

ClearPath RD

clearpathrd.com

Certificate Generation Specification

Version 1.0 — February 2026 — Confidential

What this document covers

- Certificate visual design — layout, typography, colour system, zone variants
- PDF generation pipeline — pdf-lib implementation, coordinate system, all rendered elements
- Certificate number format and sequential generation logic
- QR code generation and verification URL construction
- Supabase Storage structure — bucket layout, file naming, access control
- Signed URL download flow
- Public verification page specification — what it shows and what it withholds
- Certificate supersession logic
- Generation trigger, async job pattern, and certificate_ready email hook
- Implementation checklist

1. Overview

A ClearPath RD certificate is a single-page PDF generated server-side by the Fastify API when a radon test result is submitted. It is stored in Supabase Storage and made available for authenticated download via a signed URL. A QR code on the certificate resolves to a public verification page that confirms authenticity without exposing any personal information or numeric values.

Design principle: the certificate must look credible to a real estate agent, a home buyer, and a property insurer. It must be visually clean, unambiguous about what the number means, and clearly branded as a ClearPath RD document. It is not a medical document — it is a property record.

1.1 Certificate Types

There is one PDF template. The `cert_type` field (`residential` or `real_estate`) changes a single label on the certificate — everything else is identical.

Certificate type	Value / Specification
<code>residential</code>	Standard 91-day long-term test. Issued to homeowners for personal knowledge or disclosure. Valid for 5 years.
<code>real_estate</code>	48–96 hour short-term test. Issued for real estate transactions. Valid for 5 years from test completion.

1.2 Certificate Validity

- All certificates are valid for 5 years from `valid_from` (the test completion date).
- `valid_until` = `valid_from` + 5 years (calculated to the same calendar date, 5 years forward).
- Expired certificates remain in the database and are downloadable — they display an EXPIRED watermark in the PDF and on the verification page.
- A superseded certificate (e.g., after a lab error correction) displays a SUPERSEDED watermark. The replacement certificate's verification page links back to the original.

2. Certificate Visual Design

2.1 Layout Mockup

The certificate is a single A4 portrait page (210 × 297 mm). The mockup below represents the layout structure. Proportions are approximate — see Section 3 for precise coordinates.

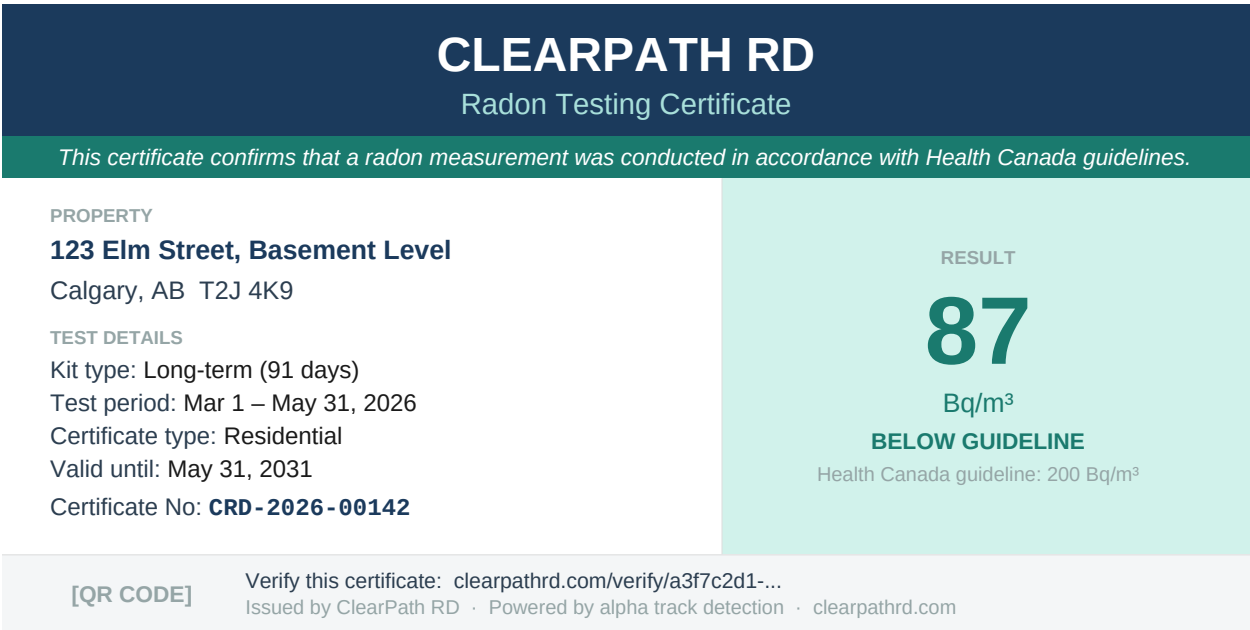


Figure 1: Certificate layout mockup (below_guideline zone variant shown). All zones use the same layout with colour and label changes in the Result panel.

2.2 Layout Zones

Zone	Value / Specification
Header band	Full-width. Navy (#1B3A5C) background. White "CLEARPATH RD" wordmark (24pt bold). "Radon Testing Certificate" subtitle (13pt, teal-tinted white #A8DFDA). Height: 28mm.
Teal accent bar	Full-width. Teal (#1A7A6E) background. Single line of italic certification statement in white (9pt). Height: 10mm.
Property panel (left)	Left 57% of body area. White background. Property address, test details, certificate metadata. Top-aligned.
Result panel (right)	Right 43% of body area. Zone-coloured background. Large numeric result, unit (Bq/m³), zone label. Vertically centred. Left border: 0.5pt #DDDDDD.
Verify footer	Full-width. Light grey (#F4F6F7) background. Top border: 0.5pt #DDDDDD. QR code left (30×30mm). Verification URL and issuer line right.

2.3 Typography

Element	Value / Specification
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Primary font	Helvetica (embedded in pdf-lib standard fonts). Fallback: Arial. No external font files required.
Wordmark	Helvetica Bold, 24pt, white, all caps, letter-spacing 2pt.
Section labels	Helvetica Bold, 7pt, colour #95A5A6 (MGRAY), all caps, letter-spacing 1pt. Used for "PROPERTY", "TEST DETAILS", "RESULT".
Property address	Helvetica Bold, 11pt, navy #1B3A5C.
Detail lines	Helvetica, 9.5pt, slate #2C3E50. Label in grey, value in black.
Result number	Helvetica Bold, 40pt, zone foreground colour. Right-aligned within result panel.
Result unit	Helvetica, 11pt, zone foreground colour. Below result number.
Zone label	Helvetica Bold, 9pt, zone foreground colour, all caps, letter-spacing 1pt.
Certificate number	Courier (monospace), 9.5pt, navy. Appears in both property panel and footer.
Verification URL	Helvetica, 8pt, slate. Truncated if necessary.
Issuer line	Helvetica, 7.5pt, grey #95A5A6.

2.4 Zone Colour System

The result panel background, result number colour, and zone label colour all change based on the result zone. All other elements remain constant.

Zone value	Bq/m ³ range	Colour on certificate	Plain language label
below_guideline	< 100 Bq/m ³	D1F2EB / Teal	Result Below Guideline
caution	100–199 Bq/m ³	FEF0E6 / Amber	Caution Zone
action_required	200–599 Bq/m ³	FDEDEC / Red	Action Recommended
urgent_action	≥ 600 Bq/m ³	#F5B7B1 / Dark Red	Urgent Action Required

2.5 Watermark States

Certificate status	Value / Specification
valid (no watermark)	No watermark element rendered.
expired	Diagonal grey text "EXPIRED" across the full page at 45°. Opacity 15%. Font: Helvetica Bold, 72pt. Colour: #95A5A6.
superseded	Diagonal text "SUPERSEDED" across full page at 45°. Opacity 15%. Font: Helvetica Bold, 72pt. Colour: #E8A020 (amber).

3. PDF Generation — pdf-lib Implementation

3.1 Page Setup

Property	Value / Specification
Page size	A4 portrait: 595.28 × 841.89 points (pdf-lib default A4).
Origin	pdf-lib origin is bottom-left. All y-coordinates are measured from the bottom of the page.
Margins	Left: 40pt, Right: 40pt, Top: 40pt (from top = 841.89 – 40 = 801.89pt y-start), Bottom: 40pt.
Content width	595.28 – 80 = 515.28pt.
Library	pdf-lib (^1.17.1). No external font files. Uses standard PDF fonts: Helvetica, Helvetica-Bold, Courier.

3.2 Element Coordinates

All measurements in pdf-lib points (pt). Y values measured from bottom of page. Elements listed top to bottom.

Element	X (left edge)	Y (bottom edge)	Width × Height
Header band (navy)	0	762	595.28 × 79.89pt (top 28mm of page)
Wordmark text	40	800	Helvetica-Bold 24pt, white, allCaps
Subtitle text	40	776	Helvetica 13pt, #A8DFDA
Teal accent bar	0	733	595.28 × 29pt (10mm)
Certification statement	40	740	Helvetica-Oblique 9pt, white, y-centred in bar
Property panel background	0	120	339.21 × 613pt (white fill)
"PROPERTY" label	40	700	Helvetica-Bold 7pt, MGRAY, allCaps
Address line 1	40	682	Helvetica-Bold 11pt, NAVY
Address line 2 (city/prov)	40	666	Helvetica 9.5pt, SLATE
"TEST DETAILS" label	40	638	Helvetica-Bold 7pt, MGRAY, allCaps
Kit type detail line	40	620	Helvetica 9.5pt
Test period detail line	40	604	Helvetica 9.5pt
Certificate type detail line	40	588	Helvetica 9.5pt
Valid until detail line	40	572	Helvetica 9.5pt
Certificate No detail line	40	548	Helvetica/Courier 9.5pt
Result panel background	339	120	256.28 × 613pt (zone colour fill)
Vertical divider	338	120	0.5pt × 613pt, #DDDDDD
"RESULT" label	339	680	Helvetica-Bold 7pt, MGRAY allCaps, x-centred in panel
Result number (large)	339	580	Helvetica-Bold 40pt, zone fg, x-centred
Unit label (Bq/m³)	339	562	Helvetica 11pt, zone fg, x-centred
Zone label	339	538	Helvetica-Bold 9pt, zone fg, allCaps, x-centred
HC guideline reference	339	510	Helvetica 7.5pt, MGRAY, x-centred
Footer background	0	40	595.28 × 80pt, #F4F6F7
Footer top border	0	120	595.28 × 0.5pt, #DDDDDD

QR code image	40	48	72 × 72pt (QR PNG embedded as image)
Verification URL text	124	95	Helvetica 8pt, SLATE
Issuer line text	124	62	Helvetica 7.5pt, MGRAY
Watermark (if applicable)	centre	centre	Helvetica-Bold 72pt, 15% opacity, 45° rotation

3.3 QR Code Generation

The QR code encodes the full verification URL: `https://clearpathrd.com/verify/{certificate_uuid}`. It is generated server-side as a PNG buffer and embedded in the PDF using pdf-lib's `embedPng` method.

Property	Value / Specification
Library	qrcode (npm package, ^1.5.3). Generates QR as PNG buffer without writing to disk.
Error correction level	M (15% recovery). Sufficient for a printed QR code at 72×72pt.
Margin	2 modules (quiet zone).
Colours	Dark: #1B3A5C (navy). Light: #FFFFFF (white).
Output	PNG buffer → <code>pdfDoc.embedPng()</code> → drawn at footer coordinates.
Code	<pre>const qr = await QRCode.toBuffer(verificationUrl, { errorCorrectionLevel: 'M', color: { dark: '#1B3A5C', light: '#FFFFFF' } })</pre>

3.4 Certificate Number Format

Certificate numbers are human-readable sequential identifiers. Format: CRD-YYYY-NNNNN where YYYY is the 4-digit year of issuance and NNNNN is a zero-padded 5-digit sequential integer per year.

- Example: CRD-2026-00001 (first certificate issued in 2026)
- Example: CRD-2026-00142 (142nd certificate issued in 2026)
- The sequence resets to 00001 each calendar year.
- Generation: `SELECT MAX(certificate_number) WHERE certificate_number LIKE 'CRD-YYYY-%'` then increment. Wrapped in a database transaction to prevent duplicates under concurrent generation. Alternatively: use a PostgreSQL sequence per year.
- The certificate UUID (id field) is the public verification token used in URLs. The certificate number is the human-readable identifier used on the PDF and in correspondence.

4. Certificate Generation Pipeline

4.1 Trigger

Certificate generation is triggered when a result is successfully submitted via POST `/api/v1/sessions/:sessionId/result`. The route handler:

1. Validates the result (`value_bqm3 ≥ 0`, session in valid status)
2. Creates the Result record in the database
3. Derives zone from `value_bqm3` server-side
4. Sets `result.is_immutable = false` initially
5. Calls `generateCertificate(sessionId, resultId)` asynchronously — does not await
6. Returns HTTP 201 to the client immediately with the result and a placeholder certificate object

The certificate is generated asynchronously. The client receives a 201 with the result immediately. The certificate object in the response will have `status = pending` until generation completes (typically 2–5 seconds). The `GET /certificates/:id` endpoint returns the live status. The download endpoint returns HTTP 202 if the PDF is not yet ready.

4.2 generateCertificate Function

Located in `src/services/certificate.ts`. Steps:

1. Generate certificate number (transaction-safe sequential generation)
2. Create Certificate record with `status = pending`, `pdf_storage_path = null`
3. Set `result.is_immutable = true` (locks the result)
4. Check if home already has a valid certificate — if so, set old certificate `status = superseded`, set `superseded_at = NOW()`
5. Generate QR code PNG buffer (qrcode library)
6. Build PDF using pdf-lib with all certificate data and QR buffer
7. Upload PDF buffer to Supabase Storage
8. Update Certificate record: `status = valid`, `pdf_storage_path = <storage path>`
9. Send `certificate_ready` email via Resend (calls email service)

Error handling: if any step after step 2 fails, the Certificate record is updated to `status = failed`. The result remains immutable (`is_immutable` stays true). An admin alert is triggered. Admin can manually retry generation or supersede and re-enter the result.

4.3 Supabase Storage Structure

Property	Value / Specification
Bucket name	certificates
Bucket access	Private. No public access. All downloads via signed URLs.
File path format	<code>certificates/{user_id}/{certificate_id}.pdf</code>
Example path	<code>certificates/a1b2c3d4-user-uuid/f7e6d5c4-cert-uuid.pdf</code>
Rationale for <code>user_id</code> prefix	Enables easy deletion of all certificates for a user (GDPR right to erasure). Also makes storage browsing easier for admin.

File size estimate	~80–120KB per certificate (A4 PDF with embedded QR PNG, no photos).
Retention	Certificates are never auto-deleted. Superseded and expired certificates remain in storage indefinitely for audit purposes.

4.4 Signed URL Download Flow

When a user requests GET /api/v1/certificates/:id/download:

- 1. Fastify verifies the user owns the certificate (via home → user ownership chain)
- 2. Checks Certificate.status — if pending, returns HTTP 202
- 3. Retrieves pdf_storage_path from the Certificate record
- 4. Calls Supabase Storage createSignedUrl(pdf_storage_path, 120) — 120 second expiry
- 5. Returns HTTP 302 redirect to the signed URL
- 6. Browser follows redirect and downloads PDF directly from Supabase CDN

The 120-second signed URL expiry means the URL cannot be shared or bookmarked. Each download generates a fresh signed URL. This is intentional — certificate PDFs are authenticated downloads, not publicly accessible files. The public verification page (which shows no PII) uses the certificate UUID directly, not the PDF.

5. Public Verification Page

5.1 Purpose and Access

The verification page at [https://clearpathrd.com/verify/\[certificate-uuid\]](https://clearpathrd.com/verify/[certificate-uuid]) is publicly accessible with no authentication. It confirms that a certificate is genuine and provides the minimum information needed for a third party (real estate agent, buyer, insurer) to trust the certificate.

Privacy rule: the verification page NEVER displays the homeowner's name, email, phone, full address (street number is omitted — city and province only), or the numeric Bq/m³ value. It shows zone, city, province, validity dates, and certificate number only.

5.2 Information Displayed

Field	Value / Specification
Certificate number	CRD-2026-00142. Shown prominently.
Certificate status	Valid / Expired / Superseded. Large coloured badge.
Certificate type	Residential or Real Estate. Plain text.
Result zone	Below Guideline / Caution / Action Recommended / Urgent Action. Zone-coloured badge. No Bq/m ³ value.
Property location	City and province only. No street address. e.g. "Calgary, AB".
Test type	Long-term (91 days) or Real estate short-term.
Valid from	Test completion date.
Valid until	5 years from valid_from.
Issued by	ClearPath RD (clearpathrd.com).

5.3 Information Withheld

Withheld field	Value / Specification
Homeowner name	Not shown. The certificate belongs to the property, not the person.
Street address	Not shown. City and province only.
Numeric result (Bq/m ³)	Not shown. Zone only. Prevents the verification page from being used to profile or devalue properties.
Email or phone	Not shown.
Kit serial number	Not shown.
Lab reference	Not shown.

5.4 Status Variants

- valid: Green badge. "This certificate is valid and was issued by ClearPath RD." Show all fields above.
- expired: Red badge. "This certificate has expired. It was valid until [date]. A new test is recommended." Show all fields.

- superseded: Amber badge. "This certificate has been superseded. A replacement certificate has been issued for this property." If the replacement certificate's ID is available, link to it. Show all fields.
- not found (404): "No certificate was found with this ID. If you believe this is an error, contact support@clearpathrd.com."

5.5 Next.js Page Implementation

The verification page is a Next.js server component at `app/verify/[id]/page.tsx`. It calls the public `GET /api/v1/verify/:id` endpoint on the Fastify API and renders the result. No client-side JavaScript is required for the core verification display.

Property	Value / Specification
Route	<code>app/verify/[id]/page.tsx</code>
Rendering	Server component. Fetches from Fastify API at render time.
Cache	revalidate = 300 seconds (5 minutes). Certificate status changes are not instant — a 5-minute cache is acceptable.
Metadata	page title: "Certificate [number] — ClearPath RD". OG image: generic ClearPath RD branded image (not certificate-specific, to avoid caching PII).
Error states	404: render <code>not-found.tsx</code> . 500: render <code>error.tsx</code> with support contact.
Mobile	Fully responsive. Must be usable on mobile as the QR code will often be scanned on a phone.

6. Certificate Supersession

A certificate is superseded when a lab error requires the result to be corrected. Supersession is an admin-only action (POST /api/v1/admin/certificates/:id/supersede).

6.1 Supersession Steps

- 1. Admin calls POST /admin/certificates/:id/supersede with a reason string
- 2. Certificate.status is set to superseded, superseded_at = NOW()
- 3. Result.is_immutable is set to false (unlocks the result for correction)
- 4. The PDF in Supabase Storage is NOT deleted — it remains as an audit record
- 5. The superseded PDF is re-generated with a SUPERSEDED watermark and re-uploaded to the same path (overwrites)
- 6. Admin can now submit a corrected result via POST /sessions/:id/result
- 7. The corrected result triggers a new certificate generation (new certificate number, new PDF, new certificate_ready email)

6.2 Verification Page Behaviour After Supersession

The old certificate UUID still resolves on the verification page but shows status = superseded with an amber badge. If the new certificate's id is stored in a superseded_by field on the old certificate record (optional enhancement), the verification page can link to the replacement. For MVP, the superseded page simply states that a replacement has been issued.

7. Certificate Data Sources

Every field rendered on the certificate PDF and displayed on the verification page. Source column references the database table and field.

PDF element	Database source	Notes
Property address line 1	<code>homes.address_line1</code>	Full street address. Shown on PDF only, not on public verify page.
Property address line 2	<code>homes.address_line2</code>	Suite/unit if present. May be null.
City, province, postal	<code>homes.city, province, postal_code</code>	Concatenated. Postal code shown on PDF only.
Kit type label	<code>test_sessions.kit_type</code>	<code>long_term</code> → "Long-term (91 days)"; <code>real_estate_short</code> → "Real estate short-term (48–96 hours)"
Test period	<code>test_sessions.activated_at - results.recorded_at</code>	Formatted as "Mon DD, YYYY – Mon DD, YYYY"
Certificate type	<code>certificates.cert_type</code>	<code>residential</code> → "Residential"; <code>real_estate</code> → "Real Estate"
Valid from	<code>certificates.valid_from</code>	Same as test completion date (<code>results.recorded_at</code> date part).
Valid until	<code>certificates.valid_until</code>	<code>valid_from</code> + 5 years.
Certificate number	<code>certificates.certificate_number</code>	Format CRD-YYYY-NNNNN.
Result value	<code>results.value_bqm3</code>	Rendered as integer if whole number, one decimal if fractional. e.g. "87" or "87.5". PDF only — not on public verify page.
Result zone	<code>results.zone</code>	Determines panel colour and zone label. Both PDF and verify page.
Zone label text	Derived from <code>results.zone</code>	See zone table in Section 2.4.
QR code URL	<code>certificates.verification_url</code>	https://clearpathrd.com/verify/{certificate.id}
Watermark	<code>certificates.status</code>	Rendered only if status = expired or superseded.

8. Implementation Checklist

Dependencies

- Add pdf-lib (^1.17.1) to clearpath-api package.json
- Add qrcode (^1.5.3) to clearpath-api package.json
- Confirm Supabase Storage bucket "certificates" is created and set to private

Certificate generation service

- Implement generateCertificateNumber() — transaction-safe sequential generation (CRD-YYYY-NNNNN)
- Implement buildCertificatePDF(data) — returns pdf-lib PDFDocument buffer
- Implement all layout elements per coordinate table in Section 3.2
- Implement zone colour switching (4 zone variants)
- Implement watermark rendering for expired and superseded states
- Implement QR code generation and embedding
- Implement uploadCertificatePDF(userId, certId, buffer) — uploads to Supabase Storage
- Implement generateCertificate(sessionId, resultId) — orchestration function
- Wire generateCertificate() as async call in POST /sessions/:id/result route handler

Download endpoint

- Implement GET /certificates/:id/download — returns 202 if pending, 302 signed URL redirect if ready
- Signed URL expiry: 120 seconds
- Confirm ownership check: user must own the home associated with the certificate

Public verification page

- Implement GET /verify/:id Fastify endpoint — returns CertificatePublic schema (no PII, no Bq value)
- Implement app/verify/[id]/page.tsx Next.js server component
- Implement all 4 status variants (valid, expired, superseded, not found)
- Confirm page is accessible without authentication
- Confirm mobile responsiveness

End-to-end test

- Submit a test result via POST /sessions/:id/result
- Poll GET /certificates/:id until status = valid (should complete within 5 seconds)
- Download the PDF via GET /certificates/:id/download, confirm it renders correctly in a PDF viewer
- Scan the QR code — confirm it opens the correct verification URL
- Open the verification URL in an incognito browser (no auth) — confirm page loads and shows correct zone
- Confirm the Bq/m³ value is NOT shown on the verification page
- Confirm the street address is NOT shown on the verification page

- Test all 4 zone variants by submitting results in each range
- Test expired watermark: manually set valid_until to a past date and regenerate PDF

— *End of Certificate Generation Specification* —
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