TABLE OF CONTENTS

4. Infrastructure Design and Performance Requirements 6

4.1 General 6
4.2 Responsibility for Design 6
4.3 Contractor's Design Documentation 6
4.4 Intentionally Deleted 8
4.4.1 Intentionally Deleted 8
4.5 Potable Water Treatment project Requirements 8
4.5.1 Preamble 8
4.5.2 Potable Water Treatment Design and Project Requirements 8
4.5.2.1 Potable Water Quality and Quantity Requirements 9
4.5.2.2 PWTP Raw Water Quality Parameters 11
4.5.2.3 PWTP Process Selection 11
4.5.2.3.1 PWTP Raw Water Pump Stations 12
4.5.2.3.2 PWTP Process (Filtration) 12
4.5.2.3.3 PWTP Disinfection Processes 12
4.5.2.4 Evan-Thomas PWTP Residuals Disposal 13
4.5.2.5 PWTP Potable Water Distribution and Pumping System 13
4.5.2.6 Existing Nakiska Base Water Treatment Plant and Potable Water Distribution 13
4.5.3 Treated Water Distribution Design and Performance Requirements 14
4.5.3.1 Metering Requirements 14
4.5.3.2 Potable Water Reservoir Requirements 14
4.5.3.3 Treated Water Distribution Piping System Requirements 15
4.6 Wastewater Treatment Design and Performance Requirements 15
4.6.1 Evan-Thomas WWTP 15
4.6.1.1 Treated Wastewater Requirements 15
4.6.1.2 Process Selection 16
4.6.1.3 Liquid Stream Minimum Process Requirements 17
4.6.1.4 Residuals Treatment 17
4.6.1.5 Influent Quantity and Quality Parameters 17
4.6.1.6 Residuals Criteria 19
4.6.1.7 Odour Criteria 19
4.6.2 Barrier Lake Lagoons Treated Wastewater Requirements 20
4.6.2.1 Process Selection 20
4.6.2.2 Residuals Disposal Criteria 20
4.7 Process Control and Monitoring System 21
4.7.1 Facility Control System and Operator Interfaces 21
4.7.2 Instrumentation 21
4.7.3 On-line Monitoring Devices 21
4.7.3.1 Flow Meters 22
4.7.3.2 Quality Monitors 22
4.7.3.3 Level Monitor 23
4.7.4 Process Alarming System 24
4.7.5 Infrastructure Security System 24
4.8 Environmental Requirements 24

4.8.1 General 24
4.8.2 Wildlife 25
4.8.3 Stormwater 25
4.8.4 Lighting 25
4.8.5 Dust 26
4.8.6 Noise 26
4.8.7 Odour 26
4.8.8 Litter 27
4.8.9 Traffic 27
4.8.10 Vectors 27
4.8.11 Erosion, Sediment Control and Restoration 28
4.8.12 Water Crossings 28
4.8.13 Spill Containment 29
4.9 Regulatory Approvals 29
4.9.1 Preamble 29
4.9.2 Overall Responsibilities for Obtaining and Maintaining Regulatory Approvals 30
4.9.2.1 Contractor Responsibilities 30
4.9.2.2 Province's Responsibilities 31
4.9.3 Status of Existing Governmental Approvals 31
4.9.3.1 Existing Potable Water Approval Status 31
4.9.3.2 Existing Wastewater Approval Status 34
4.9.4 Regulatory Compliance Requirements 34
4.9.5 Permitting Progress and Compliance Reporting 35
4.9.5.1 Payment Adjustment 35
4.10 Technical Specifications 35
4.10.1 Preamble 35
4.10.2 Overall Objectives and General Requirements 35
4.10.3 Requirements for the Contractor's Designs and the Detailed Designs 36
4.10.3.1 General 36
4.10.3.2 Reliability 36
4.10.3.3 Robustness 37
4.10.3.4 Complexity 37
4.10.3.5 Service Life 37
4.10.3.6 Ease of Operation and Maintenance 38
4.10.3.7 Chemicals 39
4.10.3.8 Controls 39
4.10.3.9 General Infrastructure Area and Layout 39
4.10.3.10 General Arrangement 40
4.10.3.11 Piping Arrangement 40
4.10.3.12 Hydraulic Elements 41
4.10.3.13 Demolition, Removal, Relocation and/or Replacement of Existing Facilities and Existing Infrastructure 42
4.10.3.14 PWTP Process and Equipment 44
4.10.3.14.1 General 44
4.10.3.14.2 Raw Water Pumping System 45
4.10.3.14.3 Filtration 45
4.10.3.14.4 Primary Disinfection 45
4.10.3.14.5 Secondary Disinfection 46

4.10.3.14.6 Distribution Pumping System 46
4.10.3.15 Potable Water Distribution System 47
4.10.3.15.1 Fire Flows 47
4.10.3.15.2 Potable Water Storage Facilities 47
4.10.3.15.3 Distribution Piping 47
4.10.3.16 WWTP Process and Equipment 49
4.10.3.16.1 Influent Pumping System 49
4.10.3.16.2 Preliminary Treatment – Fine Screening System 49
4.10.3.16.3 Preliminary Treatment – Vortex Grit Removal System 50
4.10.3.16.4 Emergency Storage 51
4.10.3.16.5 Secondary Treatment – Biological Reactors 51
4.10.3.16.6 Tertiary Filtration - Cloth and Stainless Media Filters 52
4.10.3.16.7 Tertiary Filtration – Membranes 53
4.10.3.16.8 Disinfection – UV Disinfection System 53
4.10.3.16.9 Odour Control Equipment 54
4.10.3.17 Noise Mitigation 55
4.10.3.18 Geotechnical 55
4.10.3.19 Landscaping 55
4.10.3.20 Civil Work 55
4.10.3.21 Roads, Sidewalks, Parking and Traffic Circulation 57
4.10.3.22 Stormwater 57
4.10.3.23 Security 58
4.10.3.24 Service Connections 59
4.10.3.25 Structural Design Requirements 59
4.10.3.25.1 Design Criteria 60
4.10.3.26 Architectural 61
4.10.3.26.1 Design Philosophy 61
4.10.3.26.2 Design Criteria 62
4.10.3.26.3 Building Envelope 64
4.10.3.26.4 Building Interior 65
4.10.3.26.5 Intentionally Deleted 65
4.10.3.27 HVAC, Plumbing and Fire Protection 65
4.10.3.27.1 Outside Design Conditions 66
4.10.3.27.2 Inside Design Conditions 66
4.10.3.27.3 Ventilation Requirements 66
4.10.3.27.4 Heating and Cooling System 67
4.10.3.27.5 Air-Conditioning Systems 67
4.10.3.27.6 Plumbing 67
4.10.3.27.7 Fire Protection 68
4.10.3.27.8 Heat Recovery 68
4.10.3.27.9 Controls 68
4.10.3.27.10 General 68
4.10.3.28 Electrical Design Requirements 68
4.10.3.28.1 General 68
4.10.3.28.2 Codes and Standards 69
4.10.3.28.3 Certificates 69
4.10.3.28.4 Reference Documents 69
4.10.3.28.5 Grounding 69
4.10.3.28.6 Cable Trays, Conduits, and Raceways 70
4.10.3.28.7 Identification 71
4.10.3.28.8 Motor Control Centres 73
4.10.3.28.9 Unit Mounting 73

4.10.3.28.10 Cabinets and Enclosures 74
4.10.3.28.11 Emergency Power / Power Generation 74
4.10.3.28.12 Lighting 75
4.10.3.29 Instrumentation and Control and SCADA System 75
4.10.3.29.1 General 75
4.10.3.29.2 Instrumentation 76
4.10.3.29.3 Instrumentation Cable 76
4.10.3.29.4 Twisted Pair Shielded Cables ("TPSH") 76
4.10.3.29.5 CAT 6 Cable 77
4.10.3.29.6 Teck Cables 77
4.10.3.29.7 Fiber Optic Cable 77
4.10.3.29.8 Control Systems and SCADA System 78
4.10.4 Requirements for Collection and Distribution 80
4.11 Construction Requirements 80
4.11.1 Preamble 80
4.11.2 Representatives 80
4.11.3 Construction Meetings 81
4.11.4 Applicable Laws, Standards and Guidelines and Authorizations 81
4.11.5 Protection to the Public and Fire Safety 81
4.11.6 Surveys, Limits of Construction and Signage 81
4.11.6.1 Surveys 81
4.11.6.2 Limits of Construction 82
4.11.6.3 Signage 82
4.11.7 Coordination and Management of Construction Work 84
4.11.7.1 Contractor's Construction Schedule 84
4.11.7.2 Collaboration of Work with Construction at Nearby Facilities 86
4.11.7.3 Field Offices 86
4.11.7.4 Verification of Underground Utility Locations 86
4.11.7.5 Acceptable Days and Hours of Construction 86
4.11.7.6 Lands Maintenance 87
4.11.7.7 Traffic Management 88
4.11.7.8 Landscape Protection and Lands Restoration 89
4.11.7.9 Clearing, Geotechnical, Excavation and Soils Disposal Including Contaminated Soils 90
4.11.7.10 Shoring and Dewatering 91
4.11.7.11 Abandoned Pipe 92
4.11.7.12 Confined Space Entry 92
4.11.7.13 Hazardous Materials 92
4.11.7.14 Demolition, Salvage, and Disposal 93
4.11.8 Management of Water and Sanitation Facilities during Construction 93
4.11.8.1 Sources of Construction Water 93
4.11.8.2 Temporary Drainage Features 93
4.11.8.3 Surface Water Quality and Stormwater Permit 94
4.11.8.4 Groundwater 94
4.11.8.5 Surface Water Management Monitoring 95
4.11.8.6 Sanitation Facilities 95
4.11.9 Other Construction Measures 95
4.11.9.1 Dust Control and Light Control 95
4.11.9.2 Noise Control 96

4.12 Commissioning, Startup and testing to achieve availability 96
4.12.1 Contractor's Commissioning and Startup Activities 96
4.12.1.1 Dry and Wet Testing 97
4.12.1.1.1 Dry Testing 97
4.12.1.1.2 Wet Testing 97
4.12.1.2 Hydraulic Capacity Tests 98
4.12.1.3 14 Day Performance Test 99
4.12.2 Commissioning and Startup Test Monitoring 100
4.12.3 Commissioning and Startup Test Reporting 100
4.12.4 Re-testing 101
4.12.4.1 Construction Record Documents 101

4. INFRASTRUCTURE DESIGN AND PERFORMANCE REQUIREMENTS

4.1 GENERAL

This Section sets forth the requirements applicable to the design, construction, performance, operation, and maintenance of the Infrastructure**.**

Notwithstanding the specific requirements of this Section 4, the Contractor shall ensure that the Infrastructure is designed and constructed to ensure continuous and uninterrupted delivery of the service to the End-users, and specifically that:

(a) The Infrastructure is designed and constructed to be in full compliance with the Infrastructure Licenses;

(b) The Infrastructure will reliably ensure that the PWTP, the Potable Water Distribution System, and the WWTP can deliver the Design Capacity; and

(c) The Treated Water and Treated Wastewater Quality will at all times meet the quality standards set out in Section 4.5.2.1 and Section 4.6.1.1.

4.2 RESPONSIBILITY FOR DESIGN

The Contractor is responsible for completing the design of all elements of the Infrastructure including, but not limited to, all geotechnical and environmental investigations, the requirements of all authorizations (including the finalization and issuance of the regulatory permits and approvals) and all technical analysis required to design the Infrastructure in a professional and competent manner. In preparing the Detailed Designs for the Infrastructure, the Contractor shall comply with the Project Requirements set out in this Schedule 18 (Technical Requirements).

The requirements to be met in the design of the Infrastructure include considerations with respect to safety, functionality, adaptability, durability, aesthetics, maintainability, life cycle cost, Treated Water quality and Treated Wastewater standards.

The design requirements are generally specified in this Schedule 18 (Technical Requirements). If a requirement is not specified in this Schedule 18 (Technical Requirements), the Contractor shall adhere to Good Industry Practice, all applicable laws, and the relevant Standards and Guidelines.

Review by the Province or the Provincial Construction Representative does not imply approval, and the responsibility remains with the Contractor to meet the design and performance requirements of the DBFO Agreement in every respect.

4.3 CONTRACTOR'S DESIGN DOCUMENTATION

The Contractor shall prepare design documentation for the Infrastructure to meet the performance outputs and other specific requirements of the DBFO Agreement.

The Contractor shall prepare all design and other related documentation in accordance with the requirements of the *Alberta Infrastructure Standards for Consultant Deliverables* (the edition current as of the then relevant time of application) or the *Construction Specifications Canada Master Format (1995)*.

The Contractor shall include the following in the Contractor's Designs and the Detailed Designs:

- Design development reports for all aspects of the Infrastructure including but not limited to:
    - Design basis and philosophy;
    - Drinking water treatment process design concepts and strategies;
    - Wastewater treatment process design concepts and strategies;
    - Fire fighting water supply design concepts and strategies;
    - Operation and maintenance requirements of the proposed design(s);
    - Architectural proposals including an overall description of the number, size and type of buildings that are proposed to be retained or constructed;
    - Landscaping design concepts and strategies; and
    - Description of the utility requirements for the proposed infrastructure, including standby requirements.
- Detailed designs, prepared in accordance with standard architectural/engineering practices and in accordance with other applicable requirements in the Technical Requirements; and
- Comprehensive construction specifications complying with the *Construction Specifications Canada Master Format* (2004) requirements, including the standard three part *Section Format*.

As a basis for this documentation, the Contractor shall further develop and finalize, as required by this Section 4, the design development reports, plans and specifications in the Contractor's Designs and the Detailed Designs, including but not limited to the following:

- Plans showing topography, drainage, roadways, landscaping and geodetic designs of the Lands;
- Details of tie-ins with utilities and municipal services;
- Architectural designs for the work including but not limited to floor plans, exterior elevation drawings, interior elevation drawings showing millwork, glazing and wall-mounted accessories, exterior wall sections with key wall, window and roof junction details, reflective ceiling plans, roof plans and wall, ceiling and floor finish schedules;
- Structural designs for the work including but not limited to tank and foundation designs and superstructure framing designs including roof deck;
- Process designs for the work including process flow diagrams and mass balances,

hydraulic profiles, piping and instrumentation drawings, equipment and piping general arrangement drawings;

- Mechanical system designs for the work including but not limited to mechanical foundation plans, plumbing floor plans, heating and ventilation floor plans, mechanical room plans, schematics and details;
- Electrical system designs for the work including but not limited to floor plans for electrical power distribution system including transformers, main service, feeders, distribution panels and exterior power, floor plans indicating location of power, communications and fire alarm devices, lighting floor plans and exterior lighting, lighting fixture and security system design details and device locations, power distribution to equipment, field wiring for all instruments and devices, cabling diagrams and schedules;
- Instrumentation and control designs for the work including network architecture, location of field devices, cabling diagrams and schedules;
- Location of power, lighting and communications devices and lighting fixture details; and
- Detailed colour, finishing and materials schedules including but not limited to interior finishes, colour and materials for all exposed surfaces and exterior finishes.

4.4 INTENTIONALLY DELETED

4.4.1 Intentionally Deleted

4.5 POTABLE WATER TREATMENT PROJECT REQUIREMENTS

4.5.1 Preamble

This Section sets forth the Project Requirements applicable to the design, construction, operation, and maintenance of the PWTP and the Potable Water Distribution System.

4.5.2 Potable Water Treatment Design and Project Requirements

The PWTP shall be designed and constructed to deliver the 2029 water quantity requirements defined in Table 4.5.2.1.A. The service area for this facility shall be:

(a) Mount Kidd R.V. Park;
(b) Kananaskis Golf Course;
(c) Kananaskis Village;
(d) Kananaskis Village Staff Housing;
(e) Kananaskis Emergency Services Centre;
(f) Boundary Ranch; and
(g) Nakiska Ski Hill.

The new PWTP shall utilize source water from the two existing raw water wells that currently service the Existing Facilities. The PWTP process will include but not be limited to the following:

(a) Raw water pumping;
(b) Primary and secondary disinfection; and
(c) Ability to pump potable water to the following potable water storage facilities:

    (i) Kananaskis Village Reservoirs (existing and new reservoirs); and
    (ii) Nakiska Reservoirs (existing and new reservoirs).

Potable water for the purposes of fire protection and operational storage shall gravity feed from the reservoirs to the respective service areas.

4.5.2.1 Potable Water Quality and Quantity Requirements

The potable water treatment plant that comprises part of the Existing Facilities is governed by EPEA license #1517-02. This license is the subject of a review process that will lead to its amendment or replacement; the Infrastructure is required to meet the anticipated quality and other requirements of the new or amended license as set out herein. The Contractor hereby acknowledges having received a copy of the existing license for information only.

As part of the license review process Alberta Environment has granted a filtration exemption for the PWTP. The terms of this exemption are described in the letter from Alberta Environment to Alberta Infrastructure dated September 30, 2010, which refers to the "Evan-Thomas Water Treatment Plant Upgrade" a copy of which the Contractor hereby acknowledges as having received.

If the Contractor's Designs makes use of the filter exemption, then the design must include a Raw Water monitoring program to demonstrate continued compliance with the terms of the filter exemption, including the limit on Raw Water turbidity.

If the Contractor's Designs make use of the filter exemption, then the Contractor must also include the appropriate action plans as part of the Drinking Water Safety Plan and the Emergency Response Plan to protect public health and ensure the continued delivery of the Treated Water service in the event that the Raw Water turbidity exceeds 1 NTU. The action plan(s) included there-in must set out the response both in the event of a short term increase in turbidity that impacts the effectiveness of the UV system and in the event of a long term trend of increasing turbidity.

If the Contractor decides to rely upon the filtration exemption then continuous monitoring and recording of the raw water turbidity entering the UV disinfection process is required at a sample frequency of less than or equal to five minutes.

If the raw water turbidity measurements increase to the point where they regularly equal or exceed one NTU, then Alberta Environment must be notified by the Contractor and consulted on

the appropriate course of action. This may result in the withdrawal of the filtration exemption, resulting in the need to install a filtration process at very short notice; the timeline for such action would be determined by Alberta Environment.

In the event that a filtration process is mandated then the process will be required to meet the AE Standards & Guidelines to provide as a minimum an additional 2.5 Log reduction for *Giardia lamblia cysts* and *Cryptosporidium oocysts*.

The Indicative Detailed Designs that were submitted to Alberta Environment by the Department with the license amendment application included membrane filtration. If the Contractor's Designs include a membrane filtration system, then Alberta Environment requires the submission of additional information including pilot data for the membrane system, the type of membranes, the nature and disposal arrangements of any waste streams, details of any pre-treatment processes in front of the membrane filtration system, documentation of third party testing of the membrane filtration system, and verified log reduction of the specific membrane filtration system as demonstrated through direct integrity testing.

If the Contractor's Designs differ from the Indicative Detailed Designs then the Contractor must submit a revised license amendment to Alberta Environment including details of the treatment process. If the Contractor's Designs make use of the filter exemption then details of the Raw Water monitoring system and the action plans proposed in the event that the Raw Water turbidity exceeds one NTU must be included in the revised submission.

Regardless of whether the Contractor's Designs make use of the filter exemption, the PWTP shall achieve the minimum treated water quality requirements set out in the following Table 4.5.2.1.A:

Table 4.5.2.1.A - Minimum Treated Water Quality Requirements

Indicator Organism	Required Log Reduction
Giardia lamblia cysts	3.0
Cryptosporidium oocysts	3.0
Viruses	4.0

The treated potable water put into distribution shall fulfil all Alberta Environment water quality requirements including the requirements in the Infrastructure Licenses in respect of CDWQG. The minimum testing regime to demonstrate compliance is described in Section 5.6.2.3.

The design potable water quantity and fire flow requirements for the PWTP are summarized in the following Tables 4.5.2.1.B and 4.5.2.1.C:

Table 4.5.2.1.B - Water Quantity Requirements (2029)

	Average Daily Demand (m^3/day)	**Maximum Daily Demand (m^3/day)**
Kananaskis Village and Village Staff Housing, Kananaskis Reservoir	1,062	2053
Mount Kidd R.V. Park, Boundary Ranch, and Emergency Services Centre		517
Nakiska Reservoir	64	284
Total	**1,126**	**2,854**
PWTP Design Capacity		**3,000**

Table 4.5.2.1.C - Fire Flow Requirements

Reservoirs	**Design Fire Flow (L/s)**	**Design Fire Duration (hours)**	**Maximum Number of Simultaneous Hydrants In Use**
Kananaskis Village	284	3	3
Kananaskis Village Staff Housing	217	3	4
Golf Course Club House Area	150	2	2
Mount Kidd R.V. Park	150	2	2
Nakiska Base	250	3.25	4

4.5.2.2 PWTP Raw Water Quality Parameters

Historical raw water quality data has been provided to the Contractor, which the Contractor hereby acknowledges having received. The Contractor is solely responsible for determining the Raw Water quality parameters to be used for the Contractor's Designs and the Detailed Designs.

4.5.2.3 PWTP Process Selection

The Contractor shall provide the Province with a treatment facility that:

- Meets the applicable potable water quality requirements set out in Table 4.5.2.1.A including the requirements in the Infrastructure Licences in respect of CDWQG;

- Provides the client best value (life cycle costs);
- Minimizes the need for confined space entry by operators;
- Is robust and user friendly;
- Incorporates sufficient flexibility and redundancy to maintain availability at all times;
- Uses proven technology;
- Minimizes impacts on the Existing Facilities End-users during construction and commissioning;
- Minimizes the impacts and disturbance to the environment surrounding the facility;
- Incorporates flexibility to upgrade in the future to meet even more stringent standards that may be required; and
- Has no negative impact on the Kananaskis River or downstream users.

4.5.2.3.1 PWTP Raw Water Pump Stations

The two existing raw water wells servicing the Existing Facilities potable water treatment plant have already been approved by Alberta Environment as the water source for the PWTP raw water supply. The existing raw water wells are regulated under Alberta Environment Licence to Divert and Use Water No. 11148.

The Contractor shall provide upgrades to the Raw Water pump stations as required by the Contractor's Designs.

The Contractor must maintain and operate the raw water pump stations, and ensure that the Alberta Environment Licence to Divert and Use water No. 11148 is kept in good standing at all times.

Flow measurement of the Raw Water drawn from the wells shall be provided; the flowrate recorded shall be logged on the PWTP SCADA System.

4.5.2.3.2 PWTP Process (Filtration)

The PWTP filtration process shall be designed to produce water that meets the minimum treated water requirements set out in Table 4.5.2.1.A and to comply with the AE Standards and Guidelines.

4.5.2.3.3 PWTP Disinfection Processes

As a minimum, the disinfection process shall provide:

- Primary disinfection consisting of UV disinfection; and
- Secondary disinfection.

More than one primary disinfection unit shall be provided such that the full design dose can be provided when one unit is out of service.

4.5.2.4 Evan-Thomas PWTP Residuals Disposal

The upgrade must include a residuals stabilization and disposal system that meets the requirements of any Governmental Authority having jurisdiction over the selected disposal method.

4.5.2.5 PWTP Potable Water Distribution and Pumping System

The distribution pumping system shall have the ability to direct Treated Water to each Treated Water storage facility simultaneously. The transmission pipelines to the Nakiska Base area and to the Kananaskis area shall be valve-isolated from each other but shall also be interconnected to permit the reverse flow of water from one area to another in an emergency situation.

Multiple pump units shall be provided such that full design capacity can be provided when one unit is out of service.

4.5.2.6 Existing Nakiska Base Water Treatment Plant and Potable Water Distribution

The Nakiska Base potable water distribution system that is currently supplied by the existing Nakiska Base water treatment plant shall be connected to, and form part of, the Potable Water Distribution System and supplied Treated Water by the PWTP.

The Contractor shall tie-in the Potable Water Distribution System servicing the Nakiska Base area via valve assembly located in an accessible valve vault at a location within the Lands.

Additional treatment or conditioning as necessary shall be provided to ensure the Treated Water remains potable prior to distribution in the Nakiska Base service area. Water entering the Nakiska Base service area shall be monitored for flow.

The operation and maintenance of the existing Nakiska Base water treatment plant will not form part of the O&M and the Existing Facilities O&M.

The Contractor shall take over the provision of Treated Water for the Potable Water Distribution System servicing the Nakiska Base area, including the operation and maintenance, as soon as the Treated Water supply is from the PWTP.

The exact timing for the Contractor to take over the provision of Treated Water service to the Nakiska Base shall be determined in accordance with the Commissioning and Startup Plan, but in any event, shall be prior to the Contractor conducting Hydraulic Capacity Tests on the Potable Water Distribution System.

4.5.3 Treated Water Distribution Design and Performance Requirements

4.5.3.1 Metering Requirements

The Potable Water Distribution System shall meter the following parameters as a minimum, but is not necessarily limited to:

- Flow, total volume, pressure, temperature, pH, turbidity, and chlorine residual of treated water leaving the PWTP;
- Flow, total volume, pressure, temperature, pH, turbidity, and chlorine residual of water exiting the PWTP directed to the Kananaskis Golf Course, Boundary Ranch, and Mount Kidd R.V. Park;
- Flow, total volume, pressure, and chlorine residual of treated water at Nakiska Base service area;
- Flow, total volume, pressure, and chlorine residual of treated water entering the Mount Kidd R.V. Park service area;
- Water level and chlorine residual in each Treated Water storage reservoir; and
- Concentration of chemicals added during the treatment process measured and recorded on a continuous online basis at the PWTP and any other dosing systems within the distribution system.

All metering requirements shall be fulfilled using continuous on–line monitoring devices.

The radio access point at the existing Kananaskis Emergency Services Centre radio tower is the communication hub for all the Existing Facilities, relaying the data from the remote locations to the treatment plant and vice versa.

The location and communication frequency must be verified by the Contractor through liaison with Alberta Environment and Kananaskis Emergency Services.

The metering requirements for specific on-line monitoring devices are set forth in Section 4.7.3.

4.5.3.2 Potable Water Reservoir Requirements

Potable water reservoirs shall provide sufficient capacity to satisfy the potable water quantity and fire fighting demands identified in Table 4.5.2.1.B and Table 4.5.2.1.C plus operational needs as specified in latest version of the AE Standards and Guidelines.

The reservoir design shall consider one concurrent fire event in each of the defined service areas identified in Table 4.5.2.1.C.

The existing reservoirs may be incorporated into the Potable Water Distribution System. If the existing reservoirs are not to be incorporated into the Contractor’s Designs then the demolition requirements in Section 4.10.3.13 shall apply.

4.5.3.3 Treated Water Distribution Piping System Requirements

The Infrastructure must provide Treated Water service to all of the End-users.

All pipe materials, pipe bedding, and pipe fittings shall be in accordance with the condition of the serviced areas.

Pipe hydraulics shall satisfy fire flow conditions with a minimum residual system pressure of 20 psig throughout the system.

All road and river crossings shall be executed in accordance with the applicable regulatory approvals obtained by the Contractor.

Tie-ins to existing systems shall satisfy the constraints of the existing system.

4.6 WASTEWATER TREATMENT DESIGN AND PERFORMANCE REQUIREMENTS

4.6.1 Evan-Thomas WWTP

4.6.1.1 Treated Wastewater Requirements

The Existing Facilities wastewater treatment works at Evan-Thomas are governed by the EPEA license #1518-02. This license is the subject of a review process that will lead to its amendment or replacement; the Infrastructure is required to meet the anticipated quality and other requirements of the new or amended license as set out in Schedule 18 (Technical Requirements) of which this Section 4 forms a part.

The WWTP will be located in the Evan-Thomas Provincial Recreational Area. Due to the sensitive environment in which the WWTP will be located and in order to maintain environmental leadership, stewardship and heritage conservation, the treated wastewater targets are more stringent than those for many other municipalities.

The Treated Wastewater design standards for the WWTP are defined in Table 4.6.1.1 below.

Table 4.6.1.1 - Treated Wastewater Discharge Standards (Monthly Average)

Parameter	**Discharge Limit**
Total Phosphorous ("**TP**")	≤ 0.20 mg/L
Total Ammonia Nitrogen ("**TAN**")	≤ 1.5 mg/L
cBOD5	≤ 5 mg/L
Total Suspended Solids ("**TSS**")	≤ 5 mg/L
Fecal Coliforms ("**FC**")	≤ 200 FC per 100 mL
Total Coliforms ("**TC**")	≤ 1,000 TC per 100 mL

The Treated Wastewater limits in Table 4.6.1.1 are based on the monthly arithmetic mean of daily composite samples for TP, ammonia, cBOD5, and TSS.

Bacteria limits are based on the monthly geometric mean of daily samples.

The sampling regime shall be in accordance with the Alberta Environment approval requirements for the WWTP and as a minimum, the Contractor shall conform to the testing regime to demonstrate compliance as set out in Section 5.

4.6.1.2 Process Selection

The Contractor shall provide the Province with a treatment facility that:

- Meets the treated wastewater discharge standards as set out in Table 4.6.1.1;
- Provides the Province with the lowest life cycle costs;
- Minimizes the need for confined space entry by operators;
- Is robust and user friendly;
- Does not include a process element comprising of lined earthen lagoon(s);
- Incorporates sufficient flexibility and redundancy to maintain availability at all times and meets or exceeds the AE Standards and Guidelines for redundancy;
- Uses proven technology;
- Minimizes impacts on the Existing Facilities End-users during construction and commissioning;
- Minimizes the impacts and disturbance to the environment surrounding the facility;
- Incorporates flexibility to upgrade in the future to meet even more stringent standards that may be required; and
- Has no negative impact on the Kananaskis River or downstream users.

4.6.1.3 Liquid Stream Minimum Process Requirements

The selected treatment process must meet or exceed the Treated Wastewater discharge standards listed in Table 4.6.1.5 of this Schedule 18 (Technical Requirements). The WWTP treatment process must also comply with the AE Standards and Guidelines for wastewater systems and include, as a minimum, the following treatment systems:

- Influent flow metering;
- Influent fine mechanical screening;
- Emergency storage;
- UV disinfection; and
- Treated Wastewater flow metering.

4.6.1.4 Residuals Treatment

The upgrade must include a sludge stabilization and disposal system that meets the requirements of Alberta Environment and any Governmental Authority for the selected disposal route. The Contractor shall ensure that construction of the upgraded or replacement solids treatment and disposal works be planned and implemented in such a way as to prevent any impact on the ongoing operation and treatment performance of the existing solids treatment and disposal system prior to Availability.

4.6.1.5 Influent Quantity and Quality Parameters

Table 4.6.1.5 defines the requirements for the influent quantity and quality parameters to be used by the Contractor for the Contractor's Designs and the Detailed Designs of the WWTP.

Table 4.6.1.5 - Design Flows and Loadings for the WWTP (2029)

Component	Unit	Quantity
Flow		
Allowance for water treatment plant reject	m3/d	112
Annual average day flow	m3/d	1,425
Maximum month average day flow	m3/d	1,840
Maximum day flow	m3/d	2,655
Peak hourly flow	m3/hr	137

Table 4.6.1.5 - Design Flows and Loadings for the WWTP (2029)		
Component	**Unit**	**Quantity**
BOD5		
Annual average day loading	kg/d	260
Maximum month average day loading	kg/d	340
Maximum day loading	kg/d	615
Total Suspended Solids		
Annual average day loading	kg/d	360
Maximum month average day loading	kg/d	470
Maximum day loading	kg/d	700
Total Kjeldahl Nitrogen		
Annual average day loading	kg/d	36.8
Maximum month average day loading	kg/d	47.3
Maximum day loading	kg/d	88.3
Total Ammonia Nitrogen		
Annual average day loading	kg/d	23.6
Maximum month average day loading	kg/d	30.4
Maximum day loading	kg/d	56.6
Ortho-Phosphorus		
Annual average day loading	kg/d	3.3
Maximum month average day loading	kg/d	4.2
Maximum day loading	kg/d	7.9
Total Phosphorus		
Annual average day loading	kg/d	8.4
Maximum month average day loading	kg/d	10.8
Maximum day loading	kg/d	20.2
Temperature		
Minimum day	Degrees C	8
Minimum week	Degrees C	10
Alkalinity (CaCO3)		
Average day loading	kg/d	327

There is no limit on maximum loadings of shorter durations than those stated in Table 4.6.1.5 above.

4.6.1.6 Residuals Criteria

The Contractor shall upgrade the residual stabilization and disposal systems at the WWTP to treat and dispose of all residuals generated by the selected liquid stream processes for the design flows and loads set out in Table 4.6.1.5.

The Contractor shall dispose of the waste sludge and any processed sludge from the WWTP in compliance with the requirements of any Governmental Authority having jurisdiction over the selected disposal method.

Notwithstanding the Contractor's decision to re-use the sludge drying beds located at the Barrier Lake Lagoons and Sludge Drying Beds; the latter must be retained and maintained as part of the Infrastructure after Availability in accordance with the requirements of EPEA Registration No. 395-03-00.

4.6.1.7 Odour Criteria

No objectionable odours shall be emitted from the upgraded treatment processes to the surrounding area that would be discernible by the nearest sensitive receptors, including people using the adjacent leisure facilities (i.e. parks and golf courses).

Given the visible location of the plant and its proximity to the golf course, new unit processes will require odour control scrubbing system(s), such as carbon absorption or equivalent, to remove all possible odorous off-gases or odour-laden air.

At points in the WWTP where odours will be generated, where possible, equipment shall be enclosed in covers with odorous air extracted directly to an odour control system.

Rooms where the enclosed equipment is located shall also use an HVAC system appropriately sized to ensure that the spaces are adequately ventilated.

Where odours will be generated and it is not possible to enclose equipment, there shall be extraction points that are connected to a common odour control system. At a minimum, the following locations must be contained and ventilated to an odour control system:

- Headworks;
- Pre-treatment processes;
- Primary treatment processes; and
- Residuals processing and handling facilities.

Furthermore, if hauled sludge trucks are used, the trucks must be covered and connected to the odour control system at the WWTP during loading.

4.6.2 Barrier Lake Lagoons Treated Wastewater Requirements

The Contractor shall conform to the requirements of the Code of Practice for Wastewater Systems Using a Wastewater Lagoon under the current EPEA Registration No. 395-03-00.

4.6.2.1 Process Selection

The Contractor must operate and maintain the existing facultative lagoons and keep the current EPEA Registration No. 395-03-00 in good standing. Upgrades to the lagoons will not be permitted without prior written approval by the Province.

The Contractor shall determine the capacity of the existing drying beds for dewatering the residuals produced from the WWTP according to the Contractor's Designs and the Detailed Designs for the influent flows and loads set out in Table 4.6.1.5 and for the aerobically digested sludge from the William Watson Lodge wastewater treatment facility.

The volume of aerobically digested solids from the William Watson Lodge wastewater treatment facility that the Contractor must receive and treat at the Barrier Lake Lagoon and Sludge Drying Beds is 150 m^3/year with a solids concentration range of 3% to 5%.

The Contractor's Designs shall also allow for the continued receipt and treatment of incoming sewage flows from the University of Calgary Field Station through the facultative storage lagoons located at the Barrier Lake Lagoons and Sludge Drying Beds.

Any modifications to the design or the operation of the facultative storage lagoons shall maintain their availability for this purpose.

4.6.2.2 Residuals Disposal Criteria

The Contractor may incorporate the sludge drying beds located at the Barrier Lake Lagoons and Sludge Drying Beds into the Contractor's Designs for the treatment of residuals from the WWTP.

Regardless of the site that is chosen or the treatment process that is used in the Contractor's Designs and the Detailed Designs for the WWTP, the Contractor is responsible for the ultimate disposal of all sludge and the dewatered residuals from the WWTP and the Barrier Lake Lagoons and Sludge Drying Beds to an accredited landfill. This requirement applies to the aerobically digested sludge from the William Watson Lodge wastewater treatment facility whether the Contractor utilizes the Barrier Lake Lagoons and Sludge Drying Beds for the WWTP residuals disposal or otherwise.

The Contractor may choose to stockpile the dewatered sludge at the Barrier Lake Lagoons and Sludge Drying Beds, in accordance with Good Industry Practice and the requirements of any

Governmental Authority having jurisdiction over the sludge management and disposal activities.

Trucks hauling residuals or other waste for disposal must be covered, and appropriately licensed haulers must be used for sludge disposal.

4.7 PROCESS CONTROL AND MONITORING SYSTEM

4.7.1 Facility Control System and Operator Interfaces

The Contractor shall provide new PCS and SCADA Systems for the Infrastructure.

Because of the remote location of the PWTP and the WWTP, well proven and reliable control systems and applications shall be used, consistent with Good Industry Practice.

The PWTP and WWTP PCS and SCADA Systems shall meet the reporting and data collection requirements of the Technical Requirements.

The process control and monitoring system design must address the following key design considerations:

- Simple User Interface: the operator interface shall be easy to use;
- Maintainable system: The small plant size and remote location means ease of maintenance must be considered in the system design. System failures shall be easily isolated, repairs readily executed, and replacement parts commonly available in Alberta;
- System flexibility: The upgraded instruments and control system shall be adaptable to future plant expansions and modifications and use a network bus design that permits expansions and modifications; and
- System and Equipment Reliability: The system design shall be such that it provides failure resistance and redundancy. In addition, all equipment shall be capable of being operated manually and all instruments shall have local or integrated displays.

4.7.2 Instrumentation

The instruments in the Existing Facilities shall be replaced with up-to-date models unless they are in suitable working condition and are still supported with spare parts by the original equipment manufacturer.

4.7.3 On-line Monitoring Devices

All metering requirements for the Infrastructure shall be fulfilled using continuous on–line monitoring devices.

4.7.3.1 Flow Meters

The Contractor shall provide and maintain Flow Meters to measure and record the flow at the following locations:

- PWTP inlet Flow Meter to measure the volume of Raw Water input to the PWTP;
- PWTP outlet Flow Meter to measure the volume of Treated Water put into the Potable Water Distribution System;
- WWTP inlet Flow Meter to measure the volume of wastewater received by the WWTP for treatment; and
- WWTP outlet Flow Meter to measure the volume of Treated Wastewater discharged through the WWTP outfall.

The locations of the Flow Meters shall be selected to ensure accurate flow measurement for compliance purposes, such locations to be determined so as to exclude any treatment process recycle and/or waste flows from the quantity measured. The recording and measurement accuracy of the Flow Meters shall be as follows:

- Measure both instantaneous flow and cumulative flow;
- Have an accuracy of +/- 0.25% or better of actual flow; and
- Continuously record and archive the flow measurement readings in the plant SCADA Systems.

The Contractor shall submit details of its proposed Flow Meters, including the locations of the Flow Meters as part of the Contractor's Designs. The Contractor shall also set out in the Operation and Maintenance Plan procedures to be implemented in the event of a Flow Meter failure.

4.7.3.2 Quality Monitors

The Contractor shall install at the Treated Water Quality Monitoring Points, and maintain in good working order, Quality Monitors to obtain on-line data with respect to the following Treated Water quality parameters at a minimum, but not limited to:

- Chlorine residual;
- Turbidity; and
- pH value.

The location of the Treated Water Quality Monitoring Point shall be shown in the Contractor's Designs and the Detailed Designs, and shall be as close to the Treated Water quality sampling point as possible.

The Contractor shall install at the Raw Water Quality Monitoring Point(s), and maintain in good working order Quality Monitors to obtain on-line data with respect to Turbidity.

The location of the Raw Water Quality Monitors shall be shown in the Contractor's Designs and the Detailed Designs, and shall be as close to the Raw Water Quality Monitoring Point as possible.

The recording and measurement accuracy of the Quality Monitors shall be as follows:

- Chlorine: the Quality Monitor shall provide a resolution of ±0.01mg/L on a 0 to 5 mg/L range;
- Turbidity: the Quality Monitor shall provide a linear response and a resolution of ±0.0001 NTU on a 0.0001 NTU to 9.9999 NTU range;
- pH value: the Quality Monitor shall provide a resolution of 0.01 pH units over the range of 2 to 12 pH units; and
- Continuously record and archive the Quality Monitor measurement readings in the plant SCADA Systems.

The Province and Contractor shall jointly inspect, calibrate and test each Quality Monitor when it is commissioned. The Contractor shall inspect, calibrate and test each Quality Monitor at least once every month during the Term.

The Contractor shall also set out in the Operation and Maintenance Plan procedures to be implemented in the event of a Quality Monitor failure.

4.7.3.3 Level Monitor

The Contractor shall install and maintain in good working order Level Monitors to obtain on-line data with respect to the water level at the following locations as a minimum:

- All Treated Water storage reservoirs;
- PWTP contact tank used for disinfection Log Reduction in any treatment process that has a CT requirement; and
- WWTP equalization tanks and other holding tanks.

The locations of the Level Monitors shall be selected to ensure accurate measurement for compliance purposes, such location to be determined so as to provide an accurate representation of the total Treated Water levels and volumes. The recording and measurement accuracy of the Level Monitors shall be as follows:

- Measure both instantaneous water level and the utilized tank volume;
- Have an accuracy of +/- 0.25% or better of actual water level; and
- Continuously record and archive the Level Monitor measurement readings in the SCADA System.

The Contractor shall submit details of its proposed Level Monitors, including the locations of the Level Monitor as part of the Contractor's Designs. The Contractor shall set out in the Operation

and Maintenance Plan procedures to be implemented in the event of a Level Monitor failure.

4.7.4 Process Alarming System

In addition to controlling and operating the process at the PWTP and the WWTP, the control system shall also monitor the health and operation of individual equipment items and package plant systems to ensure they are functional and operating within the design parameters.

An alarm system shall be included in the Contractor's Designs and the Detailed Designs to notify the operator of possible problems or if corrective action is required.

4.7.5 Infrastructure Security System

The PCS shall monitor the status of the Infrastructure security systems (see Section 4.10.3.23 for security system minimum requirements). During out-of-hours periods when the Infrastructure is unmanned, a security breach shall initiate an alarm condition that will trigger a 'call-out' alarm to notify the Contractor's on-call staff.

4.8 ENVIRONMENTAL REQUIREMENTS

4.8.1 General

All work under the DBFO Agreement shall be performed in strict accordance with all applicable federal, provincial and local environmental legislation.

The Contractor shall be responsible for complying with all applicable regulations and guidelines and obtaining any required permits and approvals necessary to design, construct and commission the Infrastructure.

The design, construction, operation, and performance of the Infrastructure must comply with the requirements of EPEA and the *Canadian Environmental Assessment Act* (Canada) ("**CEAA**") and all other applicable acts and regulations.

The Indicative Detailed Designs was environmentally screened by Transport Canada under the CEAA. A separate environmental screening report was also submitted to Alberta Tourism, Parks and Recreation. The Contractor is required to comply with the requirements of these agencies with respect to the Project and the O&M.

Fish and fish habitats assessments for the anticipated river crossings within the Lands were completed for the Indicative Detailed Designs and submitted to Fisheries and Oceans Canada ("**DFO**"). The Contractor shall follow requirements of the DFO with respect to the Project and the O&M.

The Contractor must properly notify Alberta Environment, Alberta Tourism, Parks and Recreation, Transport Canada, Alberta Environment, DFO and any other Governmental Authority, and obtain any required approval to proceed before any construction work on the

Project is started.

The following Sections describe specific environmental requirements which apply to the Project and the O&M. Notwithstanding the specific requirements herein, the Contractor is responsible for obtaining, maintaining, observing and renewing and complying with all environmental approvals, authorizations, and permits required under applicable federal, provincial and local environmental legislation.

4.8.2 Wildlife

The Infrastructure will be located in the Evan-Thomas Provincial Recreation Area, characterized by mountains and mountain valleys exhibiting alpine and subalpine biophysical features. The Evan-Thomas Provincial Recreation Area provides habitat for a wide variety of wildlife species.

Construction and operational activities must be planned and controlled in a manner that minimizes and eliminates any adverse impact to wildlife and wildlife habitat within the Lands and the Evan-Thomas Provincial Recreation Area.

Potential impacts include change in habitat, change in movements, and wildlife mortality.

The Contractor must implement mitigation measures and Good Industry Practices as required by any Governmental Authority, including but not limited to, Transport Canada and Alberta Environment in order to reduce or eliminate adverse impacts. To this end the footprint of construction activities must be minimized, construction activities must be restricted to designated work spaces, activities must be scheduled to avoid sensitive periods (e.g. spring breeding periods, late winter for ungulates, nesting periods for migratory birds), traffic speed must be controlled, proper storage and disposal of food and garbage must be undertaken, and construction must be limited to daylight hours.

Any impacts to protected or at-risk species or their habitats must be reported to the Governmental Authority.

4.8.3 Stormwater

Stormwater management requires Alberta Environment's approval, both under the EPEA and under the *Water Act* (Alberta). The Contractor must obtain the required approvals and plan, design and operate stormwater drainage system(s) on the Lands based on the *Storm Water Management Guidelines for the Province of Alberta* (the edition current as of the then relevant time of application). The Contractor is solely responsible for the storm water management of the Existing Facilities and the Infrastructure as it pertains to the Project and the O&M.

4.8.4 Lighting

Artificial light pollution that leads to discomfort and adverse health effects must be avoided by the Contractor. Unnecessary use of artificial light that leads to over-illumination, light trespass,

glare, light clutter, and skyglow will be not permitted. Lighting should be used efficiently to ensure energy conservation. It is the Contractor's responsibility to determine and comply with the requirements of the Local Authority and any other Governmental Authority having jurisdiction over lighting for the Project and the Infrastructure**.**

4.8.5 Dust

It is the Contractor's responsibility to provide adequate dust control measures as required and directed by the Local Authority and any other Governmental Authority.

4.8.6 Noise

The Contractor must determine and comply with the requirements of any Governmental Authority regarding both environmental and occupational noise control. The Contractor must maintain records of all requirements regarding noise control as may be imposed by the Local Authority and any other Governmental Authority.

Noise levels for the operation of the Infrastructure shall comply with the requirements set forth below. The total sounds emissions from the Infrastructure including, but not limited to, process equipment, portable engine-driven equipment, such as standby generators and pumps, delivery and haulage trucks, and maintenance equipment shall not exceed the permissible sounds levels shown in Table 4.8.6 at a distance of 15 meters from the noise emitting source.

Table 4.8.6 - Permissible Sound Levels at 15 meters from the Noise Emitting Source

Time Period	Permissible dBA L_{eq}
Daytime (7:00 a.m. – 7:00 p.m.)	65
Night time (7:00 p.m. – 7:00 a.m.)	50

The Contractor shall design the Infrastructure to control worker noise exposure and to comply with the maximum eight hour exposure levels for working areas set forth by the Occupational Health and Safety Act.

If noise exceeds specified levels, the Contractor shall implement additional corrective measures until noise is reduced to the required level.

4.8.7 Odour

The Contractor is responsible for determining and complying with the requirements of any Governmental Authority regarding odour control and must maintain a record of all requirements and actions taken.

The Contractor must ensure that all odour control system(s) and activities required for the

Project, the Existing Facilities O&M, and the O&M are implemented to minimize the release of fugitive odorous emissions from all potential odour sources.

4.8.8 Litter

The Contractor is responsible to regularly remove all mud, dirt, debris, and all other materials and liquids deposited by construction forces travelling on or using existing roads in the area during the Construction Period, in strict accordance with all applicable federal, provincial and local environmental regulations.

The Lands and adjacent public properties must be maintained free from accumulations of waste materials and rubbish arising from the Project.

All waste materials and rubbish must be removed from the Lands regularly.

Rubbish and waste materials must not be burned or buried on or adjacent to the Lands.

Disposal of waste or volatile material, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers is prohibited.

The Contractor must ensure that all waste is disposed of in an accepted waste management facility during the Construction Period or, where unavoidable, stored safely on the Lands in the short term and removed for disposal to an accepted waste management facility.

4.8.9 Traffic

The Contractor is responsible for all required permits for transportation of equipment. All equipment and materials must be mobilized and demobilized in accordance with all local, provincial and federal laws related to transportation and safety. Upon completion of the construction work, the Contractor must restore all access areas to the same or better condition as prior to the start of the work.

During the Construction Period, wildlife may be killed or injured as a result of vehicular traffic. The Contractor must minimize this environmental impact by adopting mitigation measures including vehicle speed reduction measure, maximizing the use of existing roads during construction, minimizing the length of new access and road routes, providing transitional buffer areas at the interface between road ways and wildlife habitat to minimize “edge-effect” and by minimizing the duration of the Construction Period.

4.8.10 Vectors

The Contractor must effectively control vectors and pathogens that may possibly be present on the Lands for the Construction Period to prevent human health problems. The Contractor must comply with the requirements of any Governmental Authority regarding vector control.

4.8.11 Erosion, Sediment Control and Restoration

The Contractor must provide temporary erosion and sediment controls during and following construction until vegetation can be re-established to provide permanent erosion protection.

Necessary erosion controls to prevent loss of topsoil and upper subsoil during construction and reclamation must be employed.

The Contractor will be responsible for any loss or charges created by, or resulting from, flooding of the Lands, seepage, and drainage.

4.8.12 Water Crossings

The Contractor shall be responsible for all applicable regulations and guidelines and obtaining any required permits and approvals related to water crossings.

The Indicative Detailed Designs water crossing regulatory approvals and permits are listed in Table 4.9.3.1 for reference. The Contractor is responsible for obtaining approval from the Governmental Authority, including:

- Alberta Environment;
- Alberta Tourism, Parks and Recreation;
- Parks Canada;
- Transport Canada; and
- Fisheries and Oceans Canada.

The current status of the regulatory approvals and permits that have been initiated on the basis of the Indicative Detailed Designs are referenced in Table 4.9.3.1.

The Contractor shall familiarize itself with and follow the recommendations of all pre-existing reports and information provided to the Contractor regarding water crossings, including those prepared in support of the approvals and permits listed in Table 4.9.3.1.

The Contractor must ensure that the flow of water, if present in a watercourse, is maintained during the construction and reclamation of any water crossing.

When using open-cut water crossing techniques the Contractor shall stockpile all salvaged topsoil, upper subsoil or spoil at least three meters from the watercourse top of bank or edge of open water, and where applicable clear of the ice surface or riparian zone.

Stockpiled spoil must be contained by berms or similar isolation techniques. The Contractor must not clear, grub or excavate within an undisturbed buffer strip or riparian zone, except when required along the pipe trench and travel lane or when permitted in writing by the Province.

Existing water crossings must be used by the Contractor for transporting equipment and vehicles.

Equipment or vehicles shall not be permitted to enter a watercourse before a temporary water crossing is in place.

4.8.13 Spill Containment

When conducting operations adjacent to or up gradient of water bodies during the Construction Period, the Contractor must take all reasonable precautions to avoid the release of construction materials, disturbed topsoil and subsoil or any other detrimental substances into the water body or watercourse. Precautions to prevent such occurrences shall include:

- Installing silt fences, straw bale check dams or synthetic permeable ditch barriers around watercourses, water bodies, stockpiles, and across drainage paths, including slopes, ditches and watercourses;
- Use of silt fences, curtains, floating booms or cofferdams to prevent the release of deleterious substances while performing in stream work;
- Performing work during dry and/or frozen conditions;
- Stabilizing disturbed areas, stockpiles and excavation surfaces using vegetation, erosion protection blankets, or temporary covers. Erosion control measures to be implemented within 10 days of work completion adjacent to the water body;
- Minimize disturbance to shoreline vegetation; Do not service or refuel vehicles or equipment within 30 m of a watercourse; and
- Installing chemical spill containment for truck deliveries and chemical storage vessels.

4.9 REGULATORY APPROVALS

4.9.1 Preamble

This Section defines the responsibilities of the Contractor and the Province for obtaining and maintaining the regulatory approvals and permits required for the Project and the O&M. Contact has previously been made with the agencies listed in Tables 4.9.3.1 and 4.9.3.2. These contacts have been conducted on the basis of the Indicative Detailed Designs.

The Contractor hereby acknowledges having received copies of previously submitted approval applications. These applications were based on the Indicative Detailed Designs.

The Contractor shall obtain all required approvals for the Project and the O&M from the following governmental authorities and agencies and any other Governmental Authority:

- Alberta Environment;
- Alberta Tourism, Parks and Recreation;
- Alberta Transportation;
- Alberta Infrastructure;

- the Local Authority;
- Fisheries and Oceans Canada;
- Transport Canada;
- Environment Canada;
- Indian and Northern Affairs Canada;
- Stoney Tribal Administration;
- Kananaskis Emergency Services;
- Fortis Alberta Inc; and
- TransAlta Corporation.

4.9.2 Overall Responsibilities for Obtaining and Maintaining Regulatory Approvals

The responsibilities of the Contractor and the Province for obtaining and maintaining regulatory approvals for the Project are detailed in the following.

4.9.2.1 Contractor Responsibilities

All work under this DBFO Agreement shall be performed in strict accordance with all applicable federal, provincial and local environmental regulations. The Contractor is responsible for familiarizing itself with all applicable regulations and guidelines.

The Contractor shall conduct all studies, testing and investigations, and prepare all reports and applications and other information as required to obtain and to maintain all regulatory approvals and permits required for the Project, the Existing Facilities O&M, and the O&M.

The Contractor shall act on behalf of the Province and be responsible for identifying permit requirements, preparing and submitting applications, and for obtaining and maintaining all regulatory approvals and permits necessary for the Project, the Existing Facilities O&M and the O&M.

Omission of any required regulatory approvals and permits from this Schedule 18 (Technical Requirements) does not relieve the Contractor of responsibility for identifying and obtaining any and all approvals and permits required for the Project, the Existing Facilities O&M, and the O&M.

The Contractor shall obtain and renew as required the permits and approvals and shall bear the expense of preparing and submitting applications, including any fees, and provide copies of all approval and permitting documents to the Province upon request.

Where it is unavoidable that a specific regulatory approval be held in the name of the Province, the Contractor shall be responsible for preparing all applications, plans, and supporting

information, as well as conducting any required studies, investigations, consultations, and advertising that is necessary to obtain the approval on behalf of the Province. In these circumstances the Contractor shall provide the Province with adequate prior notice of any input or involvement of the Province that is required.

The Contractor will be responsible for ensuring that any approvals and permits, including approvals and permits obtained by the Province, remain valid and that all conditions are adhered throughout the duration of the Construction Period and the Operating Period.

The Contractor shall be responsible for the scheduling and timeframes required for obtaining all the necessary regulatory approvals and permits to conform to the Contractor's Construction Schedule.

4.9.2.2 Province's Responsibilities

The Province will, upon the Contractor's request, assist the Contractor in the Contractor's efforts to obtain regulatory approvals and permits, provided that in no event shall the Province's level of assistance be construed as the Province's fault for failure of the Contractor to secure the regulatory approvals and permits.

The Province will assist the Contractor by providing supporting information for approval and permit applications, reviewing approval and permit applications, and attending approval and permitting agency meetings at the request of the Contractor acting reasonably.

Supporting information that the Province may provide will include information that the Province has already developed or that is readily available to the Province. When the Contractor requests assistance from the Province, the Contractor shall notify the Province in a timely manner regarding upcoming Contractor meetings that the Province should attend. In addition, the Province may attend approval or permit hearings and pre-application meetings at its sole discretion.

4.9.3 Status of Existing Governmental Approvals

This Section provides an overview of the regulatory approvals and permits as they pertain to the Indicative Detailed Designs. The Contractor is responsible for securing the required approvals and permits for the Project and the O&M. Should aspects of the Contractor's Designs vary from the current approvals and applications that are in process, the Contractor shall be responsible for making new or amendment applications as required.

4.9.3.1 Existing Potable Water Approval Status

The Province holds the following existing approvals for the potable water treatment systems that form part of the Existing Facilities:

- The existing potable water treatment systems at Evan-Thomas are regulated under Alberta Environment Approval 1517-02; and

- The existing groundwater wells at Evan-Thomas are regulated under Alberta Environment Licence to Divert and Use Water No. 11148.

The existing Nakiska Base potable water distribution system servicing the Nakiska Base area is regulated under Alberta Environment Approval 17990-01 and is controlled by the Resorts of the Canadian Rockies Inc. The existing Nakiska Base potable water distribution system shall be segregated from Alberta Environment Approval 17990-01 and form part of the Potable Water Distribution System which shall be included in the amendment or replacement of Alberta Environment Approval 1517-02 held by the Province.

Table 4.9.3.1 identifies the current status of the regulatory approvals and permits that have been initiated on the basis of the Indicative Detailed Designs.

Table 4.9.3.1 - Kananaskis Country Evan-Thomas Water Treatment Plant Upgrade: Indicative Detailed Designs Regulatory Approvals and Permit Status

Regulatory Authority	Application Regarding	Applicable Legislation	Application	Status
Alberta Environment	Evan-Thomas Water Treatment Plant and Distribution System	*Environmental Protection and Enhancement Act*	*Environmental Protection and Enhancement Act* – Approval	Application submitted and waiting on approval
Local Authority	Building Permits	Alberta Building Code	Building Permit	Contractor responsibility - required
Local Authority	License to do Business in Local Authority	Municipal Requirements	Business License	Contractor responsibility - required
Transport Canada	Pipeline Crossings of Water Bodies	*Navigable Waters Protection Act*	"Minor Work Orders" for Evan-Thomas Creek, Kananaskis River Crossing A and Ribbon Creek	Application complete and joint approval from Fisheries and Oceans Canada and Transport Canada acquired.
Transport Canada	Pipeline Crossings of Water Bodies	*Navigable Waters Protection Act*	"Formal Approval" for Kananaskis River Crossing B	Application complete and joint approval from Fisheries and Oceans Canada and Transport Canada acquired.
Fisheries and Oceans Canada	Fish and Fish Habitat	*Fisheries Act*	Operational Statement Notification Form for Kananaskis River	Application complete and joint approval from Fisheries and Oceans Canada and Transport

Table 4.9.3.1 - Kananaskis Country Evan-Thomas Water Treatment Plant Upgrade: Indicative Detailed Designs Regulatory Approvals and Permit Status				
Regulatory Authority	**Application Regarding**	**Applicable Legislation**	**Application**	**Status**
			Crossing A and Evan-Thomas Creek	Canada acquired.
Fisheries and Oceans Canada	Fish and Fish Habitat	*Fisheries Act*	Application to Harmfully Alter, Disrupt, or Destroy Fish Habitat for Kananaskis River Crossing B, Unnamed Creek, and Ribbon Creek	Application complete and joint approval from Fisheries and Oceans Canada and Transport Canada acquired.
Alberta Environment	Pipeline Crossings of Water Bodies	*Water Act*	*Water Act* Code of Practice – Notification for Evan-Thomas Creek, Unnamed Creek, Kananaskis River Crossing A, Kananaskis River Crossing B, Ribbon Creek	Notifications to be resubmitted. All work must take place within one year of approval.
Alberta Sustainable Resource Development	Pipeline Crossings of Water Bodies	*Public Lands Act*	Application for Shore Line/Water Body Modification for Kananaskis River Crossing A, Kananaskis River Crossing B, Ribbon Creek	Application submitted and awaiting approval. Letter received indicating Evan-Thomas Creek and Unnamed Creek are not under ASRD jurisdiction.
Alberta Culture and Community Spirit	Impact to Resources of Cultural Significance	*Alberta Historical Resources Act*	Historical Resources Impact Assessment	Clearance received.
Alberta Tourism, Parks and Recreation	Road Crossings	*Provincial Parks Act*	Application for road crossings	Submitted but requires approval by Alberta Transportation; application forwarded to AT. Waiting on approval.

4.9.3.2 Existing Wastewater Approval Status

The Province holds the following existing approvals for the wastewater treatment systems that form part of the Existing Facilities:

- The Province currently operates the existing Evan-Thomas wastewater treatment systems under Alberta Environment Approval 1518-02, with expiration April 1, 2016.

- The Province currently operates the Barrier Lake Lagoons and Sludge Drying Beds under EPEA Registration No. 395-03, with no expiration date. The registration requires the wastewater system to be operated in accordance with the Code of Practice for Wastewater Systems Using a Wastewater Lagoon.

Table 4.9.3.2 identifies the current status of the regulatory approvals and permits as they relate to the Indicative Detailed Designs.

Table 4.9.3.2 - Kananaskis Country Evan-Thomas Wastewater Treatment Plant Upgrade: Indicative Detailed Designs Regulatory Approvals and Permit Status

Regulatory Authority	Application Regarding	Applicable Legislation	Application	Status (Indicative Detailed Designs)
Alberta Environment	Evan-Thomas Wastewater Treatment Plant	*Environmental Protection and Enhancement Act*	*Environmental Protection and Enhancement Act* – Approval	Application submitted and waiting on approval
Alberta Environment	Barrier Lake Lagoons and Sludge Drying Beds	*Environmental Protection and Enhancement Act*	*Environmental Protection and Enhancement Act* – Registration	Issued as of Jun. 01, 2005 and does not expire – In good standing.
Local Authority	Building Permits	Alberta Building Code	Building Permit	Contractor responsibility - required
Local Authority	License to do Business in Local Authority	Municipal Requirements	Business License	Contractor responsibility - required

4.9.4 Regulatory Compliance Requirements

The Contractor will be responsible for ensuring that the Infrastructure Licenses and Existing Facilities Licenses remain valid and in good standing, and that all approval and permit requirements are adhered to throughout the Construction Period and the Operating Period.

4.9.5 Permitting Progress and Compliance Reporting

The Contractor shall submit monthly progress reports to the Province to report progress in the implementation of the Permitting Plan, in the format set out therein until the permitting activity is complete, including the tracking, monitoring and close out of all permit conditions. Each monthly report shall be submitted by the 15th day of the month, reporting progress up to and including the last day of the previous month.

4.9.5.1 Payment Adjustment

If the Contractor fails to submit an up to date monthly permitting progress report in the form set out in the Permitting Plan, a Payment Adjustment of $200 per day will be assessed for each day or part thereof until Contractor submits an up to date report in the proper form.

4.10 TECHNICAL SPECIFICATIONS

4.10.1 Preamble

This Section sets out the technical specifications for the design of the Infrastructure including, but not limited to, codes and standards to be used, functional requirements, design criteria and material specifications to be met. These technical specifications are not intended to be all inclusive of the design requirements.

The Contractor will be required to meet the Project Requirements. However, nothing in the Project Requirements shall relieve the Contractor of its obligation to meet the O&M Requirements.

4.10.2 Overall Objectives and General Requirements

The Contractor shall perform the Project such that the Infrastructure is in compliance with the Project Requirements, the requirements of any Governmental Authority, as well as the following objectives and general requirements. The Contractor shall:

- Design and construct the Infrastructure required to meet the objectives of the DBFO Agreement, including all necessary unit processes, process control, monitoring and control, hydraulic components, and redundancy to meet the Project Requirements;
- Provide the capability to safely manage and dispose of all residuals generated on the Lands;
- Design to maximize available space for future expansion;
- Provide odour control using proven technologies and minimize odour-related complaints; and
- Design based on multiple units for each major process treatment such that the upgraded treatment facilities can be efficiently and effectively operated at design flows and loads with one major equipment or process unit out of service in accordance with the AE

Standard and Guidelines.

4.10.3 Requirements for the Contractor's Designs and the Detailed Designs

4.10.3.1 General

This Section summarizes the general technical specifications for the Infrastructure.

The Contractor's Designs and the Detailed Designs shall comply with the requirements of any Governmental Authority, applicable laws, relevant Standards and Guidelines, and the Technical Requirements.

If a minimum design standard for the Infrastructure is not specified in this Schedule 18 (Technical Requirements), the Contractor shall follow the applicable design standards identified in the Department's Master Specifications referred to in the *Alberta Infrastructure Standards for Consultant Deliverables* (the edition current as of the then relevant time of application).

These general technical specifications define the minimum design standards for the Infrastructure. Where the Contractor deems that more stringent technical requirements are necessary to meet the overall Project Requirements, the Contractor shall adopt such additional technical requirements in the Contractor's Designs and the Detailed Designs.

For all other material or installation requirements not otherwise included in the aforementioned documents, the Contractor shall follow Good Industry Practice and manufacturers' guidelines and requirements.

When requested by the Province, the Contractor shall provide literature, examples, and other supporting evidence that demonstrates that any specifications that are proposed as an alternative to, or are in apparent conflict with, Schedule 18 (Technical Requirements) will meet or surpass the level of quality and performance set out in Schedule 18.

4.10.3.2 Reliability

The Contractor shall:

- Base the design on technology that has a proven track record. Processes or equipment that are unproven will not be incorporated into the design; a proven track record is defined as three similar full-scale applications in similar service and climatic conditions over the last five years operating successfully, unless otherwise accepted in writing by the Province;
- Design the Infrastructure to meet instantaneous and seasonal fluctuations and peaks in demands, flows and loads in accordance with Good Industry Practice without undue requirements for operator intervention; and
- Design the PWTP and the WWTP to operate under all reasonably foreseeable conditions, while complying with the requirements of any Governmental Authority,

with a minimum of one process unit or critical equipment item out of service.

4.10.3.3 Robustness

The Contractor shall:

- Select materials and the grade of those materials for each process unit and equipment item that are compatible with the environment in which the units are to operate; submerged steel components in corrosive environments shall as a minimum be constructed of grade 304 stainless steel or better to suite the service condition;
- Select the grade or rating of equipment components to ensure that they are fit for the conditions in which they are operated; assess potential failure modes of each item of equipment;
- All metallic buried piping, fittings and valves shall be provided with appropriate sacrificial cathodic protection;
- Ensure that operating strategies can be implemented that protect personnel and other equipment from harm due to failure and which, wherever possible, maintain process viability;
- Make decisions related to standby and backup equipment, isolation valves/gates, and equipment design ratings; and
- Consider potential disaster scenarios including “loss of power” situation for every item of process equipment.

4.10.3.4 Complexity

The Contractor shall:

- Develop the design to allow future expansions without compromising the equipment, systems, and processes incorporated in the Infrastructure; and
- Develop a design that minimizes system complexity.

4.10.3.5 Service Life

The Contractor’s Designs and the Detailed Designs shall select materials that will achieve service lives in accordance with Good Industry Practice. The minimum service lives described in Table 4.10.3.5 shall apply.

Table 4.10.3.5 – Minimum Service Life

Item Description	Minimum Service Life (Years)
Transmission pipelines	60
Structural elements, including tanks, foundations, structural steel, and all building substructures and superstructures	50
Underground utilities	40
Roofing systems	20
Mechanical and electrical equipment	20
Instrumentation, control and computer equipment	10

The Contractor shall provide evidence to the Province to support the service life rating in the Contractor's Designs and the Detailed Designs.

4.10.3.6 Ease of Operation and Maintenance

The Contractor shall:

- Make all equipment accessible, with adequate clearances around equipment needing regular maintenance (e.g. pumps, compressors, blowers, etc.);
- For rotating equipment greater than 3.75 kW or with a mass greater than 100 kg, provide a minimum horizontal clearance of 1.0 meters on three sides and 1.5 meters on the fourth side and ensure that vertical clearance above the equipment to the structure (including beams) is greater than 2.0 meters for maintenance or equipment replacement;
- For rotating equipment less than or equal to 3.75 kW and with a mass less than or equal to 100 kg, provide a minimum horizontal clearance on two sides of 1.0 meters, and ensure that vertical clearance above the equipment to the structure (including beams) is greater than 1.0 meters;
- Size structure so temporary loads can be supported from the structure when equipment is removed for repair;
- Provide local shut-off switches for equipment, within 3.0 meters and in the direct line of sight; and
- Provide operator walkways to all equipment; access paths or walkways shall be at least 1.0 m wide where just operator access is required, or where it is necessary to move lifting devices to the equipment or to transfer equipment with a dolly when it has to be removed for maintenance access paths or walkways shall be a minimum 1.5 m wide with a minimum headroom of 2.5 m.

4.10.3.7 Chemicals

The Contractor shall:

- Pace the chemical feed rate in proportion to flow or other process parameter to allow economic feed rate control;
- Ensure adequate mixing is incorporated so that chemical dosages are effective;
- Account for all related chemical hazards and incorporate safety features necessary to protect workers and the public; and
- Provide a minimum of 30 days of chemical storage for those critical chemicals required for the Treated Water and the Treated Wastewater to achieve the quality standards set out in Section 4.5.2.1 and Section 4.6.1.1.

4.10.3.8 Controls

The Contractor shall:

- Include in the design an explanation of how each item of the plant will be controlled;
- Select the appropriate control mode after considering all relevant factors, including how critical the equipment is to the process, the overall plant control design philosophy, and the need to modify process set points from a central location; and
- Identify alarms that are required to protect safety, process integrity, and public health.

4.10.3.9 General Infrastructure Area and Layout

The Contractor shall:

- Design the Infrastructure roadway geometry to suit all reasonably foreseeable delivery and service vehicles, including vehicles operating the services towards the cost effective delivery of consumables;
- Develop a functional infrastructure arrangement in which each building's function and the access requirements for maintenance vehicles are defined;
- Pay special attention to access to tunnels or galleries for equipment;
- Plan pathways in the same manner as the roadways;
- Consider above-ground pedestrian traffic with respect to an operator's normal rounds and to traffic between buildings;
- Integrate walkways into which are provided as part of the plant and equipment (e.g. clarifier bridges, etc.) into the overall access arrangements;
- Undertake emergency access planning, considering requirements for ingress and egress routes for ambulances, fire trucks, and other safety personnel into the roadways and pathway design to ensure that distances are not excessive between any point where

accidents or fires could occur and a roadway accessible to the appropriate emergency vehicle;

- Consult the Local Authority and any other Governmental Authority early in the design to facilitate their input;
- Consider piping distances, wherever possible minimize distances and bends of all piping arrangements;
- Consider future requirements including making a reasonable allowances for the installation of future pipes, conduits, access ways, tanks, treatment processes, buildings, and other infrastructure; and
- Not locate any part of the Infrastructure within a 10 metre protection zone around each of the two existing raw water wells servicing the PWTP, except for the raw water pumps, conveyance pipe work, and other auxiliary components that are directly associated with the raw water wells and unavoidable for the purpose of servicing the PWTP.

4.10.3.10 General Arrangement

The Contractor shall:

- In a gallery or building, locate pressure vessels at least 0.6 meters from the back wall and 0.9 meters apart and provide sufficient space in front of the vessel for the face piping plus 1.2 meters;
- Provide 1.2 meters clearance in front of any other equipment face or panel requiring maintenance;
- Minimize piping located above blowers, compressors, or pumps to facilitate lifting;
- Provide permanently installed lift equipment with motorized overhead hoists where equipment component masses exceed 45 kg and when frequent lifting for maintenance is required;
- Allow adequate space for control panels and consider the control wiring and power wiring servicing in the layout and provide sufficient space; and
- Arrange pumps used for sludge, scum and grit pumping to minimize the distance and number of bends through which the liquid must be conveyed.

4.10.3.11 Piping Arrangement

The Contractor shall:

- Arrange sidewall pipe racks so they do not contain more than three pipes nor are more than 1.5 meters wide; if the headroom over a pipe rack is not sufficient for personnel to access and remove interior pipes, limit pipe rack width to 1.0 meters;
- Make wall penetrations perpendicular to the wall whenever possible;

- Make full allowance in design of the process air piping for expansion and contraction due to temperatures ranging from 0^{o}C to 150^{o}C, or as required to suite the intended service;
- Provide sludge piping with smooth flow fittings and use long radius elbows and bends;
- Place flanges, grooved joint couplings, or unions at appropriate spacings to allow pipe disassembly; the length of runs between disassembly points should be minimized for piping that may be prone to plugging;
- Exercise care in the layout of sludge, scum, or grit piping to minimize potential plugging problems; do not install dead ends in the downstream direction in which solids could accumulate;
- Keep valves within operator reach (below 2.5 meters) as far as possible; on any valve over 2.5 meters above the operating floor, provide chain operator or valve stem extension;
- Provide sufficient straight runs for flow meters and other instrumentation and control elements;
- Design the pipe support/restraint system;
- Provide purge points at high points and drain points at low points of piping and ensure that these points are accessible to operating staff;
- Place utility stations in logical areas to facilitate wash down and pipe flushing; the maximum length of hose required should be limited to 15 meters; and
- Locate yard hydrants at locations which facilitate tank washdown so that the maximum length of hoses is limited to 25 meters; design and install yard hydrants to ensure they do not freeze in cold weather.

4.10.3.12 Hydraulic Elements

Design the hydraulic components of the Infrastructure to best meet the following objectives:

- Low headloss and low energy consumption;
- Minimize solids deposition where not intended;
- Ensure accurate flow splits through parallel treatment processes and devices;
- No dead end channels or pipes;
- Provide for maintenance of elements such as the valving and bypasses;
- Prepare a hydraulic profile for the PWTP, the WWTP and the Potable Water Distribution System to illustrate the routing of flow through the systems and to establish tank, channel, pipe, and water elevations; the hydraulic profile shall be part of the Contractor's Designs and the Detailed Designs;
- Provide gates and valves as necessary to isolate each tank and treatment process for maintenance; provide functionality (bypasses, redundancy, etc.) to bypass major

equipment in the event that tanks or treatment process units have to be removed from service for maintenance;

- Ensure that the hydraulic elements are able to convey the expected peak instantaneous flows to the appropriate process units;
- Design piping using the Darcy-Weisbach equation to calculate friction losses. Use of another system is acceptable after providing verification of the use of that approach and the similarity in friction coefficients when uses in similar applications; and
- Design to prevent problems with flow splits, solids depositions, etc. at the foreseeable minimum flows.

4.10.3.13 Demolition, Removal, Relocation and/or Replacement of Existing Facilities and Existing Infrastructure

The Contractor shall be responsible for demolition, removal, relocation and/or replacement of the buildings, structures, and equipment forming the Existing Facilities as required for construction of the Potable Water Distribution System, the PWTP and the WWTP.

The Contractor shall also be responsible for demolition, removal, relocation and/or replacement of those components of the existing Nakiska potable water reservoir and the existing Nakiska Base potable water distribution system that will not form part of the Infrastructure.

If the Contractor determines that any existing equipment or structures can effectively be retained and employed as part of the Potable Water Distribution System, the PWTP and the WWTP, the Contractor shall demonstrate to the Province that the equipment or structure is acceptable for use.

Any unused equipment, above grade and below grade buildings or structures, including tanks, shall be demolished and the Lands fully remediated according to, Alberta Tourism, Parks and Recreation and the Local Authority requirements and to conditions to match the surrounding landscape.

Prior to the existing Evan-Thomas water treatment plant and existing Evan-Thomas wastewater treatment plant ceasing operation, the Contractor shall comply with the terms and conditions of the Existing Licenses for reclamation and decommissioning. These requirements include submission of a decommissioning and land reclamation plan to Alberta Environment within six months of the Existing Facilities ceasing operation; further to this submission, reclamation or decommissioning shall not commence until written authorization is received from Alberta Environment.

All existing underground water pipelines not required for the upgraded distribution system can be abandoned in place.

Surface features on abandoned water pipelines including valve boxes and stems shall be removed to no less than 2.0 m below grade.

Abandoned lines shall be capped, plugged or sealed in accordance with Good Industry Practice.

The Contractor shall execute demolition to meet the following specifications:

- All open excavation shall be protected prior to backfilling to ensure safety of the public;
- The Contractor shall make arrangements with the utilities to disconnect service lines entering areas to be demolished in accordance with the requirements of any Government Authority;
- Blasting operations shall be not permitted during demolition;
- Prior to demolition all existing equipment and services shall be removed;
- All underground gas piping shall be purged;
- Items to be salvaged are to be carefully removed and protected as directed by the Province;
- At end of each day's work, the Contractor shall leave work in a safe condition such that no part are in danger of toppling or falling;
- The Contractor shall demolish and keep materials wetted as may be required to minimize dusting;
- The Contractor must sort and distribute demolished materials in accordance with the construction waste management procedures set out in the Construction Management Plan;
- The Contractor shall notify the Province immediately of hazardous materials and shall not proceed without written instruction from the Province;
- Upon removal of foundation structure, basements and tanks, the Contractor shall supply and place backfill material. The backfill material shall consist of select subgrade material imported to the Lands;
- Grade all disturbed areas and level with adjacent areas. The material shall be placed in lifts to 200 mm (loose) and uniformly compacted to at least 95% of the material’s standard proctor maximum dry density;
- The Contractor shall co-ordinate distribution of materials from the Lands in accordance with the construction waste management procedures set out in the Construction Management Plan; and
- The Contractor shall be responsible for the removal of all unused equipment. Equipment included in the list below shall be returned to the Province and remaining unused equipment shall be disposed of off the Lands in accordance with all applicable regulations:

- Sample refrigeration unit
- HACH 40D Sampler
- Diesel Genset
- SX 900 Direct Drives
- Two Submersible Chopper Pumps
- Sludge Pumps
- RBC Multi Stage Blower #1
- Gravity convection oven
- Robotic Transfer Switch
- Air Dryer
- Compressor
- Gould sewage pump
- Washer and Dryer set
- RBC Multi Stage Blower #2
- Sample Scale
- 600 Volt Panel
- Genset control switch
- Kitco block and tackle
- Portable compressor
- Lighting sludge mixer
- UV Systems panel

The Contractor shall deliver the equipment listed above in its original condition (prior to the decommissioning) to a location within the Lands approved in writing by the Province. Prior to construction of the WWTP and the PWTP, the Contractor and the Province will conduct a joint inspection of the Existing Facilities to clearly identify the locations of the equipment listed above.

4.10.3.14 PWTP Process and Equipment

The PWTP process design criteria and equipment shall meet or surpass the standards and guidelines set out in the AE Standards and Guidelines. In addition to the AE Standard and Guidelines, the subsections below describe the minimum process design standards, as appropriate for the Contractor's selected treatment process.

4.10.3.14.1 General

Technical criteria to be followed for the Contractor's Designs and the Detailed Designs shall include but not be limited to:

- Water shall be potable prior to exiting the PWTP;
- The waste from the water treatment process(es) and online instrumentation shall be directed to the WWTP; and
- All precautions must be taken to minimize the potential for confined space entries;

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include :

- All piping and appurtenances shall be thrust restrained as required and be of a minimum of class 150; and
- All pumps shall be designed in accordance with the ANSI/HI standards.

4.10.3.14.2 Raw Water Pumping System

Technical criteria to be followed for the Contractor's Designs and the Detailed Designs shall include but not be limited to:

- Provide access such that the pumps can be readily removed for repair or replacement; and
- Raw water flow and turbidity shall be continuously monitored.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include :

- Pumps shall be vertical turbine complete with inverted duty, high efficiency motors.

4.10.3.14.3 Filtration

Technical criteria to be followed for the Contractor's Designs and the Detailed Designs shall include, as a minimum:

- Redundancy; and
- Pilot testing conducted in accordance with AE Standards and Guidelines.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include :

- All submerged equipment, including filtration media and supports, shall be of chemical resistant materials; and
- The PWTP shall allow for a minimum of two filtration skids.

4.10.3.14.4 Primary Disinfection

Technical criteria to be followed for the Contractor's Designs and the Detailed Designs shall include but not be limited to:

- The UV system shall meet the Deutscher Verein des Gas und Wasserfaches - German Technical and Scientific Association for Gas and Water ("**DVGW**") and United States Environmental Protection Agency ("**USEPA**") standards, having undergone comprehensive validation at a wide range of flow rates and UV transmittance levels; and
- N+1 unit redundancy is required such that the treatment capacity can be achieved when one unit is out of service.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include :

- Each reactor shall have intensity pacing. The intensity pacing system shall modulate

the lamp power levels in relation to the incoming flow and UV transmittance to provide the proper UV dosage to achieve the minimum specified log removal credit;

- Each UV reactor shall have an automatic quartz sleeve wiper. The automatic system shall allow cleaning at preset intervals using a motor driven wiper assembly and shall operate while the UV unit is online and disinfecting;
- The UV reactors shall be in-vessel type; and
- If cooling water is required by the technology selected, the UV reactors shall be equipped with actuated valves for warm up and cool down periods.

4.10.3.14.5 Secondary Disinfection

A secondary disinfectant such as chlorine is required to meet the water quality requirements and to protect the potable water in the distribution system. The Contractor shall select a suitable disinfectant and contact time to meet the disinfection requirements of the AE Standards & Guidelines.

4.10.3.14.6 Distribution Pumping System

Technical criteria to be followed for the Contractor's Designs and the Detailed Designs shall include but not be limited to:

- The distribution pumping system shall consist of a sufficient number of pumps to fill the Kananaskis reservoirs (existing and new) and the Nakiska Base reservoirs (existing and new) from two separate distribution headers;
- N+1 pump redundancy is required such that full service can be provided when one pump is out of service;
- Provision of access such that the pumps can be readily removed for repair or replacement;
- Both headers shall be normally hydraulically isolated but headers shall be connected to permit water to flow from one service area (Kananaskis Village area) to the other service area (Nakiska Base area) in an emergency situation (both directions);
- A pressure safety device shall be installed on each distribution header to relieve the distribution header of excess pressure;
- Flow, temperature, turbidity, disinfection residual, and pressure shall be measured at the point of exit of the PWTP; and
- Disinfection residual shall be monitored continuously before water reaches the Nakiska Base area. Ability to add disinfectant at the monitoring location shall be provided.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include vertical turbine type pumps complete with high efficiency motors.

4.10.3.15 Potable Water Distribution System

4.10.3.15.1 Fire Flows

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Fire flows shall be provided by gravity flow from potable water storage facilities elevated above the service areas;
- Hydrants shall be sited to ensure sufficient fire fighting coverage; hydrant locations require approval from the Kananaskis Emergency Services; and
- Pipe hydraulics shall satisfy fire flow conditions with a minimum residual system pressure of 20 psig.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include :

- Hydrants shall be ULC, UL or FM approved dry barrel compression type conforming to AWWA 502-94;
- Hydrant inlet elbow connections shall be bell-end 150 mm CI. OD pipe supplied with moulded rubber-ring gaskets conforming to AWWA C111-95; and
- All hydrants shall be provided with sacrificial cathodic protection.

4.10.3.15.2 Potable Water Storage Facilities

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Potable water storage facilities shall be sited and designed such that they are inconspicuous. Semi-mature trees and/or shrubs shall be planted as necessary to achieve this. As the potable water storage facilities will be located in a provincial recreation area with natural landscapes of scenic value, potable water storage facilities shall also be located underground and earthen covered; and
- Measures to maintain reservoir chlorine residuals shall be implemented. This may include but shall not be limited to re-chlorination facilities, baffling and reservoir recirculation measures.

4.10.3.15.3 Distribution Piping

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- All measures necessary to ensure chlorine disinfection residuals are maintained, in accordance with all regulatory approvals, shall be incorporated into the potable water distribution system. This may include but shall not be limited to re-chlorination

facilities;

- Minimum pressure throughout the distribution system shall be 50 psig when operating at the maximum hourly design flowrate for normal operation (i.e. no fire hydrants in operation);
- Potable water pipelines shall be installed such that they are not subject to frost penetration in accordance with the local environmental and geotechnical conditions;
- Pressure reducing valves and/or flow meters shall not be direct buried;
- Excavation of rock shall be by mechanical methods. Blasting is not permitted; and
- Saw cut existing asphalt that requires removal for the purpose of pipeline installation. Disturbed asphalt within the Kananaskis Village shall be restored by full road width paving.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Piping across the Nakiska Ski Hill shall be steel, minimum Schedule 40, with inside and outside protective coating;
- Isolation valves shall be installed at each side of each pipeline crossing of a water body;
- Isolation valves shall be installed at each major tee. The spacing between isolation valves shall not exceed 600 m;
- Isolation valves shall open counter-clockwise;
- All pipe material, pipe bedding, and pressure classes shall be in accordance with the condition of the serviced area;
- Provide sacrificial cathodic protection to meet the specified minimum service life requirements for:
    - metallic buried piping, fittings and valves.
    - steel, cast iron and ductile iron piping, casings and appurtenances.
- Tie-ins to existing systems shall satisfy the constraints of that system;
- All piping and appurtenances shall be thrust restrained as required;
- Hot mix restoration materials shall be of equal or better mix design than the adjacent hot mix material; and
- Importing of fill or topsoil requires prior written approval of the Province. Importing from sources east of Kananaskis is not permitted.

4.10.3.16 WWTP Process and Equipment

The WWTP process design criteria and equipment shall meet or surpass both the standards and guidelines set out in the AE Standards and Guidelines. In addition to the AE Standard and Guidelines, the subsections below describe the minimum process design standards, as appropriate for the Contractor's selected treatment process(es).

4.10.3.16.1 Influent Pumping System

The wastewater enters the WWTP at an elevation which is significantly lower than the level to feasibly facilitate gravity flow to a screening process. An influent wet well and pumping system is required.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- The wet well shall be sized to provide a sufficient storage buffer to allow for reasonable control and minimize pump starts, as required by the pump manufacturer;
- All precautions must be taken to minimize the potential for confined space entries;
- The influent pumps shall be installed in a dry well arrangement;
- The dry well shall be sized with adequate space for pumps and piping, in accordance with the ANSI/HI pump standards;
- Provision of pumps capable of operating satisfactorily in a submerged environment without damage to the motor;
- Installation of multiple pumps for minimum N+1 redundancy and to allow automatic pacing to match the range of influent flows; and
- Provision of lifting device(s) to safely remove pumps from service and land at grade.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Provision of units capable of operating satisfactorily in a submerged environment without damage to the motor; and
- Provision of non-clog chopper style pumps.

4.10.3.16.2 Preliminary Treatment – Fine Screening System

Influent screening and compaction shall be installed prior to the biological treatment process to remove materials such as rags, wood, and plastic objects. Screening shall be conveyed to a washer/compactor prior to discharge into covered collection bins.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- The screen(s) shall have a maximum screening opening size of 6 mm and sized to have a maximum face velocity of 1 m/s;
- Minimum N+1 redundancy is required and shall be provided with an identical screening unit;
- Size the washer/compactor to handle the peak screenings quantities;
- The Contractor shall provide a spray bar that operates whenever the washer/compactor operates;
- The screenings system shall achieve as a minimum, 50% reduction in water content, 50% reduction in volume, and produce compacted screening with a solids concentration of at least 35%; and
- The washer/compactor shall be designed to deliver the compacted screening into a screenings bin.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Screens that depend on the weight of the rake to engage at the bottom of their stroke are not allowed;
- Washer/compactors that utilize a hydraulic ram principle to compact screenings are not allowed; and
- All wetted parts shall be constructed of 304 stainless steel or better to suit service conditions.

4.10.3.16.3 Preliminary Treatment – Vortex Grit Removal System

Grit comprises of heavy inorganic and some organic particulates contained in the raw wastewater.

The Contractor may include a vortex grit removal system as part of the Contractor's selected treatment process(es) to facilitate the removal of grit from the process stream prior to the primary and biological treatment processes to minimize abrasive wear on downstream equipment and to prevent accumulation and deposition of heavy, non-biodegradable material in downstream tankage.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- The vortex grit removal system shall remove a minimum of 95 percent of plus 300 micron material and 65 percent of plus 150 micron material;
- The grit solids concentration shall be greater than 80 percent solids;

- The grit volatile content shall be less than 25 percent of the total solids;
- The minimum nominal diameter of the vortex chamber is 1.8 meters;
- Provision of a system to fluidize the grit prior to extraction; and
- Provisions shall be incorporated into the design to bypass the unit when taken out of service for maintenance.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- All wetted parts shall be constructed of 304 stainless steel or better to suit service conditions;
- Air lift pumping as a means of removing grit from the chambers is not allowed; and
- Shallow, square basins (detritors) or similar basin geometry are not allowed.

4.10.3.16.4 Emergency Storage

Emergency storage shall be incorporated into the design prior to the biological treatment process.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Provision of a minimum of four hours emergency storage at maximum month average day flows;
- Diversion of the wastewater to emergency storage shall be automatic by way of automation and/or hydraulics;
- The system shall be designed to allow the stored wastewater to flow back into the main liquid stream at a controlled rate; and
- Provision of a minimum N+1 redundancy for pumping systems, if pumping is required.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- All wetted parts shall be constructed of 304 stainless steel or better to suit service conditions.

4.10.3.16.5 Secondary Treatment – Biological Reactors

Biological reactors may be used for the removal of dissolved and suspended organic matter and nutrients from the wastewater. The performance of biological reactors depend upon the design parameters and the capability of the system to control the physical environment in which the organisms operate and the biochemical reactions take place. The following requirements below shall apply for the design of the biological reactors.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Provision of a minimum of two independent biological reactors in parallel;
- A maximum mixed liquor solids concentration of 4,000 mg/L, with secondary sedimentation following the biological reactors;
- A maximum mixed liquor solids concentration of 15,000 mg/L, with membranes following the biological reactors;
- Dissolved Oxygen ("**DO**") in the aeration zones shall be automated to control to an operator adjustable value;
- The maximum DO levels for design in the aerobic zone(s) shall not exceed 2.0 mg/L;
- The DO levels in the aerobic zones(s) shall not drop below 0.7 mg/L;
- Design the reactors for plug flow;
- The aeration system shall consist of fine bubble diffusers;
- The inclusion and sizing of mixers, as required, to eliminate the potential for solids disposition;
- Sufficient that mixing energy input in the aerobic zone(s) to prevent stratification and floor deposition; and
- Provision of a minimum N+1 redundancy for the blower systems.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- All wetted parts shall be constructed of 304 stainless steel or better to suit service conditions. The aeration piping below the water level can be constructed of CPVC or better. The diffusers can be constructed with PVC or Polyethylene holders and EPDM diffusers;
- Surface aerators are not allowed;
- The reactors shall be concrete;
- Complete mix aeration basins are not allowed; and
- Jet aeration as a means of introducing oxygen to the system is not allowed.

4.10.3.16.6 Tertiary Filtration - Cloth and Stainless Media Filters

The treated wastewater requirements may facilitate the need for tertiary filtration as part of the Contractor's selected treatment process(es). The following requirements in the subsections below shall apply if cloth or stainless media filters are included in the Contractor's Designs and the Detailed Designs.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- A maximum hydraulic loading rate at peak flows of 399 $m^3/d/m^2$;
- A maximum hydraulic loading rate at average day flows of 202 $m^3/d/m^2$; and
- Minimum N+1 redundancy is required.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- All submerged equipment, including filtration media and supports, shall be of chemical resistant materials compatible with the process fluid and filter cleaning agents.

4.10.3.16.7 Tertiary Filtration – Membranes

The treated wastewater requirements may facilitate the need for tertiary filtration as part of the Contractor's selected treatment process(es). The coupling of a membrane to a biological reactor, has demonstrated inherent advantages over conventional biological wastewater treatment systems. The following requirements below shall apply if membranes are considered.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- The design membrane flux rate for peak flows shall not exceed 28 L/m^2-hr;
- The design membrane flux rate for average day flows shall not exceed 16 L/m^2-hr;
- The membrane scour air shall not exceed 0.7 Nm^3 (air)/m^2 (membrane area)-hr;
- Filtration direction shall be from outside to inside of the membrane;
- The maximum design mixed liquor concentration in the reactors shall not exceed 15,000 mg/L if coupled with membranes; and
- N+1 redundancy is required.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- The membranes shall be hollow fiber type suitable for immersed service;
- The membrane tank(s) shall be concrete; and
- The membrane and module assemblies shall be of chemically resistant materials.

4.10.3.16.8 Disinfection – UV Disinfection System

A UV disinfection system shall be included in the Contractor's selected treatment processes to achieve the treated wastewater bacteriological requirements. In UV disinfection systems, germicidal lamps produce the UV light which imparts a damaging dose of UV radiation to the

cells' DNA as the wastewater flows through the reactor.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- The maximum UV transmissivity for design shall not exceed 60%;
- The minimum design dose shall not be less than 24 mJ/cm^2, independent third party verified;
- The system shall be designed to deliver the required dose at the end of lamp life and with fouled sleeves to compensate for lamp output reduction over the time period corresponding to the manufacturer's warranty;
- The discharge from the UV system shall facilitate continuous flow to the outfall during the 1-100 year flood elevation;
- N+1 redundancy is required;
- The UV system shall be able to continue providing disinfection while the automatic wiping system is in operation; and
- The UV system shall be installed in an enclosed heated building.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Each UV reactor shall contain high-intensity low-pressure amalgam UV lamps;
- The provision of an automatic cleaning system; and
- The provision of either in-channel or closed-vessel systems.

4.10.3.16.9 Odour Control Equipment

The Contractor shall design and implement odour control system(s) and technologies to minimize the release of fugitive odorous emissions from all existing and potential odour sources at the WWTP. At a minimum, the Contractor shall cover, enclose and treat air from the headworks, primary treatment, and solids handling facilities.

Performance criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- A minimum odour removal efficiency of 90% of inlet dilution to threshold values as measured using the latest version of European Standard EN 13725 "Determination of Odour Concentration by Dynamic Olfactometry";
- N+1 redundancy for the blowers;
- A minimum of 2-cells are required for biofilter technologies; and
- Humidification system to ensure 100% humidity for biofilter technologies.

Product criteria to be followed for the Contractor's Designs and the Detailed Designs shall include:

- Inorganic media;
- The provision of corrosion resistant materials, including 304 stainless steel or better for steel components, fiberglass-reinforced plastic, or polyethylene; and
- The provision of either in-channel or closed-vessel systems are acceptable.

4.10.3.17 Noise Mitigation

The Contractor shall be responsible for designing, installing and implanting all noise mitigation measures require to meet the Technical Requirements during the Construction Period and the Operating Period.

4.10.3.18 Geotechnical

The Contractor is solely responsible for all geotechnical testing and analysis in the subject area as may be required to meet the Project Requirements and for any necessary authorizations from any Governmental Authority.

An existing geotechnical report was completed for the Indicative Detailed Designs and has been provided to the Contractor as information only.

The existing geotechnical report provided to the Contractor shall not be construed as importing any duty of care to the Contractor on the part of the Province in relation to the accuracy of such geotechnical reports or the studies or other information contained therein, it being mutually understood and agreed that the Contractor will perform its own research, investigation and due diligence for the Project.

4.10.3.19 Landscaping

The PWTP and the WWTP landscaping shall be designed to maintain a well-kept appearance while minimizing the frequency of required maintenance.

4.10.3.20 Civil Work

The Infrastructure shall be designed and constructed to meet the following general civil work objectives and design criteria:

- The manner in which the Infrastructure is designed and constructed shall be both environmentally sustainable and compatible with the existing infrastructure and Lands conditions;
- During the layout and Infrastructure design, the existing Lands conditions shall be considered to balance the cut-and fill volumes to the maximum, feasible extent. All

excess excavated material shall be preserved. When possible, the Contractor shall use suitable, excess excavated material for landscaping purposes on the Lands. Otherwise, the Contractor shall contact the Local Authority regarding the excess excavated material;

- All Infrastructure shall be arranged on the Lands in a manner that access to the Lands complies with both emergency and fire vehicle requirements and provides safe access into and throughout the Lands;
- The Infrastructure design and layout shall be such that operation, maintenance, and monitoring can be done easily to optimize operational data collection, storage and use;
- Provide open space on the Lands to allow for future expansion, located such that construction of future Infrastructure expansions shall not interfere with the ongoing operation of the Infrastructure;
- The Infrastructure layout, building design, and landscaping shall be such that a well-kept appearance is provided while minimizing the frequency of required maintenance; and
- Demolition, removal, relocation and/or replacement of components must be completed as described in Section 4.10.3.13.

The specific civil work design criteria for the upgrades are as follows:

- Lands access, hydraulic profile and influent and treated wastewater conveyance facility locations shall be carefully considered and arranged in the design as to not interfere with the existing utilities and water wells, and to allow for future expansion;
- The existing Evan-Thomas wastewater treatment plant has been raised to an elevation above the 1/100 year flood plain. Earthwork to raise the Infrastructure may be required;
- Provision and maintenance of walk-up access to all equipment and cart access to all equipment that is greater than 50 kg;
- Provision and maintain access for tote deliveries at the Infrastructure as required;
- Provision and maintenance of safe operator and maintenance vehicle access to the Infrastructure during all seasonal conditions;
- All surface runoff and stormwater from the Lands shall be collected and managed according to the stormwater management guidelines for the Province and as described in Section 4.10.3.22;
- Separation and treatment of all surface runoff from areas in the Infrastructure that may contain spills from the treatment processes; and
- Provision of administration space that includes lab space, restrooms, lunch area, office area, and work space as described in Section 4.10.3.26.2.

4.10.3.21 Roads, Sidewalks, Parking and Traffic Circulation

The Contractor shall design, construct and maintain the road and parking system to meet the following objectives:

- Roadways, parking and manoeuvring areas that efficiently and safely provide for anticipated traffic level on the Lands including facility staff, visitors, standard trucks, tractor trucks, and semi-trailers used for chemical and other deliveries, residual hauling, and for emergency rescue vehicles, including firefighting and rescue equipment;
- Circulation patterns and roadways on the Lands that are arranged to minimize the interaction of commercial vehicles with staff and visitor vehicles;
- Parking for visitors that are clearly marked and that are located to provide easy access to the administration building. The minimum number of visitor parking spaces, including handicapped accessible stalls, shall be provided in accordance with the requirements of the Local Authority;
- Staff parking spaces including handicapped accessible stalls, in accordance with the Local Authority;
- Construction and operations traffic shall be considered during the roadway and parking design. The overall approach shall consolidate construction traffic to minimize impacts to the Lands and surrounding environments and to ensure efficient deliveries and pickups during construction and operation;
- The roadway width, radius of curvature, sight distances, grades, and vertical curves of all Lands roadways shall, at a minimum, conform to the Alberta Transportation Highway Geometric Design Guide (1999);
- Signage shall clearly direct visitors to the administration facilities and delivery trucks to the delivery and storage areas. All buildings shall be clearly identified to comply with the fire code;
- Grading of adjoining surfaces at road edges and subsurface intercept drains as necessary to prevent run-on of precipitation and snowmelt; and
- Preservation of existing walking trails and golf course landscaping in close vicinity to the Existing Facilities during the Construction Period and the Operating Period.

4.10.3.22 Stormwater

The Contractor shall design, construct, maintain and manage all service roadway, parking lot and building collection and drainage systems at the Infrastructure for the duration of the Construction Period and the Operating Period. In addition to new stormwater drainage facilities, the Contractor may modify existing stormwater drainage facilities to meet the PWTP and the WWTP stormwater management requirements.

To ensure that sediment does not enter natural drainage paths, grades shall be sloped away from drainage courses. Any water entering the storm drainage systems shall be free of all dirt and

sediments. All erosion and sediment control measures shall be inspected every seven days and following storm events and/or snowmelts and repaired or replaced and cleaned as necessary. Sediment is to be removed from silt fence when the sediment level reaches half the silt fence height.

The existing ground elevation of the Existing Facilities has been raised to an elevation above the 1/100 year flood plain. In the event that the PWTP and the WWTP facilities require additional space, additional earth works to raise the Infrastructure will be required. The Infrastructure shall be protected from physical damage and remain fully operational and accessible during the 1/100 year flood event.

4.10.3.23 Security

The Contractor shall be responsible for ensuring the security of the Infrastructure, including but not limited to the:

- PWTP;
- Raw Water wells;
- Raw Water storage reservoirs;
- Treated Water storage reservoirs;
- Chlorination buildings;
- WWTP;
- Wastewater storage reservoirs/lagoons; and
- Treated Wastewater storage reservoirs/lagoons.

As a minimum each of the buildings comprising the PWTP and the WWTP shall be equipped with an independent dedicated security system to monitor all entrance ways.

The security system shall also address the safety and public health protection requirements of the Raw Water source, Treated Water storage facilities, and the Potable Water Distribution System as determined by the risk assessments conducted as part of the Drinking Water Safety Plan.

The security systems shall also be linked to the PCS as set out in Section 4.7.4.

Perimeter fencing at the PWTP and the WWTP is not necessarily required. However, the Contractor is responsible for provided fencing and safety measures at individual facility components as required by Occupational Health and Safety Act regulations and the AE Standards and Guidelines. As a minimum, the following measures shall be taken:

- Reservoirs shall be fenced;
- Entrance gates, access manholes, and valve or vent houses shall be locked; and
- Chlorination buildings shall be locked and equipped with the same independent, dedicated security system as described for the PWTP, the WWTP and administration

facilitates.

4.10.3.24 Service Connections

The Contractor shall be responsible for the following:

- Connection of Infrastructure service lines to existing lines and sources, regardless of whether the required work is performed by Contractor's own staff, subcontractors, or by the utility;
- Co-ordination of service connection work and making of all necessary arrangements with, compliance with requirements of, and full cooperation with each utility; and
- Service connection charges, if any, levied by each utility.

The Contractor shall coordinate with the utility in continuing to provide propane and tanks as per the existing leasing agreement with the Province until notified of changes.

The Contractor shall separately provide their own fuel requirements for all construction during the Construction Period and shall provide additional propane storage as required to meet the demands of the Infrastructure.

If the Contractor's power supplies are provided through the power supplies of the Existing Facilities then the Contractor shall sub-meter their power usage during the Construction Period and reimburse the Province the actual cost of power used by the Contractor. This reimbursement shall be remitted to the Province by the Contractor within four weeks of the Availability. The reimbursement rate shall be $0.12 per kilowatt hour.

If required, the Contractor shall coordinate with the utility to supply and install new transformers including primary meter and Medium Voltage ("**MV**") cables between the existing MV pad mount switch and any new transformer location as decided by the Contractor. The Contractor shall supply and install required transformer pad, MV cable duct bank and Low Voltage ("**LV**") cables between transformer and switchgear if required by the Infrastructure design.

The Contractor shall protect all cabling and connection points during any demolition or relocation of telephone, internet, or other communication services. The Contractor shall also reconnect, test and commission all points upon completion of the PWTP and the WWTP.

4.10.3.25 Structural Design Requirements

The Contractor's Designs and the Detailed Designs for the structures shall comply with the following design codes (in the edition current as of the then relevant time of application):

- Alberta Building Code ("**ABC**"); and
- Supplement to the National Building Code ("**NBC**").

The buildings shall be designed to the applicable CSA standards and the liquid retaining concrete tanks shall be designed to the applicable ACI standards. The design of the structures shall comply with the following standards:

- Structural Steel:

CAN/CSA-S16-09	Limit States Design of Steel Structures
CISC	Code of Standard Practice for Structural Steel
CISC	Handbook of Steel Construction; and

- Concrete:

CAN/CSA-A23.3	Design of Concrete Structures for Buildings
ACI 318M-08	Building Code Requirement for Structural Concrete
ACI 350M-06	Code Requirement for Environmental Engineering Concrete Structures
ACI 350.3-06	Seismic Design of Liquid Containing Concrete Structures.

4.10.3.25.1 Design Criteria

The climatic loading on the structures for design shall be obtained in accordance with the ABC. As the Evan-Thomas Provincial Recreation Area is not listed in Appendix C of the ABC, the snow and wind design data have been obtained from the Meteorological Service of Canada for this location and are summarized below as follows:

- Snow Load
  - The structures shall be designed to resist a snow load calculated with the following design data:
    - Ground Snow Load S_s = 7.4 kPa (50 year);
    - Rain Load S_r = 0.1 kPa;
  - The snow load applied to the structures shall include snow accumulation in accordance with the NBC Commentary G;

- Wind Load
  - The structures shall be designed to resist the following hourly wind pressures, as they apply:
    - 1/10 year probability $q_{1/10}$ = 0.35 kPa;
    - 1/50 year probability $q_{1/50}$ = 0.50 kPa;
    - The wind load shall be applied in accordance with the NBC Commentary I;

- Seismic Design
  - The structures shall be designed to resist seismic loads based on the following seismic data:

- Spectral Response Acceleration Sa(0.2) = 0.24;
- Sa(0.5) = 0.14;
- Sa(1.0) = 0.07;
- Sa(2.0) = 0.04;
- Peak Ground Acceleration PGA = 0.12;

- The geotechnical lands classification as Class D;
- The buildings shall be checked for seismic loading as outlined in the ABC. The tanks shall be designed for seismic loading outlined in the ACI 350.3 Standard for Seismic Design for Liquid Containing Structures;

- Existing Structures
  - The current environmental design loads exceed those specified for the existing buildings. The existing buildings, if reused, must be strengthened to comply with the current NBC.

4.10.3.26 Architectural

4.10.3.26.1 Design Philosophy

The Contractor's Designs and the Detailed Designs philosophy must:

- Meet all programmatic and functional needs;
- Recognize and enhance the environmental systems and promote sustainability by the incorporation of sustainable design system into the building concept;
- Use materials and components that ensure minimum inconvenience and disruption from breakdowns, repairs and maintenance activities;
- Provide aesthetic treatments to screen mechanical equipment, tanks and infrastructure from sightlines associated with tourist activity, corridors, and the Local Authority, and conform to the Local Authority design review requirements;
- Comply with the following codes and guides:
  - ABC;
  - Alberta Fire Code;
  - Alberta Infrastructure's Technical Design Requirements for Alberta Infrastructure Facilities, the "Red Book";
  - Health Canada's Occupational Health & Safety standards;
  - Kananaskis Improvement District Development Permit guidelines; and
  - Guideline to the Kananaskis Improvement District Subdivision and Development Permit Application Processes and The Subdivision and Development Appeal Process under the Kananaskis Land Use Order (August 1, 2002, or later as applicable).

4.10.3.26.2 Design Criteria

The Contractor's Designs and the Detailed Designs shall incorporate the following design criteria:

- Interior Environment Design Requirements:
  - Indoor Air Quality:
    - The elimination of materials that may off-gas or contain potential environmental pollutants is preferred. If the use of materials that may off-gas or contain potential environmental pollutants is required then the use of such materials should be minimized;
    - The Contractor's design for the ventilation system for the functional areas shall be designed to suite their respective purposes;
    - For HVAC systems employing outside air economizers, the Contractor shall ensure that the minimum outside air flow rate to every occupied space shall meet the requirements of the most current ASHRAE Standard 62;
    - Regardless of the proposed heating and ventilation system, the Contractor shall provide equipment to allow full outside air economizer cycle for "free cooling" when outside air temperatures permit;
  - Thermal Comfort:
    - The Contractor shall design for thermal comfort; include energy conservation in the design criteria. The Contractor's HVAC design shall respond to the loads imposed by building envelope, internal loads and ventilation loads in an integrated fashion to achieve good thermal comfort, superior indoor air quality and to avoid excessive energy use.
    - The Contractor Design's shall meet the requirements of the current ASHRAE Standard 55.
    - The heating and cooling systems shall be designed to maintain the following conditions in the space, based on the worst case winter design conditions set out in the ABC;
  - Visual Comfort:
    - The Contractor shall integrate natural light into the functional areas. Where possible provide windows of sufficient size to augment electrical lighting. Design lighting to provide appropriate levels of lighting for the functional area tasks and in accordance with the O&M Requirements. Refer also to Section 4.10.3.28 (Electrical Design Requirements);

- Acoustical Comfort:
  - Maximum ambient sound levels shall be as follows:
    - Office: 42 dB(A)
    - Laboratory: 52 dB(A)
    - Light Maintenance Shops: 57 dB(A)

- Functional Area Design Requirements for the Infrastructure:
  - The Contractor shall include the functional spaces and associated floor areas in the facility listed in Table 4.10.3.26.2, such areas to be maintained during the Operating Period.
- All buildings shall be designed and constructed based on an F-2 building classification as set out in the ABC.

Table 4.10.3.26.2 - Functional Area Minimum Requirements

Function	**Minimum Area (m^2)**	**Additional Requirements**
Chemical Storage Room	30.1	
Work Room	8	Provide lifting monorail with capacity to lift the heaviest equipment in the room
Mechanical Room	As required	Ensure the area is designed for performing maintenance and renewal of equipment
Server Room	13.1	
Electrical & Motor Control Centre Room	As required	Same as mechanical room
Laboratory	27.0	
Office	19.2	
Staff Room	6.5	
Washroom	3.8	Fit out per Occupational Health and Safety Act requirements and barrier free access requirements under the *Safety Codes Act* (Alberta)
Storage Room	19.2	

4.10.3.26.3 Building Envelope

The Contractor's Designs and the Detailed Designs shall incorporate the following building envelope design criteria:

- Superstructure:
  - Floor Design – refer to Section 4.10.3.25 (Structural Design Requirements);
  - Roof Design – refer to Section 4.10.3.25 (Structural Design Requirements).
- Exterior Enclosure:
  - Exterior Walls:
    - The Contractor shall ensure that exterior walls shall be designed to stand up to a reasonable level of vandalism and wear and tear. The Contractor shall design exterior wall assemblies that separate spaces that require differing environmental conditions by controlling the flow of air, water and energy;
    - The Contractor shall design the exterior walls to ensure that water, snow and ice sheds safely from exterior surfaces and is not trapped in the assembly to cause deterioration, staining or mould. The air barrier system shall be designed to also function as a vapour retarder;
  - Exterior Windows:
    - Exterior windows, doors and sidelights shall be hermetically sealed double glazed windows. Low emissivity (Low E) coating on surface #2 in sealed double glazing units shall be used in the Contractor's design. The Contractor shall include the performance of a small box aluminium curtain wall as the exterior window assembly design;
    - In addition, windows shall meet or exceed requirements of CAN/CSA-A440 current edition;
    - The Contractor's curtain-wall design shall use mechanically keyed gaskets in the box section and pressure plate. The main mass of window frames shall not project beyond the exterior plane of the air barrier. The Contractor shall bridge the cavity of the wall by means of flashings (not the frame or covercap). Caulking covercaps to flashings is not acceptable and caulking the cover cap in place is not acceptable;
    - The Contractor shall design exterior sills with a minimum 6% drainage slope to exterior; and
  - Exterior Doors:
    - The exterior doors shall resist vandalism and allow some vision

through the doors. The exterior doors shall withstand the exterior environmental elements while providing a strong enough finish to withstand the usual vandalism that could occur in remote areas. The doors must be designed to be able to endure abusive contact with minimal visual dents and damage.

4.10.3.26.4 Building Interior

The Contractor's Designs and the Detailed Designs shall incorporate the following building interior design criteria:

- All wall finishes shall be durable, impact resistant and to require minimal maintenance; the Contractor shall design the overall colour scheme with light colours for added reflectance and brightness;
- The Contractor shall include a rubber base, except in wet areas such as washrooms; and
- For wet areas the Contractor shall provide wall finishes with a waterproof backing board, and with a water and impact resistant finish such as ceramic or porcelain tile complete with an integral base.

4.10.3.26.5 Intentionally Deleted

4.10.3.27 HVAC, Plumbing and Fire Protection

This Section defines the minimum requirements for the heating, ventilating, air conditioning, controls, plumbing and fire protection systems for the Infrastructure. This Section is intended to form the basis for the design of the heating, ventilating, air conditioning, energy recovery, controls, plumbing, and fire systems.

The mechanical systems shall be designed in accordance with the current edition of the following codes, standards and references:

- ABC;
- Alberta Fire Code ("**AFC**");
- National Fire Protection Association ("**NFPA**") Standards;
- National Energy Code/American Society of Heating, Refrigerating and Air-Conditioning Engineers ("**ASHRAE**") Standard 90.1;
- ASHRAE Standards Handbooks, and Periodicals;
- American Society of Plumbing Engineers ("**ASPE**") Data Book;
- American Society of Mechanical Engineers ("**ASME**") and Sheet Metal and Air-Conditioning Contractors' National Association ("**SMACNA**") Standards and Guidelines;

- Kananaskis Improvement District Development Permit guidelines; and
- Guideline to the Kananaskis Improvement District Subdivision and Development Permit Application Processes and The Subdivision and Development Appeal Process under the Kananaskis Land Use Order (August 1, 2002, or the edition current as of the then relevant time of application).

4.10.3.27.1 Outside Design Conditions

The design of the heating and cooling systems shall be based on the weather conditions reported in the ABC for the area as follows:

- Winter: 1% January, -32°C; and
- Summer: 2 ½%, 27°C db, 17°C WB.

4.10.3.27.2 Inside Design Conditions

The inside design conditions vary depending on the type of building served, and whether it is air-conditioned in summer. The following conditions shall serve as the basis for design for any mechanical systems for office space and/or labs.

Regularly Occupied Areas:

- Winter: 22°C ± 2°C, 20% RH minimum; and
- Summer: 24°C ± 2°C, 50% RH maximum.

Process buildings, and other buildings without air-conditioning, shall be maintained at an indoor winter design temperature of 15°C. Any tunnels shall be kept at an inside winter design temperature of 10°C.

4.10.3.27.3 Ventilation Requirements

NFPA 820 defines the minimum ventilation criteria for protection against fire and explosion of wastewater treatment and plumbing facilities. These recommended rates shall largely define the ventilation rates to be used in the process space.

However, human occupancy of certain spaces may require more than the minimum ventilation required by NFPA and thus, shall be governed by ASHRAE Standard 62.1. This standard specifies the minimum ventilation rates to maintain acceptable indoor air quality to minimize the potential for adverse health effects.

The ABC and ASHRAE Standard 62.1 shall also be used as guidelines to define the minimum ventilation requirements for ancillary spaces such as laboratories and administration areas.

Further requirements are as follows:

- Office, Laboratory and Administration Spaces:
  - The occupant ventilation and comfort levels shall conform to the levels set out in ASHRAE Standard 62.1;
- Space Pressurization:
  - Ventilation serving classified areas shall maintain a negative space pressure of 25 Pa, under all operation conditions. For systems serving unclassified areas adjacent to classified areas, a positive pressure of 25 Pa shall be maintained under all operating conditions;
- Process Buildings:
  - Ventilation for process buildings shall use 100% outside air; and
- Tunnel Ventilation:
  - Any tunnels shall be ventilated through exhaust fans.

4.10.3.27.4 Heating and Cooling System

The Contractor's Designs and the Detailed Designs should permit circulation around the perimeter of equipment for convenient servicing.

4.10.3.27.5 Air-Conditioning Systems

Air-conditioning shall be provided in rooms where temperature sensitive equipment such as instrumentation, controls, or computer equipment are located. For smaller areas with low occupant levels or low equipment loads, localized cooling shall be provided. Outside air shall be kept to a minimum for electrical rooms.

If an electrical room is served from a main unit using a large amount of outside air, chemical filters shall be provided to protect equipment from corrosion due to hydrogen sulphide gas.

Cooling coils shall be either direct expansion served by remote condensers located in mechanical spaces, or by forced air cooling.

4.10.3.27.6 Plumbing

Plumbing fixtures used in the Contractor's Designs and the Detailed Designs shall be of commercial quality throughout. Domestic water recirculation pumps shall be used on larger systems to ensure hot water is readily available at the fixtures. High temperature hot water shall be provided where required, for process loads.

Emergency showers and eyewashes shall be provided in accordance with all safety requirements as contained in the regulations as issued under authority of the Occupational Health and Safety

Act. Tempered water shall be provided to the emergency fixtures by a thermostatic mixing valve.

Hot and cold hose bibs shall be located in the process areas where required. The sanitary system shall be set up to take drainage back to the sanitary sewer system upstream of the WWTP treatment process.

4.10.3.27.7 Fire Protection

Fire extinguishers shall be provided as per NFPA. Fire hydrants shall be placed on the roadway system on the Lands. Building siamese connections shall be installed at principal entrances, and located such that they are within 45 meters of a fire hydrant. If and when sprinkler systems are not deemed appropriate due to process or material hazard reasons, alternate systems shall be provided.

4.10.3.27.8 Heat Recovery

Ventilation rates for the process buildings shall be kept to a minimum, while still maintaining the required air change rate for the building classification in accordance with NFPA and the ABC. Heat recovery shall be considered wherever practical.

4.10.3.27.9 Controls

Building controls shall be provided through a direct digital control system. This system shall have its own front-end; but may be integrated with the PCS.

4.10.3.27.10 General

The Contractor should consider energy efficient systems, low flow fixtures, continuous metering equipment, zero use of CFC-based refrigerants, and base building systems that do not include HCFC's.

4.10.3.28 Electrical Design Requirements

4.10.3.28.1 General

All equipment, systems and associated software packages shall be of new supply solely for the services of the Infrastructure. The Contractor shall provide only industrial grade equipment, components and solutions provided by standard manufacturers normally involved in the provision of equipment to the water and waste water treatment industry. All products are to be new supply and free from defect at the time of installation.

The area where the Infrastructure is located has experienced power cycling and power fluctuations. The Contractor shall mitigate the effects of these occurrences and ensure that the Infrastructure continues to provide the level of treatment required under these circumstances.

4.10.3.28.2 Codes and Standards

The Contractor's Designs and the Detailed Designs shall incorporate the following electrical design criteria:

- Compliance with the *Safety Codes Act* (Alberta) and rules and regulations made pursuant thereto, including the CEC;
- Unless otherwise indicated, all references in the DBFO Agreement to the CEC shall mean the edition of the CEC, Part I, CSA C22.1 and the variations made thereto by Alberta regulation;
- All electrical products shall be tested, certified and labelled in accordance with a certification program accredited by the Standards Council of Canada; where a product is not so labelled, the Contractor shall provide written approval by the Governmental Authority;
- Submission to the Local Authority and any other Governmental Authority, and the utility company, the necessary number of drawings and specifications for examination and approval prior to commencement of electrical work; and
- Submission of a copy of the electrical permit to the Province obtained from the Governmental Authority.

4.10.3.28.3 Certificates

When any Governmental Authority conducts an electrical inspection, the Contractor shall submit a copy of the certificate of acceptance provided by the authority having jurisdiction to the Province.

4.10.3.28.4 Reference Documents

The Contractor shall comply with all of the applicable codes and standards of the following organizations:

- EEMAC;
- NEMA;
- IEEE; and
- IPCEA.

4.10.3.28.5 Grounding

The Contractor shall include the following grounding design criteria:

- Provision of a complete and permanent grounding and bonding solution as required to adequately protect the building, facilities, electrical service equipment and ancillaries;

- Provision of and installation of equipment in accordance with CSA C22.2 No. 41 M1987 and No. 41 M1982;
- Provision of a permanent grounding solution of grounding rods interconnected with 4/0 copper conductors between rods and connected to electrical system neutral point;
- Make all grounding connections with bushings, lugs, clamp or cup washer and screw as appropriate; solder type connections may not be used;
- Installation of separate insulated grounding conductor in conduit installed in concrete or underground installation;
- Connection of the grounding grid to all building structural steel, metallic constructions, and metallic water piping using flexible copper bonding;
- Connection of bonding around water meters or insulated flanges, in metallic piping; and
- Connection of all electrical and electronic control equipment and control panels, to the grounding grid and all cable shielding, cable tray, and conduit runs.

4.10.3.28.6 Cable Trays, Conduits, and Raceways

The Contractor shall provide conduit according to CEC to protect all individual wiring installed above grade and open to atmosphere. The Contractor shall avoid connection of dissimilar metals when running conduit and use corrosion inhibiting compound where connection cannot be avoided.

The Contractor shall install conduit concealed in floors, walls, ceilings and underground in all finished areas. The Contractor may leave conduit in unfinished areas exposed.

The Contractor shall seal conduit ends where conduit travels between heated and unheated areas. When spanning building expansion joints with conduit, the Contractor shall install expansion fittings with ground bonding.

Where conduit is installed in concrete floors, the maximum conduit size shall be 27 mm.

Contractor shall provide cable trays and fittings to CSA C22.2 No. 126 M91 and shall incorporate the following design criteria:

- Provision of tray barriers and ensure cable separation where cables of differing voltages are run on a single tray;
- Provision of trapeze style hangars where support is required;
- All cables shall be run on cable trays and raceways; and
- Shall be armoured type cables secured to the tray and segregated according to voltage.

4.10.3.28.7 Identification

The Contractor shall include the following electrical equipment identification design criteria:

- Provision of all equipment with mechanical identification nameplate.
  - Lamicoid nameplates: 3 mm thick phenolic plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:
    - Size 1: 12 mm high with 5 mm high letters;
    - Size 2: 20 mm high with 8 mm high letters; and
    - Size 3: 25 mm high with 12 mm high letters.
- Wire identification materials shall use one of the following:
  - Heat shrink sleeves, blank;
  - Clear plastic tape wrap on strips with white writing section;
  - Wrap on strips, pre numbered;
  - Slip on identification bead markers or sleeves, blank or pre numbered; or
  - Colour banding Tape: Adhesive backed plastic tape, integrally coloured.
- Electrical equipment shall be prefinished in coded colours designating voltage or system.
  - Voltage colour identification for line voltage equipment shall be as follows:
    - 120/208 V: Grey;
    - 347/600 V: Sand; and
    - High voltage (above 750 V): Brown.
  - System colour identification for low voltage systems equipment shall be as follows:
    - Fire alarm and fire telephone: Red;
    - Telephone cabinets: Green;
    - Low voltage switching: Black; and
    - Computer and data systems: Orange.
  - The Contractor shall refer to the *Colour Coding Requirements for Mechanical & Electrical Systems* (Alberta Infrastructure) document for specific paint colour numbers.
- Where impracticable to obtain equipment prefinished in coded colours, equipment may be painted in coded colours after delivery;
- Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory;
- The Contractor shall identify pull and junction boxes over 100 mm size as follows. The Contractor shall:

  - Use boxes which are prefinished in coded colours, or spray paint inside and outside of boxes prior to installation, in coded colours designating voltage or system; and
  - Apply size 2 lamecoid nameplate to cover of each box. Identify system name. Where sequence identification is required, identify system name and number.

- The Contractor shall identify pull and junction boxes 100 mm or less in size as follows. The Contractor shall:
  - Spray paint inside of boxes in coded colours designating voltage or system; and
  - Apply permanent identifying markings directly to box covers designating voltage or system using indelible black ink.
- For the colour identification of wiring, the Contractor shall:
  - Identify No. 4/0 AWG wiring and smaller by continuous insulation colour;
  - Identify wiring larger than No. 4/0 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices;
  - Colour code in accordance with the Canadian Electrical Code;
  - Where multi conductor cables are used, use the same colour coding system for the identification of wiring throughout each system; and
  - Maintain phase sequence and colour coding throughout each system.
- For the name/number identification of wiring, the Contractor shall:
  - Identify No. 8 AWG wiring and smaller using machine print heat shrinkable labelling;
  - Identify wiring at all pull boxes, junction boxes, and outlet boxes for all systems; and
  - Identify each conductor as to panel and circuit, terminal, terminal numbers, system number scheme, and polarization, as applicable.
- For the identification of receptacles and fire alarm end-of-line resistors and duct detectors, the Contractor shall:
  - On standard duplex receptacles: provide lamicoid nametag with 6 mm high white lettering on black background (red background for emergency receptacles) indicating circuit and panel designation and locate on wall above receptacle.
  - On all other receptacles provide lamicoid nametag indicating voltage, phase, amps, circuit and panel designations; and
  - On fire alarm end-of-line resistors and duct detectors: identify zone number with 6 mm high white lettering on red background on lamicoid nametag located on wall above device and identify remote LED indicators for duct detectors.

4.10.3.28.8 Motor Control Centres

The Contractor shall include in the Contractor's Designs and the Detailed Designs the following Motor Control Centre ("**MCC**") design criteria:

- The Contractor shall equip the MCC with the combination starters, variable frequency drives and assisted start devices as required by the process equipment;
- All starters are to be controlled and monitored by the PCS via hardwired or device net interface;
- The Contractor shall provide PC Windows based communications software for setting and monitoring all smart starter devices where necessary; and
- The Contractor shall provide units EEMAC size 5 and smaller, circuit breaker units 225 A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision must be made for units to be installed or removed, off load, while busses are energized.

4.10.3.28.9 Unit Mounting

The Contractor shall include in the Contractor's Designs and the Detailed Designs the following unit mounting design criteria:

- Engaged position - unit stabbed into vertical bus;
- Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter;
- Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position;
- Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs;
- External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for one to four padlocks to lock operating handle in "off" position and lock door closed;
- Hinge unit doors on same side;
- Smart electronic overload relays manually or remotely reset from front with door closed;
- Pushbuttons, selector switches and indicating lights (push to test type) mounted on door front;
- Devices and components supplied by one manufacturer to facilitate maintenance;
- Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring;
- Provide motor starter interlocking connectivity for motors located in hazardous

locations and as process control logic dictates;

- For starters provided with electronic smart overload relays provide with device net communications interface in accordance with relay and motor manufacturers' recommendations, considering motor service factors, ambient temperature, temperature differences between motor and starter locations;
- Monitor motor operation during startup to ensure motor operation is satisfactory and relays provide proper protection;
- For side inlet fans and other long acceleration time motors, provide special overload relays to suit the startup condition; and
- Provide manufacturers' curves and data sheets where necessary to provide supporting data for motor protection.

4.10.3.28.10 Cabinets and Enclosures

The Contractor's Designs and the Detailed Designs shall include the following cabinet and enclosure design criteria:

- All cabinets, panels and enclosures for location within an electrical room shall be minimum NEMA 12 type construction. For locations within the process areas or outdoor installation, the Contractor shall provide minimum NEMA 4 type construction. The Contractor shall provide NEMA 4X in possible corrosive environments. For location in hazardous areas provide NEMA 7 minimum and equip with explosion proof cable glands and accessories in accordance with CEC; and
- For PCS control cabinets/panels provide internal door switched lighting and 120v duplex power receptacle.

4.10.3.28.11 Emergency Power / Power Generation

The Contractor's Designs and the Detailed Designs shall include the following emergency power design criteria:

- A backup emergency power system shall be provided to power all critical processes to continue the level of treatment and services from the PWTP and the WWTP identified in the Project Requirements;
- Provision of emergency power system for supply of power in the event of failure of normal supply as indicated and in accordance with CEC and local inspection authority;
    - The system shall consist of a complete standby power supply unit, liquid cooled, diesel engine directly coupled to AC alternator complete with fittings, connections, auxiliaries, control panels, safety devices, meters, sub-base fuel tank, standby battery bank and charger, automatic start and transfer switch etc. installed within a walk-in enclosure for a complete operating system;

- Provision of full automatic operation such that upon power failure, unit is on line taking full required load within 10 seconds. On resumption of normal power after time delay on transfer switch, load shall re-transfer to normal power and after rundown time delay; generator unit shall automatically shut down and return to starting condition ready for another operating cycle;
- Provision of self-cooled generator engine complete with pusher type fan to maintain safe operating temperatures under full load conditions. Provide adequate ventilation facilities to provide required air changes to allow fan to operate as designed; and
- Connection of a generator control panel, engine alarm panel and automatic transfer switch status to PCS to allow for the monitoring of generator status and fault condition.

4.10.3.28.12 Lighting

The Contractor's Designs and the Detailed Designs shall include the following lighting design criteria:

- Provision of luminaires of construction type suitable for environment to be installed in and in accordance with CEC. Diffusers may be acrylic, tempered glass or polycarbonate; styrene diffusers are not acceptable. At minimum connect night lights to power generation circuit;
- Provision of motion sensors and energy saving devices where possible; and
- Provision of battery operated emergency lighting units in accordance with latest NBC requirements and CSA C22.2 No. 141-M1985. Self-contained units to be complete with sealed lead acid battery of minimum one hour capacity for connected load, solid state charger, wall bracket or shelf, and two integral 12 W, MR16 heads. Remote heads: two 12 W, MR16 heads mounted on common wall bracket.

4.10.3.29 Instrumentation and Control and SCADA System

4.10.3.29.1 General

At a minimum, the design, materials and construction of instrumentation and equipment provided for the control and operation the Infrastructure shall comply with the applicable requirements and recommendations of the following codes and standards:

- Canadian Standards Association ("CSA**"**):
  - C22.1 – Canadian Electrical Code, Part 1; and
  - C22.2 – Canadian Electrical Code.
- Electrical & Electronics Manufacturers Association of Canada ("**EEMAC**"), E14-1 – Industrial Control and Systems.
- National Electrical Manufacturers Association ("**NEMA**"):

- 1S1.1 – Enclosures; and
- 1C5 – Enclosures for Industrial Controls and Systems.

4.10.3.29.2 Instrumentation

At a minimum all instrumentation and electrically or pneumatically powered actuators for valves, gates, etc. shall carry the approval of CSA or the ULC. Use single source manufacturer for each instrument type. Use the same manufacturer for different instrument types whenever possible.

All instrumentation and actuators shall conform to the following:

- Instrument Systems and Automation Society, ISA-S50.1, current edition, Compatibility of Analog Signals for Electronic Industrial Process Instruments;
- ISA Standard-S20: Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves; and
- Underwriter Laboratories, UL508, Standards for Industrial Control Equipment.

Provide instrument enclosures NEMA/EEMAC rated for the environment. In areas subject to flooding, provide submergence rated enclosures. Enclosures in process areas must be a minimum of NEMA 4/4X.

The Contractor shall provide instrumentation of rugged construction designed for the Infrastructure conditions.

The Contractor shall provide only new materials throughout, conforming to standards established by Underwriters Laboratories, Inc., CSA approved and so marked or labelled, together with manufacturer's brand or trademark.

4.10.3.29.3 Instrumentation Cable

All equipment supplied shall be equipped with terminal blocks to accept conductor connections. Instrumentation conductors, where terminated at equipment terminals other than clamping type terminal blocks, shall be equipped with Burndy-YAE-2 or STA-KON, self-insulated, locking type terminators, sized as required to fit conductors and screw terminals. Test all conductors for opens, shorts, or grounds. Resistance values shall not be less than those recommended by the cable manufacturer. The Contractor shall identify all instrumentation cables, and identify each conductor with wire numbers using a machine printed heat shrink wire marker.

4.10.3.29.4 Twisted Pair Shielded Cables ("TPSH")

The Contractor shall use TPSH cable for all low level analog signals such as 4-20 mA, 1-5 VDC, 0-10 VDC, pulse type circuits 24 VDC and under, and other signals of a similar nature. The TPSH shall be constructed as follows:

- Two copper conductors, stranded, minimum #18 AWG, PVC insulated, twisted in nominal intervals of 50 mm;
- Insulated for 600V, 90° C;
- One hundred percent coverage aluminium foil or tape shield;
- Separate bare stranded copper drain wire, minimum #18 AWG;
- Overall flame retardant PVC jacket to CSA-C22.2;
- Entire cable assembly to be suitable for pulling in conduit or laying in cable tray;
- Shaw approved type or Beldon equivalent; and
- Where multiconductor TPSH cables are called for, each pair shall be individually shielded, continuous number coded, and the cable assembly shall have an overall shield and overall flame retardant PVC jacket.

4.10.3.29.5 CAT 6 Cable

- The CAT 6 Cable shall be CSA approved and constructed as follows:
  - Complies with TIA/EIA-568-B2 CAT 6 standards;
  - Twenty-four gauge solid copper conductors;
  - Minimum four twisted pairs;
  - Bandwidth 600 MHz; and
  - Type – Plenum Rated Cable.

- RTD and Multi-Conductor Shielded Cable.
  - The Contractor shall use RTD cable for connections between RTDs and transmitters. RTD shall be CSA approved and constructed as follows:
    - Three or more copper conductors, stranded, minimum #18 AWG;
    - PVC insulated for 600V;
    - One hundred percent coverage aluminium foil or tape shield;
    - Separate bare stranded copper drain wire; and
    - Overall flame retardant PVC jacket to CSA-C22.2.

4.10.3.29.6 Teck Cables

The Contractor's Designs and the Detailed Designs shall use Teck cable wire and conduit for power to instruments and for 120V signals except as specifically permitted otherwise in this Section 4.10.3.29.

4.10.3.29.7 Fiber Optic Cable

The Contractor shall use fiber optic cable in compliance with IEC 60793, ISO/IEC 11801, EIA/TIA 492, and ANSI/EIA/TIA 568B.3 standards. Use fiber optic cables as follows:

- The Contractor shall use colour-coded PVC buffers with orange colour jacket;
- The Contractor shall mark with the manufacturer's name, sequential length, cable type and rating, strand count, and UL/CSA listing;
- Maximum acceptable loss for a mated connector pair should be no greater than 0.75 dB;
- Maximum allowable splice loss should be no greater than 0.3 dB;
- The Contractor shall label all fiber optic patch panels, jacks and fiber optic cabling at each end, as follows: Plant Area – Fiber and Jack Number (i.e.,06A-F001);
- The Contractor shall place a unique identifier on each connecting passive hardware component installed, such as riser cables, horizontal cables, faceplates, etc., including cables in the main server and electrical rooms;
- All (individual) horizontal cables are to be labelled within 150 mm to 230 mm from the cable ends;
- All riser cables are to be labelled at each end, indicating source and destination, and number of pairs/strands;
- The Contractor shall label all components as per ANSI/TIA/EIA 606-A standards and as per manufacturer recommendations;
- Labels are to be visible during and after the installation of the cabling infrastructure and are to be resistant to the environment, such as moisture, heat, grease and ultraviolet light;
- Labels are to be printed or generated by a mechanical device; no hand-written labels will be accepted;
- Labels are to support linkages to other individual/groups of records, such as "as-built" drawings, that will allow easy location/relation of outlets, pathways, and spaces within a given area or room; and
- The Contractor shall comply with NORDX/CDT as the accepted manufacturer standards for riser and horizontal cabling and passive hardware components .

4.10.3.29.8 Control Systems and SCADA System

The PCS for the PWTP and the WWTP shall be normally monitored and operated from the common control room located in the administration building. However the PCS for each of the PWTP and the WWTP shall be provided as standalone and independent systems such that should the control system for either of the plants fail in any way or form, the other plant shall continue to function unaffected by the failure.

Each individual PCS shall be provided with a local panel mounted Human–Machine Interface ("**HMI**") control station located in a non-process area other than the electrical room such that an operator can fully control an individual plant as a standalone facility on failure of the administration buildings common control room HMI equipment.

The common control room in the administration building shall house the historian, reporting and alarming systems connected to and monitoring the PCS for each of the PWTP and the WWTP and providing connectivity outside the plant as required for alarming and remote monitoring purposes.

All equipment furnished shall be provided with not only the resources required to meet the functional requirements of the Infrastructure but in addition, all equipment and resources including Input/Output ("**I/O**") cards, HMI graphic displays, data base, reporting packages, storage disks, report RW-CDR, etc., shall be provided to accommodate a 20 percent growth for future expansions.

All equipment and resources provided shall be able to modularly accept anticipated expansion without the need to replace or retire any component or resource.

The operators consoles located in the control room shall house SCADA System workstations, i.e., process and control graphics, etc., utilizing a minimum of one individual complete equipped PC based workstations for each plant and alarm line printer, report printer, and an audible alarm to alert operators to process status and alarm conditions and provide control action. These stations shall function with equal process and historian monitoring and manipulation capability thereby giving complete flexibility to assign any mix of displays relevant to a given situation and shall be comprised of at least four layers of prescribed access with associated authority.

A Historian System ("**HS**") server shall be installed in the HMI equipment rack to be located in the electrical room. The HS shall provide a plant-wide historical report generation and engineering resource. The HS shall maintain on-line historical records of all process I/O, manually entered I/O, and formatted reports for recall and trending purposes. All data held by the HS shall be maintained in at least one form of automatic redundancy/backup system.

Communications between the PCS and MCC shall be designed such that the time delay between issuing of a command from the PCS to the MCC and the concerned drive reacting shall not be more than three seconds. All status information from MCC shall be displayed at the PCS within three seconds of a status change.

The main Process Control Panels ("**PCP**") will be located indoors, in the electrical rooms of each plant, and shall be provided in a NEMA 12 enclosure with an integral thermostatically controlled cooling fan. All process data link and I/O shall be terminated in the marshalling enclosure integral into the PCP. All communications and I/O cards shall be IEEE surge withstand qualified, conform to SAMA - PMC 33.1, have individual A/D and D/A converters on a per card basis with all inputs and outputs being optically or galvanically isolated.

All data highway cable (both fieldbus & ethernet) shall be protected against ground surges due to lightning and switching. Suitable protectors that meet the IEEE-472 requirements shall be installed at each end of the cable, for cables leaving the protected environment (same building). The capacitive loading of protectors shall be small to avoid affecting transmission performance, and shall not exceed values for a standard tap. A low impedance, heavy-duty ground connection is required.

4.10.4 Requirements for Collection and Distribution

All data transmission and collection for the wastewater collection and water distribution systems shall fulfil the Flow Metering requirements as stated in Sections 4.5.3.1 and 4.7.3.1.

4.11 CONSTRUCTION REQUIREMENTS

4.11.1 Preamble

The Contractor is responsible for the supply of all management, professional and technical services, supervision services, construction quality control and quality assurance services, labour, materials and equipment for performing all of the duties and obligations necessary for delivering all of the requirements of the Project. The Contractor is responsible for complying with all legal requirements including but not limited to obtaining and complying with requirements of all permits and other authorizations required for the construction.

The Contractor shall ensure that construction conforms to the requirements of the design. All construction is to reflect a high degree of workmanship and all materials utilized must meet long-term safety, durability and functionality requirements.

4.11.2 Representatives

The Contractor shall appoint a representative (the "**Contractor Construction Representative**") for the Construction Period and shall notify the Province of such appointment not less 10 Business Days before any construction work is commenced.

The Contractor Construction Representative shall be the person responsible for all communications with the Province regarding the construction activities.

The Province shall appoint one or more persons to serve as project representatives (the "**Provincial Construction Representative**") and shall notify the Contractor of such appointment(s) within 10 Business Days of receipt of the Contractor's notice of appointment.

The Provincial Construction Representative shall be the persons responsible for all communications with the Contractor Construction Representative regarding the construction activities.

The Contractor Construction Representative and the Provincial Construction Representative may appoint alternatives to serve in addition to, or temporarily in their place, or may delegate some of the functions of such representatives.

The Contractor shall not rely upon any acts, omissions, requirements or directions of the Provincial Construction Representative or any other person whatsoever as authority for any departure from the requirements of the DBFO Agreement.

4.11.3 Construction Meetings

The Contractor Construction Representative shall schedule and coordinate the following meetings with the Provincial Construction Representative(s) for the entire Project, if required:

- Bi-weekly construction progress meetings; and
- Weekly commissioning and start up progress meetings.

The purpose of these meetings is to review personnel assignments, responsibilities, administrative and procedural requirements and to obtain updates on construction and commissioning progress. The Contractor Construction Representative shall also coordinate location, attendees and agenda with the Provincial Construction Representative(s).

4.11.4 Applicable Laws, Standards and Guidelines and Authorizations

In all aspects of the Project, the Contractor shall comply with all applicable legal requirements, Standards and Guidelines, Good Industry Practice and manufacturers' guidelines and requirements.

The Contractor shall comply with all safety requirements as contained in the regulations as issued under authority of the Occupational Health and Safety Act.

The Contractor shall pay all fees in connection with Workers' Compensation and comply with all requirements of the *Workers' Compensation Act* (Alberta).

4.11.5 Protection to the Public and Fire Safety

The Contractor shall ensure that at all times during the Construction Period and the Operating Period, construction activities on the Lands comply with requirements of the ABC, part 8; the AFC*;* the Occupational Health and Safety Act, the *Occupational Health and Safety Code,* and any other pertinent legislation related to public and fire safety.

4.11.6 Surveys, Limits of Construction and Signage

4.11.6.1 Surveys

The Contractor shall be responsible for obtaining all of the required engineering and legal survey(s) of the Lands where the construction is going to be undertaken. This work includes surveys needed to establish and maintain benchmarks, surveys to establish the limits of construction, surveys to make measurements to verify the location of existing construction and all legal surveys required during and after any construction undertaken.

The field engineering survey services shall measure and stake the Lands, verify existing conditions, lay out the work for construction, obtain as-built information and obtain measurement of quantities (if required). The Contractor is responsible to establish the subsurface

conditions based both on Lands investigation and reference to geotechnical investigations performed by a third party.

The Contractor hereby acknowledges having received an AutoCAD digital file in order to lay out the work. The Contractor is responsible for location, confirmation, protection and preservation of control points during construction.

4.11.6.2 Limits of Construction

The Existing Facilities and the Lands are described in Schedules 7 and 12 to the DBFO Agreement respectively. The Contractor must provide adequate worker training, flagging, staking and monitoring to ensure that the limits of construction are observed in the field.

The Contractor must accomplish the construction work using only the area designated for such work. Any construction or commissioning activities outside of the designated construction areas shall be subject to the controls defined in the Interface Protocol.

The Contractor is not allowed to use areas outside the Lands for construction activities, for material/equipment storage or to move equipment through, unless accepted in writing in advance by the Province.

The Contractor must not partially or completely block the access road to the Lands at any time unless prior written acceptance from the Province is obtained. The Contractor is responsible for maintaining the work access during the Project. Maintenance involves any repairs required to damaged or settled areas during the work.

The Contractor is responsible for the daily inspection and maintenance of the Lands to avoid any damage to the Lands. The Contractor is responsible to instruct its personnel, subcontractors, manufacturer's representatives and any other personnel who visit the Lands, on the exposure with wildlife, construction elements, water, wastewater, sludge, solids and chemicals that may be present on the Lands.

The Contractor is responsible for providing and installing and maintaining all measures required to securing the construction areas during construction.

The Contractor shall not carry out any construction work within a 10 metre protection zone around each of the two existing raw water wells that currently service the Existing Facilities and that will service the PWTP, other than the construction of portions of the Infrastructure that is unavoidable for the purpose of conveying Raw Water to the PWTP.

4.11.6.3 Signage

The Contractor must provide one project identification signboard, fabricated and lettered as indicated by the Province, including the following:

- Logos and Premier's and Province's names;

- Member of Legislative Assembly's name;
- Completion Date;
- Total Project Cost: The Province will provide this information after the Execution of the DBFO Agreement;
- Logos: Available from Alberta Infrastructure, Procurement Section, by calling (780) 422-7620;
- Project Name:

  KANANASKIS COUNTRY

  Evan-Thomas Water and Wastewater Treatment Facilities Upgrade, Kananaskis Country, Alberta, Canada.
- Names of Contractor and major subcontractors;
- Framing and foundation: 89 x 140 mm select structural Douglas Fir or Western Red Cedar dressed four sides;
- Signboard: 19 mm Douglas Fir Plywood to CSA O121-M1978, medium density overlay;
- Fasteners: aluminium or hot dip galvanized steel nails; hot-dip galvanized or cadmium coated screws;
- Paint: Master Painters Institute ("**MPI**") system EXT-6.4G, premium grade consisting of 1st coat - alkyd primer; 2nd and 3rd coats - latex gloss, applied in accordance with the MPI Architectural Painting Specification Manual, 2001 edition, with products selected from the latest edition of the MPI Approved Product List;
- Type Style: Helvetica Neue Lt Std or Arial, upper and lower case, sizes as indicated on detail drawing;
- Colours:
  - Framing members: Black;
  - Signboard background: to match Pantone 286 blue; and
  - Lettering and logos: White.
- Weather tight seal on signboard edges: wood filler and paint or aluminium edge moulding cover.

The Contractor must set project identification signs plumb and level, at locations accepted by the Province. All information signs must be erected at optimum locations for visibility, on ground mounted poles or temporarily attached to structural surfaces. No signs may be erected other than those specified. Erection of new signs requires prior written approval of the Province.

The Contractor must maintain specified signs for the duration of the Construction Period and remove them from Lands when the construction has been completed or when otherwise directed by the Province.

The Contractor must install appropriate signage throughout the Lands identifying construction

and construction traffic areas including but not limited to the following:

- Route closures and appropriate detour routes;
- Gate closures;
- Redirection of traffic for incoming visitors and construction related deliveries;
- Internal traffic revisions required to avoid interfering with construction-related activities;
- Parking changes;
- Any other signage the Contractor considers necessary to minimize the impact of construction-related activities; and
- Warning, traffic directing, and other information signs must be painted signs with painted lettering, or standard manufacturer's products.

4.11.7 Coordination and Management of Construction Work

The Contractor must coordinate with the Province all construction activities, especially those activities that may affect operations of the existing infrastructure.

4.11.7.1 Contractor's Construction Schedule

The Contractor's Construction Schedule is contained in Schedule 2 of the DBFO Agreement.

The Contractor's Construction Schedule must outline the design and construction activities in a sufficient level of detail to enable the Province to readily interpret the schedule and facilitate monitoring of the Project progress including the following:

- Commencement date;
- Availability;
- Identification and a concise description of the major activities, key tasks and milestones to be undertaken during the Project;
- Approvals and permit dates planned and required;
- Submittal and approval dates for the Contractor's Management Plans and Systems required for the Project;
- Submittal and approval dates for the Contractor's Management Plans and Systems required prior to Availability;
- Submittal dates for the Contractor's Management Plans and Systems required for the Existing Facilities O&M;
- The Transition Target Date;
- Key Public Communication Plan activities including open-houses;

- Submittal dates for various draft and final O&M Manuals;
- Detailed Designs package submittals;
- Key activities for achieving external accreditation of the Quality Management System and the Environmental Management System;
- Anticipated construction start date(s);
- Major construction completion milestone dates for each discrete section of the Infrastructure;
- Milestones for the purchase of major equipment items and key subcontracts;
- Equipment installation;
- Staff training;
- A breakdown of long duration activities and sub-activities, which are continuous, repetitive or sequential in nature;
- For the Construction Period, a listing of all key tasks and milestones related to the major design component that addresses any related studies, investigations, surveys, consultation with key stakeholders, public communication tasks, and approvals and permits to be obtained;
- All major tie-in and connection activities to be carried out under the Interface Protocol;
- Milestone dates for all commissioning and startup activities including the Hydraulic Capacity Tests and the 14 Day Performance Test; and
- Start and finish dates for all demolition and decommissioning activities, including post Availability activities.

The Contractor's Construction Schedule shall include:

- A separate horizontal bar for each activity of sufficient size to clearly indicate all required information;
- Time divisions into months, weeks and days identifying first work day of each week;
- Start and completion dates for each activity; and
- Projected percentage of completion for each activity as of first day of each month.

Subject to section 5.5 of the DBFO Agreement, the Contractor's Construction Schedule shall be amended and updated by the Contractor as the Project progresses at least monthly. The Contractor shall:

- Keep the Contractor's Construction Schedule up-to-date for the duration of Project;
- Indicate actual progress of work against the Schedule 2 - baseline;
- Revise projections of progress and completion as required; and
- Revise and resubmit Contractor's Construction Schedule at least monthly or as otherwise required by the Province.

4.11.7.2 Collaboration of Work with Construction at Nearby Facilities

The Contractor shall be responsible for developing and updating the Collaboration Plan as described in Section 3.5 of this Schedule 18 (Technical Requirements).

4.11.7.3 Field Offices

The Contractor shall provide and maintain, during the Construction Period, a suitable office on the Lands, for own use, with suitable tables or benches for the examination of drawings, specifications, etc., and where all notices and instructions from the Province may be received and acknowledged. A meeting space for 15 persons with chairs and table space for meetings shall be provided.

The Contractor shall provide and maintain a suitable office for use of the Provincial Construction Representative with separate access and the following characteristics:

- Minimum size to be 2400mm x 4800 mm;
- Furnished office with a desk, 3 chairs, one drawer file cabinet, plan table (minimum size 900 mm by 1200 mm), plan rack, shelves, waste basket and coat rack;
- Furnished desktop computer with internet access, colour printer, photocopier, and telephone; and
- Furnished office with a adequate heating, ventilating and lighting.

The office must be secure by lock and key and acceptable to the Province acting reasonably.

4.11.7.4 Verification of Underground Utility Locations

The Contractor must identify and verify the existing underground utility locations prior to excavating. The Contractor is responsible for potholing, hand exposing, and other measures to confirm the locations of all underground utilities for design purposes. Once the utilities are located, the Contractor must exercise due caution to prevent damage to the utilities during the construction work.

The Contractor is responsible for all tie-points and connections of utility services from the existing pipelines as required for the Project. This responsibility includes paying all associated fees and costs for coordination, construction and inspections with the municipalities and the utility companies, whether the work is to be carried out by the Contractor or the utility.

4.11.7.5 Acceptable Days and Hours of Construction

Construction work must be undertaken by the Contractor only during the following times:

- For the pipeline component of the Project at the Kananaskis Village when within 100 meters of occupied buildings: seven days per week from 8:00 a.m. to 8:00 p.m.; and

- For all other locations: seven days per week from sunrise to sunset.

The Contractor may apply in writing to the Province and Alberta Tourism, Parks and Recreation for extended work hours. No construction work shall be undertaken by the Contractor on different times until accepted in writing by the Province.

The Contractor shall adjust its construction schedule to these requirements. No construction work shall be undertaken by the Contractor on times other than those specified above without prior written approval by the Province.

The construction schedule in regard to the pipeline crossing of water bodies shall satisfy all timing restrictions imposed by all relevant Governmental Authority.

The Contractor shall ensure that the premises of the Lessees, operators and businesses within or adjacent to the Lands are accessible at all times during construction. In particular, for the following designated work sites and associated following dates, construction work CANNOT cause material disruption or interference with the use by the Lessees, operators, or businesses of their respective premises including, without limitation, access and egress to and from the said premises:

- Kananaskis Golf Course: 2nd Friday of May to 2nd Monday of October;
- Mount Kidd R.V. Park: 2nd Wednesday of May to 2nd Monday of October;
- Nakiska Base and Nakiska Ski Hill facilities: 4th Friday of September to 1st Friday of May;
- Hotel Operators (Delta Hotels) at Kananaskis Village: 1st Friday of December to 2nd Friday of April and 4th Friday of June to 2nd Monday of October; and
- Remainder of Kananaskis Village (including Kananaskis Village Staff Housing): 3rd Friday of December to 4th Friday of March and 4th Friday of June to 1st Monday of September.

4.11.7.6 Lands Maintenance

The Contractor is responsible for taking all precautions, providing all programs and taking all actions necessary to protect the Lands, Existing Facilities, and all public and private property and facilities from damage located within or adjacent to the Lands.

Surface structures include all existing building, structures, and facilities above and below the ground surface including the foundations or any extension below the surface. Structures include, buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, electrical wiring and conduits, duct banks, HVAC ductwork, poles, wires, posts, signs, markers, curbs, walks, and all other facilities.

The Contractor must provide barricades, fences, lights, warning signs and danger signals, and must take other precautionary measures for the protection of persons or property and of the work when performed on or adjacent to any roadway, right-of-way or public place.

Facilities that are temporarily removed to facilitate the construction or installation of the work must be replaced and restored to their original condition by the Contractor.

The Contractor must provide all labour and materials to construct subsurface pipes for water, sewer, recycled water, stormwater drainage, electrical and control conduits, and connect existing utilities to the utilities required for the work including potable water, electricity, natural gas, telephone, cable and other utilities.

The Contractor is responsible for installing, operating, maintaining and paying all services of all temporary utilities as required during the Construction Period. Temporary utilities shall include:

- Temporary sanitation facilities;
- Required clean water supply for construction activities;
- Temporary light and power;
- Temporary heating;
- Telephone;
- Dewatering; and
- Any other temporary utility that may be required by the Contractor during the Construction Period.

The Contractor is responsible, at its own cost, for:

- Any modification, relocation and re-connection of all the utility services, including water, sanitary services, storm sewer, natural gas, electrical power;
- Any modifications or relocations of existing street lighting, communication lines, fire hydrants; and
- Repairs or replacement of existing roads, curbs gutters, sidewalks and portions thereof.

The Contractor shall be responsible for making good all damage caused to existing roads, curbs, gutters and sidewalks arising as a result of the construction activities at the Lands.

Where the Contractor fails to make good any damage it causes to existing infrastructure and/or property, the Province may elect to make the repairs it deems necessary and the Contractor shall be responsible for the Province's actual cost in making the repairs plus an administration fee of 25% as liquidated damages both of which may be deducted from the Progress Payments or the Payments.

4.11.7.7 Traffic Management

The Contractor shall develop, implement and maintain and shall monitor, update and manage, during the Construction Period, traffic management plans and procedures for the Lands as a part of the Construction Management Plan.

The Contractor shall maintain the safe and efficient passage of traffic on existing roadways

within the Lands. If the Contractor needs to truck haul materials over roads that are not designated as truck haul roads by the Local Authority, the Contractor shall be responsible for obtaining written acceptance from the Local Authority and the Province for use of proposed haul routes within their respective jurisdictions

4.11.7.8 Landscape Protection and Lands Restoration

Prior to construction, the Contractor shall identify all land resources to be preserved and protected within the Lands.

The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without consultation and written consent of Alberta Tourism, Parks and Recreation, Transport Canada and Alberta Environment unless otherwise detailed as “proposed treelines” in the Schedule 12 Appendix B-Lands and Work Sites Drawings.

The Contractor must protect existing trees, shrubs and plants on or adjacent to the Lands that are shown or designated to remain in place against unnecessary cutting, breaking or skinning of trunk, branches, bark or roots. It is the Contractor’s responsibility to implement landscape and Lands restoration management plans in the areas where the construction is undertaken.

The Contractor shall replace trees damaged or destroyed in Kananaskis Village using replacement trees located within the Local Authority. The specific replacement trees and their location will be identified by an Alberta Tourism, Parks, and Recreation representative.

Replacement trees must be removed and re-planted at optimal seasonal periods identified by an Alberta Tourism, Parks, and Recreation representative, to maximize successful growth in the new location.

Construction must be scheduled to minimize bare, cleared and excavated areas so that surfaces are hydroseeded and seed germinates and grows stabilizing surfacing as soon as possible. Temporary irrigation, mulch or plastic sheeting to hydroseeded areas as required by the construction schedule must be provided by the Contractor.

All seed and mixture composition must conform to the Local Authority specific guidelines. The grass seed shall be certified Canada No. 1 seed, free of disease, weed seeds or other foreign materials, meeting the requirements of the *Seeds Act* (Canada). At a minimum, seed mixture shall satisfy the composition outlined in Table 4.11.7.8:

Table 4.11.7.8 - Seed Mixture Composition

Name	% by Dry Weight
Kentucky Blue Grass	40 %
Creeping Red Fescue	45 %
Perennial Rye Grass	15 %

Sod mixtures must conform to the Local Authority specific guidelines and at a minimum, shall be good quality Kentucky bluegrass and fescue mix suitable for the Alberta climate.

All sod shall be freshly cut and healthy with strong, fibrous root system, cultivated in nursery field as turf grass crop containing maximum of 2% of other grass species, and maximum of two broad leaf weeds and ten other weeds per 40 m2.

The Contractor shall cut sod by approved methods in accordance with recommendations of the Canadian Nursery Landscape Association.

4.11.7.9 Clearing, Geotechnical, Excavation and Soils Disposal Including Contaminated Soils

The Contractor shall provide a geotechnical report to the Province with sufficient information to assess the anticipated soil and groundwater conditions. The geotechnical report is to contain, but not be limited to the following:

- Soil stratigraphies;
- Moisture contents;
- Plasticity;
- Estimated standard proctor optimum moisture content;
- Erodability;
- Frost susceptibility; and
- Anticipated subgrade support values.

The Contractor is responsible for the Lands clearing and grubbing necessary for the construction activities during the Construction Period as required for the Project including the removal and disposal of rocks, stumps, trees, roots, abandoned construction material, surface structures and pipes and unsuitable soil materials from the existing infrastructure.

The Contractor must perform operations in connection with excavation of materials, regardless of the character of that material, and backfilling necessary for the construction of the Infrastructure, including furnishing all supervision, labour, tools, materials and equipment in connection therewith.

Excavation and backfilling activities including fill and backfill material, compaction, subgrade preparation and stabilizing, shoring and dewatering methods must be approved by a Professional Engineer specializing in soil mechanics.

The Contractor is responsible for obtaining all fill, backfill, topsoil and other required materials to achieve final grade lines and complete the work. Backfill materials must consist of suitable clean soil. All materials have to be tested for conformance with the design and approved by a Professional Engineer specializing in soil mechanics.

The Contractor must take appropriate action when soils are not suitable for sustaining design loads according to established codes and accepted engineering practices.

Backfill material cannot be placed against concrete walls until the walls have obtained sufficient strength to safely withstand the pressure of the fill material and water-retaining structures have been leak-tested.

The Contractor must test all soils to be disposed off the Lands for contaminants in accordance with minimum requirements established by any Governmental Authority and the landfill selected by the Contractor for disposal.

The Contractor must maintain a record of the disposed soils and provide a copy to the Province.

Contaminated soils must be separated from the rest of excavated material, and removed, tested, and disposed by the Contractor according to the Governmental Authority.

Construction workers involved in any excavation work of contaminated soils must have the necessary safety training and experience requirements as per the Occupational Health and Safety Act.

4.11.7.10 Shoring and Dewatering

The Contractor must provide all dewatering services as required to facilitate construction of below grade structures that may be in the water table.

The Contractor is responsible for the design, planning, installation, maintenance and removal (if necessary) of all shoring required to support the sides of any excavation and all other measures to prevent settlement of surrounding areas or any movement that may damage adjacent facilities, delay the work or endanger life or health.

Settling monitoring must be established by the Contractor, when excavating activities are undertaken adjacent to existing structures that will be maintained.

The shoring method to be established is solely the responsibility of the Contractor and the shoring system must comply with the Local Authority and any other Governmental Authority. The shoring system must be designed by a Professional Engineer.

The Contractor must provide all work and equipment necessary for temporary drainage and pumping systems required to keep open basements, excavations and the Lands free from accumulations of water.

Water removed from excavations must be disposed of in a manner to prevent flooding, erosion and property damage and in accordance with the Local Authority and any other Governmental Authority. Discharge to the sanitary sewer of water removed from excavations is not allowed.

4.11.7.11 Abandoned Pipe

The Contractor must follow the *Pipeline Act* (Alberta) regarding the discontinuation, abandonment and removal of pipelines, including the circumstances under which a pipeline must be discontinued, abandoned and removed, or the timing of such discontinuation, abandonment or removal and the manner in which discontinuation, abandonment and removal are to be carried out.

The Contractor is solely responsible for obtaining all required licenses and permits regarding abandoned pipe with the Governmental Authority.

4.11.7.12 Confined Space Entry

The Contractor must comply with all Occupational Health and Safety Act regarding confined space entry. A worker entering a confined space must have a written code of practice as per the Occupational Health and Safety Act. The Contractor is solely responsible for preparing and developing a code of practice for confined space entry to identify confined spaces and identify hazards in the confined space(s).

The Contractor is responsible for providing confined space entry training to work supervisors, workers and rescue personnel who work in a confined space entry. The Contractor must obtain all permits regarding confined space entry for its personnel with the relevant authorities before performing any work in a confined space.

4.11.7.13 Hazardous Materials

Hazardous wastes must be separated, stored, and disposed of by the Contractor according to applicable laws.

The Construction Management Plan shall include the Contractor’s procedures for waste management, including dangerous and hazardous waste management training for employees and subcontractor staff.

4.11.7.14 Demolition, Salvage, and Disposal

The Contractor is responsible for demolition required for the Project and the disposal of all demolition and construction debris and equipment at appropriately permitted facilities and as required by the Local Authority and any other Governmental Authority. All demolitions shall be conducted under the requirements established in the Occupational Health and Safety Act.

The construction waste management procedures shall be set out in the Construction Management Plan.

4.11.8 Management of Water and Sanitation Facilities during Construction

The Contractor must follow minimum Governmental Authority regulations for managing surface water and storm water on the Lands during construction. The Contractor shall comply with minimum requirements for managing sanitation facilities during the Construction Period.

4.11.8.1 Sources of Construction Water

The Contractor must provide for the detention, treatment and discharge of all water generated during construction. Construction water includes surface water runoff and water removed from excavated areas. The Contractor must schedule all construction activities to minimize the amount of construction water to be managed in a given period.

The Contractor's plans and procedures for the management and protection of all water present at the Lands throughout the Construction Period shall be set out in of the Construction Management Plan.

4.11.8.2 Temporary Drainage Features

The Contractor's Designs and the Detailed Designs shall include standards, specifications and design methods that will be implemented during the Project with respect to proposed drainage facilities.

Specific items to be addressed in the Contractor's Designs and the Detailed Designs shall include:

- Storm management facilities;
- Storm sewers;
- Open ditches;
- Canals;
- Catch basins;
- Third-party drainage arrangements;
- Sub-drainage;

- Erosion control features;
- Area drainage plan; and
- All drainage connections that tie into local master drainage plans.

Identify and provide details for all off-lands drainage arrangements that relate directly or indirectly to the Infrastructure. The Contractor shall describe the methodology and approach employed for the preliminary design of the drainage facilities required for the Infrastructure. The Contractor shall provide the factors, parameters and assumptions used in the derivation of the design flows and other drainage analysis.

4.11.8.3 Surface Water Quality and Stormwater Permit

The Contractor shall implement measures to prevent the contamination of surface water through stormwater runoff. The Contractor must employ all necessary measures required to comply with any stormwater permit applicable.

The Contractor is responsible for installing and maintaining adequate drainage to prevent soil erosion at construction areas during the Construction Period.

The Contractor must implement and maintain best management practices at all times. Temporary erosion control and protection measures must be in place at all times during the Construction Period and must be inspected prior to and throughout the rainy season. As permanent drainage structures are installed, the Contractor must protect intakes to avoid plugging.

The Contractor must monitor and maintain the effectiveness of the runoff protection at all times.

The Contractor's plans and procedures for erosion and sediment control throughout the Construction Period shall be set out in the Construction Management Plan. The Contractor must maintain an adequate supply of erosion control materials on the Lands at all times during the Construction Period for immediate use.

4.11.8.4 Groundwater

The Contractor must establish the existing groundwater conditions from the available geotechnical reports and by conducting such investigations as the Contractor deems necessary. It is responsibility of the Contractor to ensure the protection of groundwater from contamination during construction through the implementation of the care of water plans and procedures set out in the Construction Management Plan.

Dewatering discharge generated during construction activities must not be discharged to the stormwater system without adequate treatment. Discharge of dewatering water to the sanitary sewer is not allowed. Disposal of water removed during construction activities must be conducted in a manner that prevents flooding, erosion, property damage, and turbidity or sediment contamination of surface waters.

The Contractor shall comply with the *Water Act* (Alberta) and the Alberta Environment Licence to Divert and Use Water No. 11148 for diversion of groundwater. The Contractor is responsible for groundwater monitoring for water quality at the wells before, during and post construction to avoid any groundwater contamination. In the event that any groundwater contamination is generated due to construction activities or deficiencies, the Contractor assumes full responsibility and shall take immediate corrective actions at its own cost.

4.11.8.5 Surface Water Management Monitoring

Continuous monitoring of surface water during construction must be conducted by the Contractor in accordance with the procedures set out in the Construction Management Plan to avoid surface water contamination.

4.11.8.6 Sanitation Facilities

The Contractor must provide and maintain during the Construction Period, temporary toilets on the Lands for the use of all personnel employed on the Project.

Toilets in the finished portion of the buildings form part of the Infrastructure shall not be used by the Contractor's personnel.

The Contractor shall comply with the Provincial Board of Health Regulations under the *Public Health Act* (Alberta) and Alberta's Occupational Health and Safety Code (Part 24). The Contractor shall provide separate facilities for both sexes as required.

Upon completion of construction activities, the Contractor must remove the temporary sanitation facilities. At that time, the Contractor's personnel may use the new or existing permanent sanitation facilities.

4.11.9 Other Construction Measures

4.11.9.1 Dust Control and Light Control

The Contractor is responsible for furnishing all labour, materials and equipment necessary for dust and light control. Dust and artificial light pollution must be avoided. In the event that dust and/or light attenuation may be required in order to meet the Technical Requirements, the Contractor shall indicate to the Province the strategy to control dust and light in accordance with those requirements throughout the Construction Period.

The Contractor must comply with the following requirements:

- Maintain dust control procedures during construction;
- Minimize the amount of open ground disturbed at any given time;
- Use silt fences to capture low-flying dust and debris; and

- Perform cleaning activities of the Lands as work is completed.

4.11.9.2 Noise Control

The Contractor is responsible for furnishing all labour, materials and equipment necessary for both environmental and occupational noise control. Operations considered generating noise concerns include, jack hammering, shotblasting, sandblasting, cutting and coring of concrete, and use of power actuated fasteners.

The Contractor must minimize construction noise throughout the Construction Period by incorporating mitigation measures into work plans as needed to meet the noise limits established by the Local Authority and any other Governmental Authority.

The Contractor shall indicate to the Province the intended strategy to control environmental and occupational noise in accordance with the Technical Requirements throughout the duration of Construction Period in the event that noise mitigation may be required.

4.12 COMMISSIONING, STARTUP AND TESTING TO ACHIEVE AVAILABILITY

4.12.1 Contractor's Commissioning and Startup Activities

The commissioning and startup testing activities shall be carried out by the Contractor in accordance with the Commissioning and Startup Plan. This includes, dry tests, wet tests, Hydraulic Capacity Tests, and the 14 Day Performance Test. These testing activities shall be executed on the PWTP, the WWTP and the Potable Water Distribution Systems, as described below.

The general requirements and sequence of each of the commissioning and startup testing activities are summarized below:

- Dry and wet testing: both dry and wet tests shall be carried out on each piece of equipment and sub-system and to confirm that the process, mechanical, electrical, control and other components of the Infrastructure are correctly installed in compliance with the Contractor's Designs and the Detailed Designs;
- Hydraulic Capacity Tests: demonstration of the capability of the PWTP, the Potable Water Distribution System and the WWTP to treat, store and convey the Design Capacity for Treated Water (including fire-fighting flows), and Wastewater respectively whilst simultaneously meeting the Technical Requirements for Treated Water and Treated Wastewater quality; and
- 14 Day Performance Testing of:
    - PWTP - Demonstration of the capability of the PWTP to reliably treat the Raw Water to meet the Treated Water quality, quantity and capacity requirements set out in Section 4.5 for 14 consecutive days; this test will

include the Potable Water Distribution System sampling and analysis of Treated Water in distribution specified in Table 5.6.2.4; and

- WWTP –Demonstration of the ability of the WWTP to reliably treat the influent wastewater to meet the Treated Wastewater quality, quantity and capacity requirements defined in Section 4.6 for 14 consecutive days; this test will include the Contractor's residuals treatment facilities.

The detailed testing processes, procedures, sequence and schedule to demonstrate the ability of the Infrastructure to meet the Technical Requirements shall be set out in the Commissioning and Startup Plan. General requirements of the startup, commissioning and testing are further described below.

4.12.1.1 Dry and Wet Testing

All process, mechanical, electrical, control and any other equipment related to the Infrastructure shall be dry and wet tested to demonstrate that they are successfully installed in full compliance with the Contractor's Designs and the Detailed Designs. This stage of testing must be completed on each piece of equipment, sub-system and system prior to that component of the Infrastructure being placed in service.

Any part of the Existing Facilities that forms part of the Contractor's Designs and the Detailed Designs shall be tested as part of the dry and wet testing phase to demonstrate that it can meet the duty and performance requirements of the Technical Requirements.

4.12.1.1.1 Dry Testing

The Contractor shall carry out dry testing of the Infrastructure to the extent possible before introducing flows into the PWTP, the Potable Water Distribution System and the WWTP. Dimensional, alignment, piping connections and electrical connections, and equipment and control system functionality shall all be verified.

The Contractor shall obtain the assistance of the supplier's representatives to demonstrate that the equipment is properly installed.

4.12.1.1.2 Wet Testing

Wet testing shall be completed in two stages.

In the first stage, equipment shall be run for a short period, either individually or as complete sub-systems or systems, as appropriate. During this first stage, local controls shall be satisfactorily verified by cycling the equipment through several start-stop operations and modulating its output, or a combination thereof. Operating parameters such as temperature, pressure, voltage, vibration and any other applicable supplier or design criteria shall be checked to ensure they are consistent with the Contractor's Designs and the Detailed Designs and the

supplier's recommended limits, as appropriate.

In the second stage, equipment shall be restarted and run continuously for a minimum of three days in automatic control. During this second stage, as far as practicable, conditions shall be simulated which represent maximum or most severe, average, and minimum or least severe conditions as defined by the Contractor's Designs and the Detailed Designs.

The test conditions shall be as set out in the Commissioning and Startup Plan, and shall be determined so as to ensure that the wet testing properly verifies the performance of the Infrastructure in accordance with the Contractor's Designs and the Detailed Designs.

The three day wet testing of individual systems may be conducted either concurrently or in sequence as is practicable and as set out in the Commissioning and Startup Plan.

In the event that any of the three day wet tests are terminated before completion or are unsuccessful, then that test shall be repeated in its entirety.

Pipelines, valves and all other Potable Water Distribution System appurtenances shall be pressure tested to ensure the pipeline can satisfy the design pressures determined in the Contractor's Designs and the Detailed Designs. All pipelines shall be superchlorinated and undergo bacteriological testing prior to being placed into service.

Storage reservoirs shall be wet tested to demonstrate their capability to perform in accordance with the Contractor's Designs and the Detailed Designs for the reservoirs, including leakage testing, secondary chlorination and level control; reservoirs shall be leak tested prior to backfilling. Reservoirs shall undergo bacteriological testing prior to being placed into service.

4.12.1.2 Hydraulic Capacity Tests

The capability of the Infrastructure to successfully treat, store and convey the Design Capacity (including maximum daily, hourly and instantaneous peak flows) stated in Tables 4.5.2.1.B, 4.5.2.1.C and 4.6.1.5 shall be demonstrated during the Hydraulic Capacity Tests.

The Contractor shall plan and conduct the tests so as to ensure that the systems are subjected to the Design Capacity flows, including the peak instantaneous flow conditions.

The Hydraulic Capacity Tests shall also demonstrate that the PWTP, the WWTP and the Potable Water Distribution Systems function in accordance with the key hydraulic parameters of the Contractor's Designs and the Detailed Designs.

The Potable Water Distribution System shall be placed into the final configuration of the Infrastructure prior to the commencement of the Hydraulic Capacity Tests.

Where necessary to achieve the Design Capacity flows for the Hydraulic Capacity Tests, the flows shall be augmented using temporary equipment to simulate the Design Capacity flows.

Where it is necessary to modify settings or utilize temporary equipment outside the limits of the

PWTP and the WWTP, such modifications must be coordinated with the Province.

The Hydraulic Capacity Tests can be conducted separately from, or as part of, the 14 Day Performance Tests. If the Hydraulic Capacity Tests are conducted separately from the 14 Day Performance Test and are terminated before successful completion, the testing shall be repeated in its entirety.

The Treated Water and the Treated Wastewater quality sampling shall be conducted during the Hydraulic Capacity Tests to demonstrate that the Infrastructure meets the specified quality performance at the Hydraulic Capacity Test flow rate(s).

As part of the Hydraulic Capacity Tests of the Potable Water Distribution System, fire-flows shall be tested at each location within the Potable Water Distribution System, as set out in Table 4.5.2.1.C. Pressure and flow shall be monitored during the fire-flow testing.

4.12.1.3 14 Day Performance Test

The 14 Day Performance Test shall be conducted on the PWTP and the WWTP to demonstrate that they can successfully treat the Raw Water and influent wastewater, respectively, to meet the Treated Water and the Treated Wastewater standards set out in Section 4.

The tests shall also demonstrate that the Infrastructure meets the key parameters of the Contractor's Designs and the Detailed Designs, and can operate reliably for a minimum of 14 consecutive days without Unplanned Maintenance or any other unplanned operator intervention.

The 14 Day Performance Test for the PWTP and the WWTP may be carried out simultaneously or separately, however the test shall not be considered to be complete until both tests have been carried out successfully.

Prior to the commencement of the 14 Day Performance Test on the PWTP, the Potable Water Distribution System shall be placed into the final configuration per the Contractor's Designs and the Detailed Designs and the test shall include the Treated Water sampling and analysis identified in Table 5.6.2.4 throughout the Potable Water Distribution System.

The 14 Day Performance Test of the WWTP shall include testing of the Contractor's residuals processing and treatment facilities.

The PWTP and the WWTP shall be placed into their final configuration and shall be in full service prior to the commencement of the 14 Day Performance Test. During the test(s) all components and systems shall be operated in automatic mode to prove proper operation of the PCS and the SCADA System.

The Contractor shall plan the 14 Day Performance Test to ensure that the system is subjected to the maximum design flows and loads for at least two 24 hours periods during the 14 Day Performance Test, and shall modify the plant configuration and vary the number of treatment components in service as required to simulate these conditions.

In the event that the 14 Day Performance Test is terminated prior to the end of the 14 day period, the 14 Day Performance Test shall be re-started at the beginning of the 14 Day Performance Test when the Contractor is ready to re-commence the test.

The operation and maintenance of the PWTP and the WWTP during the 14 Day Performance Test shall follow with operating procedures and protocols in the Operation and Maintenance Plan and the O&M Manuals.

The Raw Water, the Treated Water and the Treated Wastewater testing requirements for the 14 Day Performance Test shall as a minimum include the categories and frequencies of analysis required for the O&M (set out in Section 5.6.2), augmented as required by additional sampling and analysis to demonstrate that the PWTP and the WWTP meet the key parameters of the Contractor's Designs and the Detailed Designs.

All Raw Water, Treated Water and Treated Wastewater sampling and analysis carried out during the 14 Day Performance Test shall be carried out in accordance with the procedures set out in the Water and Wastewater Sampling and Analysis Plan.

Duplicates of all of the Raw Water, the Treated Water and the Treated Wastewater samples taken during the test shall be provided to the Province for independent analysis if so required.

4.12.2 Commissioning and Startup Test Monitoring

During the commissioning and startup testing the Treated Water, the Treated Wastewater and residuals shall be regularly monitored for specific key parameters identified in the Commissioning and Startup Plan to evaluate the performance of the PWTP, the Potable Water Distribution System, and the WWTP.

The frequency of sampling and analysis conducted shall be equal or greater to that specified in Section 5.6.2. All samples shall be analyzed by a certified, independent lab that utilizes standard analytical and quality control procedures. The lab shall be identified and agreed upon by the Contractor and the Province prior to testing.

4.12.3 Commissioning and Startup Test Reporting

The Contractor shall prepare the commissioning and startup test report and submit the report to the Province in accordance with the form set out in the Commissioning and Startup Plan as a condition of Availability.

The PWTP, the WWTP and the Potable Water Distribution System will be deemed to have passed the Hydraulic Capacity Tests and 14 Day Performance Tests if the results for every parameter comply with the Technical Requirements and the test standards and criteria identified in the approved Commissioning and Startup Plan in accordance with the Contractor's Designs and the Detailed Designs, and all components and systems operate successfully throughout the tests in automatic control without any Unplanned Maintenance or other unplanned operator intervention.

The Treated Water and the Treated Wastewater quality testing must meet the specified quality standards during the Hydraulic Capacity Test in order for this test to be deemed to have passed.

The Commissioning and Startup test report shall include, at a minimum, the following information:

- All sampling, analysis and monitoring data measured and recorded pursuant to the Commissioning and Startup Plan including laboratory analysis, chemical consumption, instrument calibration certificates, and any relevant calculations based on the data provided;
- All SCADA System trend data from the Flow Meters, the Quality Monitors and the Level Monitors;
- All necessary certification relating to the testing, analysis and evaluation;
- A record of all equipment failures, repairs, replacements and maintenance encountered during execution of the Commissioning and Startup Plan;
- Certification stating that all testing was completed in accordance with the approved Commissioning and Startup Plan; and
- Certification of the Hydraulic Capacity Tests and 14 Day Performance Test results and a determination of the extent to which the results comply with the Technical Requirements.

A meeting between the Contractor and the Province shall be held to review the commissioning and startup test report to confirm that status of each treatment system.

4.12.4 Re-testing

If the Hydraulic Capacity Tests or the 14 Day Performance Test results fail to demonstrate compliance with the Technical Requirements and to fulfil the test standards and criteria identified in the approved Commissioning and Startup Plan in accordance with the Contractor's Designs and the Detailed Designs, the Contractor shall take corrective actions and repeat the Hydraulic Capacity Tests or the 14 Day Performance Test, as applicable.

Any test result failures at any stage of the 14 Day Performance Test shall require the 14 Day Performance Test to be repeated in full at the expense of the Contractor.

4.12.4.1 Construction Record Documents

As the construction work progresses, the Contractor shall maintain a minimum of two duplicate up-to-date sets of design documents, including the design drawings, specifications, equipment vendor drawings, and construction drawings. These documents shall be kept up to date with any field measurements and field construction changes and discrepancies on a continuous basis, and shall never be more than 14 days behind the current state of the design and construction. The two sets shall be maintained in separate locations such that a disaster shall not jeopardize both

sets simultaneously.

Upon Availability, the Contractor shall submit to the Province two sets of record drawings and specifications ("**Record Drawings**"). Compliant Record Drawings will be a condition of Availability being achieved.

Record Drawings shall be prepared and submitted on the Province's title block and drafted in accordance with the *Alberta Infrastructure Standards for Consultant Deliverables* (the current edition as of the then relevant time of application).

Record Drawings shall be designated in the revision block as "construction record" drawings and shall be checked and signed by the Contractor's Engineer of Record to verify that the field changes shown are accurate and consistent with the design intent.

Changes to specifications and appendices shall be on compact discs, modified to clearly and accurately show all changes made during construction. The Record Drawings submittal shall also include a complete set of all change orders, numbered and bound in chronological order of issuance.