounds. Local work force will be utilized as much as possible.

1.3.3 Concrete Batch Plant

A concrete batch plant will not be required on site as concrete can be sourced in Petawawa.

1.3.4 Cofferdams

Temporary cofferdams will be installed in the river during the construction process. At this time, cofferdams are contemplated to be built to manage the 1:20 year flow rate. The cofferdams are used to divert flow first from the powerhouse area, then the weir and fishway area, to allow the construction to occur in dry conditions. Type A cofferdams as presented on the attached Drawing 00-151 will be used for all stages of construction. Type A cofferdams consist of cargo bags filled with clean, local granular material and are transported to site in haul trucks or on a tractor trailer bed. They are installed using an excavator and/or a crane to place the bags sequentially in the river. The total footprint of the cofferdams will depend on the elevation of the dam required to prevent overtopping during the 1:20 year flood event, and depth to a suitable base material in the river. This information will be determined once further investigation and design work are completed.

1.4 Portage Trail

A portage trail will be added to provide recreational users of the river a route to bypass the weir and powerhouse tailrace. The portage trail will be added during the last phase of construction. The permanent safety boom will direct users to the portage route which will start just north of the intake canal and will end beyond the tailrace. Signs will be installed instructing users of the portage route at both entrances. The route will utilize steps and handrails to allow safer passage in steep sections.

1.5 Construction Sequence

Table 1 provides estimated footprint areas for the permanent Project components based on the current concept designs. These are as-constructed footprint areas, meaning that during

construction, there may be additional areas affected, but these areas will be reclaimed at the end of the construction stage.

Table 1 – Big Eddy Hydro Project Concept Design Footprint Areas

Project Area	Footprint (m^2)
Intake Canal	5,000
Powerhouse	600
Powerhouse Yard	600
Substation	800
Tailrace	1,100
Weir	2,300
Fishway	1,600
Overflow Channel	2,000
Dam	1,300
TOTAL	**15,300**

The construction sequence has been represented on attached Drawing 151 for Option 1 and Drawing 152 for Option 2 and is described in the sections below.

Stage 1 (4-6 months)

The first stage of construction will start by constructing access to the site. This would include construction of new access roads and clearing and levelling the laydown and stockpile areas. Clearing for the power line right of way would also occur in this stage. Stage 1 would start in early summer or other suitable timing to co-ordinate with the first in-stream construction window, so that the installation of the Stage 1 cofferdams can be completed in this window.

The Stage 1 cofferdams will divert water away from the north bank of the weir and the intake canal, allowing excavation and construction to be carried out in dry conditions. Stage 1 cofferdams are anticipated to be a total of 420 m long with an estimated temporary footprint area of 1,400 m^2 and dewatering an area of 7,000 m^2.

Once dewatered, the intake canal, powerhouse and tailrace will be excavated by an excavator, and drilling and blasting. The blast rock will be removed and hauled to a stockpile/storage area, or repurposed directly from the excavation in areas such as site roads, the substation, powerhouse yard, or laydown areas for final grading.

Following the powerhouse excavation, concrete construction will commence with the placement of a levelling mudslab, followed by successive stages of wood forming, reinforcing, and embedded steel installation and concrete pouring. This work will require a mobile or tower crane set up near the edge of the excavation to move forms, reinforcing steel, and other materials into and out of the work site. Concrete will be placed either by pump truck or crane and bucket. The powerhouse construction will likely involve steel erection and installation by crane for the roof and potentially the upper portion of the powerhouse walls. Water-tight gates will be installed in

the powerhouse intake and tailrace openings to allow the mechanical and electrical construction to continue inside the powerhouse during the next stages.

A portion of the intake canal excavation will be in granular material and will likely require lining or concrete walls for containment. In addition, structural support will be required for both the railway and the pedestrian trail crossings.

Construction of the north portion of the weir, including the fishway, will be completed in the dry behind the cofferdam. For both weir options, this work will involve the structure subgrade preparation using excavators and potentially drill and blast as required. A combination of concrete and earthworks construction will follow following the same general sequence as the powerhouse construction for the concrete components.

Stage 2 (8-10 months)

Removal of the Stage 1 cofferdams and installation of the Stage 2 cofferdams will proceed in the next available in-stream window. If only one window is granted each year, this stage is assumed to start in the following summer. The Stage 2 cofferdams will divert water flow through the conveyance system keeping the powerhouse dry behind closed gates, diverting flow through the overflow channel. The south portion of the weir will be isolated from the river, passing flow through the completed fishway and allowing construction to proceed on the remainder of the weir following the same general construction steps. Minimum flow requirement will be maintained in the bypassed reach through the completed fishway.

Stage 2 cofferdams are anticipated to be a total of 150 m long with an estimated temporary footprint area of 500 m^2 and dewatering an area of 3,600 m^2. This construction may involve some blasting for site levelling, which will be followed up by a combination of earthfill and/or concrete construction to complete the structure, depending on the final Project design.

Substation construction can start in Stage 2 once the powerhouse has been constructed to yard grade and the structure backfill is complete.

Headpond clearing is fairly minimal on this Project as the headpond area is mostly grassy bays and low sand and gravel banks. Headpond clearing will be completed in a time period that will least impact the river and surrounding environment, which is assumed to be in the winter. This assumption will be confirmed during the EA process and scheduling of the headpond clearing will be finalized as required. Generally the clearing of trees and wood debris will be completed to an elevation 0.5 m above the Design Flood Level.

Stage 3 (1-2 months)

The final stage of construction will involve the removal of the Stage 2 cofferdam allowing water to flow across the spillway structure. The water-tight intake gate at the powerhouse will be lowered into place causing the headpond to fill to the spillway overflow elevation. The substation and remaining power line construction will be completed.

Before filling the headpond, an inspection of the cleared banks will be carried out and loose woody debris will be removed from the inundation area to prevent a large amount of debris from collecting in the headpond and flowing downstream.

Once powerhouse installations are complete, the final cofferdam will be removed. Additional work will include reclamation of the overall site, removal and restoration of the temporary works, construction of the portage trail and commissioning.

APPENDIX A
Drawings

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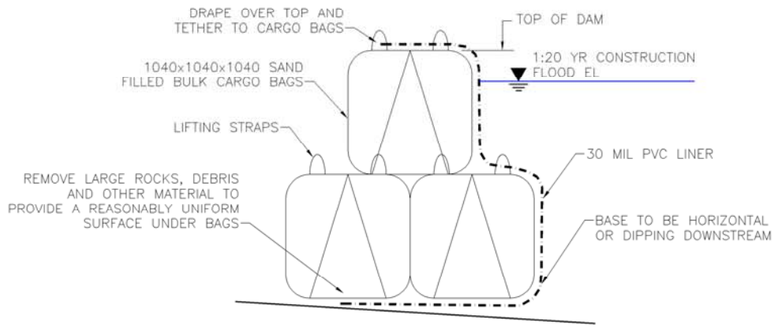
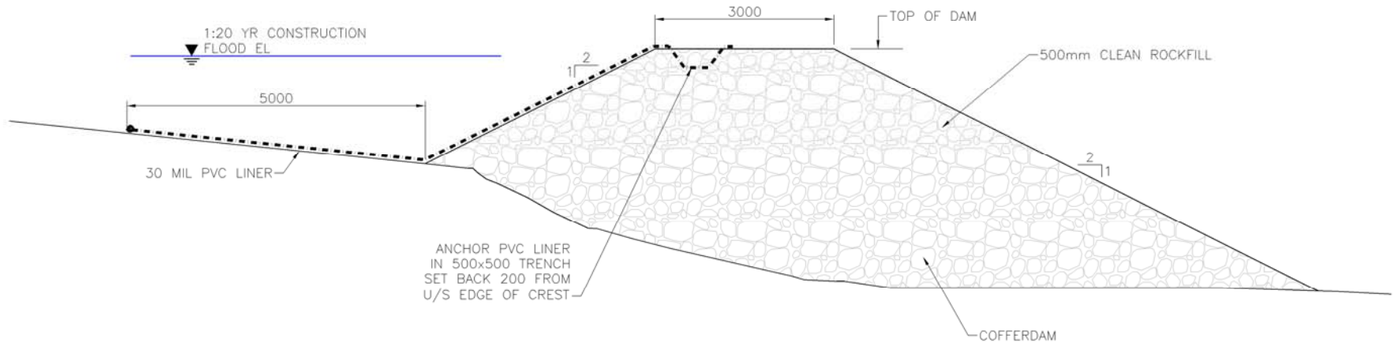


COFFERDAM - TYPE A (MULTI CARGO BAGS)
1:50



COFFERDAM - TYPE B
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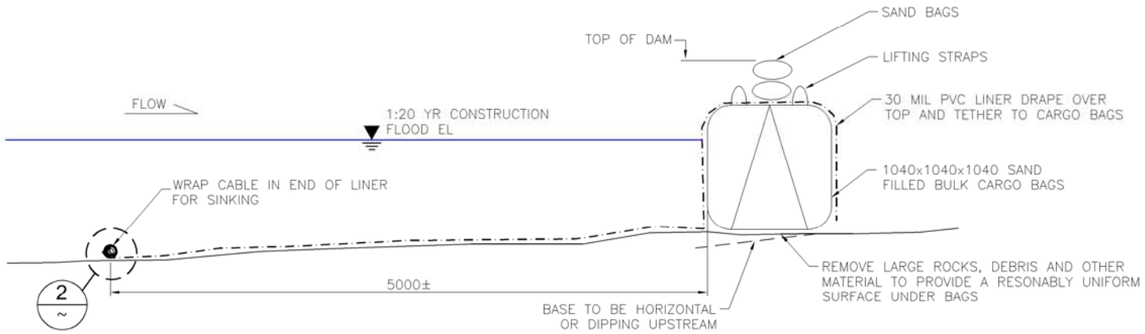
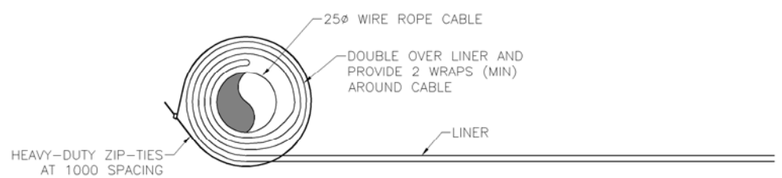


COFFERDAM - TYPE A (SINGLE CARGO BAGS)
1:50



DETAIL 2 ~
NTS

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS IN METRES, UNLESS NOTED OTHERWISE.
2. COFFERDAM SHOWN TO ILLUSTRATE CONSTRUCTION DETAILS. INSTALL COFFERDAMS IN SIMILAR FASHION TO THE NECESSARY SIZES AND ELEVATIONS.
3. EXERCISE CAUTION WHEN WORKING INSIDE OF COFFERDAM AREAS, ESPECIALLY DURING FLOOD CONDITIONS. EVACUATE WORK AREA IF DESIGN FLOOD LEVEL IS EXPECTED TO BE EXCEEDED.
4. MONITOR COFFERDAMS DAILY TO MAINTAIN INTEGRITY.

PRELIMINARY - NOT FOR CONSTRUCTION

0 1000 2000 3000 4000 1:100
0 500 1000 1500 2000 1:50
MILLIMETRES

REV	Y	M	D	REVISION DESCRIPTION	DES	CHK	DRN	CHK
A	11	05	26	FOR REVIEW	CPB	RJS	DMB	CPB

Canadian Projects Limited
CALGARY, ALBERTA

Xeneca Power Development Inc.

XENECA POWER DEVELOPMENT INC.

ONTARIO HYDRO PROJECTS
GENERAL - PROJECT
COFFERDAMS
SECTIONS AND DETAIL

PROJECT NUMBER 1052-001
CADD NUMBER 4.3.080
DRAWING NUMBER 00-151

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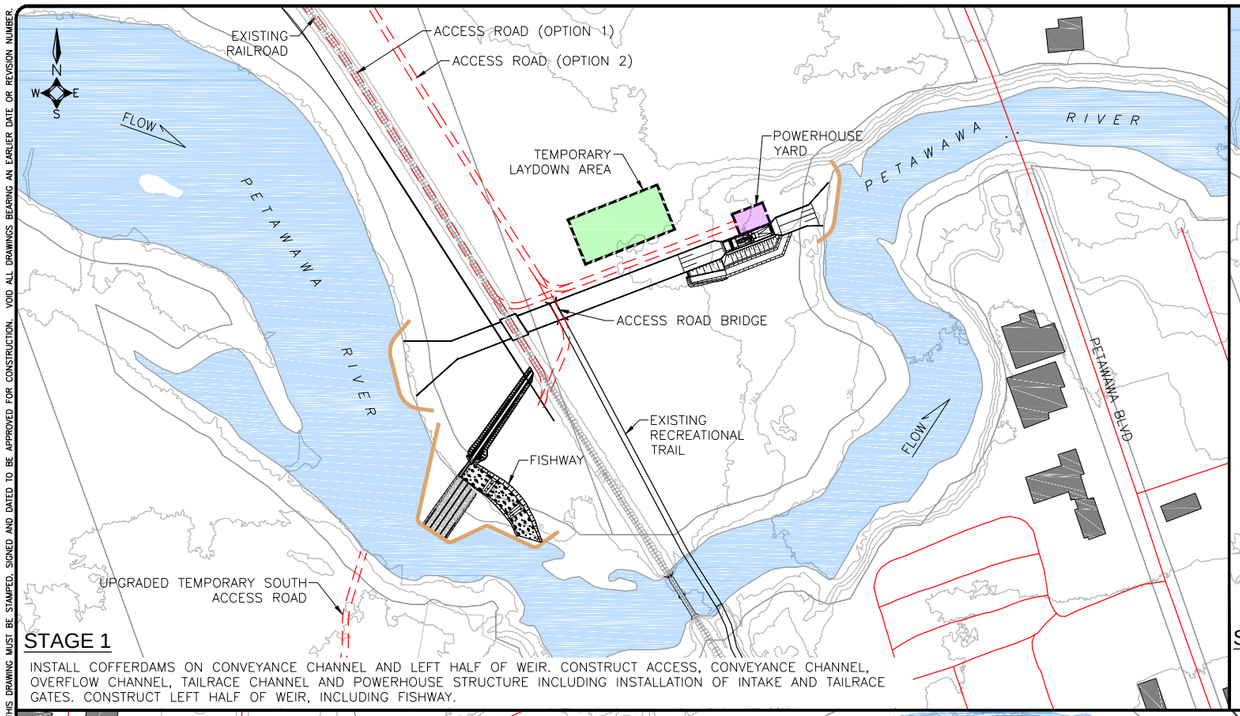
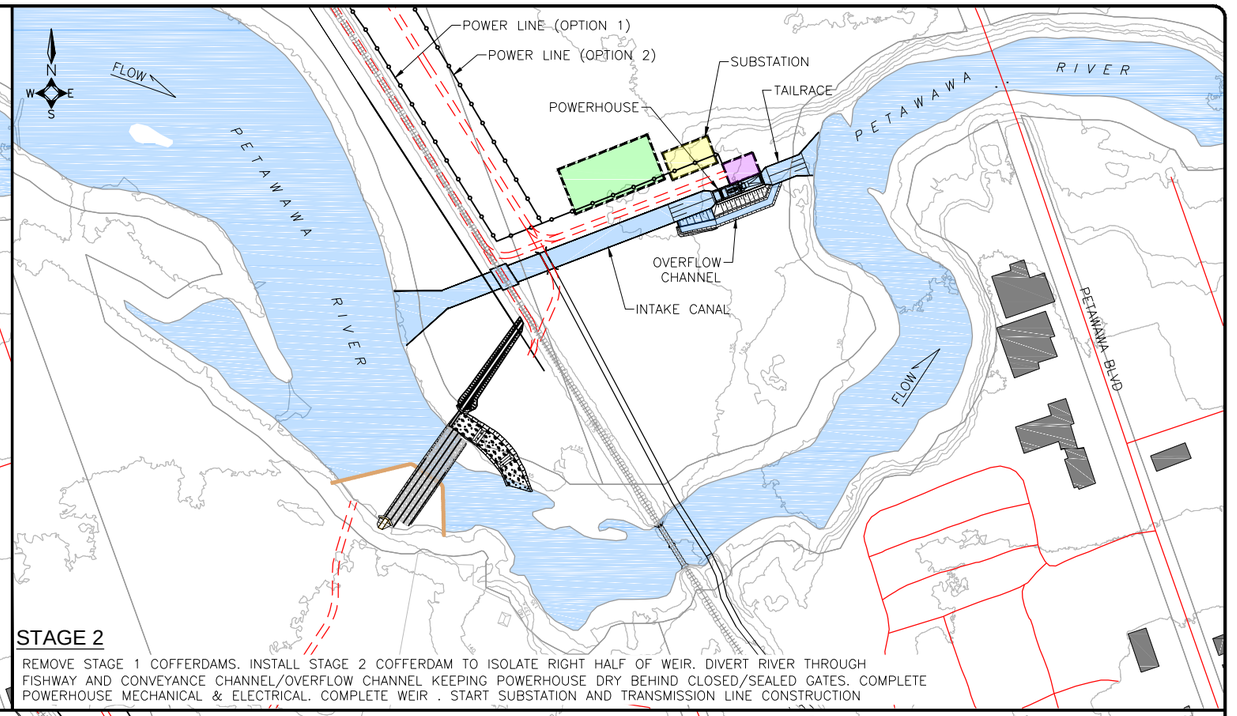


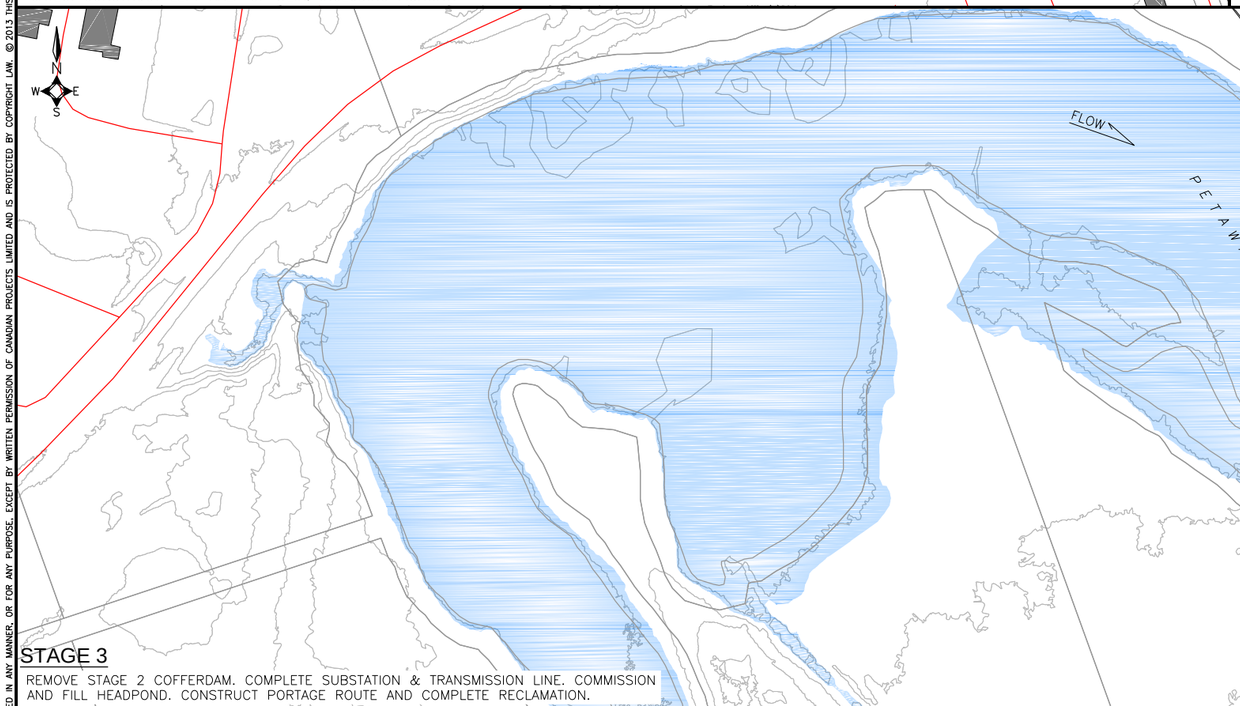
STAGE 1

INSTALL COFFERDAMS ON CONVEYANCE CHANNEL AND LEFT HALF OF WEIR. CONSTRUCT ACCESS, CONVEYANCE CHANNEL, OVERFLOW CHANNEL, TAILRACE CHANNEL AND POWERHOUSE STRUCTURE INCLUDING INSTALLATION OF INTAKE AND TAILRACE GATES. CONSTRUCT LEFT HALF OF WEIR, INCLUDING FISHWAY.



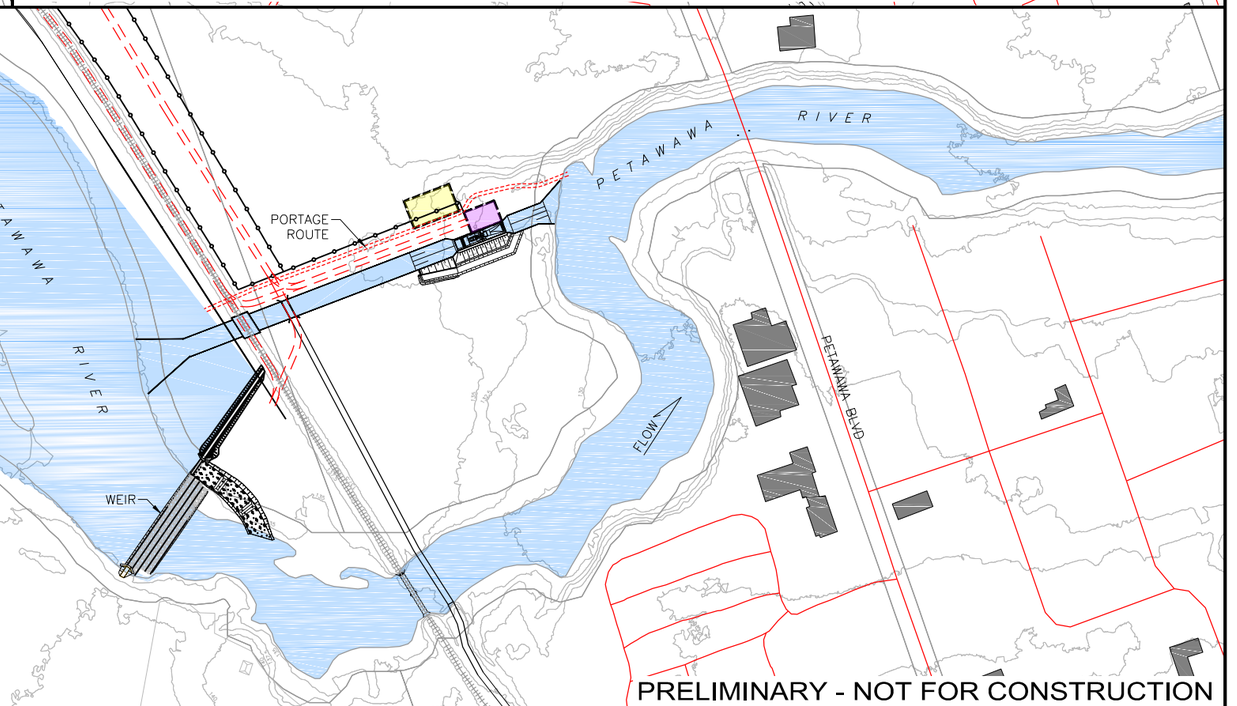
STAGE 2

REMOVE STAGE 1 COFFERDAMS. INSTALL STAGE 2 COFFERDAM TO ISOLATE RIGHT HALF OF WEIR. DIVERT RIVER THROUGH FISHWAY AND CONVEYANCE CHANNEL/OVERFLOW CHANNEL KEEPING POWERHOUSE DRY BEHIND CLOSED/SEALED GATES. COMPLETE POWERHOUSE MECHANICAL & ELECTRICAL. COMPLETE WEIR . START SUBSTATION AND TRANSMISSION LINE CONSTRUCTION



STAGE 3

REMOVE STAGE 2 COFFERDAM. COMPLETE SUBSTATION & TRANSMISSION LINE. COMMISSION AND FILL HEADPOND. CONSTRUCT PORTAGE ROUTE AND COMPLETE RECLAMATION.



PRELIMINARY - NOT FOR CONSTRUCTION

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. 2.5 m INTERVAL CONTOURS FROM LiDAR FLOWN JUNE, 2009.
3. BASE MAPPING FROM ONTARIO MINISTRY OF NATURAL RESOURCES OBTAINED DECEMBER, 2010.

SCALE 1:5 000

0 50 100 150 200 250

METRES

REV	Y	M	D	REVISION DESCRIPTION	DES	CHK	DRN	CHK
H	13	06	27	ADDED PORTAGE ROUTE	AR	RJS	ADF	CPB

Canadian Projects Limited
CALGARY, ALBERTA

Xeneca Power Development Inc.

XENECA POWER DEVELOPMENT INC.

BIG EDDY HYDRO PROJECT
PROJECT - GENERAL
CONSTRUCTION SEQUENCE
OPTION 1 - PLANS

PROJECT NUMBER 1052-004
CADD NUMBER 4.3.010
DRAWING NUMBER 151

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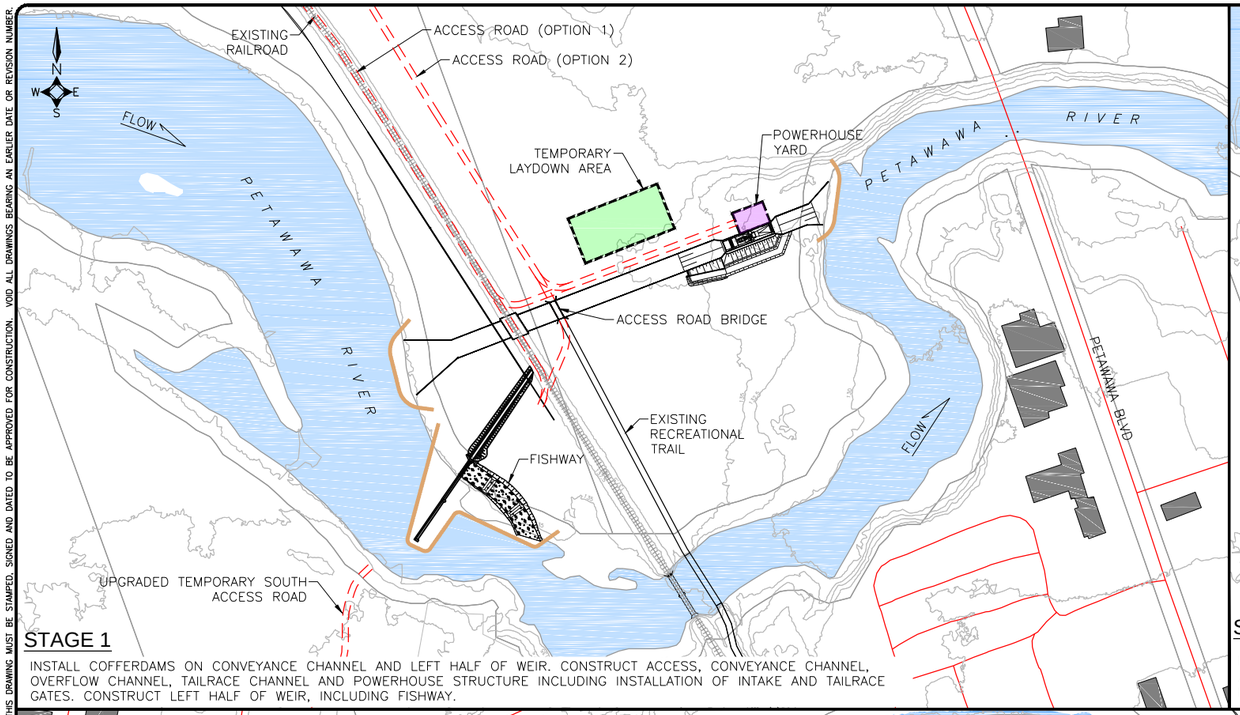
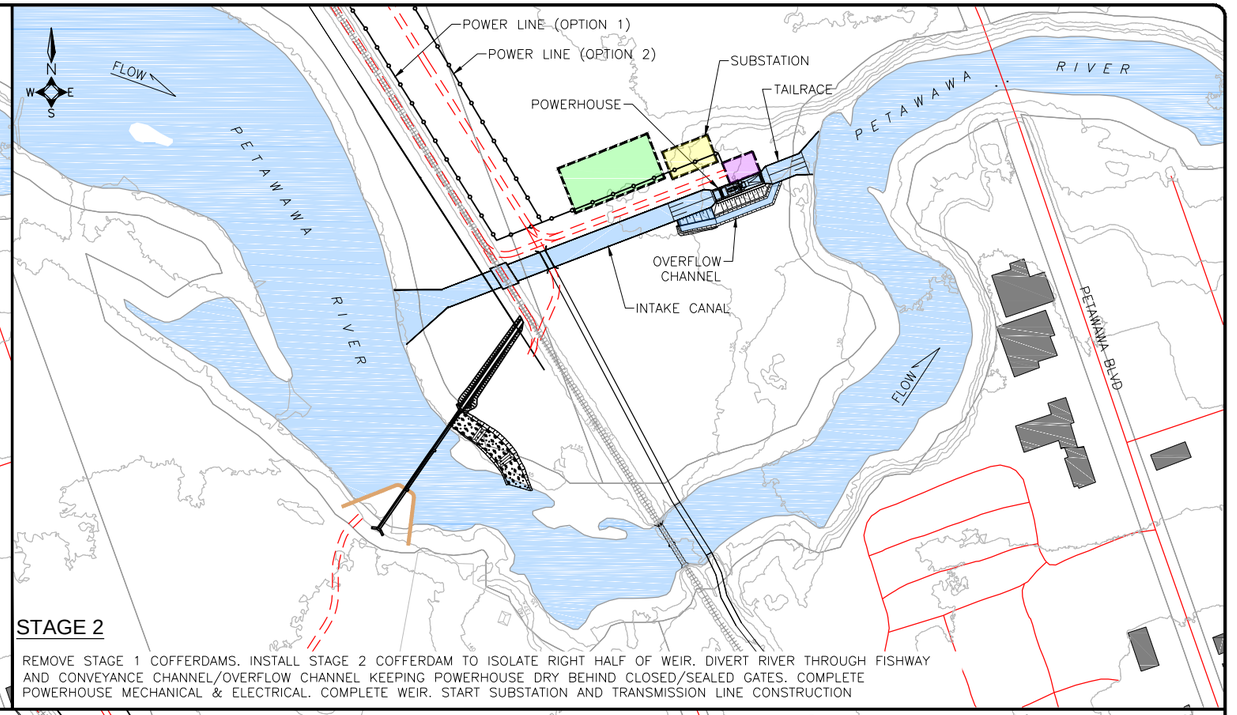


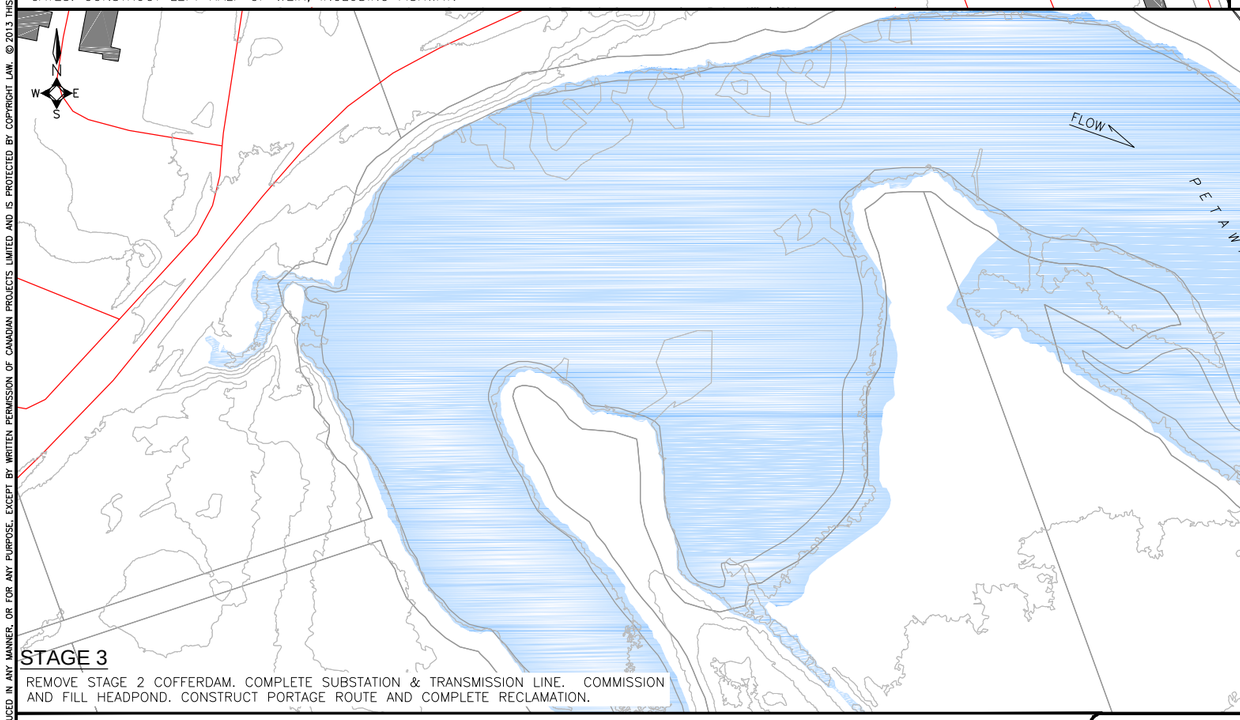
STAGE 1

INSTALL COFFERDAMS ON CONVEYANCE CHANNEL AND LEFT HALF OF WEIR. CONSTRUCT ACCESS, CONVEYANCE CHANNEL, OVERFLOW CHANNEL, TAILRACE CHANNEL AND POWERHOUSE STRUCTURE INCLUDING INSTALLATION OF INTAKE AND TAILRACE GATES. CONSTRUCT LEFT HALF OF WEIR, INCLUDING FISHWAY.



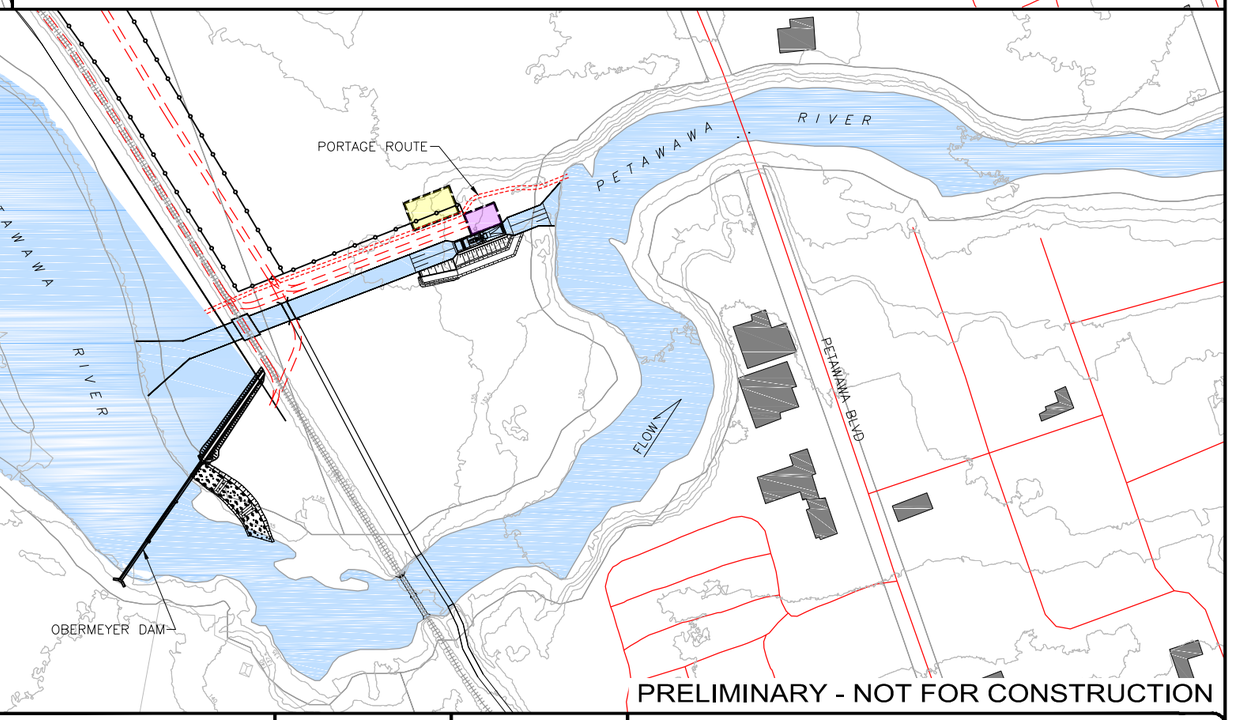
STAGE 2

REMOVE STAGE 1 COFFERDAMS. INSTALL STAGE 2 COFFERDAM TO ISOLATE RIGHT HALF OF WEIR. DIVERT RIVER THROUGH FISHWAY AND CONVEYANCE CHANNEL/OVERFLOW CHANNEL KEEPING POWERHOUSE DRY BEHIND CLOSED/SEALED GATES. COMPLETE POWERHOUSE MECHANICAL & ELECTRICAL. COMPLETE WEIR. START SUBSTATION AND TRANSMISSION LINE CONSTRUCTION



STAGE 3

REMOVE STAGE 2 COFFERDAM. COMPLETE SUBSTATION & TRANSMISSION LINE. COMMISSION AND FILL HEADPOND. CONSTRUCT PORTAGE ROUTE AND COMPLETE RECLAMATION.



PRELIMINARY - NOT FOR CONSTRUCTION

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. 2.5 m INTERVAL CONTOURS FROM LiDAR FLOWN JUNE, 2009.
3. BASE MAPPING FROM ONTARIO MINISTRY OF NATURAL RESOURCES OBTAINED DECEMBER, 2010.

SCALE 1:5 000

0 50 100 150 200 250

METRES

REV	Y	M	D	REVISION DESCRIPTION	DES	CHK	DRN	CHK
E	13	06	27	ADDED PORTAGE ROUTE	AR	RJS	ADF	CPB

Canadian Projects Limited
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Xeneca Power Development Inc.

XENECA POWER DEVELOPMENT INC.

BIG EDDY HYDRO PROJECT
PROJECT - GENERAL
CONSTRUCTION SEQUENCE
OPTION 2 - PLANS

PROJECT NUMBER 1052-004
CADD NUMBER 4.3.015
DRAWING NUMBER 152

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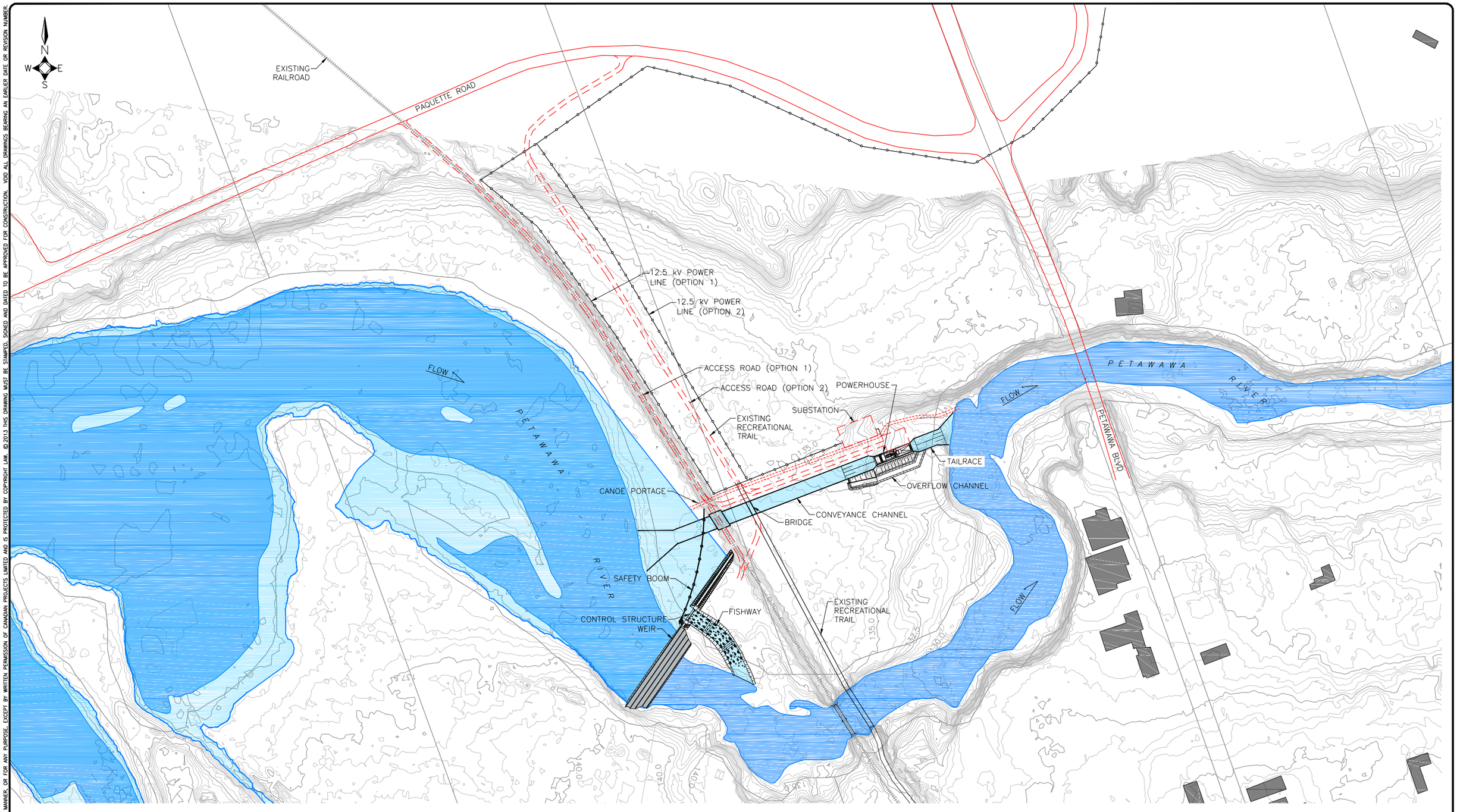

PRELIMINARY - NOT FOR CONSTRUCTION

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. 2.5 m INTERVAL CONTOURS FROM LiDAR FLOWN JUNE, 2009.
3. BASE MAPPING FROM ONTARIO MINISTRY OF NATURAL RESOURCES OBTAINED DECEMBER, 2010.

LEGEND

- EXISTING RIVER
- INUNDATION AREA
- ROADS
- RAILWAY
- NEW 12.5 kV TRANSMISSION LINE
- CANOE PORTAGE

SCALE 1:4 000

0 40 80 120 160 200

METRES

REV	Y	M	D	REVISION DESCRIPTION	DES	CHK	DRN	CHK
C	13	06	27	ADDED SUBSTATION	ADF	AR	ADF	CPB

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BIG EDDY HYDRO PROJECT
PROJECT - GENERAL
SITE LAYOUT - OPTION 1
PLAN

PROJECT NUMBER	1052-004
CADD NUMBER	4.3.020
DRAWING NUMBER	221

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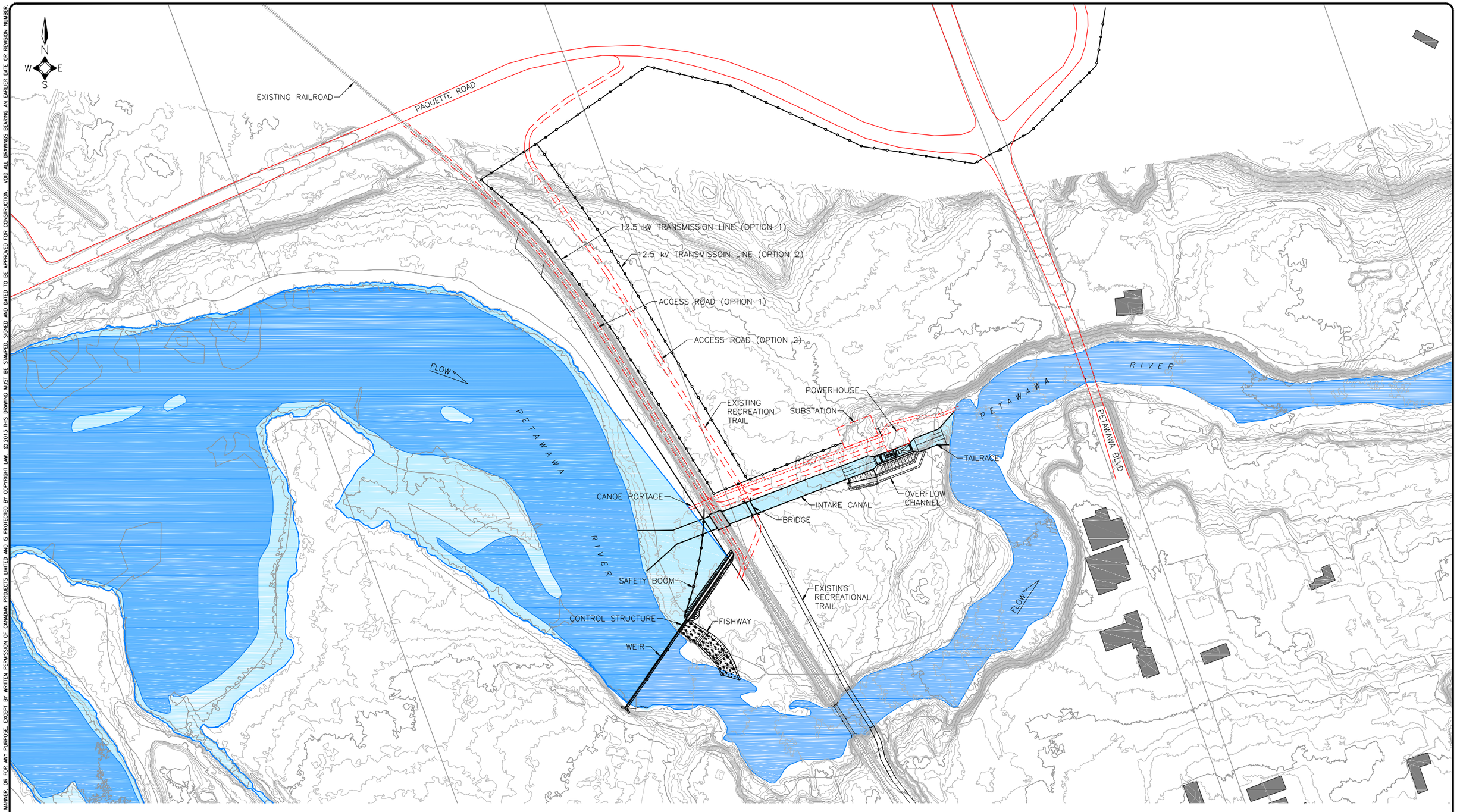

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. 2.5 m INTERVAL CONTOURS FROM LiDAR FLOWN JUNE, 2009.
3. BASE MAPPING FROM ONTARIO MINISTRY OF NATURAL RESOURCES OBTAINED DECEMBER, 2010.

LEGEND

- EXISTING RIVER
- INUNDATION AREA
- ROADS
- RAILWAY
- NEW 12.5 kV TRANSMISSION LINE
- CANOE PORTAGE

PRELIMINARY - NOT FOR CONSTRUCTION

SCALE 1:4 000

0 40 80 120 160 200

METRES

REV	Y	M	D	REVISION DESCRIPTION	DES	CHK	DRN	CHK
A	13	06	27	NEW DRAWING	ADF	AR	ADF	CPB

Canadian Projects Limited
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Xeneca Power Development Inc.

XENECA POWER DEVELOPMENT INC.

BIG EDDY HYDRO PROJECT
PROJECT - GENERAL
SITE LAYOUT - OPTION 2
PLAN

PROJECT NUMBER 1052-004
CADD NUMBER 4.3.021
DRAWING NUMBER 222

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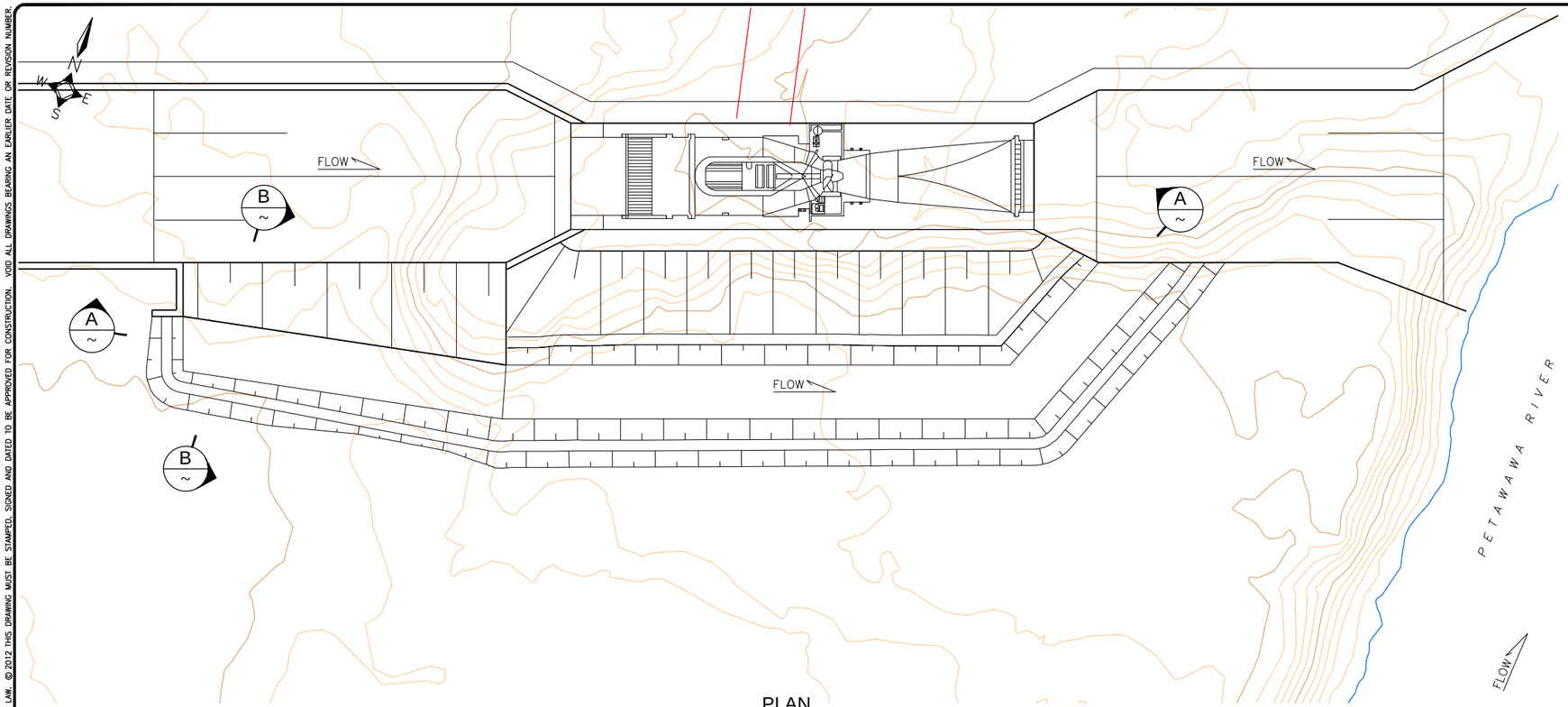
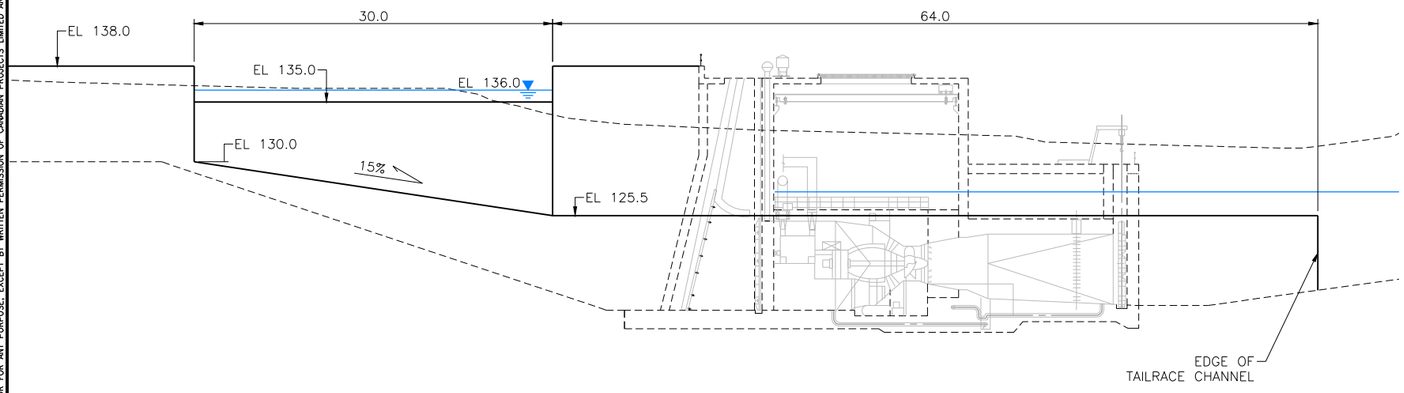
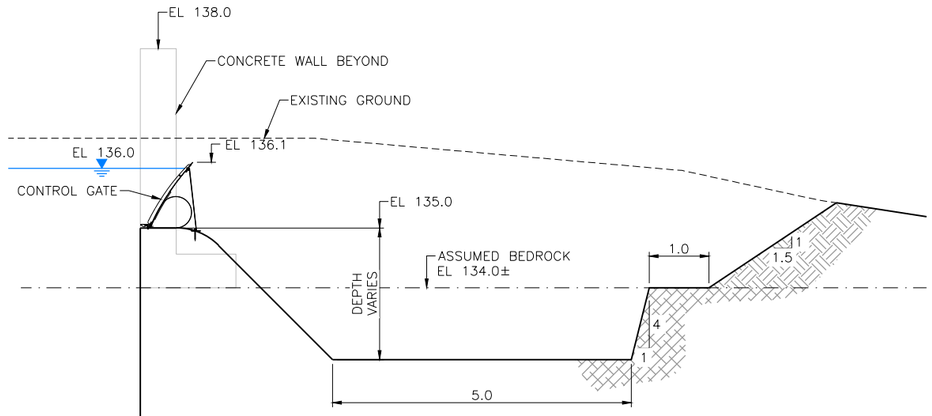


PLAN
1:500



SECTION A
1:500



SECTION B
1:100

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. 0.5m INTERVAL CONTOURS FROM LiDAR SURVEY FLOWN JUNE, 2009.

PRELIMINARY - NOT FOR CONSTRUCTION

0 5 10 15 20 1:500
0 1 2 3 4 1:100
METRES

REV	Y	M	D	REVISION DESCRIPTION	DES	CHK	DRN	CHK
B	12	05	29	REVISED ELEVATIONS AND SLOPES	ADF	BT	ADF	CPB

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BIG EDDY HYDRO PROJECT
PROJECT - GENERAL
OVERFLOW CHANNEL
PLAN, ELEVATION AND SECTION

PROJECT NUMBER 1052-004
CADD NUMBER 4.3.009
DRAWING NUMBER 162

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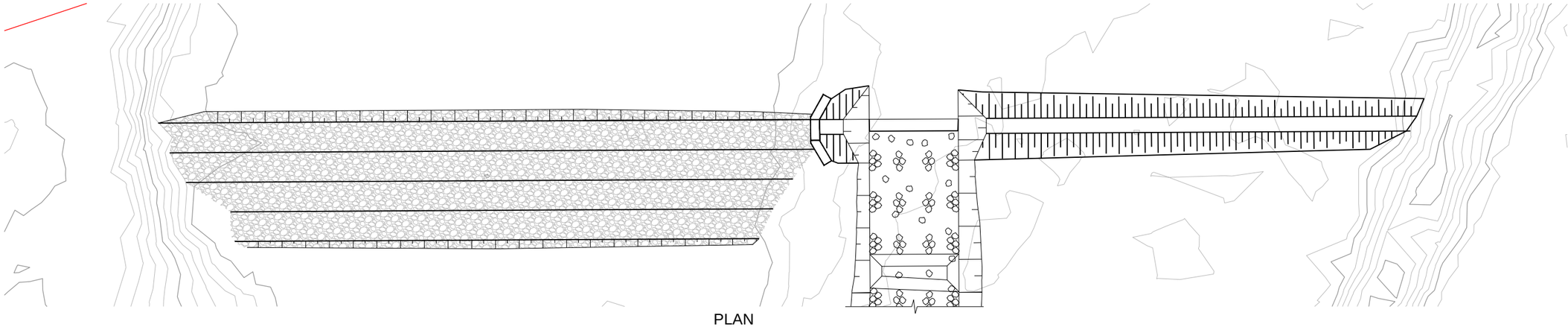
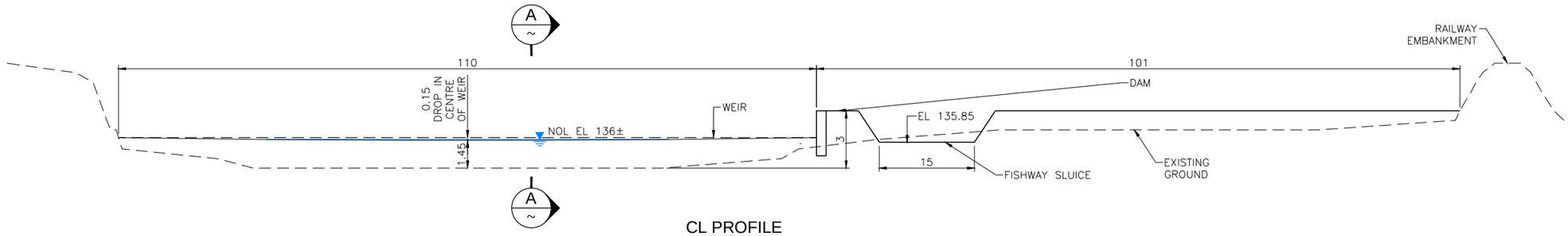
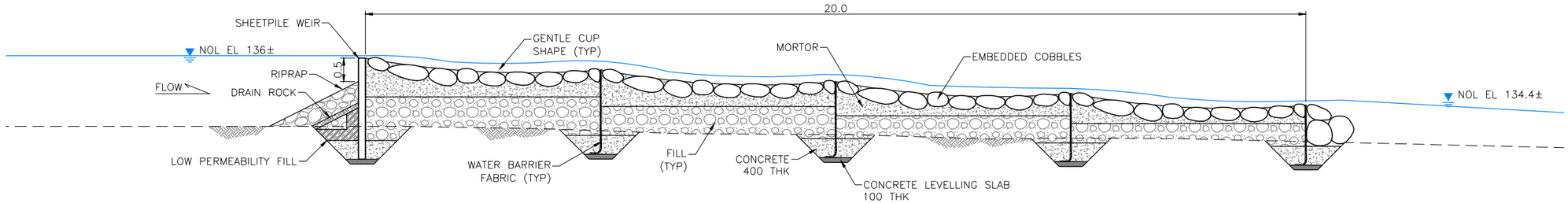


PLAN
1:750



CL PROFILE
HOR 1:750
VER 1:250



SECTION A
1:100

PRELIMINARY - NOT FOR CONSTRUCTION

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. 2.5 m INTERVAL CONTOURS FROM LiDAR FLOWN JUNE, 2009.
3. BASE MAPPING FROM ONTARIO MINISTRY OF NATURAL RESOURCES OBTAINED DECEMBER, 2010.

0	7.5	15	22.5	30	1:750
0	2.5	5	7.5	10	1:250
0	1	2	3	4	1:100

METRES

REV	Y	M	D	REVISION DESCRIPTION	DES	CHK	DRN	CHK
D	13	04	10	CHANGED WEIR TO OPTION 1	ADF	JK	AB	ADF

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XENECA POWER DEVELOPMENT INC.

BIG EDDY HYDRO PROJECT
PROJECT - GENERAL
WEIR - OPTION 1
PLAN, PROFILE AND SECTION

PROJECT NUMBER 1052-004
CADD NUMBER 4.3.017
DRAWING NUMBER 163

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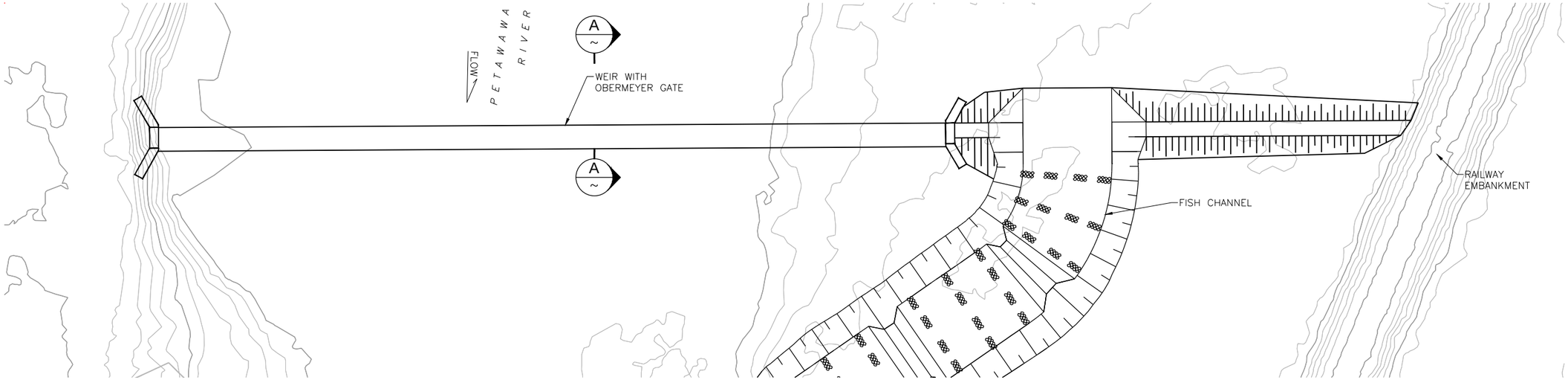
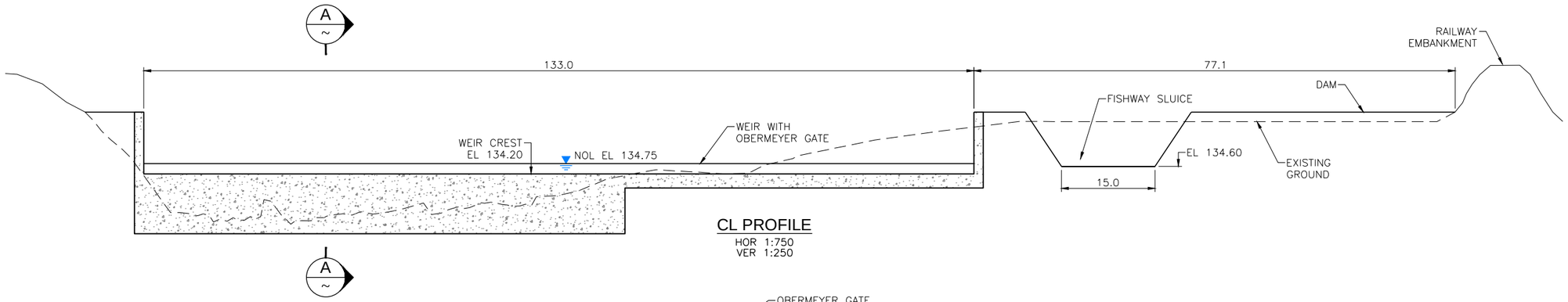
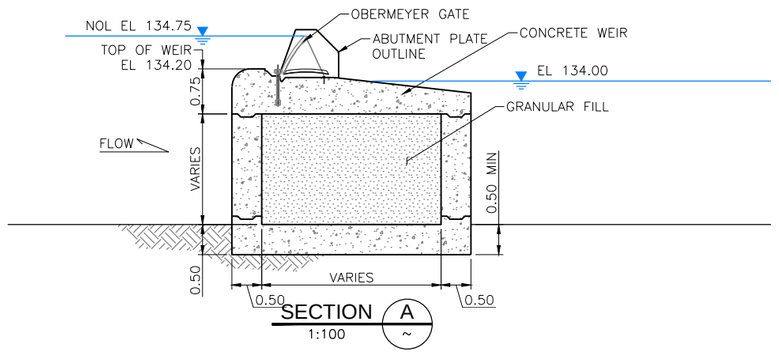


PLAN
1:750



CL PROFILE
HOR 1:750
VER 1:250



SECTION A
1:100

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. 0.5 m INTERVAL CONTOURS FROM LiDAR FLOWN JUNE, 2009.
3. BATHYMETRIC DATA OBTAINED FROM 2010 BPR ENGINEERING SURVEY.
4. BASE MAPPING FROM ONTARIO MINISTRY OF NATURAL RESOURCES OBTAINED DECEMBER, 2010.

PRELIMINARY - NOT FOR CONSTRUCTION

0	7.5	15	22.5	30		1:750
0	2.5	5	7.5	10		1:250
0	1	2	3	4		1:100

METRES

REV	Y	M	D	REVISION DESCRIPTION	DES	CHK	DRN	CHK
C	13	04	09	REVISED ELEVATIONS	JK	RJS	ADF	CPB

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BIG EDDY HYDRO PROJECT
PROJECT - GENERAL
WEIR - OPTION 2
PLAN, PROFILE AND SECTION

PROJECT NUMBER 1052-004
CADD NUMBER 4.3.002
DRAWING NUMBER 164

Preliminary Erosion and Sediment Control Plan

Erosion is defined as the process where individual soil particles are detached from the ground, whereas sedimentation is defined as the subsequent transport and deposition of the detached soil particles. In order to prevent and mitigate potential erosion and sedimentation, a preliminary sediment and erosion control plan is proposed below.

Surface soils can be disturbed throughout the construction sites due to excavation, vegetation clearing, topsoil and subsoil stripping, grading and use of heavy machinery. These activities have the potential to increase soil erosion due to exposure of bare soil (not protected by vegetation) to the effects of water (rain, river flow) or wind.

Measures preventing erosion from occurring such as proper construction phasing, minimizing the size and duration of soil disturbance and exposure and re-vegetating or stabilization as soon as possible after disturbance are all identified as effective erosion control measures. Sediment control measures are the last line of defense and are implemented to ensure that eroded soil particles are not transported off site or to watercourses. Sediment control measures include silt fences and instream silt curtains to trap and retain sediments.

The main mitigation measures for potential erosion and sedimentation will include:

• Minimize the size of the cleared and disturbed areas at the construction site. Install fencing to prevent the contractor from operating outside the defined construction area.

• Phase construction to minimize the time that soils are exposed.

• Maximize the retention of the existing vegetation cover, including the woodlot ground cover, when trees are to be removed. Fencing should be installed outside the drip line of residual trees, where possible. Grubbing should only be conducted where absolutely required.

• An adequate supply of erosion control devices (e.g., geotextiles, revegetation materials) and sediment control devices (e.g., in-water silt barriers, straw bales, silt fences) to be provided on site to control erosion and sedimentation and respond to unexpected events.

• Divert runoff from the temporary and permanent access roads through vegetated areas or into properly designed and constructed sediment traps or a drainage collection system and temporary settling pond to ensure that exposed soils are not eroded. Runoff velocities in ditches or other drainage routes, or along slopes, to be kept low via proper installation of flow velocity control

measures such as rock check dams, to minimize erosion potential. Runoff discharge locations to be protected with erosion resistant material, if required.

• Grade disturbed slopes or stockpiles to a stable angle as soon as possible after disturbance to eliminate potential slumping. Use seeding, mulching, sodding, matting, terracing or riprap for additional erosion control.

• Revegetate or stabilize exposed sites as soon as possible after they have been disturbed, using quick growing grasses or other native vegetation species. Where re-vegetation is not possible, other erosion protection methods, such as riprapping, bioengineering, or erosion matting would be used.

• Place excavated erodible material stockpiles in suitable designated areas away from the river or other watercourses (i.e., outside the floodplain, away from drainage channels) and install properly constructed silt fences around the stockpiles to limit the transport of sediment.

•Implementation of these mitigation measures is anticipated to be effective in minimizing soil erosion and off-site transport from the construction area. Monitoring will be conducted by a qualified firm throughout the construction period to assess erosion, the effectiveness of mitigation measures and remedial requirements to account for any unforeseen circumstances. A detailed Erosion and Sediment Control Plan for the site including drawings and background information will be developed before the start of construction of the project.

Engineering mitigation measures will be implemented to ensure that all riverbanks disturbed during construction will be stable over the long term. No long-term impact on bank stability is anticipated as a result of these activities. Areas of possible concern flagged in the Erosion and Sediment Control Plan would be monitored during construction or operation, as required.