Au service du GOUVERNEMENT, au service des CANADIENS.

Serving GOVERNMENT, serving CANADIANS.

BIM Management Plan

Professional and Technical Services Centre of Expertise

PROJECT: *Clinical Trial Materials Facility (CTMF) / Infrastructure de production de matériel pour essais cliniques (IPMEC)*

VERSION: V1.0
April 2021

By signing below, the stakeholders involved in BIM within this project agree to the adoption of this BIM Management Plan (BMP), dated [DATE], and commit to implementing the BIM approach within the professional services provided during the project's start-up, planning and delivery phases.

Stakeholder Signatures

NAME	TITLE	SIGNATURE	DATE

RECORD OF AMENDMENTS TO THE BIM MANAGEMENT PLAN (BMP)

Amended by	Date of amendment			Description of amendment	Version	Chapters affected

TABLE OF CONTENTS

Table of Contents

1. CONTEXT OF THE BMP

The BIM Protocol of the Professional and Technical Services Centre of Expertise of Public Works and Government Services Canada (PWGSC) consists of two documents: the BIM Management Plan (BMP) and the BIM Implementation Plan (BIP).

1.1 BIM Management Plan (BMP)

The BMP serves as a roadmap for all parties involved in the development of BIM mock-ups for a project delivered according to the BIM ("Building Information Model") process, for the duration of the project.

It describes the intentions of the PWGSC Professional and Technical Services Centre of Expertise with respect to the use of the BIM process in the current project, Clinical Trial Materials Facility (CTMF)

This BMP is the result of the collaboration of all project stakeholders for the optimal deployment and successful implementation of the BIM approach in this project. It defines the objectives to be achieved as well as the implementation and monitoring strategy for the BIM processes deployed throughout the project.

This BMP (BIM Agreement) is a living document and will be modified and/or improved throughout the project based on the needs raised by the various stakeholders. Any request for adjustments, modifications, improvements or other requests must be submitted to the Senior BIM Manager for analysis. If the request is accepted, the BMP will be amended by the Senior BIM Manager in collaboration with the discipline BIM managers, and the revised version will be circulated to all project stakeholders.

In the event of an amendment changing the scope of the BIM approach in the project, the BMP will have to be revised, commented on and signed by all stakeholders concerned by the BIM Agreement.

1.2 BIM Implementation Plan (BIP)

Each discipline BIM manager is responsible for producing a BIM Implementation Plan that must include all the elements and modelling principles preferred by his or her team for the implementation of the BIM deployment strategy defined in this BMP. This document should follow the common guidance jointly developed by all stakeholders involved in the BIM approach and be made available to all so that the other disciplines can refer to it.

Each party is responsible for drafting, in collaboration with the relevant stakeholders, the sections of the BIP that concern it. **A single BIP for all suppliers during the design and construction phase is required**. Collaboration and coordination between supplier parties in the design phase is therefore essential. Senior design and construction BIM managers are responsible for preparing and maintaining the BIPs.

The construction BIP must be linked to the design BIP in order to maintain consistency between project processes. Thus, all processes presented in the construction BIP that share elements of the processes used in the design must refer to the appropriate section of the design BIP. Contractors required to prepare models to refine the level of detail of the professionals' mock-ups

(e.g., steel structure, curtain walls, electromechanical systems, wrought metals) must be identified and participate in the development and adherence to the general contractor's or Construction Manager's BIP. Common processes (validation, communications, etc.) with engineers must be clearly identified and described.

1.3 Ownership of digital data

All digital data created during the project will be provided to the PWGSC Professional and Technical Services Centre of Expertise for building management and operations activities and future projects. This data, including all copyright therein, will become, in its entirety and without reservation, the exclusive property of Public Works and Government Services Canada (PWGSC).

1.4 Scope of digital data

Digital mock-ups and centralized databases are tools for collecting and collating project information. They are used to develop the design and construction documents required to complete the project. All communicating parties must provide other project stakeholders with authorization to use this information in the activities required to carry out the project.

1.5 Data structuring method according to the Uniformat II standard

Uniformat	Tables	Use
Level 1 to 3	TECHNICAL REQUIREMENTS	Technical requirements of the client: Performance targets. Standards and references Performance requirements. Technical requirements.
Level 3	TECHNICAL CONCEPTS	Brief descriptions meeting technical requirements
Level 4	OBJECTS	Uniformat level 4 object-oriented
Level 5	TECHNICAL REFERENCES	Brief technical descriptions associated with the object
Level 6	ITEM	Type of object as described in the model and plans
Level 7	COMPOSITION	Assembly according to specification sections
Level 8	PRODUCTS	Products installed according to specifications

1.6 Definitions

BIM: BIM is a digital representation of the physical and functional characteristics of a building. It is a shared resource of knowledge about a facility that can be used to make decisions about the building throughout its life cycle. (Definition taken from the National Building Information Modeling Standard [NBIMS]).

Quality control of digital mock-ups: Quality control of digital mock-ups is a process to ensure that all BIM mock-ups produced in the project comply with the standards set out in the BMP.
Quality control of digital mock-ups is a continuous process carried out by all professionals involved in the BIM approach. The BIM expert will carry out an independent quality control in order to guarantee the quality of the BIM deliverables required by the client.

Interference detection: Interference detection is an automated analysis performed on federated models that identifies interference between different elements or modelled systems.

BIM model: A BIM model, in native format, developed by each of the disciplines involved (architecture, structural, plumbing, electrical and mechanical).

Federated model: A digital BIM model that combines, with dead links, all the BIM models produced by the design and construction teams. This model is produced and updated by the BIM expert on key dates defined in the coordination schedule. This model will be used for interference detection, design tracking, visualization and centralization of information for reference.

Integrated model: A digital BIM model that combines, with live or dead links, all the BIM models produced by the design and construction teams. This model is created and used by the professionals for their internal coordination.

Design model: Any 3D digital model produced by design professionals during the entire life cycle of the project.

Construction model: During the construction phase, the Construction Manager is responsible for producing construction models from the design models produced by the design professionals. It is the contractor's responsibility to forward the construction models to trade contractors and manufacturers.

Level of development (LOD): The LOD defines the level of development of an object in the digital model.

Level of detail (LOd): The LOd defines the level of geometric precision relative to an object in the digital model.

Level of information (LOi): The LOi defines the level of information contained in each object of the digital model. This allows optimal use of the model for the 4D, 5D and 6D.

Information exchange matrix (LOD): The BIM expert is responsible for setting up an LOD exchange matrix. This indicates the level of detail and information needed to achieve the objective throughout the project life cycle.

Risks and opportunities matrix: The BIM expert in collaboration with the discipline BIM managers will set up a Risk Matrix, which is based on qualitative criteria to identify possible risks and potential consequences. The risk analysis matrix also identifies the mitigation measures to be taken to exploit the opportunities arising from the change.

Shared parameters: All parameters created and shared by one or more disciplines. They can be used in several models or families. The creation of shared parameters makes it possible to structure the information contained in the models.

BMP: BIM Management Plan (this document and all its appendices)

BIM Implementation Plan (BIP): BIM managers in each of the disciplines (architecture, structural, civil, mechanical, electrical and construction) will be responsible for producing a BIP that will include all the modelling elements and principles preferred by their discipline within their respective mandates. This manual must be made available to all concerned.

Collaboration platform: A virtual workspace for centralizing all information and activities related to a project or organization. The collaborative platform provides, among other things, efficient document management that is accessible to all stakeholders in a project or organization.

Coordination platform: A virtual workspace for centralizing all information and activities related to the coordination of the project or an organization. The coordination platform provides, among other things, an efficient and accessible “issue” management of interferences for all stakeholders in a project or organization.

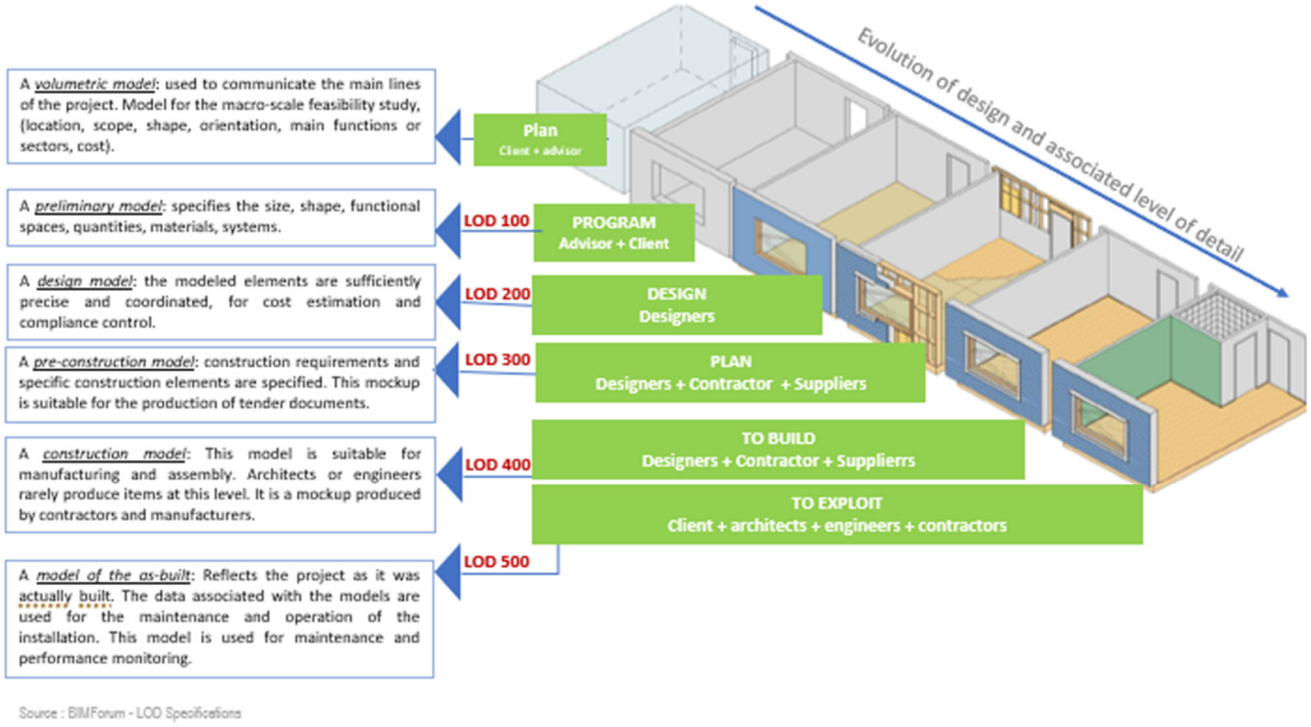
Revit phasing: Revit phasing is a feature of Revit that allows the classification of project phases, such as existing and new construction. By applying phase filters to views and schedules, you can display the project according to these various stages.

Construction phase: Tasks and steps related to the construction timeline.

Construction packages: Specialty packages and contracts for the delivery stage.

Project breakdown structure (WBS): The project breakdown structure comes from the term “work breakdown structure” (WBS). It is intended to help structure the project and modelling to meet the needs of the project.
The WBS is used to code elements using an occurrence parameter, to enable classification, tracking and viewing of information based on the specific needs of a task.

1.7 Levels of detail (LOD)



Source : BIMForum - LOD Specifications

2. PROJECT DESCRIPTION

2.1 Project Identification

Project name	Clinical Trial Materials Facility (CTMF)
Project number	R.115859
Project address	6100, avenue Royalmount, Montréal, Québec

2.2 Project Approach

The BIM approach developed by all parties concerned must take the components of the project approach into account and be planned and managed appropriately to ensure that project objectives are achieved.

2.3 Stakeholders concerned with the BIM

ORGANIZATION	ROLE	NAME	EMAIL	TELEPHONE
CLIENT				
Public Works and Government Services Canada (PWGSC)				
TPSGC	Support BIM	Yvon Chabot	Yvon.Chabot@tpsgc-pwgsc.gc.ca	
TPSGC	BIM Expert	Fatima Zohra Grebici	FatimaZohra.Grebici@tpsgc-pwgsc.gc.ca	
	BIM Manager			
BIM EXPERT TEAM				
	Senior Manager			
	BIM Integrator(s)			
	BIM Coordinator(s)			
ARCHITECTURAL				
	Project Authority			
	Senior Designer			
	BIM Manager			
MECHANICAL				
	Project Authority			
	Senior Designer			
	BIM Manager			
STRUCTURAL				
	Project Authority			

	Senior Designer			
	BIM Manager			
CONSTRUCTION TEAM (CONSTRUCTION MANAGER OR GENERAL CONTRACTOR)				
	Project Authority			
	Foreperson			
	BIM Manager			
OTHER SPECIALIZED RESOURCES				
	Constructability Analyst			
	Estimates			
	Sustainable Development			
	Commissioning			

** For other stakeholders, see the list of project stakeholders.

2.4 Project schedule and stages

Refer to the project schedule with key deliverable dates.

The main stages of the project are as follows:

Stage	Date

2.5 Communication matrix

Communications regarding BIM within projects should be addressed to the appropriate persons in accordance with the following principle:

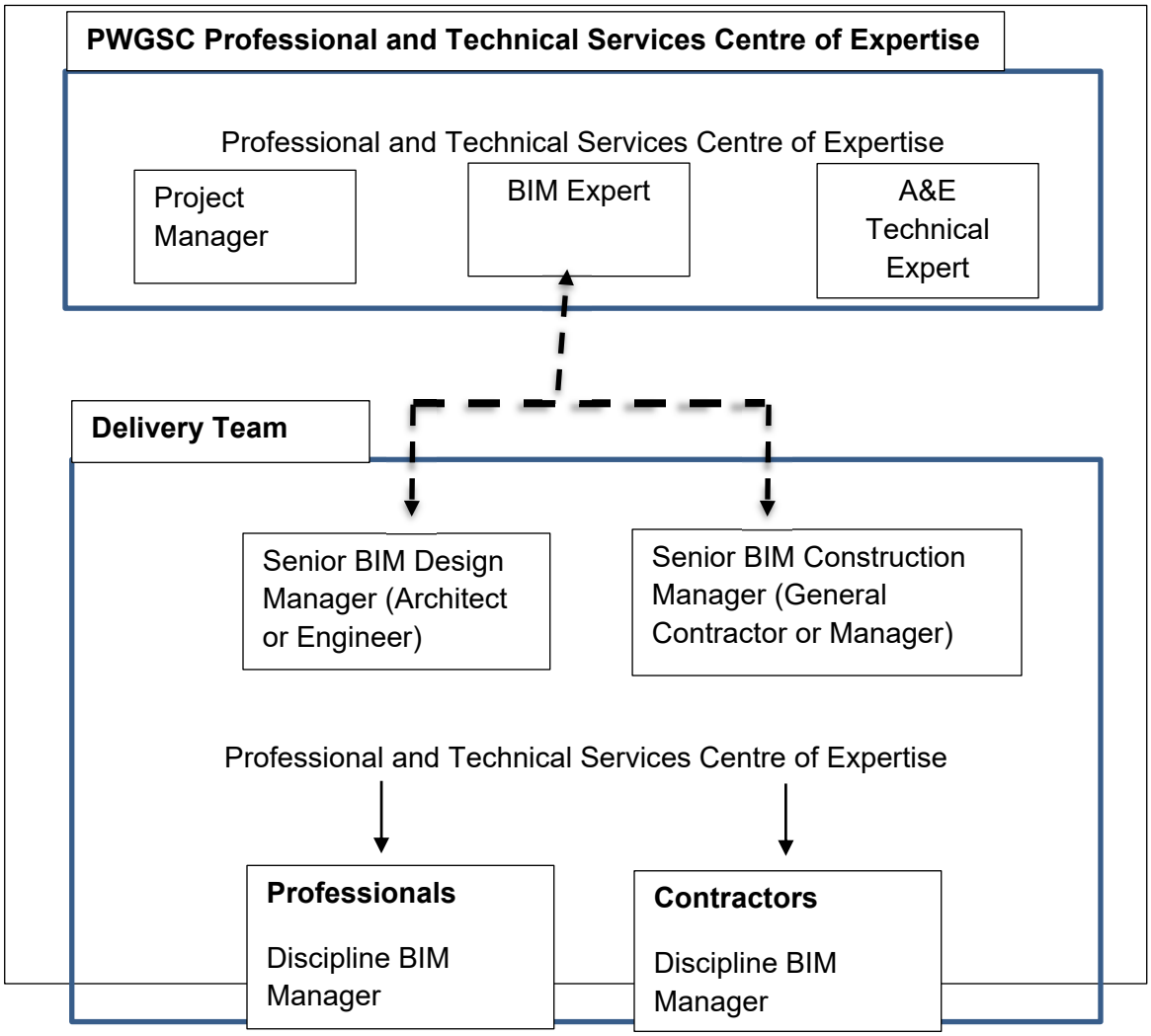
Any project management communication impacting BIM must be primarily addressed to project managers with a cc to BIM managers (discipline and senior). However, any questions regarding the BIM process should be directed to the BIM managers (discipline and senior) with a cc to the Project Authority(ies).

SUBJECT	TO	CC
BIM-specific	BIM managers (discipline and senior; PWGSC BIM Expert)	Project officers; Departmental Representative
Project management impacting BIM	Project officers; Departmental Representative	BIM managers (discipline and senior; PWGSC BIM Expert)

3 DUTIES AND RESPONSIBILITIES

3.1 Organization chart

The organization chart below identifies the **BIM-specific** authority relationships. Relationships in the form of dotted lines are relationships supporting the oversight of the Departmental Representative, while relationships represented by solid lines represent relationships of immediate authority.



3.2 Scope of responsibilities

General responsibilities are described in the contract documents. Each team must be able to meet all required responsibilities.

4.2.1 BIM Expert

The BIM Expert's mandate is to act as the BIM representative for PWGSC. His/her primary role is to act as a liaison between PWGSC, the Project Team and the discipline BIM managers

(Architecture, Mechanical, Electrical, Plumbing [MEP] and Civil/Structural Engineering). The BIM Expert must ensure that BIM goals, objectives and use requirements are met.

3.2.1.1 Responsibilities

- Implement, maintain and monitor the BIM approach in the project in order to meet the identified BIM objectives and uses. Act as a specialist in the planning, implementation and coordination of the BIM approach in collaborative and integrated mode;
- Oversee the development of the BMP, based on the goals and objectives defined by APAC;
- Update the BMP on an ongoing basis, as the project evolves, by collecting all requests for changes to the BMP from the various stakeholders, analyzing their relevance and advising the PWGSC project manager of any impact these change requests may have on the project. Inform all stakeholders in a timely and effective manner of any changes to the BMP;
- Ensure, in collaboration with the stakeholders concerned by the BIM approach, that BIM models adequately meet the modelling needs of the various uses implemented by carrying out quality control of the models and federated models;
- Produce reports on the quality of the models being prepared by professionals.

3.2.2 Senior Design BIM Manager

The mandate of the Senior Design BIM Manager is to act as the BIM representative for the design team.

3.2.2.1 Responsibilities

- In conjunction with discipline BIM managers, create and manage the design BIP;
- Create and manage the overall quality assurance plan and incorporate it into the BIP;
- Assist the discipline BIM managers in BIM planning and implementation for the project;
- Structure and coordinate the design BIM processes and uses required to meet PWGSC's objectives for the project;
- Establish, in collaboration with Project Managers and discipline BIM managers, the schedule for interference detection reviews;
- Organize and lead BIM management meetings to coordinate the internal process within the design team, prepare minutes for follow-up and distribute copies to all participants within 48 hours;
- Ensure that modelling requirements are met by the team of professionals;
- Upload the most recent version of the virtual model weekly to the file-sharing site provided by the Construction Manager;
- Ensure that PWGSC standards are met;
- Define a sequence of intervention with discipline BIM managers for the numbering of spaces for MEP professionals;
- Coordinate the placement of rooms and spaces between professionals in order to ensure that two different professionals do not name the same space not covered by a room in two different ways, for example;
- Coordinate the numbering of equipment in the models in relation to PWGSC requirements;
- Validate 3D coordination through visual inspections and perform automatic interdisciplinary conflict detection for client review, if required.

3.2.3 Senior Construction BIM Manager

The mandate of the Senior Construction BIM Manager is to act as the BIM representative for the construction team.

3.2.3.1 Responsibilities

- Assist discipline BIM managers in BIM planning and implementation for the project, and in defining their discipline's quality assurance plan;
- Structure and coordinate the construction BIM processes and uses required to meet PWGSC's objectives for the project;
- Establish, in collaboration with Project Managers and discipline BIM managers, the schedule for interference detection reviews;
- Using the template provided and in conjunction with the discipline BIM managers, draw up and manage the construction BIP;
- Draw up and manage the overall quality assurance plan and incorporate it into the BIP;
- Organize and lead BIM management meetings that are useful for coordinating the internal process within the construction team and draft the minutes to ensure follow-up;
- Ensure that modelling requirements are met by the contractor or subcontractor team;
- Ensure that PWGSC standards are met;
- Validate 3D coordination through visual inspections and perform automatic interdisciplinary conflict detection for client review, if required;
- Coordinate the transfer of asset information for operation and maintenance according to PWGSC requirements;
- Carry out 4D simulation of the projected construction schedule;
- Plan the construction work.

3.2.4 Discipline BIM Manager

The mandate of the discipline BIM manager is to act as the BIM representative for the design and construction modelling team

3.2.4.1 Responsibilities

- Act as an interface with BIM managers and BIM modellers from other disciplines (Architecture, Mechanical, Electrical, Plumbing [MEP] and Civil/Structural Engineering) in order to achieve the project’s BIM objectives;
- Identify the BIM capability of own team;
- As required, coordinate the training required by own team based on the identification of BIM capacity and the planning of training offered by the BIM team;
- Identify the need for common shared parameters across disciplines;
- Prepare and maintain the section of the BIP related to own discipline;
- Monitor the quality of BIM deliverables in own discipline to ensure compliance with the BIP and the BMP;
- Ensure compliance of deliverables with the BMP and its appendices;
- Monitor the creation of new models for own discipline;
- Ensure that the models for own discipline are in accordance with the modelling requirements and that the required information is modelled at the required time;
- Manage the creation of BIM content related to own responsibilities;
- Manage own firm's BIM team;

- Carry out intra-disciplinary quality control prior to submission to the Project Team in accordance with the BMP;
- Ensure intra-disciplinary 3D coordination before sharing information with the Project Team;
- Proactively submit proposals for the implementation of modelling standards for the project;
- Establish, in conjunction with the Senior BIM Manager, the schedule for interference detection reviews;
- In conjunction with the Discipline Project Authority, follow up on the resolution of detected interference between professionals in own discipline;
- Ensure the sharing of own team's models and the recovery of models from other disciplines;
- Supervise and coordinate the updating of the models during the construction phase based on change orders and actual conditions for continuing the work;
- If anomalies or problematic discrepancies are detected, perform a review of the models provided by contractors by overlay and visual inspection;
- Verify that the models for which he/she is responsible are properly filed in the document management platform;
- Adhere to the schedule for own team's deliverables;
- Manage changes to the master file based on the responsibilities defined with the Project Team and the progress of the project;
- Ensure integration and coordination of part numbers/spaces based on PWGSC requirements;
- Ensure integration and coordination of equipment codes based on PWGSC requirements;
- Ensure the transfer of asset information for operation and maintenance based on PWGSC requirements.

4. GOALS OF USING BIM

The goal of the Professional and Technical Services Centre of Expertise is to integrate the BIM process into its projects in order to take advantage of the various models and information that will be developed during the design process and the development of tender documents. These BIM models and the information they contain, combined with the various work processes developed and to be developed by the stakeholders, will be used to produce projects that are properly coordinated among stakeholders, comply with the standards set by the Professional and Technical Services Centre of Expertise and stay within the defined budgets.

To that end, the Professional and Technical Services Centre of Expertise has developed specific objectives to serve as a reference throughout the project. Those objectives are described below.

5. BIM OBJECTIVES AND USES

The project's BIM objectives are mandatory. They are listed in the table below. Each of the objectives is based on an expected benefit. BIM usage is the activity carried out using a BIM tool to achieve the goal.

By using BIM in this project, PWGSC hopes to achieve the following BIM objectives and uses.

5.1 Table of BIM Objectives and Uses

	BIM Objectives	BIM Uses	Deliverables	Timeline Period	Responsibilities
1	Project documentation	• 2D documentation • 3D modelling	All drawings required at each stage of the project	All stages and according to the issuance schedule Officials	Designer
2	Compliance with functional requirements	• Integration and validation of program data/client needs • Design review	Comparative report of areas under design vs areas under the program;	All stages and according to the issuance schedule Official	TPSGC Designer
3	Compliance with technical requirements	• Integration and validation of technical requirements • Design review	An object-oriented database, meeting technical requirements	All stages and according to the issuance schedule Official	TPSGC Designer
4	Accurate modelling of existing conditions	• Modelling of existing conditions	• Records of existing conditions • Georeferencing	Start Planning	Designer
5	Develop an optimized implementation hypothesis	Design review If needed : - Analysis Lighting - Analysis of sunshine, wind and snow - Planning of Works	• Site analysis • Design review	Start Planning	Designer

6	Interdisciplinary and intra-disciplinary coordination	• Visualization • Design review • 3D coordination • Visual coordination • Interference detection	• BIM models in native format, from all disciplines • BIM models in Navisworks format, from all disciplines • Interference detection report	All stages and according to the issuance schedule Official	Designer Construction manager Specialized contractors
7	Cost estimating and analyses	Taking quantities (5D) and estimating costs according to the data structuring method according to the Uniformat II standard described in section 1.4 Scope of numerical data	Quantities, descriptions and measurement plans of building elements and systems from BIM models and database according to their state of maturity and the LOD matrix	All stages and according to the issuance schedule Official	Designer Construction manager
8	Understanding of design intentions	• 3D design • Visualization • Design review	BIM models in native format, from all disciplines; and other exchange formats if required,	All stages	Designer
10	Sustainable development	Energy efficiency Lighting analysis Analysis Sunshine	• Planning and organization of the site • Simulation of construction work sequences and assembly installations	Design and constructio n	Designer Construction manager Specialized contractors
11	Design model issued in the tenders	Model for tendering	Complete and coordinated mock-up allowing contractors to bid and carry out the work based on the design mock-ups	constructio n	Designer Construction manager

12	Prefabrication and off-site construction	Modeling for manufacturing (off-site construction)	Complete and coordinated mock-up allowing specialized contractors to provide shop drawings	Manufacturing and machining stage of the assemblies	Designer Construction manager Specialized contractors
13	Documents retrievable by the client for quality control and operation	• Updating of models • Updating of the object library	3D models, Library of model objects with their up-to-date data	All stages Closing	Designer Construction manager

5.2 Table of targets and performance indicators

The target is used to determine the strategy for achieving the objective. The performance indicator is used to measure the achievement of the objective and track the expected benefits.

BIM Objectives	Targets	Performance Indicators
Project documentation	• Produce the required plan specifications for various stages of the project; • Produce bid documents enhanced by interdisciplinary coordination, communication and visualization; • Serve as a tool for auditing weekly and contract progress; • Have (updated) models at the end of the project.	All drawings are produced directly from the various BIM models.
Compliance with functional requirements	• Tracking the functional requirements and the surface areas and their characteristics planned for the project; • Track the functional areas planned in the program and the net/gross ratio of projected spaces;	The design models are an accurate representation of the functional needs of client departments entered in the FTP.

	• Serve as a design support and concept validation tool for tracking client functional requirements by synchronizing data between modelling and a centralized database of functional requirements.	
Compliance with technical requirements	• Track the technical requirements and their characteristics planned in the project; • Serve as a design support and concept validation tool for monitoring client functional requirements by synchronizing data between modelling and a centralized database of technical requirements.	The design models are an accurate representation of the technical needs of client departments entered in the FTP.
Documents retrievable by the client for quality control and operation	• Updating of the models and the object library; • Upon completion of the work, provide representative models of actual conditions for use in future projects.	Models retrievable for quality control and operation
Cost estimating and analyses	• Support for cost estimates to be produced. The estimates must comply with the Uniformat II - ASTM E1557 standard; • Bill of materials for building components and systems from the BIM models, based on their state of maturity and the LOD matrix.	At each stage of the project, the various professionals refer to the BIM models to ensure that the project is on budget.
Understanding of design intentions	• Support the various implementation hypotheses; • Serve as a communication and visualization tool during the integrated design workshops and other quality workshops (value engineering, design audits, sustainable development, standardization of rooms, etc.) to stimulate discussions and optimize decision-making;	Obtain a federated BIM model for review of design intentions and informed decision-making.

	• Support presentation of the project to obtain authorizations and permits from authorities; • Provide contractors with design mock-ups to optimize the constructability analysis (e.g., systems coordination, planning and work monitoring).	
Interdisciplinary and intra-disciplinary coordination	• Carry out interference detection analyses and model reviews, and follow-up on them (3D).	No major or critical interference that could have an impact during the project's construction phase is detected.
Concept constructability	• Design review • 3D coordination • Timeline planning • Cost monitoring • Statement of quantities • 4D simulation of worksite progress	Compliance with and optimization of budget envelope costs and timeline
Design model used in calls for tenders	• Provide the contractors with design models to optimize the constructability analysis (e.g., systems coordination, planning and work monitoring); • Model for use in calls for tenders.	A complete, coordinated model enabling the contractor to bid on and carry out the work based on the design models
Accurate modelling of existing conditions	• Create reliable and accurate input data that adds value to the work of the designers.	• Reduced survey effort for validation of input data; • Decrease in the number and value of change orders (COs) on the work site due to existing conditions observed during the work.
Develop an optimized implementation hypothesis	• **Site analysis** • Work planning	The selected hypothesis is optimized, taking into account project functionality and

		alignment with the built environment.
Sustainable development	• List of deliverables required to meet energy performance and certification objectives	Obtained when the criteria are met

5.3 BIM uses

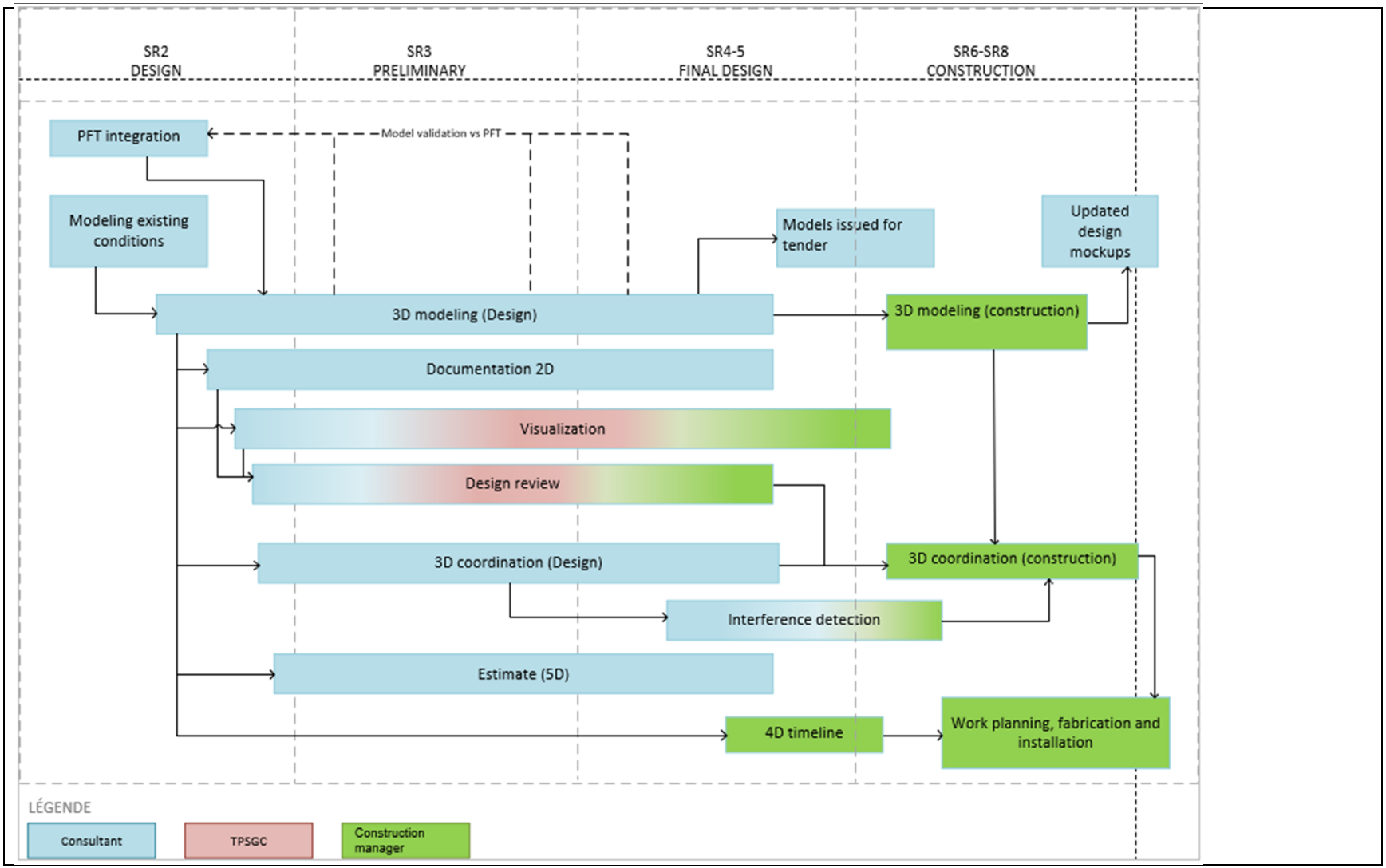
The BIM uses are the processes to be applied in order to meet the BIM objectives and requirements. For each of the BIM objectives described below, one or more BIM uses are assigned.

Use	Description
2D documentation	Process by which the various 2D drawings used to document a work are produced directly and solely from various BIM models. The 2D documents generally include plans, elevations, sections, details and various tables, as well as legends.
3D modelling	Process consisting of using various BIM models in order to validate the conformity of stated design criteria and enable various stakeholders to provide their feedback on multiple aspects of the design. The aspects may include the aesthetic aspect, constructability validation, and compliance with the FTP.
Integration and validation of program data/client needs	Process by which the models are used to ensure that the concept developed complies with the needs stated in the program. BIM models can be linked bi-directionally with the program's database. Information from various BIM models for the spaces will be exported as a database (Access or Excel) and submitted to the Departmental Representative. This process is also used to produce detailed colour plans of the standardized spaces by space categories and sub-categories.
Integration and validation of technical requirements	The process of creating an object-oriented content library for technical requirements and incorporating it in the model. The validation process will compare the technical requirements with the designers' design proposal.
Concept/design review	Process consisting of using various BIM models in order to validate the conformity of stated design criteria and enable various stakeholders to provide their feedback on multiple aspects of the design. The aspects may include the aesthetic aspect, constructability validation, and compliance with the FTP.
Updating of the models and the object library	The design models are updated throughout the work in order to incorporate the COs and contractors' annotated plans. The construction models are an accurate representation of actual conditions after the work is completed.

Quantity takeoff (5D) and cost estimate	Process that involves directly extracting the various quantities from the BIM models, based on their state of development according to the LOD information-sharing matrix, in order to ensure that all phases of the project are on budget. Depending on the estimation approach required by the client (Uniformat II), the information extracted from the models may be areas, materials, construction systems, equipment, etc. Apart from budget validation, the estimate may be used to compare various design options.
3D design	Process whereby 3D modelling software and analysis applications are used to develop BIM models that are rich in information, based on specified design criteria. The use of this process and various tools enable a design to be developed and to be analyzed and verified through iterations. It also helps communicate design intentions and use the information to extract data on quantities, costs, time frames, etc.
Visualization	Process by which the 3D models are generated or enhanced to communicate the visual, spatial or functional qualities of the project or parts of the project through perspectives, renderings, overviews, etc.
3D coordination	Process by which the various BIM models are used to coordinate works for the various disciplines involved in the project. May be carried out visually by navigating through various models or by automating certain tasks at coordination meetings.
Visual coordination	Process that involves using BIM models from the various disciplines to detect interferences between the works of these disciplines.
Interference detection	Process that involves using BIM models from the various disciplines to detect interferences between the works of these disciplines with the software.
4D timeline	Process whereby the model is used to simulate the construction work.
Work planning	Process whereby the model is used to sequence the construction work, including site preparation, temporary work, moves and any other activity related to site operations that impacts the timeline.
Model for use in calls for tenders	Process by which the model is used to produce the tender documents in 2D. The model is also provided as a reference when tenders are issued. Contractors will be able to use them for a better understanding when submitting their bid.
Modelling of existing conditions	The process of using tools, such as laser scan surveys, to create project input data; Use of geo-referencing for optimum integration into planning and delivery

Energy efficiency	Process by which the various models are used to calculate the project's environmental impact. In this case, calculations are carried out to meet the energy performance targets for LEED certification.
Sunlight, wind and snow analysis	Process by which the model is used to carried out sunlight/shadow area studies on the building and/or site.

5.4 BIM Objectives and Uses – Implementation Strategies



6. QUALITY ASSURANCE AND CONTROL

6.1 Quality Control Procedure

For this project, the Senior Design and Construction BIM Manager is responsible, in collaboration with the discipline BIM managers, for the development of quality control procedures covering the implementation of BIM in the project. The overall quality control procedure and the specific procedures for the various project teams will be incorporated into the BIM Implementation Plan (BIP).

A discipline that identifies a problem in the models must promptly notify the author of the problem item and the BIM Coordinator, regardless of project progress. Once notified, the author of the element must act quickly to resolve the conflict or problem. The Coordinator will then be able to follow up on the resolution of the problem at the next design review.
Before each file transfer for sharing, the models must be reviewed in accordance with the quality control strategy described in the BIP to reduce the risk of problems.

6.2 Types of Quality Control

The following is a summary list of the types of quality control applicable to model tracking in this project.

Type of Control	Definition	Lead	Project Stage
Standards and good practices	Ensuring compliance with the standards and procedures set out in the BMP	BIM Expert Senior BIM Manager (design and construction) Discipline BIM managers	Design and delivery
Visual	Ensure that the models do not contain unnecessary elements or duplication.	BIM Expert Senior BIM Manager (design and construction) Discipline BIM managers	Design and Delivery
LOD	Ensure that the models meet the required level of development (LOD) and that they contain the information required by all stakeholders.	BIM Expert Senior BIM Manager (design and construction) Discipline BIM managers	Design, execution and completion of the work

Validation of the model or plans as built	Ensure that the model or plans as constructed and coordinated with the design model	Senior BIM Manager (design and construction)	Completion and closure of the work
Interference detection	Ensure that models are coordinated and that major conflicts are resolved.	Senior BIM Manager (design and construction) Discipline BIM managers	Design and delivery
[Additional monitoring]			

6.3 Information Exchange Matrix

Levels of development (LOD) are tracked with reference to the project's Information Exchange Matrix (LOD) (also called PxP Matrix) in the BIP. This document defines the status of the model at different stages of the project, as well as the scope of modelling, the level of graphical detail, and the level of informational detail (non-graphical parameter).

This tracking is important to ensure that the digital models can meet each BIM use requirement established in the project.

The establishment of the Information Exchange Matrix will be the responsibility of the Senior Design BIM Manager and the discipline BIM managers.

Tracking is based on the American reference document entitled "Level of Development Specification" issued by BIMForum, and on the BIM team's experience with local BIM practices. The following tracking points are used directly to validate compliance with the Information Exchange Grid (IEG) issued with the BMP.

- Level of development (LOD)
- Scope of modelling
- UNIFORMAT coding

7. COLLABORATION

7.1 Types of Data

7.1.1 Digital project data (shared)

- Any information that can be used for implementation, validation, coordination, analysis, and communication;
- Any information including, but not limited to, drawings, models, analyses, specifications or other documents, as created for the project in digital form;
- All information that can be used for validation, coordination and analysis must be kept within the project's collaborative tools (database, models, analysis tools, etc.);
- No data or information should ever be processed or extracted in temporary documents;

- All project data or information should be available on an ongoing basis.

Examples:
- Mock-ups
- Specifications
- Discussion papers
- Reports

7.1.2 Confidential digital data (shared exclusively for project use)
Digital data containing confidential information belonging to the communicating party.

7.1.3 Sensitive data (with restrictions)
Documents requiring special permission and/or guidance before release.

Depending on the type of data, their availability may be restricted or limited to a group of users based on the governance model.

Discipline BIM managers are responsible for establishing the type of data that will be subject to particular restrictions (sensitive data), making a request to the Senior BIM Manager, and providing reasons and/or documentation to explain the purpose of the restrictions to be applied.

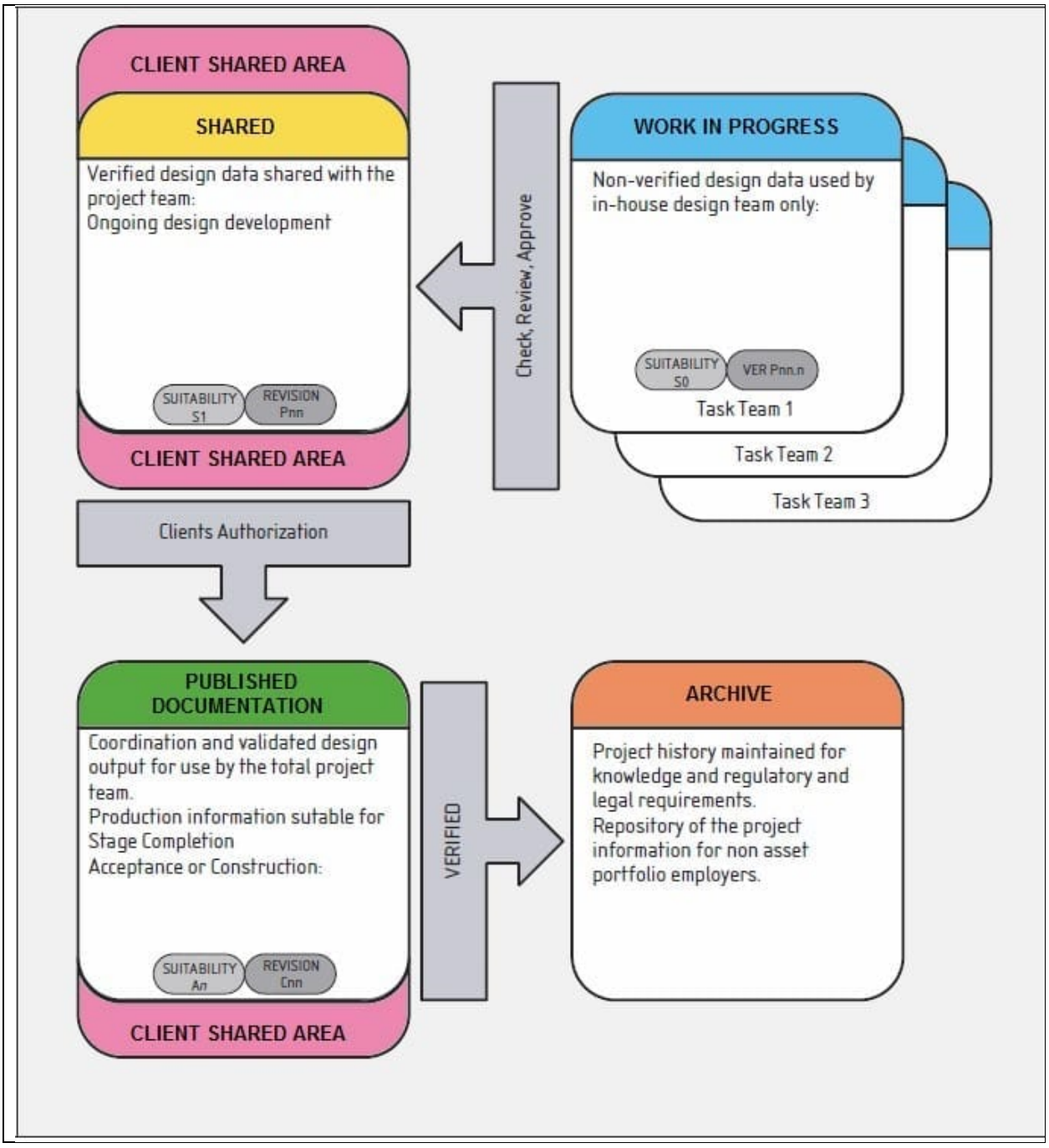
Examples:

- Letter
- Spreadsheet.
- Estimate

8. INFORMATIQUE INFRASTRUCTURE

8.1 Commun Data Environment (CDE)
In accordance with ISO 19650, the Common Data Environment becomes the sole source of information for a project; EDC is used to collect, manage and disseminate each element of the information model according to managed processes. It must be structured in 4 different sections, which represent the different stages of publication of documents:

- Work In Progess WIP ;
- Shared ;
- Published Documentation;
- Archive.



Reference : BS1192-2-2013 © The British Standards Institution

The EDC must meet the following aspects:

- Accessibility, according to the access rights in force on the project, for all project stakeholders;
- The ability to securely store all files and information used on the project;
- Preservation of history (traceability) and versioning of project documents.
- Collaboration tools;

- An integrated viewer to read the deliverables (3D models, 2D plans and other requested documents;
- The possibility of delegating actions via project validation and monitoring circuits, notably with a dashboard and indicators.

The common data environment, will be chosen and provided by the consultant, EDC may meet the requirements of a collaboration platform, but the collaboration platform is not necessarily an EDC.

8.2 Coordination platform

The coordination platform promotes the exchange of comments relating to multidisciplinary coordination between all project stakeholders, ensuring the visualization of each comment or question in its context in the Revit, Navisworks or IFC model (through a viewer web). Details relating to the choice of platform and the methodologies for its deployment will be documented in the consultant's ILL.

8.3 Software and versions

Software	Version	Description of use
Autodesk Revit	2021	Modelization
Autodesk Naviswork sManage	2021	Integration, federation, interference detection
To define	N/A (SaaS)	Common data environment
	N/A (SaaS)	Collaborative platform
AutoCAD	To define	Drawing and Modeling
AutoCAD Civil3D	To define	Drawing and Modeling

9. BIM DELIVERABLES

9.1 Format of Deliverables

9.1.1. Paper deliverables

At each stage of the project, when plans are officially issued, the various professionals must produce the number of hard copies determined by the Project Manager based on the Contract Documents.

9.1.2. Electronic deliverables

9.1.2.1. Revit native format

At each stage of the project, when the plans are officially issued, all the models in .rvt format (including federated models) will be retrieved by the BIM Expert and submitted to the Professional and Technical Services Centre of Expertise for archiving.

If necessary and as requested by the Professional and Technical Services Centre of Expertise, models in .rvt format may be provided to third parties for information.

9.1.2.2. Navisworks format

At each stage of the project, at the end of the interference detection process, all models in .nwc and .nwf format (including federated models) will be retrieved by the BIM Expert and archived.

9.1.2.3. PDF format

At each stage of the project, when drawings are officially issued, the various professionals must produce deliverables in.pdf format. Each drawing sheet will be done independently, except for uploading for submission, where the documents must be combined by discipline.

9.1.2.4. dwg format

At each stage of the project, when drawings are officially issued, the various professionals must produce deliverables (plans, sections and elevations) in .dwg format.

9.1.2.5. ifc format

The .ifc format is a standardized object-oriented file format (ISO 16739 standard) used by the building industry to exchange and share information between software applications. At each stage of the project, when drawings are officially issued, the various professionals must produce deliverables in .ifc format.

9.1.2.6. Other formats

At each stage of the project, when drawings are officially issued, the architecture BIM manager must ensure that the database of functional requirements, areas and net/gross ratios, including tables in Excel format, is submitted.

9.2 BIM Deliverables – Start-up Stages

BIM Deliverables	Leads	Status	Format	Notes
BIM Management Plan	BIM Expert	In progress	PDF	
Geo-referenced general site data	PWGSC	Forthcoming	.rvt	Models of existing condition survey data
Implementation model of the reference hypothesis	PWGSC	Forthcoming	.rvt	Volumetric model representing the site layout constraints

9.3 BIM Deliverables – Design Stages

BIM Deliverables	Leads	Status	Format	Notes
BIM Management Plan	BIM Expert Senior BIM Manager	Forthcoming	.doc / .PDF	

Models of existing conditions	Design professionals	Forthcoming	.rvt	Mock-ups for modelling existing conditions to meet the needs of the project
Design models	Design professionals	Forthcoming	.rvt .nwd .ifc	See the Information Exchange Grid (LOD) to ensure that the models contain all the required information.
2D drawings issued for calls for tenders	Design professionals	Forthcoming	.pdf	Plans extracted directly from the models.
Design model used in the call for tenders	Design professionals	Forthcoming	.rvt .ifc	Extracted directly from the models.
Interference detection	Senior BIM Manager (Design)	Forthcoming		Document produced by the Senior BIM Manager during the interference analysis and distributed to the design professionals for coordination

9.4 BIM Deliverables – Delivery Stages

BIM Deliverables	Leads	Status	Format	Notes
BIM Management Plan	BIM Expert Senior BIM Manager	Forthcoming	.doc / .PDF	Update for construction
Design models issued for construction	Design professionals	Forthcoming	.rvt	Design models including addenda
Construction models	Contractors	Forthcoming	.rvt .nwd .ifc	See the Information Exchange Grid (LOD) to ensure that the models contain all the required information.
Shop drawings (construction models)	Contractors	Forthcoming	.rvt .pdf .ifc	Plans extracted directly from construction models
Design model used in the tenders	Design professionals	Forthcoming	.rvt pdf .ifc	Extracted directly from the models.
Interference detection reports	Senior BIM Manager (Construction)	Forthcoming		Document produced by the Senior BIM Manager during the interference analysis and distributed to the design professionals for coordination

Updated design models	Design professionals	Forthcoming	.rvt .pdf .ifc	Design models updated during the work and "updated" plans extracted directly from the models
Construction models representative of actual conditions	General Contractor	Forthcoming	.rvt .pdf .ifc	Construction models updated during the execution of the work and "updated" plans extracted directly from the models

9.5 BIM Deliverables Timeline

RS	BIM Deliverables	DURATION Month	START DATE	END DATE
	BIM Management Plan			
	BIM Implementation Plan (BIP)			
SR 1	Models of existing conditions			
SR 2	Design models			
SR 3	Design models			
	3D coordination reports; conflict detection			
SR 4	Design models issued for construction			
SR 6	Design model used in the call for tenders			
	2D drawings issued for calls for tenders extracted from the design models issued in the calls for tenders			
	Integrated model for site management and construction monitoring			
	3D coordination reports; conflict detection			
	Integrated model and 4D simulation			
	Updated design models			
	Construction models representative of actual conditions			