Provincie Zeeland
Abdij 6 4331BK Middelburg
Postbus 6001 4330 LA Middelburg
+31 118631011
IBAN NL08 BNGH 0285010557

Aan

Onderwerp	Zaaknummer	Behandeld door	Verzonden
Besluit Woo-verzoek	417521		

Middelburg, 19 juni 2024

Geachte mevrouw ,

Op 1 maart 2024 heeft u Gedeputeerde Staten verzocht om informatie op grond van de Wet open overheid (Woo). De ontvangst van uw verzoek is op 22 mei 2024 aan u bevestigd. Daarbij is verzocht uw verzoek te specificeren. Dit heeft u gedaan bij brief van 27 maart 2024. Op 22 april 2024 heeft er vervolgens een Teams-meeting met u plaatsgevonden en heeft u uw verzoek nog concreter gemaakt. In overleg en met uw goedvinden is daarbij afgesproken dat er gelet op de omvang van uw verzoek zal worden afgeweken van de in de wet gestelde termijnen.

Met deze brief ontvangt u het besluit op uw verzoek. Wij hebben documenten gevonden die betrekking hebben op uw verzoek en besluiten die informatie (zonder persoonsgegevens) openbaar te maken.

Uw verzoek
U heeft bij concretisering (e-mail van 24 april 2024) gevraagd om informatie over de Molenplaat en de Auvergnepolder en de plannen over de windmolens, aan de hand van de volgende zes labels:

1. Erfgoedwet archeologie;
2. Geografisch- fysieke- functioneel gebied van de Geopark Schelde Delta;
3. Omgevingswet;
4. Kweekgebied;
5. Geodetisch systeem en de Geofysica;
6. Uitvoering regeling visserij.

U heeft daarnaast gevraagd om juridisch advies ten aanzien van het munitiedepot Gat van Zierikzee.

Inventarisatie
Binnen de systemen van Gedeputeerde Staten is gezocht naar documenten die betrekking hebben op uw verzoek. De inventarisatie van de documenten is gelet op de zes labels binnen de organisatie bij meerdere medewerkers en afdelingen belegd, te weten cultuur-erfgoed-leefbaarheid en sport, landelijk gebied-natuur en landbouw, monumenten en erfgoed, milieu, visserij en informatisering en automatisering.

Die zoekslag heeft de volgende documenten opgeleverd:

1. Aanwijzing Rijksmonument
2. Aanwijzing Rijksmonument Reimerswaal 2017
3. Advies Aanwijzing Rijksmonument 2015
4. Besluit Erfgoedwet 1 april 2024
5. Bijlagen Indieningsdossier Schelde Delta
6. cultuurhistorie-2024-04-30-13-47-03
7. Kaart Geopark Schelde Delta
8. Statenvragen auvergnepolder 2018

Grenzen aan openbaarheid
Wij maken deze documenten openbaar met uitzondering van de daarin genoemde persoonsgegevens.

Persoonlijke levenssfeer (artikel 5.1, tweede lid, aanhef en onder e, van de Woo)
Op grond van artikel 5.1, tweede lid, aanhef en onder e, van de Woo blijft verstrekking van informatie achterwege wanneer het belang van de bescherming van de persoonlijke levenssfeer van personen zwaarwegender is dan het belang van informatieverstrekking. Een dergelijk belang is aan de orde wanneer documenten gegevens zoals namen, maar ook meer indirecte gegevens bevatten waarmee de identiteit van de betrokken personen achterhaald kan worden.

In een aantal documenten staan persoonsgegevens. De openbaarmaking hiervan dient geen redelijk doel omdat het gaat om gegevens van personen die naar de aard van hun functie niet in de openbaarheid treden of anderszins een publiek persoon zijn. De bescherming van de persoonlijke levenssfeer van de betrokkenen weegt in dit verband daarom zwaarder.

Voornoemde beoordeling is tot uitdrukking gebracht door bij weglakking de lettercode J op te nemen.

Informatie van derden
Wij willen u erop wijzen dat de documenten ook informatie van derden bevatten. Wij zijn gelet op artikel 2.4, vierde lid van de Woo niet verantwoordelijk voor de juistheid of volledigheid van die informatie.

Nadere toelichting
Zowel de Auvergnepolder als 90% van de Molenplaat valt buiten het grondgebied van de Provincie Zeeland. Voor wat betreft de archeologie gaan Gedeputeerde Staten hier dus niet over. De archeologie van het stuk van de Molenplaat dat binnen ons gebied valt zit in het gemeentelijk archeologiebeleid van de gemeente Tholen: het kent een deel middelhoge en een deel lage archeologische verwachting, zoals te zien is op de kaart cultuurhistorie.

De zaken ten aanzien van de uitgifte van rechten en de verhuur/pacht van percelen op het gebied van visserij liggen bij de Rijksoverheid. Provincie Zeeland speelt hier geen rol in. Ter informatie verwijzen wij u naar Rijksdienst voor Ondernemend Nederland (rvo.nl).

Juridisch advies
Ten aanzien van uw vraag om juridisch advies over het munitiedepot Gat van Zierikzee, onze juristen zijn provincieambtenaren en kunnen u gelet op die positie derhalve niet voorzien van persoonlijk juridisch advies. Ter informatie wijzen wij u erop dat informatie over het munitiedepot Gat van Zierikzee openbaar toegankelijk is bij het Zeeuws Archief te Middelburg.

Openbaarmaking
Dit besluit en de openbaar gemaakte documenten plaatsen wij (zonder persoonsgegevens) op www.zeeland.nl/loket/woo-verzoek.
Met vriendelijke groet,

Gedeputeerde Staten van Zeeland,
Namens deze,

mevr. drs. A.A. Bosscha - Boelpijp
Programmamanager Cultuur, Erfgoed, Leefbaarheid en Sport

Noem in uw contact met ons steeds het zaaknummer. Dit staat bovenaan deze brief.

Bijlagen:
1. Aanwijzing Rijksmonument
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3. Advies Aanwijzing Rijksmonument 2015
4. Besluit Erfgoedwet 1 april 2024
5. Bijlagen Indieningsdossier Schelde Delta
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Bezwaar
Belanghebbenden kunnen schriftelijk bezwaar maken tegen dit besluit bij:
Gedeputeerde Staten van Zeeland, t.a.v. de secretaris van de commissie voor bezwaarschriften,
Postbus 6001, 4330 LA Middelburg.

In het bezwaarschrift neemt u ten minste op uw naam en adres, de dagtekening van het bezwaarschrift, tegen welk besluit u bezwaar maakt en waarom. Het bezwaarschrift dient te worden ondertekend.
U moet het bezwaarschrift indienen binnen zes weken na de dag waarop dit besluit is bekendgemaakt. Doorgaans is dat de dag na de datum van verzending. Overschrijding van de inzendtermijn kan ertoe leiden dat met uw bezwaren geen rekening wordt gehouden.

Als u overweegt bezwaar te maken, kunt u meer informatie vinden op https://www.zeeland.nl/bezwaar-maken.

Wij wijzen u erop dat het bezwaar niet de werking van het besluit schorst. U kunt een verzoek doen tot het treffen van een voorlopige voorziening. U richt het verzoek aan de voorzieningenrechter van de rechtbank Zeeland-West-Brabant, locatie Breda, team bestuursrecht, Postbus 90006, 4800 PA Breda. Voor de behandeling van het verzoek is griffierecht verschuldigd.

17021340

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

> Retouradres Postbus 1600 3800 BP Amersfoort

Gedeputeerde staten van
De Provincie Zeeland
Postbus 6001
4330 LA MIDDELBURG

Smallepad 5
3811 MG Amersfoort
Postbus 1600
3800 BP Amersfoort
www.cultureelerfgoed.nl

Contactpersoon
InfoDesk
T 033 421 74 56
info@cultureelerfgoed.nl

Zaaknummer
4489494001

Datum: 04-10-2017
Betreft: Monumentnummer: 532468
Reimerswaal
Locatie: Reimerswaal; Speelmansplaat; Oesterdam
Gemeente: Tholen

Geacht college,

Ik stuur u hierbij mijn besluit om bovengenoemde zaak aan te wijzen als rijksmonument.

In het besluit kunt u lezen hoe de procedure is verlopen: of er is geadviseerd, of er zienswijzen zijn ingediend en hoe ik deze heb betrokken bij de motivering van mijn besluit.

Heeft u een vraag naar aanleiding van deze brief?
Bij vragen over deze brief kunt u gebruik maken van de contactgegevens bovenaan deze brief. Het rijksmonumentenregister kunt u raadplegen via https://monumentenregister.cultureelerfgoed.nl

Hoogachtend,

de minister van Onderwijs, Cultuur en Wetenschap,
namens deze,
de Rijksdienst voor het Cultureel Erfgoed,

[redacted]

[redacted]
hoofd Juridische Zaken

PROVINCIE ZEELAND
AFD.
AFD. TERMIJN [redacted]
DATUM – 5 OKT. 2017
DOC.NR.
ZAAK NR.
CLASS.

Bijlagen:
- Besluit

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
04-10-2017

Zaaknummer
4489494001

Betreft
Besluit aanwijzen rijksmonument

Monumentnummer(s)
532468

besluit

De minister van Onderwijs, Cultuur en Wetenschap besluit, gelet op artikel 9.3, eerste lid, onder a, van de Erfgoedwet in samenhang met artikel 3, eerste lid, van de Monumentenwet 1988, het onderstaande monument aan te wijzen als rijksmonument.

Het betreft:
- Rijksmonumentnummer 532468, Reimerswaal; Speelmansplaat; Oesterdam

Rijksmonumentnummer
532468

Adres
Reimerswaal; Speelmansplaat; Oesterdam

Gemeente
Tholen

Provincie
Zeeland

Kadastrale aanduiding

Kadastrale gemeente	*Sectie*	*Kad. object*	*App.*	*Grondperc.*
THOLEN	K	133		
THOLEN	K	267		
THOLEN	K	268		
THOLEN	K	270		
THOLEN	K	271		
THOLEN	K	342		
THOLEN	K	343		
THOLEN	K	344		
THOLEN	K	345		
THOLEN	K	346		
THOLEN	K	347		
THOLEN	K	348		
THOLEN	K	354		
THOLEN	K	357		
THOLEN	K	359		
THOLEN	K	360		
THOLEN	K	368		
THOLEN	K	372		
THOLEN	K	387		
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THOLEN	K	399		
THOLEN	K	401		
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THOLEN	K	413		
THOLEN	K	415		
THOLEN	K	416		
THOLEN	K	417		
THOLEN	K	430		
THOLEN	K	433		
THOLEN	K	434		
THOLEN	K	435		
THOLEN	K	436		
THOLEN	K	438		
THOLEN	K	439		
THOLEN	K	440		

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
04-10-2017

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Besluit aanwijzen rijksmonument

Monumentnummer(s)
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THOLEN	K	441
THOLEN	K	443
THOLEN	K	444
THOLEN	K	454
THOLEN	K	455
THOLEN	K	456
THOLEN	K	457
THOLEN	K	458
THOLEN	K	459
THOLEN	K	461
THOLEN	K	462
THOLEN	K	463
THOLEN	K	464
THOLEN	K	465

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
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Betreft
Besluit aanwijzen rijksmonument

Monumentnummer(s)
532468

Naam van het rijksmonument

Reimerswaal

Omschrijving

Verdronken stad uit de 11e/12e-16e eeuw.

Situatie op de kaart

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
04-10-2017

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Besluit aanwijzen rijksmonument

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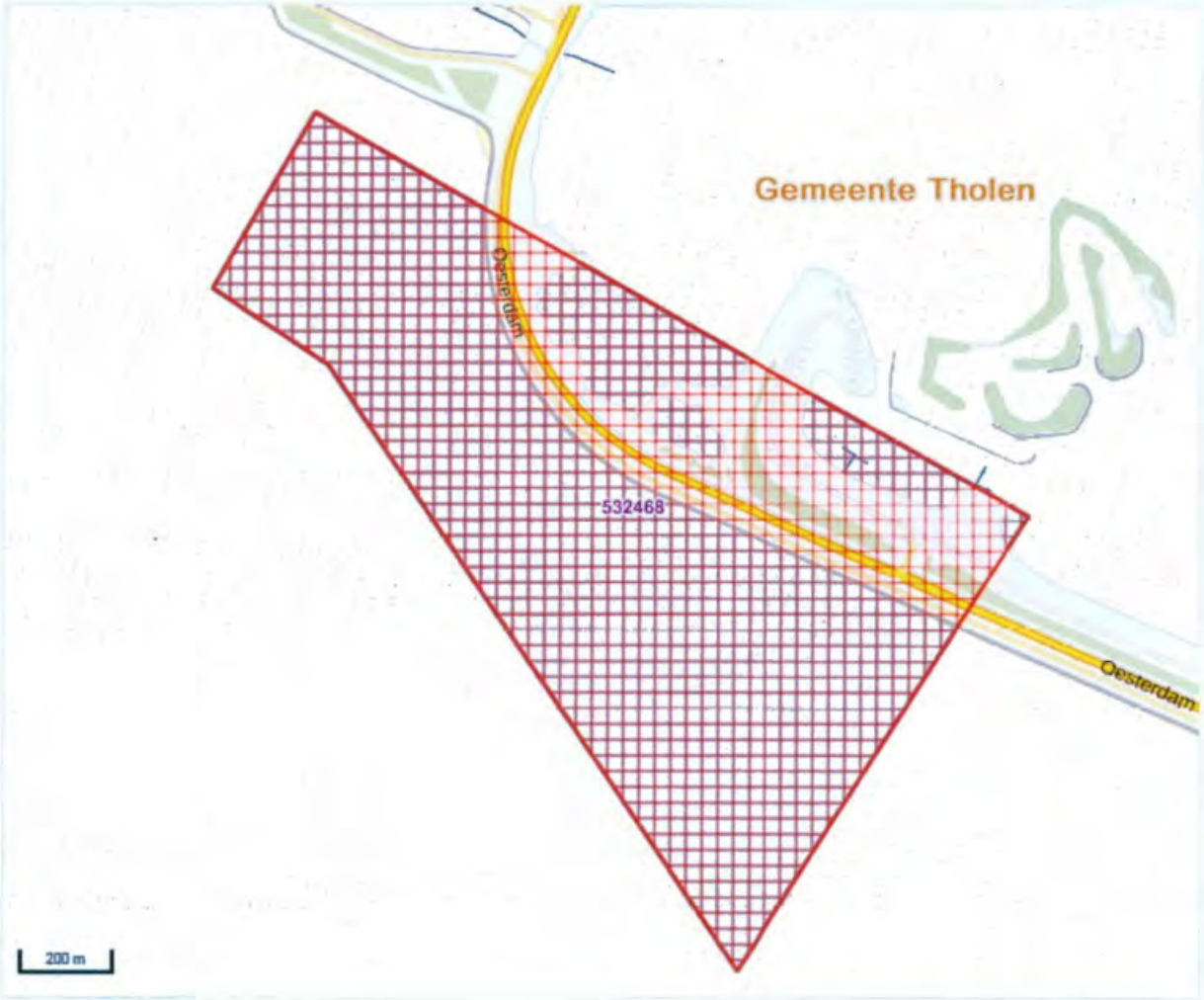

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
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Betreft
Besluit aanwijzen rijksmonument

Monumentnummer(s)
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Besluitmotivering

Aanleiding

De aanwijzing gebeurt op voorstel van de Rijksdienst voor het Cultureel Erfgoed in het kader van het aanwijzingsprogramma Archeologie 2013.
Op 10 augustus 2015 is de aanwijzingsprocedure, bedoeld in de Monumentenwet 1988 (artikel 3), gestart.

Aanwijzingsbeleid

Vanaf 1 januari 2013 geldt de Beleidsregel aanwijzing beschermde monumenten 2013, beleidsregel van de Minister van OCW van 15 februari 2013, Staatscourant 26 februari 2013, nr.5217 (hierna: Beleidsregel 2013).

Op grond van de Beleidsregel 2013 (artikel 8) kan de Minister een archeologisch monument aanwijzen als beschermd monument, indien:

a. het monument is opgenomen in een aanwijzingsprogramma, of
b. het monument
   1. vanwege zijn schoonheid, betekenis voor de wetenschap of cultuurhistorische waarde kan worden aangemerkt als een nationaal of internationaal erkend monument; en
   2. een wezenlijke lacune opvult in het geheel van de beschermde archeologische monumenten.

In dit geval is het monument opgenomen in een aanwijzingsprogramma.

Op grond van de Beleidsregel 2013 (artikel 9) past de Minister bij het opstellen van een aanwijzingsprogramma, bedoeld in artikel 8, onder a., de volgende criteria toe:

a. het desbetreffende monument kan vanwege zijn schoonheid, betekenis voor de wetenschap of cultuurhistorische waarde worden aangemerkt als een nationaal of internationaal erkend monument, en
b. het desbetreffende monument vult een wezenlijke lacune op in het geheel van de beschermde archeologische monumenten.

Horen van belanghebbenden

Ter voldoening aan het bepaalde in de Monumentenwet 1988 (artikel 3, vierde lid), heeft het college van burgemeester en wethouders van de gemeente Tholen belanghebbenden op de hoogte gesteld van de aanwijzingsprocedure en hen in de gelegenheid gesteld zich te doen horen. De hoorzitting vond plaats op 3 december 2015.

De aanwezige belanghebbenden hadden vragen en opmerkingen die beantwoord werden door de gemeente. Daarnaast gaven zij aan dat ze graag in gesprek gaan met de Rijksdienst voor het Cultureel Erfgoed (RCE) om een nadere motivering te vernemen van dit besluit tot aanwijzing. Vertegenwoordigers van de RCE hebben op 28 november 2016 gevolg gegeven aan het verzoek van aanwezigen. Tijdens een bijeenkomst 's avonds zijn nadere gegevens verstrekt over de aanwijzing en de gevolgen ervan. Van bezwaar van belanghebbenden tegen de aanwijzing is naar aanleiding van de hoorzitting en de informatieavond, of op andere wijze, niet gebleken.

Advies gemeente
Burgemeester en wethouders van Tholen hebben bij brief d.d. 6 januari 2016 positief geadviseerd ten aanzien van aanwijzing als beschermd monument.

Advies provincie
Gedeputeerde staten van Zeeland hebben bij brief d.d. 3 november 2015 positief geadviseerd ten aanzien van aanwijzing als beschermd monument.

Advies Raad voor Cultuur
De Raad voor Cultuur (RvC) heeft bij brief d.d. 20 maart 2017 positief geadviseerd ten aanzien van aanwijzing als beschermd monument.
De Raad acht het terrein met de resten van de verdronken stad Reimerswaal van nationale betekenis. Hij beveelt aan de begrenzing van de bescherming meer inhoudelijk te motiveren.

Waardering
Waardering van de vindplaats
Het monument is beoordeeld op basis van de waarderingssystematiek zoals hieronder weergegeven in de tabel.

Waarden	***Criteria***	***Scores***		
		Hoog	Midden	Laag
Beleving	Schoonheid	n.v.t.		
	Herinneringswaarde	3		
Fysieke kwaliteit	Gaafheid	3		
	Conservering	3		
Inhoudelijke kwaliteit	Zeldzaamheid	3		
	Informatiewaarde	3		
	Ensemblewaarde		2	
	Representativiteit	n.v.t.		

Beleving
Boven water is van de stad niets meer zichtbaar, behalve bij zeer laag tij. Het criterium 'Schoonheid' is daarom niet van toepassing. Herinneringswaarde heeft het monument wel; Reimerswaal is afgebeeld op tal van historische kaarten en staat quasi symbool voor wat teloor ging bij de vele stormvloeden die Zeeland hebben geteisterd.

Fysieke kwaliteit
Grote delen van de vindplaats zijn goed bewaard gebleven. Na de Middeleeuwen hebben nauwelijks bodemverstorende bouwwerkzaamheden plaatsgevonden.

Bovendien ligt op delen van de vindplaats een dik, deels opgespoten sedimentpakket. Niet alleen anorganische overblijfselen (o.a. muur- en vaatwerk), maar ook organische, zoals houtconstructies en menselijke begravingen, blijken door de natte omstandigheden uitermate goed geconserveerd te zijn.
Aan de westzijde staan delen van de stad via de open stormvloedkering in verbinding met de Noordzee. Door de realisering van de Oosterscheldewerken is daar 'zandhonger' ontstaan: er vindt geen sedimentaanvoer meer plaats vanuit zee, terwijl de hogere delen door golfslag (storm) eroderen. De aanwezige archeologische resten verliezen daarmee een beschermende laag sediment, met aantasting tot gevolg.

Inhoudelijke kwaliteit
Reimerswaal is de enige middeleeuwse Nederlandse stad die in zee, c.q. een zeegat is verdwenen. Waar in andere historische steden de ontwikkeling van de gebouwde omgeving doorging, werd die in Reimerswaal door natuurlijke oorzaken stopgezet. Dit maakt de vindplaats, in relatie ook tot de uitstekende fysieke kwaliteit, uiterst zeldzaam. De informatiewaarde van de resten en daarmee samenhangende vondsten is hoog. Zowel uit de NOaA (Nationale Onderzoeksagenda Archeologie) als uit de Archeologiebalans 2002 en de Provinciale Onderzoeksagenda Archeologie Zeeland (POAZ) is af te leiden dat de ontwikkeling van steden gedurende de Middeleeuwen en Nieuwe tijd in Zeeland een onderzoeksthema is waarvan de huidige stand van kennis heterogeen en lacuneus is.
De stad Reimerswaal staat niet op zichzelf, maar maakt deel uit van een eveneens verdronken cultuurlandschap met daarin meerdere nederzettingen, infrastructuur, verkavelingssystemen, etc. Over wat zich aan archeologische resten rond de stad bevindt, is nog relatief weinig bekend, maar in potentie kan hier de wisselwerking tussen stad en omringend platteland worden bestudeerd.

Motivatie Begrenzing
De contour van het monument is bepaald in overleg met de Stichting Cultureel Erfgoed Zeeland (SCEZ) en weergegeven op het bijgevoegde kaartje. De begrenzing kwam tot stand door het combineren van de stadsplattegrond op historische kaarten (o.a. Jacob van Deventer, circa 1560) met de huidige topografie en veldwaarnemingen van SCEZ en amateur-archeologen. Op die manier ontstond een contour waar de archeologische resten binnen liggen.

Overwegingen

Aan de overwegingen van de Monumentenwet 1988 ligt onder meer ten grondslag het meer betrekken van lagere overheden bij het behoud van monumenten. In de Memorie van Toelichting wordt het grote belang gememoreerd dat in de huidige wet wordt gehecht aan de inbreng van vooral de gemeente over de aanwijzing. Hoewel op rijksniveau over het al dan niet beschermen wordt beslist, komt aan de adviezen van de lagere overheden een invloedrijke plaats toe. Slechts op zwaarwegende gronden zal de minister van die adviezen kunnen afwijken. In dit geval bestaat daartoe geen aanleiding.

Op 3 december 2015 heeft een hoorzitting plaatsgevonden. De gemeente en de adviseur archeologie van het Oosterschelderegio Archeologisch Samenwerkingsverband (OAS) hebben bij die gelegenheid veel vragen van belanghebbenden beantwoord. Belanghebbenden gaven aan behoefte te hebben aan meer informatie. Er is derhalve een informatieavond belegd. Op

28 november 2016 gaven vertegenwoordigers van de RCE een aanvullende toelichting op de aanwijzing en werden vragen die er nog leefden beantwoord.
Samenvattend kwamen aan de orde:

- het verondersteld negatieve etiket dat aanwijzing vanwege de beperkingen op eigendom plakt. Het is in de regel meer een door geruchten ingegeven gevoel dan dat er sprake is van aantoonbare waardevermindering. In dit specifieke geval geldt dat er van beperkingen in de praktijk geen sprake is. Bodemingrepen die voortvloeien uit reguliere bewoning en gebruik van een perceel zijn vrijgesteld van vergunningplicht tot de onderzijde van de recent opgebrachte, naar schatting 4 m dikke laag zand. Bovendien bestaan er al beperkingen ingevolge het bestemmingsplan en is de vrijstellingsrichtlijn die samenhangt met de aanwijzing aanzienlijk ruimer dan die van het vigerende bestemmingsplan (december 2013). Daarin geldt een beperking vanaf 2 m onder maaiveld.
- de contour van het aan te wijzen monument. Aanvullend op de antwoorden van de hoorzitting is uitgelegd dat de contour tot stand is gekomen door veldgegevens (waarnemingen bij laagwater) te combineren met cartografische bronnen. De locatie van de 17e-eeuwse bebouwingskern is op de kaart bij benadering bepaald aan de hand van nog aanwezige kenmerken in het landschap.
  De beschikbare veldgegevens in het archief van SCEZ gaan terug tot het begin van de 20e eeuw en worden onderbouwd door vele vondsten. Ten aanzien van de genoemde fundamenten bij de Bergsediepsluis kan worden opgemerkt dat die al langere tijd bekend zijn. De sluis is bij de planning zelfs een stukje naar het noorden opgeschoven om de resten te ontzien; ze liggen binnen de contour van het monument.
- Reimerswaal is naar verluidt niet de enige verdronken stad. Er zijn enkele twijfelgevallen, maar afgaande op de criteria die door SCEZ zijn gehanteerd om te onderscheiden tussen een verdronken dorp en een stad, is Reimerswaal de enige nederzetting die als volwaardige stad kan worden aangemerkt.
- De beschikbare informatie over Reimerswaal moet goed worden benut (educatie, recreatie, toerisme). Er is van gedachten gewisseld over de mogelijkheden om in dit opzicht iets te doen ter plekke van het monument en over de kansen die zich aandienen.

Bij afsluiting van de informatieavond gaven aanwezigen te kennen dat de vragen afdoende zijn beantwoord en dat gevoelens van onrust, c.q. onzekerheid zijn weggenomen. Ze vormen daarmee geen beletsel meer voor aanwijzing.

De Raad voor Cultuur beveelt in zijn advies aan om de begrenzing van de bescherming meer inhoudelijk te motiveren. Het bepalen van de exacte begrenzing van de aanwezige resten is vanwege de aard van het natuurlijk milieu waarin ze liggen – onder de waterspiegel in stromend water, grotendeels afgedekt door slib en zand en slechts nu en dan droogvallend bij extreem laagwater –, en bij ontstentenis van (de mogelijkheid tot) systematisch gravend onderzoek, ondoenlijk. Niettemin kon, zoals in het bovenstaande uiteengezet, de contour goed bij benadering worden bepaald door cartografische gegevens te combineren met over een lange periode verzamelde veldgegevens. In aanvulling daarop hebben medewerkers van

de Stichting Cultureel Erfgoed Zeeland (SCEZ) zelf veldwaarnemingen verricht. Het geheel van data bood een solide basis voor het bepalen van de begrenzing van het monument.

Conclusie

Geconcludeerd kan worden dat de in de omschrijving aangegeven waarden bescherming op grond van de Monumentenwet 1988 rechtvaardigen.

Het document 'Vrijstelling vergunningplicht' maakt deel uit van dit besluit.

De minister van Onderwijs, Cultuur en Wetenschap,
namens deze,
de Rijksdienst voor het Cultureel Erfgoed,

drs. Cees van 't Veen
algemeen directeur

Heeft u bezwaar?

Mocht u bezwaar hebben tegen dit besluit dan kunt u binnen zes weken na de dag waarop dit besluit u is toegezonden, een bezwaarschrift indienen. U richt dit schriftelijke bezwaar aan de minister van OCW en stuurt het onder vermelding van "Bezwaar" ter attentie van DUO, Postbus 606, 2700 ML in Zoetermeer. Meer informatie over het maken van bezwaar vindt u op https://www.duo.nl/zakelijk/oneens-met-duo/bezwaar-maken.jsp

Bijlagen

- Vrijstelling vergunningplicht
- Aanbevelingen voor goed beheer

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
04-10-2017

Zaaknummer
4489494001

Betreft
Besluit aanwijzen rijksmonument

Monumentnummer(s)
532468

Bijlage: Vrijstelling vergunningplicht

Tholen, verdronken stad Reimerswaal

Rijksdienst voor het Cultureel Erfgoed
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Artikel 11 van de Monumentenwet 1988 stelt dat voor alle werkzaamheden die het monument verstoren of wijzigen een vergunning nodig is. Artikel 11 luidt:
1. Het is verboden een beschermd monument te beschadigen of te vernielen;
2. Het is verboden zonder of in afwijking van een schriftelijke vergunning:
   a. een beschermd archeologisch monument af te breken, te verstoren, te verplaatsen of in enig opzicht te wijzigen;
   b. een beschermd archeologisch monument te herstellen, te gebruiken of te laten gebruiken op een wijze, waardoor het wordt ontsierd of in gevaar gebracht.

Een strikte interpretatie van artikel 11 zou er toe leiden dat het gebruik van het beschermde terrein vergaand wordt beperkt. Veel (minimaal) grond-verstorende activiteiten zouden aan een vergunningvereiste worden gebonden. Oppervlakkige bodemingrepen leiden echter niet altijd tot een verstoring van het beschermde bodemarchief. In voorkomende gevallen kan een vrijstelling van vergunningplicht worden verleend voor grondwerkzaamheden tot een bepaalde diepte onder het maaiveld. Dit is bevestigd door de Afdeling bestuursrechtspraak van de Raad van State in de uitspraak van 2 juli 2014, zaaknummer 201306923/1/A2. Het opnemen van een vrijstellingsdiepte wordt opgevat als een nadere omschrijving van de omvang van de bescherming die met het aanwijzingsbesluit wordt beoogd.

Voor het onderhavige monument is het in afwijking van artikel 11 van de Monumentenwet 1988 toegestaan om zonder vergunning de volgende grondwerkzaamheden uit te voeren:
- sonderingen en grondboringen tot een maximale diameter van **10** cm.

Omdat het in het onderhavige geval een monument betreft waarvan de archeologische resten zich deels direct onder de waterbodem bevinden, geldt voor overige werkzaamheden een vrijstellingsdiepte van **0** cm. In de jaren zeventig en tachtig van de vorige eeuw zijn delen van de waterbodem opgehoogd met een pakket zand (de Oesterdam, in ruime zin). Voor de onderliggende waterbodem blijft gelden dat de vrijstellingsdiepte **0** cm is. Werkzaamheden in de laag recent opgebracht / opgespoten zand die niet dieper reiken dan de onderkant van die laag, blijven buiten de vergunningplicht. In twijfelgevallen kan de dikte van de laag worden bepaald door het laten uitvoeren van enkele grondboringen. Ook het gecontroleerd opbrengen van zand (suppletie) blijft vergunningvrij mogelijk, na voorafgaand overleg met de Rijksdienst voor het Cultureel Erfgoed.

Vergunningplichtig
Onderstaande ingrepen zijn op grond van artikel 11 van de Monumentenwet 1988 altijd vergunningplichtig:
1. bodemverstorende ingrepen dieper dan de vrijstelling van **0** cm, uitgezonderd de voornoemde sonderingen en grondboringen en werkzaamheden in recent opgebracht / opgespoten zand;
2. onderstaande ingrepen, ook als deze de bodem niet verstoren:
   - het verlagen of egaliseren van het terrein;
   - bouw-, sloop- of graafwerkzaamheden waarvoor een omgevingsvergunning of ontgrondingenvergunning vereist is;
   - het aanbrengen van verhardingen.

Een aanvraag voor een monumentenvergunning wordt ingediend bij burgemeester en wethouders van de gemeente waarin het monument is gelegen. De Rijksdienst voor het Cultureel Erfgoed (RCE) beslist namens de minister van Onderwijs, Cultuur en Wetenschap over de aanvraag.

In geval van twijfel is het raadzaam contact op te nemen met de RCE. Aanbevolen wordt om in ieder geval vóór het indienen van een vergunningaanvraag overleg te voeren met de RCE over de voorgenomen werkzaamheden. Vooroverleg kan leiden tot een snellere afhandeling van een aanvraag.

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

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Bijlage: Aanbevelingen voor goed beheer

Tholen, verdronken stad Reimerswaal

U bent in het bezit van een wettelijk beschermd archeologisch monument. Wij hopen dat u als eigenaar en gebruiker van het terrein goed zorg zult dragen voor dit monument.

Huidig gebruik en bestemming
In het bestemmingsplan 'Buitengebied Tholen' (2013) heeft het terrein de enkelbestemmingen 'Water – Deltawater', 'Verkeer', 'Recreatie – Dagrecreatie' en 'Bos'. Als dubbelstemmingen zijn opgenomen: 'Waarde – Archeologie 1, 2 en 3'.

Algemeen
Om behulpzaam te zijn bij het beheer hebben wij aanbevelingen opgesteld. In de aanbevelingen willen wij aangeven hoe u als eigenaar kunt bijdragen aan het behoud van de archeologische informatie voor de toekomst. Vastgesteld is dat door de voortschrijdende tijd, natuurlijke processen en menselijke ingrepen de kwaliteit van het bodemarchief toch vaak afneemt (http://www.cultureelerfgoed.nl/publicaties/erfgoedbalans-2009). Eenmalige inrichtingsmaatregelen of aangepast beheer zouden aan het behoud van de archeologische waarde kunnen bijdragen. Hier zijn subsidiemogelijkheden voor.

Instandhoudingssubsidie
Om de duurzame instandhouding van rijksmonumenten te bevorderen heeft de overheid een subsidieregeling in het leven geroepen, de Subsidieregeling instandhouding monumenten (Sim). Deze regeling is bedoeld voor eigenaren die onderhoud willen plegen dan wel instandhoudingsmaatregelen willen treffen, aan de hand van een 6-jaren instandhoudingsplan.
Volledige en actuele informatie over de Sim is te vinden op
https://archeologieinnederland.nl/instandhoudingssubsidie
en https://www.monumenten.nl/monument-financieren/instandhoudingssubsidie.

Beheer
Omdat het terrein in een getijden gebied ligt waar erosie plaatsvindt/kan vinden, is het aan te bevelen om maatregelen te nemen die de zandhonger doen afnemen. Ook is het van belang om te voorkomen dat er onderzoeken op het terrein plaatsvinden zonder monumenten- en opgravingsvergunning (illegale opgravingen).

N.B. Het is van belang dat het bovenstaande ter kennis wordt gebracht van degenen die het monument beheren.

Toelichting grondslagen

In dit document kunt u secties terugvinden die onleesbaar zijn gemaakt. Deze informatie is achterwege gelaten op basis van artikel 5 van de Wet open overheid (Woo). De legenda verwijzing die hierbij is vermeld correspondeert met de bijbehorende grondslag in onderstaand overzicht.

Legenda verwijzing	Artikel verwijzing	Uitzonderingsgrond
		Artikel 5.1 lid 1 Woo – Absolute uitzonderingsgronden **De openbaarmaking van deze informatie:**
A	art. 5.1 lid 1 a	Kan de eenheid van de Kroon in gevaar brengen.
B	art. 5.1 lid 1 b	Kan de veiligheid van de Staat schaden.
C	art. 5.1 lid 1 c	Betreft bedrijfs- en fabricagegegevens die vertrouwelijk aan de overheid zijn meegedeeld.
D	art. 5.1 lid 1 d	Betreft persoonsgegevens als bedoeld in paragraaf 3.1 (bijzondere persoonsgegevens) of paragraaf 3.2 (persoonsgegevens van strafrechtelijke aard) van de UAVG.
E	art. 5.1 lid 1 e	Betreft nummers die dienen ter identificatie van personen die bij wet of algemene maatregel van bestuur zijn voorgeschreven als bedoeld in artikel 46 van de UAVG.
		Artikel 5.1 lid 2 Woo – Relatieve uitzonderingsgronden **Het belang van de openbaarmaking van deze informatie weegt niet op tegen:**
F	art. 5.1 lid 2 a	Het belang van de betrekkingen van Nederland met andere staten en met internationale organisaties.
G	art. 5.1 lid 2 b	Het belang van de economische of financiële belangen van de Staat, andere publiekrechtelijke lichamen of bestuursorganen.
H	art. 5.1 lid 2 c	Het belang van de opsporing en vervolging van strafbare feiten.
I	art. 5.1 lid 2 d	Het belang van de inspectie, controle en toezicht door bestuursorganen.
J	art. 5.1 lid 2 e	Het belang van de eerbiediging van de persoonlijke levenssfeer van betrokkenen.
K	art. 5.1 lid 2 f	Het belang van de bescherming van andere dan in art. 5.1 lid 1 sub c genoemde concurrentiegevoelige bedrijfs- en fabricagegegevens.
L	art. 5.1 lid 2 g	Het belang van de bescherming van het milieu waar deze informatie betrekking op heeft.
M	art. 5.1 lid 2 h	Het belang van de beveiliging van personen en bedrijven en het voorkomen van sabotage.
N	art. 5.1 lid 2 i	Het belang van het goed functioneren van de Staat, andere publiekrechtelijke lichamen of bestuursorganen.
O	art. 5.1 lid 4	Het belang dat de geadresseerde erbij heeft om als eerste kennis te kunnen nemen van de informatie (tijdelijke beperking).
P	art. 5.1 lid 5	Het belang van de onevenredige benadeling welke, in uitzonderlijke gevallen, wordt toegebracht aan een ander belang dan genoemd in art. 5.1 de leden 1 en 2, bij andere informatie dan milieu-informatie.
Q	art. 5.1 lid 6	Het belang genoemd in artikel 5.1 lid 1 sub c en het hier milieu-informatie betreft waardoor, bij openbaarmaking, ernstige schade wordt toegebracht aan het genoemde belang in artikel 5.1 lid 1 sub c.
		Artikel 5.2 lid 1 Woo – Persoonlijke beleidsopvattingen **De informatie uit documenten betreft:**
R	art. 5.2 lid 1	Persoonlijke beleidsopvattingen. Onder persoonlijke beleidsopvattingen worden verstaan ambtelijke adviezen, visies, standpunten en overwegingen ten behoeve van intern beraad, niet zijnde feiten, prognoses, beleidsalternatieven, de gevolgen van een bepaald beleidsalternatief of andere onderdelen met een overwegend objectief karakter.
S	Art. 5.2 lid 2	Tot personen te herleiden gegevens, met betrekking tot door het bestuursorgaan, met het oog op een goede en democratische bestuursvoering, verstrekte informatie die kwalificeert als persoonlijke beleidsopvattingen.
		Overig
T		De informatie valt buiten de reikwijdte van het verzoek.

17021340

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

> Retouradres Postbus 1600 3800 BP Amersfoort

Gedeputeerde staten van
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Postbus 6001
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Smallepad 5
3811 MG Amersfoort
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3800 BP Amersfoort
www.cultureelerfgoed.nl

Contactpersoon
InfoDesk
T 033 421 74 56
info@cultureelerfgoed.nl

Zaaknummer
4489494001

Datum: 04-10-2017
Betreft: Monumentnummer: 532468
Reimerswaal
Locatie: Reimerswaal; Speelmansplaat; Oesterdam
Gemeente: Tholen

Geacht college,

Ik stuur u hierbij mijn besluit om bovengenoemde zaak aan te wijzen als rijksmonument.

In het besluit kunt u lezen hoe de procedure is verlopen: of er is geadviseerd, of er zienswijzen zijn ingediend en hoe ik deze heb betrokken bij de motivering van mijn besluit.

Heeft u een vraag naar aanleiding van deze brief?
Bij vragen over deze brief kunt u gebruik maken van de contactgegevens bovenaan deze brief. Het rijksmonumentenregister kunt u raadplegen via https://monumentenregister.cultureelerfgoed.nl

Hoogachtend,

de minister van Onderwijs, Cultuur en Wetenschap,
namens deze,
de Rijksdienst voor het Cultureel Erfgoed,

[redacted]

[redacted]
hoofd Juridische Zaken

PROVINCIE ZEELAND
AFD.
AFD. TERMIJN
DATUM – 5 OKT. 2017
DOC.NR.
ZAAK NR.
CLASS.

Bijlagen:
- Besluit

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
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Monumentnummer(s)
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besluit

De minister van Onderwijs, Cultuur en Wetenschap besluit, gelet op artikel 9.3, eerste lid, onder a, van de Erfgoedwet in samenhang met artikel 3, eerste lid, van de Monumentenwet 1988, het onderstaande monument aan te wijzen als rijksmonument.

Het betreft:
- Rijksmonumentnummer 532468, Reimerswaal; Speelmansplaat; Oesterdam

Rijksmonumentnummer
532468

Adres
Reimerswaal; Speelmansplaat; Oesterdam

Gemeente
Tholen

Provincie
Zeeland

Kadastrale aanduiding

Kadastrale gemeente	*Sectie*	*Kad. object*	*App.*	*Grondperc.*
THOLEN	K	133		
THOLEN	K	267		
THOLEN	K	268		
THOLEN	K	270		
THOLEN	K	271		
THOLEN	K	342		
THOLEN	K	343		
THOLEN	K	344		
THOLEN	K	345		
THOLEN	K	346		
THOLEN	K	347		
THOLEN	K	348		
THOLEN	K	354		
THOLEN	K	357		
THOLEN	K	359		
THOLEN	K	360		
THOLEN	K	368		
THOLEN	K	372		
THOLEN	K	387		
THOLEN	K	388		
THOLEN	K	390		
THOLEN	K	399		
THOLEN	K	401		
THOLEN	K	402		
THOLEN	K	405		
THOLEN	K	406		
THOLEN	K	408		
THOLEN	K	409		
THOLEN	K	410		
THOLEN	K	413		
THOLEN	K	415		
THOLEN	K	416		
THOLEN	K	417		
THOLEN	K	430		
THOLEN	K	433		
THOLEN	K	434		
THOLEN	K	435		
THOLEN	K	436		
THOLEN	K	438		
THOLEN	K	439		
THOLEN	K	440		

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THOLEN	K	441
THOLEN	K	443
THOLEN	K	444
THOLEN	K	454
THOLEN	K	455
THOLEN	K	456
THOLEN	K	457
THOLEN	K	458
THOLEN	K	459
THOLEN	K	461
THOLEN	K	462
THOLEN	K	463
THOLEN	K	464
THOLEN	K	465

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Naam van het rijksmonument

Reimerswaal

Omschrijving

Verdronken stad uit de 11e/12e-16e eeuw.

Situatie op de kaart

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

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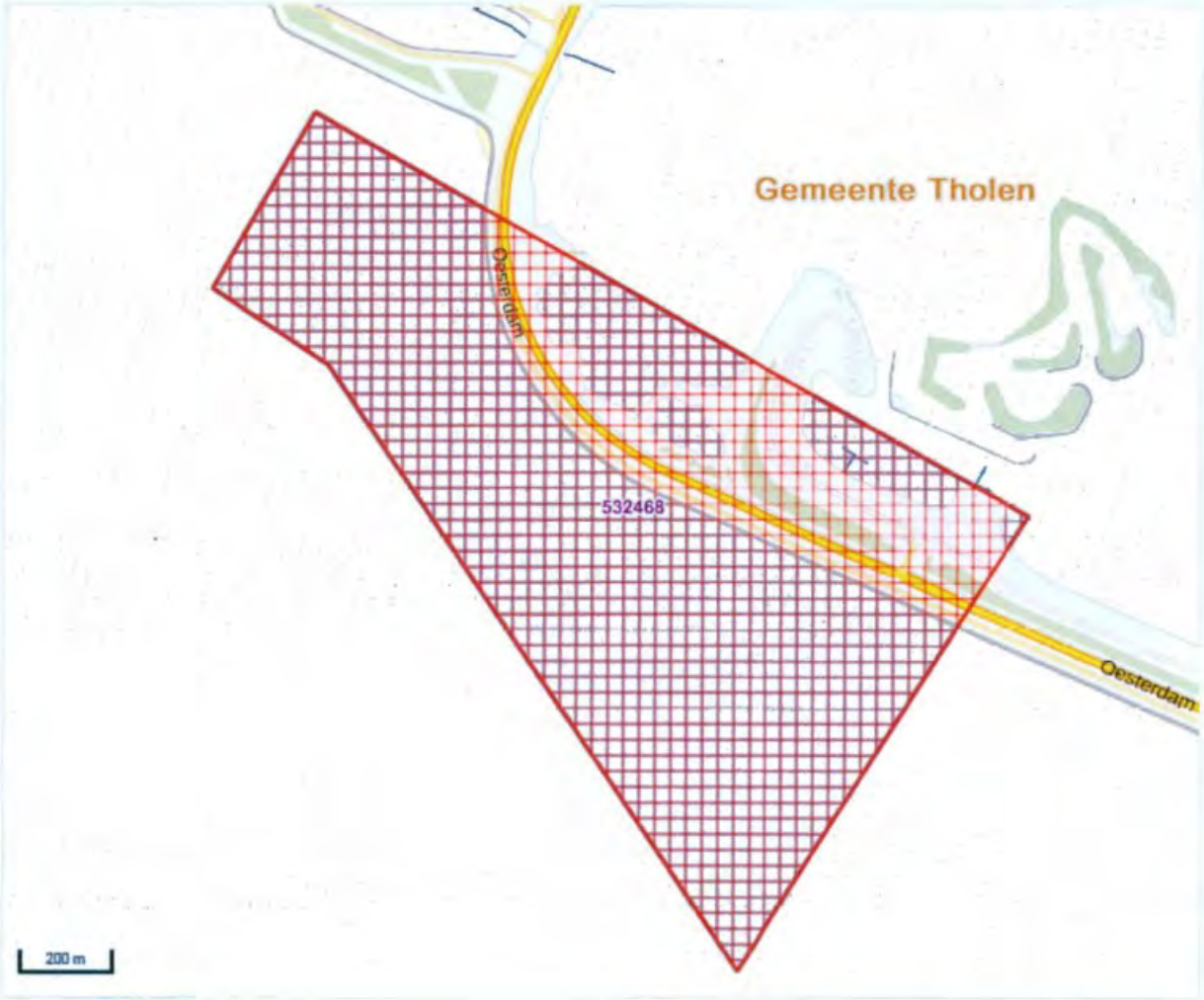

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Besluitmotivering

Aanleiding

De aanwijzing gebeurt op voorstel van de Rijksdienst voor het Cultureel Erfgoed in het kader van het aanwijzingsprogramma Archeologie 2013.
Op 10 augustus 2015 is de aanwijzingsprocedure, bedoeld in de Monumentenwet 1988 (artikel 3), gestart.

Aanwijzingsbeleid

Vanaf 1 januari 2013 geldt de Beleidsregel aanwijzing beschermde monumenten 2013, beleidsregel van de Minister van OCW van 15 februari 2013, Staatscourant 26 februari 2013, nr.5217 (hierna: Beleidsregel 2013).

Op grond van de Beleidsregel 2013 (artikel 8) kan de Minister een archeologisch monument aanwijzen als beschermd monument, indien:

a. het monument is opgenomen in een aanwijzingsprogramma, of
b. het monument
   1. vanwege zijn schoonheid, betekenis voor de wetenschap of cultuurhistorische waarde kan worden aangemerkt als een nationaal of internationaal erkend monument; en
   2. een wezenlijke lacune opvult in het geheel van de beschermde archeologische monumenten.

In dit geval is het monument opgenomen in een aanwijzingsprogramma.

Op grond van de Beleidsregel 2013 (artikel 9) past de Minister bij het opstellen van een aanwijzingsprogramma, bedoeld in artikel 8, onder a., de volgende criteria toe:

a. het desbetreffende monument kan vanwege zijn schoonheid, betekenis voor de wetenschap of cultuurhistorische waarde worden aangemerkt als een nationaal of internationaal erkend monument, en
b. het desbetreffende monument vult een wezenlijke lacune op in het geheel van de beschermde archeologische monumenten.

Horen van belanghebbenden

Ter voldoening aan het bepaalde in de Monumentenwet 1988 (artikel 3, vierde lid), heeft het college van burgemeester en wethouders van de gemeente Tholen belanghebbenden op de hoogte gesteld van de aanwijzingsprocedure en hen in de gelegenheid gesteld zich te doen horen. De hoorzitting vond plaats op 3 december 2015.

De aanwezige belanghebbenden hadden vragen en opmerkingen die beantwoord werden door de gemeente. Daarnaast gaven zij aan dat ze graag in gesprek gaan met de Rijksdienst voor het Cultureel Erfgoed (RCE) om een nadere motivering te vernemen van dit besluit tot aanwijzing. Vertegenwoordigers van de RCE hebben op 28 november 2016 gevolg gegeven aan het verzoek van aanwezigen. Tijdens een bijeenkomst 's avonds zijn nadere gegevens verstrekt over de aanwijzing en de gevolgen ervan. Van bezwaar van belanghebbenden tegen de aanwijzing is naar aanleiding van de hoorzitting en de informatieavond, of op andere wijze, niet gebleken.

Advies gemeente
Burgemeester en wethouders van Tholen hebben bij brief d.d. 6 januari 2016 positief geadviseerd ten aanzien van aanwijzing als beschermd monument.

Advies provincie
Gedeputeerde staten van Zeeland hebben bij brief d.d. 3 november 2015 positief geadviseerd ten aanzien van aanwijzing als beschermd monument.

Advies Raad voor Cultuur
De Raad voor Cultuur (RvC) heeft bij brief d.d. 20 maart 2017 positief geadviseerd ten aanzien van aanwijzing als beschermd monument.
De Raad acht het terrein met de resten van de verdronken stad Reimerswaal van nationale betekenis. Hij beveelt aan de begrenzing van de bescherming meer inhoudelijk te motiveren.

Waardering
Waardering van de vindplaats
Het monument is beoordeeld op basis van de waarderingssystematiek zoals hieronder weergegeven in de tabel.

Waarden	***Criteria***	***Scores***		
		Hoog	Midden	Laag
Beleving	Schoonheid	n.v.t.		
	Herinneringswaarde	3		
Fysieke kwaliteit	Gaafheid	3		
	Conservering	3		
Inhoudelijke kwaliteit	Zeldzaamheid	3		
	Informatiewaarde	3		
	Ensemblewaarde		2	
	Representativiteit	n.v.t.		

Beleving
Boven water is van de stad niets meer zichtbaar, behalve bij zeer laag tij. Het criterium 'Schoonheid' is daarom niet van toepassing. Herinneringswaarde heeft het monument wel; Reimerswaal is afgebeeld op tal van historische kaarten en staat quasi symbool voor wat teloor ging bij de vele stormvloeden die Zeeland hebben geteisterd.

Fysieke kwaliteit
Grote delen van de vindplaats zijn goed bewaard gebleven. Na de Middeleeuwen hebben nauwelijks bodemverstorende bouwwerkzaamheden plaatsgevonden.

Bovendien ligt op delen van de vindplaats een dik, deels opgespoten sedimentpakket. Niet alleen anorganische overblijfselen (o.a. muur- en vaatwerk), maar ook organische, zoals houtconstructies en menselijke begravingen, blijken door de natte omstandigheden uitermate goed geconserveerd te zijn.
Aan de westzijde staan delen van de stad via de open stormvloedkering in verbinding met de Noordzee. Door de realisering van de Oosterscheldewerken is daar 'zandhonger' ontstaan: er vindt geen sedimentaanvoer meer plaats vanuit zee, terwijl de hogere delen door golfslag (storm) eroderen. De aanwezige archeologische resten verliezen daarmee een beschermende laag sediment, met aantasting tot gevolg.

Inhoudelijke kwaliteit
Reimerswaal is de enige middeleeuwse Nederlandse stad die in zee, c.q. een zeegat is verdwenen. Waar in andere historische steden de ontwikkeling van de gebouwde omgeving doorging, werd die in Reimerswaal door natuurlijke oorzaken stopgezet. Dit maakt de vindplaats, in relatie ook tot de uitstekende fysieke kwaliteit, uiterst zeldzaam. De informatiewaarde van de resten en daarmee samenhangende vondsten is hoog. Zowel uit de NOaA (Nationale Onderzoeksagenda Archeologie) als uit de Archeologiebalans 2002 en de Provinciale Onderzoeksagenda Archeologie Zeeland (POAZ) is af te leiden dat de ontwikkeling van steden gedurende de Middeleeuwen en Nieuwe tijd in Zeeland een onderzoeksthema is waarvan de huidige stand van kennis heterogeen en lacuneus is.
De stad Reimerswaal staat niet op zichzelf, maar maakt deel uit van een eveneens verdronken cultuurlandschap met daarin meerdere nederzettingen, infrastructuur, verkavelingssystemen, etc. Over wat zich aan archeologische resten rond de stad bevindt, is nog relatief weinig bekend, maar in potentie kan hier de wisselwerking tussen stad en omringend platteland worden bestudeerd.

Motivatie Begrenzing
De contour van het monument is bepaald in overleg met de Stichting Cultureel Erfgoed Zeeland (SCEZ) en weergegeven op het bijgevoegde kaartje. De begrenzing kwam tot stand door het combineren van de stadsplattegrond op historische kaarten (o.a. Jacob van Deventer, circa 1560) met de huidige topografie en veldwaarnemingen van SCEZ en amateur-archeologen. Op die manier ontstond een contour waar de archeologische resten binnen liggen.

Overwegingen

Aan de overwegingen van de Monumentenwet 1988 ligt onder meer ten grondslag het meer betrekken van lagere overheden bij het behoud van monumenten. In de Memorie van Toelichting wordt het grote belang gememoreerd dat in de huidige wet wordt gehecht aan de inbreng van vooral de gemeente over de aanwijzing. Hoewel op rijksniveau over het al dan niet beschermen wordt beslist, komt aan de adviezen van de lagere overheden een invloedrijke plaats toe. Slechts op zwaarwegende gronden zal de minister van die adviezen kunnen afwijken. In dit geval bestaat daartoe geen aanleiding.

Op 3 december 2015 heeft een hoorzitting plaatsgevonden. De gemeente en de adviseur archeologie van het Oosterschelderegio Archeologisch Samenwerkingsverband (OAS) hebben bij die gelegenheid veel vragen van belanghebbenden beantwoord. Belanghebbenden gaven aan behoefte te hebben aan meer informatie. Er is derhalve een informatieavond belegd. Op

28 november 2016 gaven vertegenwoordigers van de RCE een aanvullende toelichting op de aanwijzing en werden vragen die er nog leefden beantwoord.
Samenvattend kwamen aan de orde:

- het verondersteld negatieve etiket dat aanwijzing vanwege de beperkingen op eigendom plakt. Het is in de regel meer een door geruchten ingegeven gevoel dan dat er sprake is van aantoonbare waardevermindering. In dit specifieke geval geldt dat er van beperkingen in de praktijk geen sprake is. Bodemingrepen die voortvloeien uit reguliere bewoning en gebruik van een perceel zijn vrijgesteld van vergunningplicht tot de onderzijde van de recent opgebrachte, naar schatting 4 m dikke laag zand. Bovendien bestaan er al beperkingen ingevolge het bestemmingsplan en is de vrijstellingsrichtlijn die samenhangt met de aanwijzing aanzienlijk ruimer dan die van het vigerende bestemmingsplan (december 2013). Daarin geldt een beperking vanaf 2 m onder maaiveld.
- de contour van het aan te wijzen monument. Aanvullend op de antwoorden van de hoorzitting is uitgelegd dat de contour tot stand is gekomen door veldgegevens (waarnemingen bij laagwater) te combineren met cartografische bronnen. De locatie van de 17e-eeuwse bebouwingskern is op de kaart bij benadering bepaald aan de hand van nog aanwezige kenmerken in het landschap.
  De beschikbare veldgegevens in het archief van SCEZ gaan terug tot het begin van de 20e eeuw en worden onderbouwd door vele vondsten. Ten aanzien van de genoemde fundamenten bij de Bergsediepsluis kan worden opgemerkt dat die al langere tijd bekend zijn. De sluis is bij de planning zelfs een stukje naar het noorden opgeschoven om de resten te ontzien; ze liggen binnen de contour van het monument.
- Reimerswaal is naar verluidt niet de enige verdronken stad. Er zijn enkele twijfelgevallen, maar afgaande op de criteria die door SCEZ zijn gehanteerd om te onderscheiden tussen een verdronken dorp en een stad, is Reimerswaal de enige nederzetting die als volwaardige stad kan worden aangemerkt.
- De beschikbare informatie over Reimerswaal moet goed worden benut (educatie, recreatie, toerisme). Er is van gedachten gewisseld over de mogelijkheden om in dit opzicht iets te doen ter plekke van het monument en over de kansen die zich aandienen.

Bij afsluiting van de informatieavond gaven aanwezigen te kennen dat de vragen afdoende zijn beantwoord en dat gevoelens van onrust, c.q. onzekerheid zijn weggenomen. Ze vormen daarmee geen beletsel meer voor aanwijzing.

De Raad voor Cultuur beveelt in zijn advies aan om de begrenzing van de bescherming meer inhoudelijk te motiveren. Het bepalen van de exacte begrenzing van de aanwezige resten is vanwege de aard van het natuurlijk milieu waarin ze liggen – onder de waterspiegel in stromend water, grotendeels afgedekt door slib en zand en slechts nu en dan droogvallend bij extreem laagwater –, en bij ontstentenis van (de mogelijkheid tot) systematisch gravend onderzoek, ondoenlijk. Niettemin kon, zoals in het bovenstaande uiteengezet, de contour goed bij benadering worden bepaald door cartografische gegevens te combineren met over een lange periode verzamelde veldgegevens. In aanvulling daarop hebben medewerkers van

de Stichting Cultureel Erfgoed Zeeland (SCEZ) zelf veldwaarnemingen verricht. Het geheel van data bood een solide basis voor het bepalen van de begrenzing van het monument.

Conclusie

Geconcludeerd kan worden dat de in de omschrijving aangegeven waarden bescherming op grond van de Monumentenwet 1988 rechtvaardigen.

Het document 'Vrijstelling vergunningplicht' maakt deel uit van dit besluit.

De minister van Onderwijs, Cultuur en Wetenschap,
namens deze,
de Rijksdienst voor het Cultureel Erfgoed,

drs. Cees van 't Veen
algemeen directeur

Heeft u bezwaar?

Mocht u bezwaar hebben tegen dit besluit dan kunt u binnen zes weken na de dag waarop dit besluit u is toegezonden, een bezwaarschrift indienen. U richt dit schriftelijke bezwaar aan de minister van OCW en stuurt het onder vermelding van "Bezwaar" ter attentie van DUO, Postbus 606, 2700 ML in Zoetermeer. Meer informatie over het maken van bezwaar vindt u op https://www.duo.nl/zakelijk/oneens-met-duo/bezwaar-maken.jsp

Bijlagen

- Vrijstelling vergunningplicht
- Aanbevelingen voor goed beheer

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
04-10-2017

Zaaknummer
4489494001

Betreft
Besluit aanwijzen rijksmonument

Monumentnummer(s)
532468

Bijlage: Vrijstelling vergunningplicht

Tholen, verdronken stad Reimerswaal

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
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Artikel 11 van de Monumentenwet 1988 stelt dat voor alle werkzaamheden die het monument verstoren of wijzigen een vergunning nodig is. Artikel 11 luidt:
1. Het is verboden een beschermd monument te beschadigen of te vernielen;
2. Het is verboden zonder of in afwijking van een schriftelijke vergunning:
   a. een beschermd archeologisch monument af te breken, te verstoren, te verplaatsen of in enig opzicht te wijzigen;
   b. een beschermd archeologisch monument te herstellen, te gebruiken of te laten gebruiken op een wijze, waardoor het wordt ontsierd of in gevaar gebracht.

Een strikte interpretatie van artikel 11 zou er toe leiden dat het gebruik van het beschermde terrein vergaand wordt beperkt. Veel (minimaal) grond-verstorende activiteiten zouden aan een vergunningvereiste worden gebonden. Oppervlakkige bodemingrepen leiden echter niet altijd tot een verstoring van het beschermde bodemarchief. In voorkomende gevallen kan een vrijstelling van vergunningplicht worden verleend voor grondwerkzaamheden tot een bepaalde diepte onder het maaiveld. Dit is bevestigd door de Afdeling bestuursrechtspraak van de Raad van State in de uitspraak van 2 juli 2014, zaaknummer 201306923/1/A2. Het opnemen van een vrijstellingsdiepte wordt opgevat als een nadere omschrijving van de omvang van de bescherming die met het aanwijzingsbesluit wordt beoogd.

Voor het onderhavige monument is het in afwijking van artikel 11 van de Monumentenwet 1988 toegestaan om zonder vergunning de volgende grondwerkzaamheden uit te voeren:
- sonderingen en grondboringen tot een maximale diameter van **10** cm.

Omdat het in het onderhavige geval een monument betreft waarvan de archeologische resten zich deels direct onder de waterbodem bevinden, geldt voor overige werkzaamheden een vrijstellingsdiepte van **0** cm. In de jaren zeventig en tachtig van de vorige eeuw zijn delen van de waterbodem opgehoogd met een pakket zand (de Oesterdam, in ruime zin). Voor de onderliggende waterbodem blijft gelden dat de vrijstellingsdiepte **0** cm is. Werkzaamheden in de laag recent opgebracht / opgespoten zand die niet dieper reiken dan de onderkant van die laag, blijven buiten de vergunningplicht. In twijfelgevallen kan de dikte van de laag worden bepaald door het laten uitvoeren van enkele grondboringen. Ook het gecontroleerd opbrengen van zand (suppletie) blijft vergunningvrij mogelijk, na voorafgaand overleg met de Rijksdienst voor het Cultureel Erfgoed.

Vergunningplichtig
Onderstaande ingrepen zijn op grond van artikel 11 van de Monumentenwet 1988 altijd vergunningplichtig:
1. bodemverstorende ingrepen dieper dan de vrijstelling van **0** cm, uitgezonderd de voornoemde sonderingen en grondboringen en werkzaamheden in recent opgebracht / opgespoten zand;
2. onderstaande ingrepen, ook als deze de bodem niet verstoren:
   - het verlagen of egaliseren van het terrein;
   - bouw-, sloop- of graafwerkzaamheden waarvoor een omgevingsvergunning of ontgrondingenvergunning vereist is;
   - het aanbrengen van verhardingen.

Een aanvraag voor een monumentenvergunning wordt ingediend bij burgemeester en wethouders van de gemeente waarin het monument is gelegen. De Rijksdienst voor het Cultureel Erfgoed (RCE) beslist namens de minister van Onderwijs, Cultuur en Wetenschap over de aanvraag.

In geval van twijfel is het raadzaam contact op te nemen met de RCE. Aanbevolen wordt om in ieder geval vóór het indienen van een vergunningaanvraag overleg te voeren met de RCE over de voorgenomen werkzaamheden. Vooroverleg kan leiden tot een snellere afhandeling van een aanvraag.

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
04-10-2017

Zaaknummer
4489494001

Betreft
Besluit aanwijzen rijksmonument

Monumentnummer(s)
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Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Datum
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Bijlage: Aanbevelingen voor goed beheer

Tholen, verdronken stad Reimerswaal

U bent in het bezit van een wettelijk beschermd archeologisch monument. Wij hopen dat u als eigenaar en gebruiker van het terrein goed zorg zult dragen voor dit monument.

Huidig gebruik en bestemming
In het bestemmingsplan 'Buitengebied Tholen' (2013) heeft het terrein de enkelbestemmingen 'Water – Deltawater', 'Verkeer', 'Recreatie – Dagrecreatie' en 'Bos'. Als dubbelstemmingen zijn opgenomen: 'Waarde – Archeologie 1, 2 en 3'.

Algemeen
Om behulpzaam te zijn bij het beheer hebben wij aanbevelingen opgesteld. In de aanbevelingen willen wij aangeven hoe u als eigenaar kunt bijdragen aan het behoud van de archeologische informatie voor de toekomst. Vastgesteld is dat door de voortschrijdende tijd, natuurlijke processen en menselijke ingrepen de kwaliteit van het bodemarchief toch vaak afneemt (http://www.cultureelerfgoed.nl/publicaties/erfgoedbalans-2009). Eenmalige inrichtingsmaatregelen of aangepast beheer zouden aan het behoud van de archeologische waarde kunnen bijdragen. Hier zijn subsidiemogelijkheden voor.

Instandhoudingssubsidie
Om de duurzame instandhouding van rijksmonumenten te bevorderen heeft de overheid een subsidieregeling in het leven geroepen, de Subsidieregeling instandhouding monumenten (Sim). Deze regeling is bedoeld voor eigenaren die onderhoud willen plegen dan wel instandhoudingsmaatregelen willen treffen, aan de hand van een 6-jaren instandhoudingsplan.
Volledige en actuele informatie over de Sim is te vinden op
https://archeologieinnederland.nl/instandhoudingssubsidie
en https://www.monumenten.nl/monument-financieren/instandhoudingssubsidie.

Beheer
Omdat het terrein in een getijden gebied ligt waar erosie plaatsvindt/kan vinden, is het aan te bevelen om maatregelen te nemen die de zandhonger doen afnemen. Ook is het van belang om te voorkomen dat er onderzoeken op het terrein plaatsvinden zonder monumenten- en opgravingsvergunning (illegale opgravingen).

N.B. Het is van belang dat het bovenstaande ter kennis wordt gebracht van degenen die het monument beheren.

Toelichting grondslagen

In dit document kunt u secties terugvinden die onleesbaar zijn gemaakt. Deze informatie is achterwege gelaten op basis van artikel 5 van de Wet open overheid (Woo). De legenda verwijzing die hierbij is vermeld correspondeert met de bijbehorende grondslag in onderstaand overzicht.

Legenda verwijzing	Artikel verwijzing	Uitzonderingsgrond
		Artikel 5.1 lid 1 Woo – Absolute uitzonderingsgronden **De openbaarmaking van deze informatie:**
A	art. 5.1 lid 1 a	Kan de eenheid van de Kroon in gevaar brengen.
B	art. 5.1 lid 1 b	Kan de veiligheid van de Staat schaden.
C	art. 5.1 lid 1 c	Betreft bedrijfs- en fabricagegegevens die vertrouwelijk aan de overheid zijn meegedeeld.
D	art. 5.1 lid 1 d	Betreft persoonsgegevens als bedoeld in paragraaf 3.1 (bijzondere persoonsgegevens) of paragraaf 3.2 (persoonsgegevens van strafrechtelijke aard) van de UAVG.
E	art. 5.1 lid 1 e	Betreft nummers die dienen ter identificatie van personen die bij wet of algemene maatregel van bestuur zijn voorgeschreven als bedoeld in artikel 46 van de UAVG.
		Artikel 5.1 lid 2 Woo – Relatieve uitzonderingsgronden **Het belang van de openbaarmaking van deze informatie weegt niet op tegen:**
F	art. 5.1 lid 2 a	Het belang van de betrekkingen van Nederland met andere staten en met internationale organisaties.
G	art. 5.1 lid 2 b	Het belang van de economische of financiële belangen van de Staat, andere publiekrechtelijke lichamen of bestuursorganen.
H	art. 5.1 lid 2 c	Het belang van de opsporing en vervolging van strafbare feiten.
I	art. 5.1 lid 2 d	Het belang van de inspectie, controle en toezicht door bestuursorganen.
J	art. 5.1 lid 2 e	Het belang van de eerbiediging van de persoonlijke levenssfeer van betrokkenen.
K	art. 5.1 lid 2 f	Het belang van de bescherming van andere dan in art. 5.1 lid 1 sub c genoemde concurrentiegevoelige bedrijfs- en fabricagegegevens.
L	art. 5.1 lid 2 g	Het belang van de bescherming van het milieu waar deze informatie betrekking op heeft.
M	art. 5.1 lid 2 h	Het belang van de beveiliging van personen en bedrijven en het voorkomen van sabotage.
N	art. 5.1 lid 2 i	Het belang van het goed functioneren van de Staat, andere publiekrechtelijke lichamen of bestuursorganen.
O	art. 5.1 lid 4	Het belang dat de geadresseerde erbij heeft om als eerste kennis te kunnen nemen van de informatie (tijdelijke beperking).
P	art. 5.1 lid 5	Het belang van de onevenredige benadeling welke, in uitzonderlijke gevallen, wordt toegebracht aan een ander belang dan genoemd in art. 5.1 de leden 1 en 2, bij andere informatie dan milieu-informatie.
Q	art. 5.1 lid 6	Het belang genoemd in artikel 5.1 lid 1 sub c en het hier milieu-informatie betreft waardoor, bij openbaarmaking, ernstige schade wordt toegebracht aan het genoemde belang in artikel 5.1 lid 1 sub c.
		Artikel 5.2 lid 1 Woo – Persoonlijke beleidsopvattingen **De informatie uit documenten betreft:**
R	art. 5.2 lid 1	Persoonlijke beleidsopvattingen. Onder persoonlijke beleidsopvattingen worden verstaan ambtelijke adviezen, visies, standpunten en overwegingen ten behoeve van intern beraad, niet zijnde feiten, prognoses, beleidsalternatieven, de gevolgen van een bepaald beleidsalternatief of andere onderdelen met een overwegend objectief karakter.
S	Art. 5.2 lid 2	Tot personen te herleiden gegevens, met betrekking tot door het bestuursorgaan, met het oog op een goede en democratische bestuursvoering, verstrekte informatie die kwalificeert als persoonlijke beleidsopvattingen.
		Overig
T		De informatie valt buiten de reikwijdte van het verzoek.

HS

22 OKT. 2015

Beslisnota GS

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onderwerp Advies archeologisch rijksmonument Reimerswaal

voorgesteld besluit De minister van Onderwijs, Cultuur en Wetenschap door middel van bijgevoegde brief positief adviseren over het voorgenomen besluit de verdronken stad Reimerswaal in de gemeente Tholen aan te wijzen als archeologisch rijksmonument.

aanleiding Op 10 augustus 2015 heeft de minister van OCW advies gevraagd aan uw college op haar aanwijzingsvoorstel voor het archeologisch rijksmonument de verdronken stad Reimerswaal in de gemeente Tholen.

portefeuillehouder - portefeuille Reu, B.J. de [redacted] Cultuur

paraaf afdelingshoofd [redacted] paraaf portefeuillehouder [redacted] paraaf secretaris voor agendering [redacted]

datum GS vergadering (in te vullen door agendakamer)

3 NOV. 2015

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overwegingen en advies

motivering besluit

Op 10 augustus 2015 heeft de minister van OCW advies gevraagd aan uw college op haar aanwijzingsvoorstel voor het archeologisch rijksmonument de verdronken stad Reimerswaal in de gemeente Tholen.

De Rijksdienst voor het Cultureel Erfgoed heeft de begrenzing van dit toekomstige archeologisch rijksmonument in overleg met de Stichting Cultureel Erfgoed Zeeland vastgesteld. Deze begrenzing is gebaseerd op twee archeologische veldonderzoeken en een veertigtal vondstmeldingen. Daarbij gaat het niet alleen om de historische begrenzing van de stad zelf, maar ook om structuren die een relatie hebben met de stad.
Binnen de begrenzing ligt ook de Oesterdam, die tevens de provinciale weg N659 is. De vroegere stad Reimerswaal heeft ter plaatse hiervan gelegen en onder de Oesterdam kunnen nog resten van de stad aanwezig zijn, die niet verloren zijn gegaan bij de aanleg van de dam. De opgehoogde en verstoorde gebieden van de Oesterdam liggen wel binnen het rijksmonument, maar vallen niet onder de vergunningplicht, die de aanwijzing als archeologisch rijksmonument met zich meebrengt, aangezien hier in het aanwijzingsvoorstel een vrijstelling voor opgenomen is.

Voor de dam, inclusief de hierop gelegen weg en het recreatieterrein 'Waterrijk Oesterdam / Speelmansplaten' komen er dus geen beperkingen bij. Er is zelfs sprake van een vermindering van de beperkingen, aangezien dit gebied nu nog op grond van het Thoolse gemeentelijk archeologiebeleid beschermd wordt en hierin geen onderscheid wordt gemaakt tussen de recente verstoringen en ophogingen en de onverstoorde gebieden. Op dit moment geldt daarom overal een vergunningplicht.

Omdat er ook andere belangen zijn, dan alleen de archeologische belangen, is advies gevraagd aan de mobiliteitstak van de afdeling Mobiliteit & Samenleving, de afdeling Beheer en Onderhoud, de afdeling Water, Bodem en Natuur en de beleidstak Recreatie en Toerisme van de afdeling Economie & Duurzaamheid om tot een integraal advies te komen.
Vanuit de beleidstak Mobiliteit (afdeling M&S) bestaan er geen plannen dit wegvak op te waarderen, waardoor aanpassingen aan de N659 nodig zijn. Aanwijzing tot archeologisch rijksmonument is dus niet bezwaarlijk.
Het normale onderhoud aan de N659 kan zonder monumentenvergunning uitgevoerd worden en de vergunningplicht op grond van het Thoolse gemeentelijke archeologiebeleid vervalt. Het wordt daardoor eenvoudiger onderhoud aan de weg uit te voeren. Vanuit de afdeling Beheer en Onderhoud zijn er daarom geen bezwaren tegen de aanwijzing tot archeologisch rijksmonument.
Vanuit de afdeling Water, Bodem en Natuur zijn er geen bezwaren geuit tegen de aanwijzing tot archeologisch rijksmonument.
De beleidstak Recreatie en Toerisme van de afdeling Economie en Duurzaamheid ziet vooral een meerwaarde in de aanwijzing tot rijksmonument en kansen dit toeristisch uit te nutten.

Gelet op de positieve reacties vanuit de provinciale organisatie, wordt uw college geadviseerd de minister positief te adviseren over het voorgenomen besluit en bijgevoegde brief aan de minister toe te zenden.

aansluiting bij provinciale doelstellingen en/of beleid

Het beschermen van de verdronken stad Reimerswaal past goed bij het provinciale archeologiebeleid, dat als uitgangspunt heeft dat archeologische resten *in situ* bewaard moeten worden. Daarnaast past dit heel goed binnen kernthema 6 van de Provinciale Onderzoeksagenda Archeologie Zeeland: Verdronken land en dorpen.

bestuurlijke planning en doorlooptijd

indien van toepassing

De minister wil graag zo spoedig mogelijk, maar in ieder geval voor 10 december 2015, een advies van uw college ontvangen.

consequenties besluit

Financiële consequenties

uitvoeringsparagraaf (DG, alleen voor intern gebruik)

bestuurlijke aandachtspunten, risico's en beheersmaatregelen

De gemeente Tholen is niet betrokken geweest bij de totstandkoming van dit advies. De minister van OCW heeft het college van Burgemeester en Wethouders van de gemeente Tholen eenzelfde verzoek verzonden als aan uw college. Zij zullen derhalve een eigen advies aan de minister sturen.
Er is wel ambtelijk contact geweest over deze adviesaanvraag en ambtelijk staat de gemeente er niet-onwelwillend tegenover. Wethouder Van Dis (Tholen, cultuur) zal in elk geval voor 3 november 2015 door zijn ambtenaren geïnformeerd zijn, dat er een adviesaanvraag van de minister ligt.
De gemeente Tholen verwacht haar advies rond eind januari 2016 aan de minister van OCW toe te zenden.

behandeld door	[redacted]	MS	17 39
afgestemd met	Afdelingen M&S, B&O, WBN en E&D		

uiterste beslisdatum 1 december 2015

communicatie

Vertraagd openbaar, publiceren een week na het GS-besluit

In overleg met de afdeling Communicatie en de gemeente Tholen een persmoment organiseren, in ieder geval nadat de minister uw advies ontvangen heeft en het advies van het college van Burgemeester en Wethouders van de gemeente Tholen.

tekst voor zeeland.nl

Aan de Oesterdam, ter hoogte van de Speelmansplaten, ligt de verdronken stad Reimerswaal. Deze stad kreeg in 1375 stadsrechten en was in de late middeleeuwen, na Middelburg en Zierikzee, de derde stad van Zeeland. Tijdens de stormvloeden van 1530 en 1532 zijn grote delen van Zuid-Beveland verdronken, maar bleef Reimerswaal nog overeind. De stormvloeden van 1555 en 1557 deden echter ook grote delen van Reimerswaal ten onder gaan. Wat nog resteerde is in 1573 door de Geuzen definitief platgebrand. In de 17e eeuw resteerde slechts een klein eiland met ruïnes.
De minister van Onderwijs, Cultuur en Wetenschap is voornemens deze verdronken stad aan te wijzen als archeologisch rijksmonument. Gedeputeerde Staten van Zeeland hebben besloten positief te adviseren over dit voorstel.

actieve informatieplicht PS

Niet naar PS

bijlagen

Brief aan de minister van OCW

Geen

Juridische consequenties
De minister van OCW zal het advies van uw college meenemen in haar overwegingen de verdronken stad Reimerswaal aan te wijzen als archeologisch rijksmonument. De juridische consequentie van een aanwijzing als rijksmonument zal zijn, dat er een vergunningplicht op grond van de Monumentenwet 1988 zal ontstaan, met uitzondering van de verstoorde gebieden als gevolg van de aanleg van de Oesterdam, en de vergunningplicht op grond van het Thoolse gemeentelijke archeologiebeleid zal komen te vervallen.

personele consequenties en inhuur
Geen externe inhuur nodig.

inkoop & aanbesteding
Het inkoopbeleid is niet van toepassing.

Toelichting grondslagen

In dit document kunt u secties terugvinden die onleesbaar zijn gemaakt. Deze informatie is achterwege gelaten op basis van artikel 5 van de Wet open overheid (Woo). De legenda verwijzing die hierbij is vermeld correspondeert met de bijbehorende grondslag in onderstaand overzicht.

Legenda verwijzing	Artikel verwijzing	Uitzonderingsgrond
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C	art. 5.1 lid 1 c	Betreft bedrijfs- en fabricagegegevens die vertrouwelijk aan de overheid zijn meegedeeld.
D	art. 5.1 lid 1 d	Betreft persoonsgegevens als bedoeld in paragraaf 3.1 (bijzondere persoonsgegevens) of paragraaf 3.2 (persoonsgegevens van strafrechtelijke aard) van de UAVG.
E	art. 5.1 lid 1 e	Betreft nummers die dienen ter identificatie van personen die bij wet of algemene maatregel van bestuur zijn voorgeschreven als bedoeld in artikel 46 van de UAVG.
		Artikel 5.1 lid 2 Woo – Relatieve uitzonderingsgronden **Het belang van de openbaarmaking van deze informatie weegt niet op tegen:**
F	art. 5.1 lid 2 a	Het belang van de betrekkingen van Nederland met andere staten en met internationale organisaties.
G	art. 5.1 lid 2 b	Het belang van de economische of financiële belangen van de Staat, andere publiekrechtelijke lichamen of bestuursorganen.
H	art. 5.1 lid 2 c	Het belang van de opsporing en vervolging van strafbare feiten.
I	art. 5.1 lid 2 d	Het belang van de inspectie, controle en toezicht door bestuursorganen.
J	art. 5.1 lid 2 e	Het belang van de eerbiediging van de persoonlijke levenssfeer van betrokkenen.
K	art. 5.1 lid 2 f	Het belang van de bescherming van andere dan in art. 5.1 lid 1 sub c genoemde concurrentiegevoelige bedrijfs- en fabricagegegevens.
L	art. 5.1 lid 2 g	Het belang van de bescherming van het milieu waar deze informatie betrekking op heeft.
M	art. 5.1 lid 2 h	Het belang van de beveiliging van personen en bedrijven en het voorkomen van sabotage.
N	art. 5.1 lid 2 i	Het belang van het goed functioneren van de Staat, andere publiekrechtelijke lichamen of bestuursorganen.
O	art. 5.1 lid 4	Het belang dat de geadresseerde erbij heeft om als eerste kennis te kunnen nemen van de informatie (tijdelijke beperking).
P	art. 5.1 lid 5	Het belang van de onevenredige benadeling welke, in uitzonderlijke gevallen, wordt toegebracht aan een ander belang dan genoemd in art. 5.1 de leden 1 en 2, bij andere informatie dan milieu-informatie.
Q	art. 5.1 lid 6	Het belang genoemd in artikel 5.1 lid 1 sub c en het hier milieu-informatie betreft waardoor, bij openbaarmaking, ernstige schade wordt toegebracht aan het genoemde belang in artikel 5.1 lid 1 sub c.
		Artikel 5.2 lid 1 Woo – Persoonlijke beleidsopvattingen **De informatie uit documenten betreft:**
R	art. 5.2 lid 1	Persoonlijke beleidsopvattingen. Onder persoonlijke beleidsopvattingen worden verstaan ambtelijke adviezen, visies, standpunten en overwegingen ten behoeve van intern beraad, niet zijnde feiten, prognoses, beleidsalternatieven, de gevolgen van een bepaald beleidsalternatief of andere onderdelen met een overwegend objectief karakter.
S	Art. 5.2 lid 2	Tot personen te herleiden gegevens, met betrekking tot door het bestuursorgaan, met het oog op een goede en democratische bestuursvoering, verstrekte informatie die kwalificeert als persoonlijke beleidsopvattingen.
		Overig
T		De informatie valt buiten de reikwijdte van het verzoek.

Staatsblad
van het Koninkrijk der Nederlanden

Jaargang 2024

47

Besluit van 26 februari 2024 tot wijziging van het Besluit Erfgoedwet archeologie in verband met het toevoegen van uitzonderingen op het opgravingsverbod en enkele andere aspecten

Wij Willem-Alexander, bij de gratie Gods, Koning der Nederlanden, Prins van Oranje-Nassau, enz. enz. enz.

Op de voordracht van de Staatssecretaris van Onderwijs, Cultuur en Wetenschap, gedaan mede namens Onze Minister van Defensie, van 22 maart 2023, nr. WJZ 37317930 (ID9380);

Gelet op artikel 5.1, tweede lid, van de Erfgoedwet;

De Afdeling advisering van de Raad van State gehoord (advies van 8 juni 2023, nr. W05.23.00075/I);

Gezien het nader rapport van Onze Minister van Onderwijs, Cultuur en Wetenschap uitgebracht mede namens Onze Minister van Defensie van 16 februari 2024, nr. WJZ/41290306 (ID9380);

Hebben goedgevonden en verstaan:

ARTIKEL I

Het Besluit Erfgoedwet archeologie wordt als volgt gewijzigd:

A

Artikel 2.3 wordt als volgt gewijzigd:

1. Het opschrift komt te luiden:

Artikel 2.3. Verenigingen voor vrijwilligers in de archeologie in gemeentelijk ingedeeld gebied

2. In het eerste lid wordt «een opgraving» vervangen door «een opgraving in gemeentelijk ingedeeld gebied».

3. Het tweede lid, onderdeel a, komt te luiden:

a. het terreinen betreft waarvan het college van burgemeester en wethouders heeft vastgesteld dat nader archeologisch onderzoek niet is vereist, en.

B

Na artikel 2.4 worden drie artikelen toegevoegd, luidende:

Artikel 2.5 Verenigingen voor vrijwilligers in de onderwaterarcheologie

1. Onze Minister kan aan een vereniging die het behouden en beoefenen van archeologie als statutair doel heeft, op aanvraag ontheffing verlenen van het verbod, bedoeld in artikel 5.1, eerste lid, van de wet, voor zover het betreft cultureel erfgoed onder water voor een periode van maximaal één jaar.
2. Artikel 5.4, eerste lid, en artikel 5.6 van de wet zijn van overeenkomstige toepassing.
3. De ontheffing ziet slechts op de volgende handelingen:
a. het meenemen van een archeologische vondst die acuut wordt bedreigd door natuurlijke processen;
b. het meenemen van een archeologische vondst die dient ter identificatie van het archeologisch monument; of
c. het verrichten van kleinschalige onderzoekshandelingen met zeer beperkte gevolgen voor de archeologische waarde van het archeologisch monument.
4. De ontheffing is niet van toepassing op:
a. de gevallen, bedoeld in artikel 2.2, tweede lid, onder a tot en met e;
b. een wrak van een militair vliegtuig;
c. een wrak van een oorlogsschip, tenzij
1°. de vlaggenstaat hiervoor toestemming heeft verleend; of
2°. de vlaggenstaat onbekend is; en
d. gevallen waarin de vereniging in opdracht van een derde handelt.
5. Onze Minister kan aan een ontheffing voorschriften verbinden.
6. Onze Minister kan de ontheffing intrekken.
7. Bij ministeriële regeling kunnen nadere regels worden gegeven omtrent de aanvraag, wijziging, weigering en intrekking van een ontheffing alsmede ten aanzien van de voorschriften bedoeld in het vijfde lid.

Artikel 2.6 Verkrijging van een certificaat

1. Het verbod, bedoeld in artikel 5.1, eerste lid, van de wet, is niet van toepassing op een opgraving die wordt verricht in het kader van het verkrijgen van een certificaat, als bedoeld in artikel 5.1, eerste lid, van de wet.
2. Artikel 5.4, eerste en tweede lid, en artikel 5.6 van de wet zijn van overeenkomstige toepassing.

Artikel 2.7 Opgravingen door de Minister van Defensie

1. Het verbod, bedoeld in artikel 5.1, eerste lid, van de wet, is niet van toepassing op een opgraving die door de Minister van Defensie wordt verricht met betrekking tot:
a. militaire vliegtuigwrakken;
b. slachtoffers uit de Tweede Wereldoorlog; of
c. niet-gesprongen explosieven.
2. Artikel 5.6, eerste en vierde lid, van de wet is van overeenkomstige toepassing op een opgraving bedoeld in het eerste lid, aanhef en onderdeel a.
3. De vrijstelling, bedoeld in het eerste lid, aanhef en onderdeel a, is slechts van toepassing indien een archeologische waardering heeft plaatsgevonden.

4. Onze Minister en Onze Ministers van Defensie en van Binnenlandse Zaken en Koninkrijksrelaties stellen een protocol vast over de werkwijze met betrekking tot de archeologische waardering.

ARTIKEL II

Artikel 5.17, onderdeel B, subonderdeel 1, van het Invoeringsbesluit Omgevingswet vervalt.

ARTIKEL III INWERKINGTREDING

Dit besluit treedt in werking met ingang van 1 april 2024.

Lasten en bevelen dat dit besluit met de daarbij behorende nota van toelichting in het Staatsblad zal worden geplaatst.

's-Gravenhage, 26 februari 2024

Willem-Alexander

De Staatssecretaris van Onderwijs, Cultuur en Wetenschap,
F.Q. Gräper-van Koolwijk

De Minister van Defensie,
K.H. Ollongren

Uitgegeven de *vierde* maart 2024

De Minister van Justitie en Veiligheid,
D. Yeşilgöz-Zegerius

stb-2024-47
ISSN 0920 - 2064
's-Gravenhage 2024

NOTA VAN TOELICHTING

Deze toelichting wordt gegeven mede namens de Minister van Defensie.

Algemeen

1. Inleiding

Uit de Erfgoedwet (art. 5.1) volgt dat eenieder die een archeologische opgraving wil doen over een certificaat moet beschikken. Dit besluit wijzigt een aantal zaken in het Besluit Erfgoedwet archeologie (BEa) met betrekking tot uitzonderingen op deze certificeringsplicht. In Hoofdstuk 2 van het BEa zijn reeds vier uitzonderingen neergelegd. Dit besluit voegt daar drie uitzonderingen aan toe. Hierdoor is tevens aanpassing van een bestaande uitzondering gewenst.

Met dit besluit wordt het BEa op vier punten aangepast. Toegevoegd worden voorwaardelijke uitzonderingen op het opgravingsverbod (en daarmee de certificeringsplicht) voor:

a) verenigingen voor vrijwilligers in de onderwaterarcheologie;

b) een opgraving die noodzakelijk is voor het kunnen verkrijgen van een opgravingscertificaat;

c) opgravingen onder verantwoordelijkheid van de Minister van Defensie.

Tevens is de bestaande uitzondering voor verenigingen voor vrijwilligers in de archeologie gewijzigd wat betreft de Noordzee (d).

2. Achtergrond van het besluit

Deze aanpassingen zijn nodig om

a) het mogelijk te maken dat sportduikers, als vrijwilligers in de onderwaterarcheologie, een bijdrage leveren aan de archeologische monumentenzorg en het draagvlak onder hen voor een zorgvuldige en respectvolle omgang met het cultureel erfgoed onder water te vergroten;

b) het mogelijk te maken dat ook nieuwe organisaties kunnen toetreden tot het archeologisch bestel, waarmee bijgedragen wordt aan een goede werking van het certificeringsstelsel in de archeologie, conform de Europese Dienstenrichtlijn;

c) de opgravingen die onder verantwoordelijkheid van de Minister van Defensie worden uitgevoerd te voorzien van een adequate juridische basis in het stelsel van de Erfgoedwet;

d) het huidige vrijstellingsregime voor verenigingen voor vrijwilligers in de archeologie buiten gemeentelijk ingedeeld gebied in lijn te brengen met de nieuwe uitzondering onder a.

a) Verenigingen voor vrijwilligers in de onderwaterarcheologie

Met de inwerkingtreding van de Erfgoedwet per 1 juli 2016 is de reikwijdte van het opgravingsverbod verduidelijkt. In artikel 5.1, eerste lid, is geëxpliciteerd dat het ook verboden is om cultureel erfgoed onder water van de waterbodem mee te nemen, ook als de bodem zelf niet wordt verstoord. Dit besluit maakt een uitzondering voor verenigingen voor vrijwilligers in de onderwaterarcheologie. De vrijwilligers die bij een dergelijke vereniging zijn aangesloten, kunnen namelijk bijdragen aan het identificeren van wrakken of het beschermen van onderwatererfgoed tegen bedreigingen door natuurlijke processen, zoals erosie en de paalworm. Deze hulp van vrijwilligers is welkom, zolang dit gebeurt binnen de (inter)nationale juridische kaders, geen marktverstoring tot

gevolg heeft en geen afbreuk doet aan de kwaliteit van het archeologisch onderzoek.

Vrijwilligers in de onderwaterarcheologie bepleiten dat het aangescherpte opgravingsverbod voor hen te strikt is en niet in het belang van de archeologische monumentenzorg. Zij benadrukken dat het meenemen van voorwerpen die acuut met verspoeling bedreigd worden, of het ter identificatie van een nog niet geïdentificeerde archeologische vindplaats meenemen van een of meerdere voorwerpen of andere archeologische resten, bijdraagt aan de zorg voor dit cultureel erfgoed. Ook zouden zij in dat kader kleinschalig onderzoek (zoals het nemen van een houtmonster) willen kunnen doen.

- Er zijn verschillende soorten vrijwilligers in de onderwaterarcheologie, verenigd in diverse groepsverbanden die regelmatig van samenstelling veranderen. Er zijn groepen die binnen de kaders van de wet actief zijn en er zijn groepen die ervan worden verdacht zich in het verleden niet aan de regels te hebben gehouden, maar die zich nu constructief opstellen. Daarnaast zijn er ook sportduikers die zich bewust aan regels onttrekken en waarop, ondanks het aangescherpte opgravingsverbod, handhaving heel lastig blijft. Het is niet gewenst om voor deze laatste groep een uitzondering te maken.
- Op locaties waar sprake is van sterke stromingen en die daardoor een grote veranderlijkheid van de bodem kennen (bijvoorbeeld de Waddenzee), kan het wenselijk zijn dat degene die een met verspoeling bedreigd voorwerp aantreft, direct kan handelen (of dit nu een professionele onderwaterarcheoloog is of een vrijwilliger).
- Over de vraag of het noodzakelijk is om ter identificatie of onderzoek van een vindplaats voorwerpen mee te nemen, bestaat veel discussie. Duidelijk is in ieder geval dat betrokkenheid van een professional hoe dan ook gewenst is. In het geval van oorlogswrakken waarvan de vlaggenstaat bekend is, is bovendien eerst toestemming van die vlaggenstaat noodzakelijk.
- Door professionele maritiem archeologen wordt erkend dat bepaalde vrijwilligers, mits daar strikte afspraken over worden gemaakt, een rol kunnen spelen in de onderwaterarcheologie. Daarbij kan het wenselijk zijn dat zij ook kleinschalige onderzoekshandelingen verrichten die onder het opgravingsverbod vallen.
- Het gericht geven van meer ruimte aan de goedwillende groepen vrijwilligers in de onderwaterarcheologie zou het draagvlak kunnen vergroten voor een zorgvuldige en respectvolle omgang met cultureel erfgoed onder water.
- De algemene opgave ten aanzien van de onderwaterarcheologie is fors. Veel wrakken zijn nog niet geïdentificeerd of worden bedreigd door natuurlijke processen zoals erosie en de paalworm. Hulp van vrijwilligers is welkom, zolang dit gebeurt binnen de (inter)nationale juridische kaders, geen marktverstoring tot gevolg heeft en geen afbreuk doet aan de kwaliteit van het archeologisch onderzoek.

De bestaande uitzondering voor verenigingen voor vrijwilligers in de archeologie in het BEa is niet geschikt voor de oplossing van dit probleem. Voorwaarde daarbij is namelijk dat het moet gaan om locaties waarvan het bevoegd gezag heeft vastgesteld dat geen professioneel

archeologisch onderzoek (meer) nodig is.[1] Daarmee voorziet deze uitzondering niet in de omgang met nieuwe (nog niet onderzochte) vindplaatsen en met archeologische monumenten waar sprake is van natuurlijke erosie.

De Minister van Onderwijs, Cultuur en Wetenschap (hierna: Minister van OCW) heeft een stelselverantwoordelijkheid voor een goede erfgoedzorg. Het opgravingsverbod is daar een belangrijk middel bij, maar als de huidige situatie blijft voortbestaan, worden kansen gemist om te profiteren van de inzet van vrijwilligers en zal het draagvlak onder sportduikers voor een zorgvuldige en respectvolle omgang met cultureel erfgoed onder water afnemen.

Het is daarom van belang dat de overheid strikte randvoorwaarden stelt aan de uitzondering, om te voorkomen dat er oneigenlijk gebruik gemaakt wordt en dat de kwaliteit van de archeologische monumentenzorg gewaarborgd blijft. Ook is het wenselijk dat deze uitzondering past binnen het Unesco Verdrag inzake de bescherming van het cultureel erfgoed onder water.

b) Verkrijging certificaat

Met de inwerkingtreding van de Erfgoedwet per 1 juli 2016 is het vergunningstelsel voor het doen van archeologische opgravingen vervangen door een certificeringsstelsel. Samen met de partijen die betrokken zijn bij de uitvoering hiervan (de Raad voor Accreditatie, de Stichting Infrastructuur Kwaliteitsborging Bodembeheer, de Inspectie Overheidsinformatie en Erfgoed (voorheen Erfgoedinspectie) en het Centraal College van Deskundigen Archeologie) is geconstateerd dat voor een goede werking van het stelsel een aanvulling op de regels nodig is.

Om een opgravingscertificaat te verkrijgen, moeten organisaties aan een certificerende instelling aantonen dat zij op professionele wijze een opgraving kunnen verrichten. Echter, conform het opgravingsverbod kunnen zij geen opgravingen uitvoeren, want om te mogen opgraven is een opgravingscertificaat vereist. Voor de transitie van vergunningstelsel naar certificeringsstelsel was voorzien in een overgangsregeling, maar niet voor de periode daarna.

Binnen de beoordelingsrichtlijn Archeologie (BRL SIKB 4000) is voorzien in een procedure waarbij een organisatie een «voorlopig certificaat» kan krijgen op basis van een initiële toetsing door een certificerende instelling. Deze procedure valt echter buiten het toezicht door de Raad voor Accreditatie, omdat volgens de ISO-norm 17065 waarmee wordt gewerkt, alleen certificaten mogen worden verleend als *alle* eisen zijn beoordeeld. Als gravende handelingen die worden verricht in het kader van het verkrijgen van het certificaat worden uitgezonderd van het opgravingsverbod, wordt toezicht door de Raad voor Accreditatie op het geheel mogelijk en wordt de initiële opgraving van een juridische basis voorzien.

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[1] Het is primair de taak van de gemeente om in het kader van een omgevingsvergunning een afweging te maken of een archeologisch monument al dan niet verstoord mag worden en of daarbij professioneel archeologisch onderzoek nodig is. Een gemeente zal deze afweging in de regel maken op basis van een waardenstellend rapport van het desbetreffende archeologisch monument (vindplaats) of op basis van het oordeel van een deskundige. Indien de gemeente verder professioneel onderzoek niet nodig vindt, mogen verenigingen voor vrijwilligers het desbetreffende archeologisch monument opgraven zonder certificaat, uiteraard binnen de grenzen van het plangebied waarvoor de omgevingsvergunning is aangevraagd en met inachtneming van de bepalingen uit de Erfgoedwet t.a.v. melding, documentatie, conservering, rapportage en deponering.

c) Opgravingen onder verantwoordelijkheid van de Minister van Defensie

In de Erfgoedwet en het BEa is geen rekening gehouden met de bergingsactiviteiten van de Minister van Defensie. Deze werkzaamheden zijn te kwalificeren als opgravingen als bedoeld in artikel 5.1 van de Erfgoedwet, voor zover ze betrekking hebben op cultureel erfgoed. Het bergen van recent neergestorte vliegtuigen valt dan ook niet onder dit artikel.

De Minister van Defensie is, vertegenwoordigd door de Stafofficier Vliegtuigberging (SOVB),[2] de leidende partij bij bergingen van militaire vliegtuigwrakken. Daarbij is in de regel tevens sprake van de aanwezigheid van menselijke stoffelijke resten en/of explosieven en gevaarlijke stoffen.[3]

Defensie verricht deze activiteiten op verzoek van de gemeente. De beslissingsbevoegdheid ten aanzien van het al dan niet laten uitvoeren van de berging van een vliegtuigwrak ligt bij het gemeentebestuur. Daarbij neemt het ook een besluit of en zo ja, over de mate waarin archeologisch onderzoek nodig is.

De beslissingsbevoegdheid over vliegtuigbergingen is primair gebaseerd op de verantwoordelijkheid van de burgemeester voor de openbare orde en veiligheid. Het gemeentebestuur is het beste in staat om de lokale situatie, omstandigheden en overige betrokken belangen bij zijn beslissing te betrekken. Een van die betrokken belangen is het behoud van cultureel erfgoed.

De activiteiten van Defensie rond de berging van vliegtuigwrakken vinden hun oorsprong in de reeds ruim voor inwerkingtreding van de Erfgoedwet ingevolge het internationaal humanitair recht op de overheid rustende zorgplicht voor eerbiediging en bescherming van oorlogsgraven.[4] Zo is de huidige Bergings- en Identificatiedienst van de Koninklijke Landmacht (BIDKL) sinds het besluit van het Militair Gezag van 21 augustus 1945 belast met het «Opsporen, opgraven, identificeren en weder begraven van lijken die gedurende het tijdvak van 10 mei 1940 tot 8 mei 1945 begraven zijn, hetzij anders dan op een algemene of bijzondere begraafplaats en anders dan in een graf.» Daarnaast ruimen onderdelen van de krijgsmacht sinds het laatste jaar van de Tweede Wereldoorlog, eveneens op last van het toenmalig Militair Gezag, conventionele explosieven op. Dit waren aanvankelijk vooral niet-ontplofte mijnen en vliegtuigbommen. Gelet op zwaarwegende aspecten van openbare orde en veiligheid heeft de Ministerraad van 13 april 1999 besloten dat de ruiming van explosieven is voorbehouden aan de Explosieven Opruimingsdienst Defensie (EODD), terwijl de opsporing daarvan wordt overgelaten aan de markt.

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[2] En daar waar van toepassing de Bergings- en Identificatiedienst van de Koninklijke Landmacht (BIDKL) en de Explosieven Opruimingsdienst Defensie (EODD).

[3] Circulaire vliegtuigberging, Stcrt. 2016, 54987.

[4] Artikel 130 van het op 12 augustus 1949 te Genève tot stand gekomen Verdrag van Genève betreffende de bescherming van burgers in oorlogstijd (Trb. 1954, 192) en artikel 34 van het op 8 juni 1977 te Bern tot stand gekomen Aanvullend Protocol bij de Verdragen van Genève van 12 augustus 1949 betreffende de bescherming van de slachtoffers van internationale gewapende conflicten (Protocol I) (Trb. 1994, 274).

d) Aanpassing vrijstelling verenigingen voor vrijwilligers in de archeologie

Aangezien de activiteiten van vrijwilligers in de onderwaterarcheologie met dit besluit via een ontheffing worden gereguleerd, zou de situatie ontstaan van twee elkaar overlappende regimes: een ontheffing voor kleinere werkzaamheden en een voorwaardelijke vrijstelling voor opgravingen van vindplaatsen onder water. Aangezien het opgraven van hele vindplaatsen (lees: wrakken) door vrijwilligers op de Noordzee eigenlijk nooit voorkomt, schrapt dit besluit de vrijstelling voor vrijwilligers op de Noordzee (niet gemeentelijk ingedeeld gebied). Vrijwilligers kunnen voor activiteiten op de Noordzee gebruik maken van de mogelijkheid tot het aanvragen van een ontheffing. Dit sluit beter aan bij de praktijk zoals die met dit wijzigingsbesluit wordt beoogd.

3. Inhoud van het besluit

a) Verenigingen voor vrijwilligers in de onderwaterarcheologie

Dit besluit wijzigt het BEa zodanig dat de mogelijkheid wordt gecreëerd voor de Minister van OCW om onder voorwaarden een ontheffing van het opgravingsverbod te verlenen aan verenigingen voor vrijwilligers in de onderwaterarcheologie. De ontheffing kan betrekking hebben op het meenemen van voorwerpen die acuut worden bedreigd door natuurlijke processen, zoals verspoeling door een sterke stroming of aantasting door de paalworm, het meenemen van een of enkele voorwerpen ter identificatie van het archeologisch monument of op het verrichten van specifieke kleinere onderzoekshandelingen op een locatie, beschreven in een in te dienen projectplan. Over de uitvoering zullen nadere regels worden gesteld in een ministeriële regeling. Ook kunnen aan de ontheffing nadere voorwaarden worden gesteld.

Vanwege de hierboven beschreven algemene opgave ten aanzien van de onderwaterarcheologie is in de periode 2015 – 2017 op drie plekken een pilot gestart met enkele groepen sportduikers (in de Noordzee, in de Waddenzee en in de Oosterschelde) om te verkennen wat de meest verantwoorde manier zou zijn om ruimte te creëren. Onderdeel van deze pilots was dat, onder strikte voorwaarden, werd toegestaan dat objecten werden meegenomen van de bodem, indien dat nodig was voor identificatie van het archeologisch monument of indien vondsten anders ongezien verloren zouden gaan. Deze archeologische vondsten dienden direct gemeld te worden bij de Minister van OCW. De pilot is geëvalueerd. De uitkomsten zijn betrokken bij het vormgeven van bovenstaande uitzondering. De les was dat maatwerkafspraken de voorkeur hebben boven een meer generieke uitzondering (zoals bijvoorbeeld voor metaaldetectie geldt). Dit heeft te maken met de grote verschillen tussen de vindplaatsen, maar ook met de verschillen die bestaan tussen de groepen vrijwilligers. Vandaar dat hier voor het instrument van ontheffing aan verenigingen van vrijwilligers in de archeologie is gekozen in plaats van voor een (generieke) vrijstelling.

Alternatieven voor een uitzonderingsbepaling zijn overwogen, zoals het inzetten op betere communicatie en kennisuitwisseling tussen vrijwilligers en professionals. Hoewel dit zaken zijn die hoe dan ook zinvol zijn, veranderen deze niets aan het opgravingsverbod zoals dit nu bestaat.

Belangrijk is dat de ontheffing past binnen de randvoorwaarden die het Unesco Verdrag inzake de bescherming van het cultureel erfgoed onder water uit 2001 stelt. Op één onderdeel vergt dit een toelichting. In de regels 22 en 23 van de annex van het verdrag staat dat «activiteiten onder

leiding en toezicht moeten staan van een gekwalificeerd onderwaterarcheoloog, met voor het project toepasselijke wetenschappelijke competenties» en dat ook «de overige leden van het projectteam de kwalificaties en competenties moeten hebben voor hun taak binnen het project».

Bij het vormgeven van de ontheffing is uitgegaan van proportionaliteit. Omdat de handelingen waarvoor toestemming verleend kan worden beperkt van aard zijn en uitgevoerd worden op basis van een door de Minister van OCW (voor deze de Rijksdienst voor het Cultureel Erfgoed, hierna: RCE) goedgekeurd plan van aanpak, kan volstaan worden met toezicht door een professioneel archeoloog vooraf en achteraf. Desalniettemin worden kwalificaties en competenties vereist van de vrijwilligers. Deze sluiten aan op de te verrichten handelingen: men moet minimaal over een equivalent van het NAS1 certificaat beschikken.[5]

Een gevolg van de keuze voor maatwerkafspraken is dat de verschillen tussen de omgang met vrijwilligers op land (bijvoorbeeld metaaldetectie) en op het water groter worden. Dit onderscheid wordt gerechtvaardigd door de specifieke omstandigheden bij maritiem archeologisch erfgoed wat betreft de aard van de vindplaatsen, de samenstelling van de groepen vrijwilligers en de mogelijkheden tot het uitoefenen van toezicht. De optie om de aanpak die nu voor vrijwilligers in de onderwaterarcheologie wordt ontwikkeld ook op het land toe te passen is evenmin wenselijk omdat de huidige werkwijze op het land breed wordt gedragen.

b) Werkzaamheden verkrijgen certificaat

Met dit wijzigingsbesluit is een vrijstelling, voor werkzaamheden die nodig zijn voor het verkrijgen van een opgravingscertificaat, opgenomen in het BEa. De vrijstelling geldt indien het «papieren» deel van de beoordeling door de Certificerende Instelling (verder: CI) succesvol is afgerond en het eerste gravend onderzoek wordt benut voor het uitvoeren van een audit door een CI ten behoeve van het verkrijgen van het certificaat.

c) Opgravingen onder verantwoordelijkheid van de Minister van Defensie

Dit wijzigingsbesluit creëert een vrijstelling van het opgravingsverbod voor de berging van wrakken van vliegtuigen onder verantwoordelijkheid van de Minister van Defensie. Het betreft hoofdzakelijk vliegtuigwrakken uit de periode van de Tweede Wereldoorlog. De reden voor deze uitzondering is gelegen in de specifieke omstandigheden waaronder vliegtuigbergingen dienen plaats te vinden in verband met de daaraan verbonden veiligheidsrisico's en de taak van de Nederlandse overheid bij de identificatie van menselijke stoffelijke resten, in het licht van de zorgplicht ingevolge het humanitaire recht.[6] Deze werkzaamheden worden volgens vaste procedures verricht, die zijn toegespitst op veiligheid en een zorgvuldige en respectvolle wijze van omgaan met menselijke stoffelijke resten en materiële restanten. Zo wordt voorafgaand aan iedere berging een historisch onderzoek en een milieukundig- en afbakeningsonderzoek uitgevoerd. Vervolgens wordt een projectplan opgesteld voor de uitvoering van de berging.

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[5] NAS staat voor Nautical Archaeology Society, een Britse organisatie die cursussen voor vrijwilligers ontwikkelt. De Basiscursus Maritieme Archeologie die door de RCE en de LWAOW is ontwikkeld is de Nederlandse variant hiervan.

[6] Artikel 130 van het op 12 augustus 1949 te Genève tot stand gekomen Verdrag van Genève betreffende de bescherming van burgers in oorlogstijd (Trb. 1954, 192) en artikel 34 van het op 8 juni 1977 te Bern tot stand gekomen Aanvullend Protocol bij de Verdragen van Genève van 12 augustus 1949 betreffende de bescherming van de slachtoffers van internationale gewapende conflicten (Protocol I) (Trb. 1994, 274).

Vanwege de veiligheidsaspecten en de mogelijke aanwezigheid van menselijke stoffelijke resten staat het belang van de archeologie bij de uitvoering van een berging niet voorop, maar dit belang moet wel worden meegewogen. Daartoe dient het protocol Vliegtuigbergingen en Archeologie, opgesteld door deskundigen ten aanzien van vliegtuigbergingen en archeologie en vastgesteld door de ministers van OCW, Defensie, en van Binnenlandse Zaken en Koninkrijksrelaties. Dit protocol beschrijft de werkwijze die dient te worden gevolgd bij het archeologisch waarderen van deze vindplaatsen en het opstellen van het advies aan het bevoegd gezag voor de omgang hiermee. Uiteindelijk beslist het bevoegd gezag, in de meeste gevallen de gemeente, of en in welke mate er archeologisch onderzoek nodig is. Gezien deze verantwoordelijkheid van gemeenten en vanwege het Nationaal programma berging vliegtuigwrakken is de minister van Binnenlandse Zaken en Koninkrijksrelaties medeondertekenaar van het protocol.

De uitzondering heeft geen betrekking op de opgraving van ander materieel of andersoortige vindplaatsen uit de Tweede Wereldoorlog. Uiteraard geldt hierbij wel dat Defensie (BIDKL, EODD, SOVB) wordt betrokken als bij een opgraving toch menselijke stoffelijke resten, explosieven of vliegtuigdelen worden aangetroffen.

Ten overvloede wordt opgemerkt dat, hoewel de bergingen van vliegtuigwrakken onder verantwoordelijkheid van de Minister van Defensie in juridische zin kwalificeren als opgravingen als bedoeld in artikel 5.1, eerste lid, van de Erfgoedwet, dit niet wil zeggen dat ze kwalificeren als archeologisch onderzoek dat volgens de in de archeologie geldende normen wordt uitgevoerd. De doelstellingen van vliegtuigbergingen en van archeologisch onderzoek zijn ook verschillend. Het doel van archeologisch onderzoek is het vergroten van kennis over het verleden. Het doel van een vliegtuigberging is (definitie Circulaire vliegtuigberging) «het gecontroleerd benaderen en verwijderen van vliegtuigwrakdelen en mogelijke stoffelijke resten, conventionele explosieven, radioactieve stoffen en asbest». Dit laat onverlet dat er op respectvolle en zorgvuldige wijze wordt omgegaan met het cultureel erfgoed dat bij de bergingswerkzaamheden wordt aangetroffen. Defensie doet dit in overeenstemming met de bovengenoemde vaste bergingsprocedures en de door het bevoegd gezag vastgestelde werkwijze voor de omgang met de vindplaats. Hierover heeft het bevoegd gezag een advies ontvangen dat is opgesteld aan de hand van het bovengenoemde protocol.

De beslissingsbevoegdheid voor de uitvoering van een vliegtuigberging ligt bij het gemeentebestuur. Deze bevoegdheid vloeit niet voort uit de Erfgoedwet (of voorgaande erfgoedwetgeving), maar hangt samen met de verantwoordelijkheid van de burgemeester voor de openbare orde en veiligheid. Het bevoegd gezag betrekt meerdere belangen bij zijn beslissing over een vliegtuigberging, waaronder het belang van het behoud van cultureel erfgoed. De archeologische waardering van een voorgenomen vliegtuigberging die wordt opgesteld volgens het protocol Vliegtuigbergingen en Archeologie, is het bevoegd gezag daarbij behulpzaam. Indien het bevoegd gezag besluit tot archeologisch onderzoek als onderdeel van de vliegtuigberging, dan wordt dit onderzoek uitgevoerd volgens de in de archeologie geldende normen.

d) Aanpassing vrijstelling verenigingen voor vrijwilligers in de archeologie

Met dit wijzigingsbesluit is de bestaande voorwaardelijke vrijstelling voor vrijwilligers om archeologisch onderzoek te verrichten beperkt tot gemeentelijk ingedeeld gebied. Hiermee is de vrijstelling voor de Noordzee vervallen (en vervangen door de ontheffing onder a).

4. Gevolgen voor de regeldruk

a) Het belangrijkste gevolg van de ontheffing voor vrijwilligersverenigingen in de onderwaterarcheologie is dat deze verenigingen een aanvraag moeten doen. Hier zullen tijd en inspanning mee gemoeid zijn, maar deze zal veel geringer zijn dan wanneer ook van deze groep een certificaat vereist zou worden. Het voorstel is tot stand gekomen in nauw overleg met de koepels van de vrijwilligers in de onderwaterarcheologie. Het gaat om circa 300 personen en 10 tot 15 verenigingen. De RCE houdt daarom rekening met maximaal 15 aanvragen voor een ontheffing op jaarbasis. De gevolgen voor de regeldruk zijn naar verwachting dus niet omvangrijk. De precieze regeldruk volgt uit de ministeriële regeling die de aanvraagprocedure regelt. Bij dit alles is rekening gehouden met het doenvermogen van de vrijwilligers.

b) Het uitzonderen van het verrichten van een opgraving ten behoeve van het verkrijgen van een certificaat heeft geen gevolgen voor de regeldruk, want alleen de initiële opgraving wordt van een juridische basis voorzien. Dat betreft geen administratieve last.

c) Het toevoegen van de vrijstelling voor vliegtuigbergingen door Defensie heeft geen gevolgen voor de regeldruk.

d) Het aanpassen van de vrijstelling voor vrijwilligers in de archeologie heeft geen gevolgen voor de regeldruk. Er is overigens tot nog toe geen gebruik gemaakt van de oude mogelijkheid tot het opgraven van een vindplaats op de Noordzee waarvan het bevoegd gezag heeft vastgesteld dat er geen professioneel onderzoek nodig is. Voor de nieuwe situatie, zie a).

Naar aanleiding van de ATR-toets is het wijzigingsbesluit op een aantal plaatsen verduidelijkt:

- de motivering van het niet certificeren conform de Erfgoedwet van bergingen onder verantwoordelijkheid van de Minister van Defensie, en
- de gevolgen voor de regeldruk.

Niet overgenomen is het advies van de ATR om ontheffingen voor een periode van langer dan één jaar te verlenen aan verenigingen voor vrijwilligers in de onderwaterarcheologie. Er is bewust gekozen voor een ontheffing (en geen vrijstelling) waarbij periodiek de afspraken hernieuwd moeten worden. De periode van een jaar sluit goed aan op de praktijk van het seizoensgewijs duiken.

5. Uitvoeringsgevolgen en handhaafbaarheidstoets

De RCE en de Inspectie Overheidsinformatie en Erfgoed hebben respectievelijk een uitvoerings- en handhaafbaarheidstoets uitgevoerd. Uit deze toetsen komt naar voren dat er op basis van dit wijzigingsbesluit weliswaar taken bijkomen, maar dat deze, mits hiervoor aanvullende middelen beschikbaar komen, zowel uitvoerbaar als handhaafbaar zijn. De aandachtspunten die in de beide toetsen genoemd zijn, zijn betrokken bij de uitwerking van de ministeriële regeling.

Het voorstel heeft geen betrekking op Caribisch Nederland omdat de Erfgoedwet daar geen werking heeft.

6. Financiële gevolgen

De benodigde middelen voor de uitvoering door de Inspectie en de RCE zijn reeds in 2020, vooruitlopend op de nieuwe werkwijze, opgevangen binnen de OCW-begroting. Voor de inspectie is voor onder meer deze taak een bedrag van € 270.000 per jaar vrijgemaakt. Aan de RCE is een bedrag van € 1,5 mln. per jaar beschikbaar gesteld. Hiermee werden zowel de tijdelijke programma's maritiem erfgoed structureel voortgezet als de nieuwe taak ten aanzien van vrijwilligers gefinancierd.

7. Monitoring en evaluatie

De eerste twee jaar zal de uitvoering van dit besluit met alle betrokkenen nauw gevolgd worden. De evaluatie loopt daarna mee in de periodieke evaluatie van de Erfgoedwet.

8. Consultatie

Er zijn in totaal 14 inspraakreacties ontvangen. Deze hebben geleid tot één aanpassing in het wijzigingsbesluit zelf en diverse aanpassingen in de algemene toelichting en de artikelsgewijze toelichting.

In het wijzigingsbesluit is naar aanleiding van de consultatie toegevoegd dat de ontheffing voor verenigingen van vrijwilligers in de onderwaterarcheologie evenmin van toepassing is in gevallen waarin de vereniging in opdracht van een derde handelt.

Diverse partijen benadrukten dat opgravingen met betrekking tot militaire vliegtuigwrakken, slachtoffers uit de Tweede Wereldoorlog en niet-gesprongen explosieven die onder verantwoordelijkheid van de Minister van Defensie vallen, niet gezien mogen worden als archeologisch onderzoek volgens de normen van de beroepsgroep. Dit is juist, en ook in de toelichting verduidelijkt.

Naar aanleiding van de ontvangen reacties is ook verduidelijkt dat de vrijstelling voor opgravingswerkzaamheden ter verkrijging van een certificaat niet dient ter vervanging van de bestaande praktijk van het zogenaamde «voorlopig certificaat» maar dat deze hiermee van een juridische basis wordt voorzien.

Voorts zijn in de toelichting enkele kleinere verduidelijkingen doorgevoerd.

Artikelsgewijs

Artikel I Besluit Erfgoedwet archeologie

Artikel I wijzigt het BEa, dat op grond van Hoofdstuk 5 van de Erfgoedwet nadere regels stelt over archeologische opgravingen.

Onderdeel A (artikel 2.3 BEa)

Subonderdeel 2 beperkt de werking van de vrijstelling van het opgravingsverbod voor verenigingen voor vrijwilligers in de archeologie tot het gemeentelijk ingedeeld gebied, inclusief de Waddenzee. In subonderdeel 3 wordt geregeld dat de vrijstelling alleen van toepassing is indien het terreinen betreft, waarvan het college van burgermeester en wethouders heeft vastgesteld dat nader archeologisch onderzoek niet is vereist. Hiermee komt de verwijzing naar de Noordzee, voor zover buiten gemeentelijk ingedeeld gebied, te vervallen, omdat daar het nieuwe

ontheffingsregime op grond van artikel 2.5 van toepassing is. Om het verschil tussen de twee artikelen duidelijk te maken, past subonderdeel 1 het opschrift hierop aan.

Onderdeel B (artikelen 2.5, 2.6 en 2.7 (nieuw) BEa)

Onderdeel B regelt dat drie uitzonderingen op het opgravingsverbod worden toegevoegd aan het BEa.

Artikel 2.5. Verenigingen voor vrijwilligers in de onderwaterarcheologie

De eerste uitzondering is gericht op verenigingen voor vrijwilligers in de onderwaterarcheologie. Artikel 2.5, eerste lid, bepaalt dat aan deze verenigingen op aanvraag een ontheffing van telkens maximaal één jaar kan worden verleend voor zover het betreft cultureel erfgoed onder water, indien zij in de statuten hebben opgenomen dat zij het behouden en beoefenen van archeologie als doel hebben.

Volgens het tweede lid moeten deze verenigingen voor vrijwilligers bij opgravingen de verrichte handelingen en aangetroffen archeologische vondsten documenteren, de vondsten conserveren en moet er een rapport worden opgesteld, waarin de resultaten van de handelingen zijn beschreven (artikel 5.4, eerste lid, Erfgoedwet). De aanvang van de opgraving moet worden gemeld aan de Minister van OCW, en, binnen twee weken na voltooiing van de opgraving, ook de eerste bevindingen. Binnen twee jaar na voltooiing van de opgraving moeten ook de archeologische vondsten samen met de opgravingsdocumentatie worden overgedragen aan de eigenaar. Ook voornoemd rapport moet binnen twee jaar worden overgelegd aan de Minister van OCW, de eigenaar en het college van burgemeester en wethouders van de gemeente waar de opgraving heeft plaatsgevonden, en als deze buiten gemeentelijk ingedeeld gebied heeft plaatsgevonden, aan de Minister van Infrastructuur en Waterstaat (artikel 5.6 Erfgoedwet).[7]

Het derde lid bepaalt dat de ontheffing uitsluitend gericht is op drie handelingen: het meenemen van een archeologische vondst omdat deze acuut kan worden bedreigd (daaronder ook begrepen: aangetast) door natuurlijke processen, zoals verspoeling of de paalworm, het meenemen van een archeologische vondst om een archeologisch monument mee te identificeren of het verrichten van kleinschalige onderzoekshandelingen met beperkte gevolgen voor de archeologische waarde van het archeologische monument, bijvoorbeeld het nemen van een houtmonster om de jaarringen te kunnen analyseren.

In het vierde lid is geregeld dat bepaalde categorieën monumenten en archeologische monumenten niet onder de ontheffing vallen. Dat zijn (voorbeschermde) rijksmonumenten, (voorbeschermde) provinciale monumenten, gemeentelijke monumenten en terreinen waar opgravingen worden verricht door een certificaathouder of door universiteiten en hogescholen die gebruik maken van de vrijstelling op grond van artikel 2.1 van het BEa. Daarnaast wordt een uitzondering gemaakt voor militaire vliegtuigwrakken. Ook wrakken van oorlogsschepen vallen expliciet niet onder de ontheffing. De minister kan echter besluiten om hiervoor toch toestemming te verlenen, indien de staat die eigenaar is van het wrak daarmee akkoord is gegaan of indien het onbekend is onder welke vlag

[7] Is de eigenaar op grond van artikel 5.7 van de Erfgoedwet de gemeente, provincie of Staat, dan zorgt die op grond van artikel 5.9 van de Erfgoedwet voor deponering van de archeologische vondsten en de bijbehorende opgravingsdocumentatie en rapporten in de daarvoor aangewezen depots.

het schip voer en dus onbekend is welke staat eigenaar van het wrak is. Tot slot is de ontheffing niet bedoeld voor gevallen waarin een vereniging in opdracht van een derde handelt. Dit is bedoeld om marktverstoring te voorkomen.

In het vijfde lid is bepaald dat aan een ontheffing voorschriften kunnen worden verbonden. Daarmee wordt de mogelijkheid geboden om maatwerk te leveren in individuele gevallen. Hierbij kan gedacht worden aan het stellen van aanvullende eisen ten aanzien van veiligheid voor het uitvoeren van de activiteiten in het belang van een zorgvuldige opgraving.

In het zesde lid wordt geregeld dat de minister de ontheffing kan intrekken. Het zevende lid biedt een grondslag voor het in een ministeriële regeling stellen van nadere regels over de aanvraag, wijziging, weigering en intrekking van een ontheffing en over de voorschriften bedoeld in het vijfde lid. Bij nadere regels over de aanvraag valt te denken aan procedurele regels en de vereiste gegevens en documenten.

Artikel 2.6

Een tweede uitzondering op het opgravingsverbod wordt in dit wijzigingsbesluit gemaakt voor het verrichten van een opgraving ter verkrijging van een certificaat. Op grond van artikel 2.6 is voor deze opgraving geen certificaat nodig. Hieruit vloeit voort dat de opgraving op enig moment wordt bijgewoond door de certificerende instelling, bijvoorbeeld in het kader van de audit. Wel gelden volgens het tweede lid de plichten tot het documenteren, conserveren en rapporteren en het op professionele wijze uitvoeren van een opgraving (artikel 5.4, eerste en tweede lid, Erfgoedwet) en de plichten tot het melden van de aanvang van de opgraving, de eerste bevindingen na voltooiing daarvan en de overdracht van de archeologische vondsten, opgravingsdocumentatie en rapporten (artikel 5.6 Erfgoedwet). Dit zijn dezelfde verplichtingen die ook voor een certificaathouder gelden.

Artikel 2.7

In artikel 2.7 worden opgravingen onder verantwoordelijkheid van de Minister van Defensie om wrakken van militaire vliegtuigen te bergen uitgezonderd van het opgravingsverbod. Ook wordt het opgraven door de Minister van Defensie van slachtoffers uit de Tweede Wereldoorlog en van niet-gesprongen explosieven uitgezonderd.

In het tweede lid wordt geregeld dat, hoewel de Minister van Defensie geen certificaathouder is, de aanvang van de berging van militaire vliegtuigen gemeld wordt aan de Minister van OCW (artikel 5.6, eerste lid) en dat (een afschrift van) het bergingsrapport binnen twee jaar na voltooiing van de berging wordt overgelegd aan de Minister van OCW, de eigenaar en de desbetreffende gemeente (artikel 5.6, vierde lid). Het doel hiervan is om de archeologische informatie te borgen. Dit betekent in de praktijk dat de gangbare wijze van het documenteren van de bergingshandelingen van Defensie gevolgd wordt. Alleen de melding en het toesturen van het bergingsrapport zijn een toevoeging. De verplichtingen tot het deponeren en conserveren van vondsten zijn niet van toepassing verklaard omdat hiervan in de praktijk zelden of nooit sprake zal zijn, aangezien de vondsten in beginsel eigendom zijn van de desbetreffende staat en de nabestaanden of hun rechtsopvolgers.

De in het derde lid genoemde archeologische waardering dient als advies aan het bevoegd gezag ten behoeve van de besluitvorming over de noodzaak en de vorm van archeologisch onderzoek als onderdeel van de

vliegtuigberging. Deze waardering vindt plaats conform het door de Minister van OCW en de Ministers van Defensie en van Binnenlandse Zaken en Koninkrijksrelaties op grond van het vierde lid vast te stellen protocol.

Artikel II Invoeringsbesluit Omgevingswet

In artikel 5.17, onderdeel B, subonderdeel 1, van het Invoeringsbesluit Omgevingswet (Stb. 2020, 400) wordt een verouderde verwijzing naar de Wet algemene bepalingen omgevingsrecht in artikel 2.3 van het BEa aangepast. Nu die verwijzing met het onderhavige besluit is komen te vervallen, is de wijziging waarin in het Invoeringsbesluit Omgevingswet is voorzien niet langer actueel. Daarom komt die wijziging te vervallen.

Artikel III

In verband met de start van het duikseizoen is de inwerkingtredingsdatum van dit besluit gesteld op 1 april 2024.

De Staatssecretaris van Onderwijs, Cultuur en Wetenschap,
F.Q. Gräper-van Koolwijk

De Minister van Defensie,
K.H. Ollongren

Toelichting grondslagen

In dit document kunt u secties terugvinden die onleesbaar zijn gemaakt. Deze informatie is achterwege gelaten op basis van de Wet open overheid (Woo). De letter die hierbij is vermeld correspondeert met de bijbehorende grondslag in onderstaand overzicht.

Legenda verwijzing	Artikel verwijzing	Uitzonderingsgrond
		Artikel 5.1 lid 1 Woo – Absolute uitzonderingsgronden **De openbaarmaking van deze informatie:**
A	art. 5.1 lid 1 a	Kan de eenheid van de Kroon in gevaar brengen
B	art. 5.1 lid 1 b	Kan de veiligheid van de Staat schaden
C	art. 5.1 lid 1 c	Betreft bedrijfs- en fabricagegegevens die vertrouwelijk aan de overheid zijn meegedeeld
D	art. 5.1 lid 1 d	Betreft persoonsgegevens als bedoeld in paragraaf 3.1 (bijzondere persoonsgegevens) of paragraaf 3.2 (persoonsgegevens van strafrechtelijke aard) van de Uitvoeringswet Algemene verordening gegevensbescherming, waarvoor geen toestemming is gegeven of door de betrokkene kennelijk zelf openbaar zijn gemaakt
E	art. 5.1 lid 1 e	Het betreft nummers die dienen ter identificatie van personen die bij wet of algemene maatregel van bestuur zijn voorgeschreven als bedoeld in artikel 46 van de Uitvoeringswet Algemene verordening gegevensbescherming, tenzij de verstrekking kennelijk geen inbreuk op de levenssfeer maakt
		Artikel 5.1 lid 2 Woo – Relatieve uitzonderingsgronden **Het belang van de openbaarmaking van deze informatie weegt niet op tegen:**
F	art. 5.1 lid 2 a	Het belang van de betrekkingen van Nederland met andere staten en met internationale organisaties
G	art. 5.1 lid 2 b	De economische of financiële belangen van de Staat, andere publiekrechtelijke lichamen of bestuursorganen
H	art. 5.1 lid 2 c	Het belang van de opsporing en vervolging van strafbare feiten
I	art. 5.1 lid 2 d	Het belang van de inspectie, controle en toezicht door bestuursorganen
J	art. 5.1 lid 2 e	Het belang van de eerbiediging van de persoonlijke levenssfeer van betrokkenen
K	art. 5.1 lid 2 f	Het belang van de bescherming van andere dan in art. 5.1 lid 1 sub c genoemde concurrentiegevoelige bedrijfs- en fabricagegegevens
L	art. 5.1 lid 2 g	Het belang van de bescherming van het milieu waar deze informatie betrekking op heeft
M	art. 5.1 lid 2 h	Het belang van de beveiliging van personen en bedrijven en het voorkomen van sabotage
N	art. 5.1 lid 2 i	Het belang van het goed functioneren van de Staat, andere publiekrechtelijke lichamen of bestuursorganen
O	art. 5.1 lid 4	Het belang dat de geadresseerde erbij heeft om als eerste kennis te kunnen nemen van de informatie (tijdelijke beperking)
P	art. 5.1 lid 5	De onevenredige benadeling welke, in uitzonderlijke gevallen, wordt toegebracht aan een ander belang dan genoemd in art. 5.1 de leden 1 en 2, bij andere informatie dan milieu-informatie.
Q	art. 5.1 lid 6	Het belang genoemd in artikel 5.1 lid 1 c, het hier milieu-informatie betreft waardoor, bij openbaarmaking, ernstige schade wordt toegebracht aan het genoemde belang in artikel 5.1 lid 1c
		Artikel 5.2 lid 1 Woo – Persoonlijke beleidsopvattingen **De informatie uit documenten betreft:**
R	art. 5.2 lid 1	Persoonlijke beleidsopvattingen. Onder persoonlijke beleidsopvattingen worden verstaan ambtelijke adviezen, visies, standpunten en overwegingen ten behoeve van intern beraad, niet zijnde feiten, prognoses, beleidsalternatieven, de gevolgen van een bepaald beleidsalternatief of andere onderdelen met een overwegend objectief karakter
S	Art. 5.2 lid 2	Tot personen te herleiden gegevens, met betrekking tot door het bestuursorgaan, met het oog op een goede en democratische bestuursvoering, verstrekte informatie die kwalificeert als persoonlijke beleidsopvattingen

SCHELDE DELTA

ASPIRING GLOBAL GEOPARK

aUGGp Schelde Delta UNESCO Global Geopark

List of mandatory annexes

November 2022

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1A Self-evaluation form
1B Self-evaluation background document (explanations, details, examples)

ANNEX 2

Section E1.1 Geological Heritage and Conservation

ANNEX 3

3A Letter of support from Netherlands and Flemish Commission for UNESCO
3B Cooperation agreement from initiators and letter of intent from partners
3C 1. Translation of the cooperation agreement
2. Translation of the Letter of intent

ANNEX 4

MAP aUGGp

ANNEX 5

Geological summary

ANNEX 6

Bibliography aUGGp Schelde Delta

ANNEX 7

Geosites descriptions

ANNEX 1A
SELF-EVALUATION FORM

unesco
Global Geoparks

Evaluation Document - A

Self-Evaluation

Please read the INTRODUCTION, CHECKLIST and the EXPLANATORY NOTE TO THE CHECKLIST before completing this form:
https://en.unesco.org/sites/default/files/checklist_vf.pdf
https://en.unesco.org/sites/default/files/explanatory_notes_vf_october2020.pdf

Updated: October 2021

Identity

1. Name of the (a)UGGp

aUGGp Schelde Delta

2. Name of the organization in charge of the (a)UGGp

The aUGGp Schelde Delta consists of a collaboration between 6 initiating partners, namely the Dutch provinces of Zeeland and North Brabant, the Belgian provinces of Antwerp, East and West Flanders and the cross-border entity EGTS Linieland van Waas en Hulst

Country	**Belgium and the Netherlands**
Telephone	**+31 (6)** [redacted]
E-mail (s)	info@scheldedelta.eu

3. Address of the official management body of the (a)UGGp

EGTC Linieland van Waas en Hulst, Burgemeester Omer De Meyplein 1, 9170 Sint-Gillis-Waas, Belgium

4. Size of territory and population (based on the most recently available figures)

Size in km^2	5.467
Population within the aUGGp / UGGp	1.500.000

5. Contact persons

Main contact person and e-mail	info@scheldedelta.eu; [redacted]
Management body director and e-mail	Mr. Richard Meersschaert, Director EGTC Linieland van Waas en Hulst and secretary of Steering Commitee, [redacted]@egtslinieland.eu

Submitted by:

Name	Position	Date
Mrs. Anita Pijpelink	Chairman of the Steering Committee (a)UGGp Schelde Delta and Provincial Executive of the Province of Zeeland	24-11-2022
Signature	[redacted]	

Category	Self-Assessment	Evaluators' Estimate	Applicable Maximum Score*
Some criteria and questions will not apply to all aspiring UNESCO Global Geoparks (e.g., overlapping with other UNESCO designations or international designations, indigenous peoples, illegal mining, and coastal zones). Therefore, the maximum final score will vary depending on the situation of each (a)UGGp. In order to obtain an assessment of the quality of your application, please fill in the following form, criterion by criterion, according to the questions that apply to you.			
Criterion i	1015		1110
Criterion ii	480		530
Criterion iii	390		450
Criterion iv	202		310
Criterion v	120		200
Criterion vi	60		100
Criterion vii	150		190
Total	**2417**		**2890**

EVALUATORS VERIFICATION		
Name		Date:
Signature		
Name		Date:
Signature		

***Please add the Maximum Score applicable for you (a)UGGp**

	Criterion i: (i) UNESCO Global Geopark must be single, unified geographical areas (iA) where sites and landscapes of international geological significance (iB) are managed in a holistic concept of protection (iC), education (iD), research (iE) and sustainable development (iF). A UNESCO Global Geopark must have a clearly defined border, be of adequate size to fulfil its functions and contain geological heritage of international significance as independently verified by scientific professionals.	Points Available		Self-Assessment	Evaluators' Estimate
	Please provide requested lists and details as a separate annex referring to the corresponding item numbers, but do not send entire publications, brochures, etc. (these should only be provided to field evaluators)				
iA	**Unified territory**				
	Territory	**Yes**	**No**		
iA.1	Is your (a)UGGp territory understandable as a single, unified area by each resident?	30	0	30	
iA.2	Is the entire territory involved in the operations of the (a)UGGp?	30	0	30	
	Qualitative elements of the territory : boundary and size	**Yes**	**No**		
iA.3	Does your (a)UGGp boundary correspond with a local administrative or other locally recognised boundary?	20	0	20	
iA.4	Do you have a significant population living in your (a)UGGp? (Please give details)	20	0	20	
iA.5	Does your (a)UGGp territory size and local population provide the necessary conditions for appropriate sustainable development ?	30	0	30	
	Maximum Total		**130**	**130**	**0**
iB	**International value of the geological heritage, geodiversity and singularity**				
	International value of the geological heritage	**Yes**	**No**		
iB.1	Do your sites of international importance have international recognition? (based for example on scientific referencing or international publications. Please give details)	20	0	20	
iB.2	Do you have international scientific and academic research carried out on the sites of international importance? (Please provide a list)	20	0	20	
	Geodiversity	**Yes**	**No**		
iB.3	Does your (a)UGGp have a diverse range of geological time periods? (Please give details)	10	0	10	
iB.4	Do you value different Earth Sciences disciplines present in your (a)UGGp? (for example geomorphology, sedimentolmogy, paleontology, ecology, geohydrology,.. Please give details)	10	0	10	
iB.5	Do you promote the geodiversity of your (a)UGGp to the public? (Please give details)	20	0	20	
	Singularity	**Yes**	**No**		
iB.6	Is there any other UNESCO Global Geopark with comparable geological heritage? (if NO go to iC)	0	30	30	
iB.7	Is this UNESCO Global Geopark within the same country's geographical area or in an adjacent area of a boardering country (less than 100 km away)? (if NO go to iC)	**Yes** 0	**No** 10		
iB.8	Has an independent geological study been carried out to show the difference?	**Yes** 10	**No** 0		
	Maximum Total		**110**	**110**	**0**
iC	**Geological site conservation**				
	Inventory	**Yes**	**No**		
iC.1	Does your country or the geological survey of your country have a geological site inventory?	20	0	20	
iC.2	Do you, as an (a)UGGp, have an up to date geological site inventory that is regularly reviewed?	20	0	20	
iC.3	Do you have an active geological sites' database for monitoring the sites in the entire (a)UGGp? (Please give details)	20	0	20	
iC.4	Do you have a list of geological sites that clearly identifies their use (e.g., education, tourism, recreation)? (Please provide a list)	20	0	20	
	Maps	**Yes**	**No**		
iC.5	Do you have a geological map of your (a)UGGp?	20	0	20	
iC.6	Do you have an (a)UGGp map indicating the geological sites? (Please give details)	20	0	20	
	Precautionary measures for protection of geological heritage	**Yes**	**No**		
iC.7	Do you monitor and assure the enforcement of general regulations (directly or indirectly) to prevent misuse and damage of the entire (a)UGGp? (Please give details)	10	0	10	
iC.8	Do you inform visitors about the regulations to prevent misuse and damage of individual sites in the (a)UGGp (in situ)? (Please give details)	10	0	10	
iC.9	Do you inform visitors about these regulations in your communication material (ex situ)?	10	0	10	
iC.10	Do you organize regular maintenance and cleaning of sites ? (Please give details on how often they are checked, etc.)	10	0	10	
iC.11	Do you implement non-destructive on-site conservation?	10	0	10	
iC.12	Do you implement intervention measures to protect the sites?	10	0	10	
iC.13	Is destroying and removing parts of the geological heritage prohibited? (Please give details)	10	0	10	
iC.14	Do you have a general code of conduct for your (a)UGGp visitors?	10	0	10	
iC. 15	Do you have a general policy to ensure/maintain the integrity of your (a)UGGp sites regarding the sustainable use of the landscape?	10	0	10	
	Maximum Total		**210**	**210**	**0**

	Criterion i: (i) UNESCO Global Geopark must be single, unified geographical areas (iA) where sites and landscapes of international geological significance (iB) are managed in a holistic concept of protection (iC), education (iD), research (iE) and sustainable development (iF). A UNESCO Global Geopark must have a clearly defined border, be of adequate size to fulfil its functions and contain geological heritage of international significance as independently verified by scientific professionals.	Points Available		Self-Assessment	Evaluators' Estimate
iD	**Education**				
		Yes	**No**		
iD.1	Do you have a programme of educational activities specifically on geological heritage?	10	0	10	
iD.2	Do you organize specific training for the teachers at the schools located in your (a)UGGp territory?	10	0	0	
iD.3	Do you use your (a)UGGp sites for pedagogical / educational school visits?	10	0	10	
iD.4	Do you organize specific educational programmes for different levels of students?	10	0	10	
iD.5	Have you produced educational tools, activities or programmes explaining your (a)UGGp territory and its characteristics?	10	0	10	
iD.6	Have you produced educational tools explaining the geological heritage of your (a)UGGp? (Please provide a list)	10	0	10	
iD.7	Have you produced educational tools linking geological heritage to natural, cultural and intangible cultural heritage? (Please provide a list)	10	0	10	
iD.8	Have you developed activities or educational tools focused on environmental good practices in the area? (Please provide a list)	10	0	10	
iD.9	Do you organize educational programmes on geohazards and disaster risk reduction? (Please provide a list)	10	0	10	
iD.10	Do you organize educational programmes on climate change? (Please provide a list)	10	0	10	
	Maximum Total		**100**	**90**	**0**
iE	**Research**				
		Yes	**No**		
iE.1	Do you have a formal partnership with a scientific institution or university? (Please provide a list)	10	0	10	
iE.2	Are you informed about active research taking place in your (a)UGGp in the fields of geology, ecology, culture, social and human sciences and/or sustainable development, climate change? (Please provide a list)	10	0	10	
iE.3	Do universities use your (a)UGGp for camps or field work activities in any of these fields of study? (Please provide a list)	10	0	10	
iE.4	Do you have at least one student final report on the (a)UGGp area per year?	10	0	10	
iE.5	Did you have at least one PhD thesis student working on the (a)UGGp area within the past three years?	10	0	10	
iE.6	Do you have at least five academic papers from research conducted within the (a)UGGp area during the last five years?	10	0	10	
	Maximum Total		**60**	**60**	**0**
iF	**Sustainable economic development**				
iF.1	**Visibility**	**Yes**	**No**		
iF.1.a	Do visitors to your area easily recognise and understand that they are in an (a)UGGp? (Please give details)	20	0	10	
iF.1.b	Does the population recognise and understand that they live in an (a)UGGp?	10	0	5	
iF.1.c	Do you have entrance panels to the territory?	10	0	0	
iF.1.d	Do you have (a)UGGp signage along the roads and/or at important sites?	10	0	10	
iF.2	**Infrastructure and facilities**	**Yes**	**No**		
iF.2.a	Do you have panels or other systems providing information on the (a)UGGp sites? (Please give details)	10	0	10	
iF.2.b	Do you have public information infrastructure(s) (kiosks, visitor centre, information centre) in your (a)UGGp?	20	0	20	
iF.2.c	Do you have a (a)UGGp museum or an interpretation centre in which you present your (a)UGGp?	30	0	30	
iF.2.d	Do you have other exhibition rooms and/or museums or partner museums presenting your (a)UGGp?	20	0	20	
iF.3	**Communication tools**	**Yes**	**No**		
iF.3.a	Do you use your website as a regularly updated communication tool for local population and visitors?	10	0	10	
iF.3.b	Is there a map on your website presenting the (a)UGGp territory and sites open to the public?	10	0	10	
iF.3.c	Does your website offer a diversified range of tours?	10	0	10	
iF.3.d	Does your website promote and explain the different partnerships of your (a)UGGp?	10	0	10	
iF.3.e	Do you have leaflets, publications, etc., presenting your (a)UGGp? (Please provide a list)	10	0	10	
iF.3.f	Is there communication material available in other languages (English and any other local or international languages)?	10	0	10	
iF.3.g	Have you published a paper tourist map that indicates your sites for visitors?	10	0	10	
iF.3.h	Do you actively use social media tools dedicated to the (a)UGGp? (Please provide a list)	10	0	10	
iF.3.i	Have you developed a mobile application dedicated to your (a)UGGp? (Please give details)	10	0	10	
iF.3.j	Do you have a generic email adress with dedicated staff replying daily to visitors' questions?	10	0	10	
iF.3.k	Do you have a public phone number with staff able to reply and answer in multiple languages?	10	0	0	
	Maximum Total		**240**	**205**	**0**

	Criterion i: (i) UNESCO Global Geopark must be single, unified geographical areas (iA) where sites and landscapes of international geological significance (iB) are managed in a holistic concept of protection (iC), education (iD), research (iE) and sustainable development (iF). A UNESCO Global Geopark must have a clearly defined border, be of adequate size to fulfil its functions and contain geological heritage of international significance as independently verified by scientific professionals.	Points Available		Self-Assessment	Evaluators' Estimate
	Maximum Total	240		205	0
iF.4	**Safety**	Yes	No		
iF.4.a	Are the (a)UGGp sites that you promote to visitors accessible in a safe way?	20	0	20	
iF.4.b	Are these sites themselves safe for visitors (beware of cliffs, rising tide, falling rocks, traffic, etc.)?	10	0	10	
iF.4.c	Are your parking and rest areas also safe for the public? (nearby traffic, falling rocks, etc.)	10	0	10	
iF.4.d	Do you carry out appropriate risk assessments and/or assessments of site conditions on a regular basis?	10	0	10	
	Maximum Total	50		50	0
iF.5	**Partnerships**	Yes	No		
iF.5.a	Do you have quality criteria for your (a)UGGp partners?	10	0	10	
iF.5.b	Do you have formal partnerships and agreements with them defining clear common commitments? (Please provide a list)	10	0	10	
iF.5.c	Have you developed an (a)UGGp branding policy with local products/producers based on clear criteria?	10	0	0	
iF.5.d	Do you have initiatives to showcase and promote the marketing of local products / food? (Please give details)	10	0	10	
iF.5.e	Do you actively promote local sustainable and/or organic food and gastronomy? (Please give details)	10	0	10	
iF.5.f	Do your partners clearly display that they are a Geopark partner (e.g., on their website, inside their premises, etc.)?	10	0	10	
	Maximum Total	60		50	0
iF.6	**Geotourism**	Yes	No		
iF.6.a	Have you created a basic general tourism strategy for at least the next four years or is the (a)UGGp embedded within an overarching local tourism strategy? (Please give details)	20	0	20	
iF.6.b	Do you provide information regarding your (a)UGGp at the nearest tourist hub?	10	0	10	
iF.6.c	Do you have promotional material available for visitors? (Please provide a list)	10	0	10	
iF.6.d	Do you have partnerships with tour operators?	10	0	0	
iF.6.e	Does your (a)UGGp provide training for guides or tour operators working with you?	10	0	10	
iF.6.f	Do you have sustainable car-free trails?	10	0	10	
iF.6.g	Do you create or support the marketing of sustainable souvenirs such as casts, replicas and handicrafts that are locally produced?	10	0	0	
iF.6.h	Do you have material to enable visitors to self-guide within your (a)UGGp?	10	0	10	
iF.6.i	Is your (a)UGGp at risk of unsustainable levels of tourism? (If NO go to iF.6.j)	Yes: 0 / No: 20		0	
iF.6.j	Is this monitored and do you have mechanisms in place to mitigate?	Yes: 10 / No: 0		10	
iF.6.k	Do you have a policy to limit mass tourism and encourage sustainable tourism activities?	10	0	10	
	Maximum Total	110		90	0
iF.7	**Events**	Yes	No		
iF.7.a	Do you organise a range of events that help promote and celebrate the natural, cultural and intangible cultural heritage of the (a)UGGp? (Please explain)	10	0	10	
iF.7.b	Do you encourage and associate with traditional events in your (a)UGGp? (Please explain)	10	0	0	
iF.7.c	Do you organize or support sport events within your (a)UGGp in a sustainable way? (Please explain)	10	0	0	
iF.7.d	Do you organize and/or support cultural and social events within your (a)UGGp in a sustainable way? (Please explain)	10	0	10	
	Maximum Total	40		20	0

Criterion i subtotal	Maximum Points	Maximum Points	Self-Assessment	Evaluators' Estimate
	1110	1110	1015	0

	Criterion ii: (ii) UNESCO Global Geoparks should use that heritage, in connection with all other aspects of that area's natural and cultural heritage, to promote awareness of key issues facing society (iiA) in the context of the dynamic planet we all live on, including but not limited to increasing knowledge and understanding of: geoprocesses; geohazards; climate change (iiB); the need for the sustainable use of Earth's natural resources (iiC); the evolution of life and the empowerment of indigenous peoples.	**Points Available**	**Self-Assessment**	**Evaluators' Estimate**
	Please provide requested lists and details as a separate annex referring to the corresponding item numbers, but do not send entire publications, brochures, etc. (these should only be provided to field evaluators)			

iiA.1	**Other natural heritage - biotic**	**Yes**	**No**	**Not Applicable***		
iiA.1.a	Are you aware of the designated natural heritage (international, national, local level like for example a UNESCO Biosphere Reserve, a Ramsar site, World Heritage site, National Park, Natura 2000 site,...) present in your (a)UGGp? (Please give details)	20	0	☐	20	
iiA.1.b	Have you identified, or started to identify the non-designated natural heritage in your (a)UGGp territory in an inventory? (Please give details)	20	0		20	
iiA.1.c	Do you communicate and promote your natural heritage? (Please give details)	10	0		10	
iiA.1.d	Does your (a)UGGp communicate the protection of the biodiversity?	10	0		10	
iiA.1.e	Has your (a)UGGp developed formal partnership agreements with institutions / communities / NGOs operating in your aUGGp territory in the field of natural heritage? (Please provide a list)	10	0		10	
iiA.1.f	Does your (a)UGGp develop activities with the communities / NGOs operating in your territory in the field of natural heritage?	10	0		10	
iiA.1.g	Do you have activities (education, tourism, etc.) connecting geological heritage with aspects of the natural heritage? (Please give details)	10	0		10	
iiA.1.h	Does your (a)UGGp identify, protect and communicate about the endangered and/or endemic species of fauna and flora living in the territory?	10	0		10	
iiA.1.i	Do you actively promote natural protected areas and their heritage in your (a)UGGp?	10	0	☐	10	
iiA.1.j	Does your (a)UGGp develop activities with the natural protected areas' management bodies present in your territory?	10	0	☐	10	
iiA.1.k	Does your (a)UGGp inform local population and visitors about, and carry out activities related to fragile ecosystems (forests, mountains, etc.) ?	10	0	☐	10	
iiA.1.l	Does your (a)UGGp inform local populations and visitors about, and carry out activities related to coastal and marine ecosystems?	10	0	☐	10	
	Maximum Total		**140**	**	**140**	**0**

iiA.2	**Tangible cultural heritage**	**Yes**	**No**	**Not Applicable***		
iiA.2.a	Are you aware of the designated cultural heritage (international, national, local level like for example a UNESCO World heritage site, national protected monument, recognised archeological sites..) present in your (a)UGGp territory? (Please give details)	20	0	☐	20	
iiA.2.b	Have you identified, or started to identify the non-designated cultural heritage in your (a)UGGp territory in an inventory, ? (Please give details)	20	0		20	
iiA.2.c	Do you actively promote cultural protected sites and their heritage in your (a)UGGp?	10	0	☐	10	
iiA.2.d	Does your (a)UGGp carry out activities with the cultural protected sites present in your territory?	10	0	☐	10	
iiA.2.e	Has your (a)UGGp developed formal partnership agreements with institutions / communities / NGOs operating in your aUGGp territory in the field of cultural heritage?	10	0		10	
iiA.2.f	Does your (a)UGGp develop activities with the communities / NGOs operating in your territory in the field of cultural heritage?	10	0		10	
iiA.2.g	Do you communicate and promote your cultural heritage? (Please give details)	10	0		10	
iiA.2.h	Do you have activities (education, tourism, etc.) connecting geological heritage with aspects of the cultural heritage? (Please give details)	10	0		10	
	Maximum Total		**100**	**	**100**	**0**

iiA.3	**Intangible cultural heritage**	**Yes**	**No**	**Not Applicable***		
iiA.3.a	Are you aware of the designated intangible heritage (international, national, local level, like for example Intangible Cultural Heritage of UNESCO, nationaly protected intangible cultural heritage and traditions, ..) present in your (a)UGGp territory? (Please give details)	20	0	☐	20	
iiA.3.b	Have you identified, or started to identify the non-designated intangible heritage in your (a)UGGp territory in an inventory? (Please give details)	20	0		20	
iiA.3.c	Has your (a)UGGp developed formal partnership agreements with institutions / communities / NGOs operating in your (a)UGGp territory in the field of intangible heritage?	10	0		10	
iiA.3.d	Does your (a)UGGp develop activities with the communities / NGOs operating in your territory in the field of intangible cultural heritage?	10	0		0	
iiA.3.e	Is your (a)UGGp involved in the transfer of intangible heritage to the next generations?	10	0		10	
iiA.3.f	Do you communicate and promote your intangible cultural heritage? (Please give details)	10	0		10	
iiA.3.g	Do you have activities (education, tourism, etc.) connecting geological heritage with aspects of the intangible heritage? (Please give details)	10	0		10	
iiA.3.h	If a regional/indigenous language exists in your (a)UGGp, are you involved in its promotion and transmission? (Please give details)	10	0	☑		
	Maximum Total		**100**	**	**80**	**0**

	Criterion ii: (ii) UNESCO Global Geoparks should use that heritage, in connection with all other aspects of that area's natural and cultural heritage, to promote awareness of key issues facing society (iiA) in the context of the dynamic planet we all live on, including but not limited to increasing knowledge and understanding of: geoprocesses; geohazards; climate change (iiB); the need for the sustainable use of Earth's natural resources (iiC); the evolution of life and the empowerment of indigenous peoples.	Points Available			Self-Assessment	Evaluators' Estimate
IIB	**Topics related to geoprocesses, climate change, natural hazards and renewable energies**					
		Yes	**No**			
iiB.1	Do you implement climate change mitigation and adaptation initiatives in your (a)UGGp? (Please give details)	20	0		20	
iiB.2	Do you support climate change mitigation and adaptation initiatives delivered by your partners or stakeholders? (Please give details)	10	0		10	
iiB.3	Do you provide training on climate change mitigation and adaptation initiatives for your (a)UGGp staff?	20	0		0	
iiB.4	Do you help raise awareness of climate change and its potential impacts amongst local populations and visitors?	10	0		10	
iiB.5	Do you implement natural hazard mitigation initiatives in your (a)UGGp? (Please give details)	20	0		20	
iiB.6	Do you support natural hazard mitigation initiatives delivered by your partners or stakeholders?	10	0		10	
iiB.7	Do you provide training on natural hazard mitigation initiatives for your (a)UGGp staff?	20	0		0	
iiB.8	Do you help raise awareness of natural hazards, and the associated geo-processes that cause them, amongst local population and visitors?	10	0		10	
iiB.9	Does your (a)UGGp have a Climate change Strategy that includes the reduction of carbon foorprints, the use of renewable energies, and the reduction and recycling of waste?	20	0		20	
	Maximum Total		**140**		**100**	**0**
IIC	**Needs for sustainable use**					
		Yes	**No**	**Not applicable***		
iiC.1	If legal mining is carried out in your (a)UGGp, have you developed partnerships to encourage more sustainable extraction and use of natural resources with representatives from the extractive industry (mines and quarries) in your area? (Please give details)	20	0	☐	**0**	
iiC.2	Do you promote a greater awareness and understanding of the need for the sustainable use of natural resources in your (a)UGGp? (Please give details)	20	0		**20**	
iiC.3	Do you promote a greater awareness and understanding of your (a)UGGp's water resources and their limitations? (Please give details)	20	0		**20**	
iiC.4	Do you deliver or support initiatives to encourage your partners to use water more sustainably? (Please give details)	20	0		**20**	
	Maximum total		**80**	**60**	**60**	**0**

Criterion ii subtotal	Maximum Points	Maximum point	Self-Assessment	Evaluators' Estimate
	560	**	**480**	**0**

*** when not applicable, click check box and corresponding maximum score.**

**** calculate maximum score based on N/A options**

	Criterion iii: (iii) UNESCO Global Geoparks should be areas with a management body having legal existence recognized under national legislation (iiiA). The management bodies should be appropriately equipped to adequately address the area of the UNESCO Global Geopark in its entirety (iiiB).			**Points Available**	**Self-Assessment**	**Evaluators' Estimate**
	Please provide requested lists and details as a separate annex referring to the corresponding item numbers, but do not send entire publications, brochures, etc. (these should only be provided to field evaluators)					
iiiA	**Management body**					
				Yes	**No**	
iiiA.1	Do local decision-makers have a role to play in the (a)UGGp management? (Please give details)			20	0	20
iiiA.2	Does the (a)UGGp management body have a dedicated budget for staff and activities?			20	0	20
iiiA.3	Is there a plan to secure the budget for the (a)UGGp for at least four years? (Please give details)			20	0	20
iiiA.4	Does the annual budget of the (a)UGGp cover:	a. Geoconservation activities (maintenance, cleaning, protection and conservation of geological sites)?		10	0	10
		b. Geopark infrastructure (trails, panels, info-point, museum, etc.)?		10	0	10
		c. Sustainable economic activity?		10	0	10
		d. Education?		10	0	10
		e. (a)UGGp promotion and networking activities?		10	0	10
		f. Other activities? (Please give details)		10	0	0
iiiA.5	Does the (a)UGGp management body have official partnerships with national, regional and local authorities? (Please give details)			20	0	20
			Maximum Total		**140**	**130**	**0**
iiiB	**Appropriate equipment**					
	(a)UGGp Staff			**Yes**	**No**	
iiiB.1	Is there a permanent and professional team dedicated to the (a)UGGp? (Please give details)			30	0	30
iiiB.2	Does your (a)UGGp team include geoscientist(s) working on a daily-basis?			20	0	20
iiiB.3	Does your (a)UGGp directly employ a multidisciplinary team (education, culture, tourism, marketing, etc.)? (Please give details)			10	0	10
iiiB.4	Does your (a)UGGp team include staff dedicated to:	a. Geoconservation activities (maintenance, cleaning, protection and conservation of geological sites)?		10	0	10
		b.(a)UGGp infrastructure (trails, panels, info-point, museum, etc.)?		10	0	10
		c. Sustainable economic activity?		10	0	10
		d. Education?		10	0	10
		e. (a)UGGp promotion and networking activities?		10	0	10
		f.Other activities? (Please give details)		10	0	10
iiiB.5	Is there any formal agreement(s) with partners to provide multidisciplinary staff for your (a)UGGp? (Please give details)			10	0	10
			Maximum Total		**130**	**130**	**0**
	(a)UGGp Infrastructure			**Yes**	**No**	
iiiB.6	Do you have a (a)UGGp Office?			10	0	0
iiiB.7	Is your (a)UGGp easily accessible by road?			10	0	10
iiiB.8	Can people reach your (a)UGGp by public, organized or pooled transport?			10	0	10
iiiB.9	Is your (a)UGGp equipped with sufficient vehicles for managing and monitoring the sites?			10	0	10
			Maximum Total		**40**	**30**	**0**

	Criterion iii: (iii) UNESCO Global Geoparks should be areas with a management body having legal existence recognized under national legislation (iiiA). The management bodies should be appropriately equipped to adequately address the area of the UNESCO Global Geopark in its entirety (iiiB).		Points Available		Self-Assessment	Evaluators' Estimate
	(a)UGGp Management Plan		Yes	No		
iiiB.11	Do you have a management plan including these different items:	a.(a)UGGp personnel and capacity building?	10	0	10	
		b.Geoconservation strategy including protective and conservation measures and activities?	10	0	10	
		c.Heritage interpretation infrastructure, tools and publications?	10	0	10	
		d.Geoeducation strategy including partners, educational programmes and tools?	10	0	10	
		e.Geotourism strategy including services and activities	10	0	10	
		f.Sustainable local development, partners and activities?	10	0	10	
		g.(a)UGGp promotional activities and tools?	10	0	10	
		h.Networking and partnerships?	10	0	10	
		Maximum Total		**80**	**80**	**0**
	(a)UGGp Visitor Evaluation		Yes	No		
iiiB.12	Do you count visitors? (Please give details on methodology and numbers)		10	0	5	
iiiB.13	Do you evaluate where your visitors are coming from? (Please give details)		10	0	5	
iiiB.14	Do you use questionnaires to assess visitor satisfaction?		10	0	5	
iiiB.15	Do you analyze the socio-economic profile of your (a)UGGp visitors? (Please give details)		10	0	5	
iiiB.16	Do you use these data for your (a)UGGp forward planning?		20	0	0	
		Maximum total		**60**	**20**	**0**
		Criterion iii subtotal	**Maximum Points**		**Self-Assessment**	**Evaluators' Estimate**
				450	**390**	**0**

	Criterion iv: (iv) in the case where an applying area overlaps with another UNESCO designated site, such as a World Heritage Site or Biosphere Reserve, the request must be clearly justified and evidence must be provided for how UNESCO Global Geopark status will add value by being both independently branded and in synergy with the other UNESCO designations (ivA.1). (Not applicable for intangible cultural heritage, but applicable for non UNESCO international designations such as RAMSAR, Natura 2000, etc. **(ivA.2)**).	**Points Available**	**Self-Assessment**	**Evaluators' Estimate**
	Please provide requested lists and details as a separate annex referring to the corresponding item numbers, but do not send entire publications, brochures, etc. (these should only be provided to field evaluators)			

		Yes	No	Not applicable*		
ivA.1	**Overlapping with UNESCO designated sites**					
ivA.1.a	Does your (a)UGGp overlap with or encompass any other UNESCO designated site(s). If Yes, please provide details. If no, please select not applicable and go to ivA.2	☑		☐		
ivA.1.b	Is there a complementarity between your (a)UGGp and the other UNESCO designated sites within the territory? (Please give details)	20	0		20	
ivA.1.c	Have the other UNESCO designated sites been informed about the aUGGp application?	10	0		10	
ivA.1.d	Does their management body support the (a)UGGp application?	10	0		10	
ivA.1.e	Does the (a)UGGp have a formal partnership agreement with other UNESCO designated sites?	20	0		20	
ivA.1.f	Is there a clear justification for how the UGGp status will add value to the territory by being independently branded ? (Please give details)	10	0		10	
ivA.1.g	Do you organize common meetings with the other UNESCO designated sites management and exchange experiences? (Please give details)	10	0		0	
ivA.1.h	Do you organize common capacity building activities for the management body of both designations?	10	0		0	
ivA.1.i	Do you organize common training for staff of both designations (guides, rangers, etc)?	10	0		0	
ivA.1.j	Do you develop common infrastructure to facilitate field activities? (Please give details)	10	0		0	
ivA.1.k	Do you develop common events (conferences, exhibitions, etc.) with the other UNESCO designated sites? (Please give details)	10	0		0	
ivA.1.l	Have you developed specific tools to provide a clear, visible and independent branding for your (a)UGGp?	10	0		10	
ivA.1.m	Do you develop common activities (education, tourism, sustainable development, etc.)?	10	0		0	
ivA.1.n	Do you mention in your own educational programmes and activities that the territory has other UNESCO designations?	10	0		0	
ivA.1.o	Have you developed common promotional activities and materials (e.g., press conferences, participation in tourism fairs) in conjunction with other UNESCO designated sites that contain logos of all those represented? (Please give details)	10	0		0	
	Maximum Total		160	0	60	0

		Yes	No	Not applicable*		
ivA.2	**Overlapping with other (non UNESCO) international designated areas and/or nominations (RAMSAR, Natura 2000, etc.)**					
ivA.2.a	Does your (a)UGGp overlap or encompass any other international designated site(s)? If yes, please provide the official name(s) of these designations. If no, please select not applicable and go to criteria v	☑		☐		
ivA.2.b	Is there a relationship and/or complementarity between your (a)UGGp and the other international designated sites within the territory? (Please give details)	20	0		20	
ivA.2.c	Have other international designated areas and/or international nominations been informed about the aUGGp nomination?	10	0		10	
ivA.2.d	Does their management body support the (a)UGGp application?	10	0		7	
ivA.2.e	Does the (a)UGGp have a formal partnership agreement with the other international designated sites?	20	0		15	
ivA.2.f	Is there a clear justification for how the UGGp status will add value to the territory by being independently branded ? (Please give details)	10	0		10	
ivA.2.g	Do you organize common meetings with the other international designated sites management and exchange experiences? (Please give details)	10	0		10	
ivA.2.h	Do you organize common capacity building activities for the management body of both designations?	10	0		10	
ivA.2.i	Do you organize common training for staff of both designations (guides, rangers, etc.)?	10	0		10	
ivA.2.j	Do you develop common infrastructure to facilitate field activities? (Please give details)	10	0		10	
ivA.2.k	Have you developed specific tools to provide a clear, visible and independent branding for your (a)UGGp?	10	0		10	
ivA.2.l	Do you develop common activities with the other international protected areas management?	10	0		10	
ivA.2.m	Do you mention in your own educational programmes and activities that the territory has other international designations?	10	0		10	
ivA.2.n	Do you develop common promotion and communication activities featuring both logos (press conferences, participation in tourist fairs, etc.) with the other international designated sites? (Please give details)	10	0		10	
	Maximum Total		150	0	142	0

Criterion iv subtotal	**Maximum Points**	**Maximum point for N/A**	**Self-Assessment**	**Evaluators' Estimate**
	310	**	202	0

*** when not applicable, click check box and corresponding maximum score.**

**** calculate maximum score based on N/A options**

	Criterion v: (v) UNESCO Global Geoparks should actively involve local communities (vA) and indigenous peoples (vB) as key stakeholders in the Geopark. In partnership with local communities, a co-management plan needs to be drafted and implemented that provides for the social and economic needs of local populations, protects the landscape in which they live and conserves their cultural identity. It is recommended that all relevant local and regional actors and authorities be represented in the management of a UNESCO Global Geopark. Local and indigenous knowledge, practice and management systems should be included, alongside science, in the planning and management of the area.	Points Available			Self-Assessment	Evaluators' Estimate
	Please provide requested lists and details as a separate annex referring to the corresponding item numbers, but do not send entire publications, brochures, etc. (these should only be provided to field evaluators)					
vA	**Local communities**					
	(a)UGGp Involvement	**Yes**	**No**			
vA.1	Are the local community and local leaders formally and actively involved in your (a)UGGp? (Please give details)	20	0		20	
vA.2	Are the local community and local leaders represented inside the (a)UGGp management structure?	20	0		20	
vA.3	Are the local community and local leaders participating in the drafting and implementation of (a)UGGp activities and projects?	20	0		20	
	Maximum Total		**60**		**60**	**0**
	Participation in the (a)UGGp Management Plan	**Yes**	**No**			
vA.4	Does your (a)UGGp management plan include proposals from local authorities / communities? (Please explain)	20	0		20	
vA.5	Is your (a)UGGp management plan implemented in collaboration with local communities?	10	0		10	
vA.6	Does your (a)UGGp management plan include activities to meet the social and economic needs of local communities?	10	0		10	
vA.7	Does your (a)UGGp management plan include activities to protect the landscape in which the local communities live?	10	0		10	
vA.8	Does your (a)UGGp management plan include activities to protect the environment (water, resources, agricultural areas, etc.) in which the local communities live?	10	0		10	
vA.9	Does your (a)UGGp management plan include activities to preserve, study and promote the cultural identity of the local communities?	10	0		10	
	Maximum Total		**70**		**70**	**0**
	Participation in the (a)UGGp Management Body	**Yes**	**No**			
vA.10	Does your (a)UGGp management body include representatives of the local authorities?	10	0		10	
vA.11	Does your (a)UGGp management body include relevant organisations and institutions to ensure all aspects of your geological, natural and cultural heritage are represented. (Please provide a list and organigram)	10	0		10	
vA.12	Does your (a)UGGp management body include representatives of the local university, museums, geological surveys, research institutes, and any other relevant scientific institutions? (Please give a list)	10	0		10	
vA.13	Does your (a)UGGp have a dedicated multidisciplinary scientific committee that includes scientists from all relevant disciplines?	10	0		10	
	Maximum Total		**40**		**40**	**0**
	Traditional knowledge, practice and management systems at the (a)UGGp	**Yes**	**No**			
vA.14	Is your (a)UGGp working towards transfering traditional knowledge, practices and management systems to the younger generation? (Please give details)	20	0		20	
vA.15	Does your (a)UGGp support research and inventories on traditional knowledge and culture? (Please give details)	10	0		10	
	Maximum Total		**30**		**30**	**0**
vB	**Indigenous peoples**					
	(a)UGGp Involvement and participation in the (a)UGGp Management Body	**Yes**	**No**	**Not applica**		
vB.1	Do indigenous peoples live within your (a)UGGp? (If not applicable, please go to criterion vi)	☐		☑		
vB.2	Are you aware of the areas where indigenous population(s) are living? (Please give details)	10	0			
vB.3	Are indigenous peoples formally and actively involved in your (a)UGGp? (Please give details)	20	0			
vB.4	Is the indigenous population represented inside the (a)UGGp management structure?	20	0			
vB.5	Does the indigenous population participate in the drafting and implementation of (a)UGGp actions and projects?	20	0			
vB.6	Does your (a)UGGP have formal partnerships with specialists in your indigenous populations (ethnologist, etc.) at universities / institutions ? (Please explain)	10	0			
	Maximum Total		**80**	**0**	**0**	**0**

	Criterion v: (v) UNESCO Global Geoparks should actively involve local communities (vA) and indigenous peoples (vB) as key stakeholders in the Geopark. In partnership with local communities, a co-management plan needs to be drafted and implemented that provides for the social and economic needs of local populations, protects the landscape in which they live and conserves their cultural identity. It is recommended that all relevant local and regional actors and authorities be represented in the management of a UNESCO Global Geopark. Local and indigenous knowledge, practice and management systems should be included, alongside science, in the planning and management of the area.	Points Available			Self-Assessment	Evaluators' Estimate
	Participation in the (a)UGGp Management Plan	**Yes**	**No**			
vB.7	Does your (a)UGGp management plan include proposals from indigenous communities? (Please explain)	20	0			
vB.8	Does your (a)UGGp management plan include activities to meet the social, environmental and economic needs of indigenous communities?	10	0			
vB.9	Does your (a)UGGp management plan include activities to preserve, study and promote the cultural identity of the indigenous communities?	10	0			
	Maximum Total	**40**		**0**	**0**	**0**
	Indigenous knowledge, practice and management systems at the (a)UGGp	**Yes**	**No**			
vB.10	Does your (a)UGGp support research and inventories on indigenous knowledge and culture? (Please give details)	10	0			
vB.11	Does your (a)UGGp promote the inclusion of indigenous knowledge practice management systems in its scientific activities, formal and informal education programs?	10	0			
vB.12	Does your a)UGGp scientific committee include specialists from the indigenous communities of the territory?	20	0			
	Maximum Total	**40**		**0**	**0**	**0**
	Indigenous languages	**Yes**	**No**			
vB.13	Is your (a)UGGp actively involved in the teaching and transmission of the indigenous languages?	20	0			
vB.14	Does your (a)UGGp develop activities in indigenous languages?	20	0			
vB.15	If this language is a written language, does the (a)UGGp systematically ensure production of information material about the Geopark in these languages?	10	0			
vB.16	Can your (a)UGGp rely on temporary or permanent staff able to speak each one of the indigenous languages?	10	0			
vB.17	Do you have information material for visitors that presents the indigenous populations and their culture?	10	0			
vB.18	Do you participate in national or international days and events dedicated to indigenous peoples?	10	0			
	Maximum Total	**80**		**0**	**0**	**0**

Criterion v subtotal	Maximum Points	Maximum point for N/A	Self-Assessment	Evaluators' Estimate
	440	200	200	0

*** when not applicable, click check box and corresponding maximum score.**

	Criterion vi: (vi) UNESCO Global Geoparks are encouraged to share their experience and advice and to undertake joint projects within the GGN (ViA). Membership of GGN is obligatory.			Points Available		Self-Assessment	Evaluators' Estimate
	Please provide requested lists and details as a separate annex referring to the corresponding item numbers, but do not send entire publications, brochures, etc. (these should only be provided to field evaluators)						
viA	**Networking**						
				Yes	**No**	**Not applicable***	
viA.1	If an UGGp exists in your country, have you met its management team and visited its territory? (Please give a list).			10	0	☐	10	
viA.2	Have you visited an UGGp in another country and met its management team? (Please give a list)			10	0		10	
viA.3	Has your (a)UGGp Team participated in national, regional or international Geopark related meeting(s)? (Please explain)			20	0		20	
viA.4	Has a member of your (a)UGGp Team undertaken an UGGp intensive course or training supported by UNESCO/GGN?			10	0		10	
viA.5	Does your (a)UGGp have a formal and active collaboration agreement with another UGGp? (Please give details)			10	0		0	
viA.6	Does your (a)UGGp participate in common projects with another UGGp? (Please give details)			10	0		0	
viA.7	Does your (a)UGGp define a yearly plan of action and implementation in the frame of this common project(s)?			10	0		0	
viA.8	Does your (a)UGGp participate in cooperation and exchange activities with another UGGp (twinning, field visits, etc.)?			10	0		0	
viA.9	Does your (a)UGGp encourage and support contact and cooperation with schools of another UGGp (video meetings, common projects, visits, etc.)?			10	0		0	
viA.10	Is there a National Committee of forum for UGGps in your country and do you actively engage with it?			10	0		10	
			Maximum Total		100	80	60	0

Criterion vi subtotal	Maximum Points	Maximum point for N/A	Self-Assessment	Evaluators' Estimate
	100	80	60	0

*** when not applicable, click check box and corresponding maximum score.**

	Criterion vii: (vii) A UNESCO Global Geopark must respect local and national laws relating to the protection of geological heritage. The defining geological heritage sites within a UNESCO Global	Points Available		Self-Assessment	Evaluator's Estimate
	Please provide requested lists and details as a separate annex referring to the corresponding item numbers, but do not send entire publications, brochures, etc. (these should only be provided to field evaluators)				
viiA	**Protection of geological heritage**				
	Legal instruments to protect geological heritage	**Yes**	**No**		
viiA.1	Does the entire territory have legal protection because of its geological value? (Please give details)	20	0	0	
viiA.2	Are parts of the area protected by law for its geological interest? (Please refer to which part and why)	20	0	20	
viiA.3	Are the most important geological sites of your (a)UGGp already legally protected? (Please give a list)	20	0	20	
viiA.4	Has the (a)UGGp management body legal authority (directly or indirectly) to enforce the law in case of damage and misuse of geological heritage sites?	20	0	20	
	Maximum Total		**80**	**60**	**0**
	Protection activities of geological heritage	**Yes**	**No**		
viiA.5	Does your (a)UGGp undertake initiatives to promote the protection of geological heritage locally and nationally? (Please give details)	20	0	**20**	
viiA.6	Does your (a)UGGp actively discourage the unsustainable collection of geological materials in general?	10	0	**10**	
viiA.7	Does your (a)UGGp actively discourage unsustainable trade in geological materials in general?	10	0	**10**	
	Maximum Total		**40**	**40**	**0**
	Illegal Mining	**Yes**	**No**		
viiA.8	Do illegal mines or quarries exist within your (a)UGGp's territory? (in case of NO please go to viiB)	0	30	**30**	
viiA.9	If illegal mines and quarries exist in the (a)UGGp territory, do you cooperate actively with local administration to mitigate their activities?	**Yes** 20	**No** 0		
viiA.10	If illegal mines and quarries exist in your (a)UGGp, does the (a)UGGp organize information meetings with the population on the value of geological heritage and local regulation of quarries and mines?	10	0		
	Maximum Total		**30**	**30**	**0**
viiB	**Selling of geological objects**				
		Yes	**No**		
viiB.1	Do you have active campaigns to discourage the collection and selling of rocks?	20	0	0	
viiB.2	Are fossils, minerals, and polished or ornamental rocks on sale close by or inside the (a)UGGp sites (for instance inside museums, tourist offices, ...)?	0	20	20	
viiB.3	If fossils, minerals, and polished and ornamental rocks are legally sold inside your (a)UGGp, do you provide support to their owner for developing economical alternatives?	**Yes** 10	**No** 0	0	
viiB.4	If these geological objects are mainly composed of fossils, does your (a)UGGp propose cast techniques that can be transferred through training to the owners and be used as an economical alternative for their businesses?	10	0	0	
	Maximum Total		**40**	**20**	**0**

Criterion vii subtotal			**Maximum Points**	**Self-Assessment**	**Evaluator's Estimate**
			190	**150**	**0**

ANNEX 1B
SELF-EVALUATION BACKGROUND DOCUMENT (EXPLANATIONS, DETAILS, EXAMPLES)

Criterion i: (i) UNESCO Global (a)UGGp must be single, unified geographical areas (iA) where sites and landscapes of international geological significance (iB) are managed in a holistic concept of protection (iC), education (iD), research (iE) and sustainable development (iF). A UNESCO Global (a) UGGp must have a clearly defined border, be of adequate size to fulfil its functions and contain geological heritage of international significance as independently verified by scientific professionals.

iA Unified territory

iA.4 Do you have a significant population living in your (a) UGGp? (Please give details)

Approximately 1.5 million inhabitants live in the (a)UGGp Schelde Delta. With a surface area of 5,500 km^2, this gives an average population density of 273 inhabitants per km^2.

iB International value of the geological heritage, geodiversity and singularity

IB.1 Do your sites of international importance have international recognition? (based for example on scientific referencing or international publications. Please give details)

Yes. The large estuaries of the Scheldt (sites G-03 and G-17, incl. the upstream parts G-29 and 30 and the brackish tidal marsh G-16) are internationally recognized for studies on tidal sedimentology, morphodynamics, biogeomorphology, ecology and flood protection issues, and are often referred to in review papers for purpose of comparison with similar sites around the world. The Rupel area (sites G-32 and 35) is the Oligocene historical unit-stratotype of the Rupelian stage in the International Commission of Stratigraphy reference chronostratigraphic chart. The rich record of large marine mammal fossils is a paleontological/paleobiological internationally recognized element of the Neogene of the southern North Sea basin (a.o. sites G-17 and 28). See also the list of international peer-reviewed publications per geosite as listed in question iB.2, which demonstrates the importance and recognition of these sites in international research. Note that especially the Western Scheldt (G-17) is mentioned in highly rated journals such as Nature and Science.

iB.2 Do you have international scientific and academic research carried out on the sites of international importance? (Please provide a list)

Yes. See the appendix below for (non-exhaustive) lists of international peer-reviewed publications in the field of geology and related Earth Sciences disciplines for each of our sites of international importance. These lists not only contain research carried out on the sites themselves but also international review papers that refer to these sites for comparison purposes or as part of reference data sets used in these studies.
These publication lists do not include the numerous PhD and MSc studies carried out on these sites, although these often result in one or more international peer-reviewed publications which can be found in the lists.

List of International peer-reviewed publications on the geosites of international importance in the (a)UGGp Schelde Delta

G-01. Kop van Schouwen

van den Berg, J.H., 1977a. A fast procedure for sampling sedimentary structures down to 1.1 m, in unconsolidated wet sands. Geol. Mijnbouw 56, 259–262.

van den Berg, J.H., 1977b. Morphodynamic development and preservation of physical sedimentary structures in two prograding recent ridge and runnel beaches along the Dutch coast. Geol. Mijnbouw 56, 185–202.

van der Valk, B., Beekman, F., 2013. Living in a dynamic landscape: the dune area on the island of Schouwen, province of Zeeland, during the late prehistory and early historical period, in: Thoen, E., Borger, G.J., de Kraker, A.M.J., Soens, T., Tys, D., Vervaet, L., Weerts, H.J.T. (Eds.), Landscapes or Seascapes?, Comparative Rural History of the North Sea Area. Brepols Publishers, Turnhout, pp. 127–143.
https://doi.org/10.1484/M.CORN.1.101551

van Haperen, A.M.M., 2013. Natural and anthropogenic factors in the origin and evolution of the dune landscape on the islands of the south-west Netherlands, in: Thoen, E., Borger, G.J., de Kraker, A.M.J., Soens, T., Tys, D., Vervaet, L., Weerts, H.J.T. (Eds.), Landscapes or Seascapes?, Comparative Rural History of the North Sea Area. Brepols Publishers, Turnhout, pp. 111–126.
https://doi.org/10.1484/M.CORN.1.101550

van Heeringen, R.M., 1988. Iron Age occupation of the dunes near Haamstede on the island of Schouwen-Duiveland, Province of Zeeland, The Netherlands. Helinium 28, 63–80.

G-03. Eastern Scheldt

Allen, J.R.L., 2000. Morphodynamics of Holocene salt marshes: a review sketch from the Atlantic and Southern North Sea coasts of Europe. Quaternary Science Reviews 19, 1155–1231.
https://doi.org/10.1016/S0277-3791(99)00034-7

Bos, J.A.A., Huisman, D.J., Kiden, P., Hoek, W.Z., van Geel, B., 2005. Early Holocene environmental change in the Kreekrak area (Zeeland, SW-Netherlands): A multi-proxy analysis. Palaeogeography, Palaeoclimatology, Palaeoecology 227, 259–289.
https://doi.org/10.1016/j.palaeo.2005.05.020

de Boer, P.L., 1998. Intertidal Sediments: Composition and Structure, in: Eisma, D., de Boer, P.L., Cadée, G.C., Dijkema, K., Ridderinkhof, H., Philippart, C. (Eds.), Intertidal Deposits - River Mouths, Tidal Flats, and Coastal Lagoons. CRC Press, London, pp. 345–361.

de Boer, P.L., Oost, A.P., Visser, M.J., 1989. The diurnal inequality of the tide as a parameter for recognizing tidal influences. Journal of Sedimentary Research 59, 912–921.
https://doi.org/10.1306/212F90B1-2B24-11D7-8648000102C1865D

de Kraker, A.M.J., 2015. Flooding in river mouths: human caused or natural events? Five centuries of flooding events in the SW Netherlands, 1500–2000. Hydrology and Earth System Sciences 19, 2673–2684.
https://doi.org/10.5194/hess-19-2673-2015

de Kraker, A.M.J., 2011. Sustainable coastal management, past, present and future or how to deal with the tides. Water Hist 3, 145–162.
https://doi.org/10.1007/s12685-011-0041-8

de Kraker, A.M.J., 2006. Flood events in the southwestern Netherlands and coastal Belgium, 1400–1953. Hydrological Sciences Journal 51, 913–929.
https://doi.org/10.1623/hysj.51.5.913

de Vet, P.L.M., van Prooijen, B.C., Schrijvershof, R.A., van der Werf, J.J., Ysebaert, T., Schrijver, M.C., Wang, Z.B., 2018. The Importance of Combined Tidal and Meteorological Forces for the Flow and Sediment Transport on Intertidal Shoals. Journal of Geophysical Research: Earth Surface 123, 2464–2480.
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G-30. Freshwater tidal area and polders of the Scheldt

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iB.3 Does your (a)UGGp have a diverse range of geological time periods? (Please give details)
The (a)UGGp has a diverse range of geological time periods as detailed in the Candidate's Application, more specifically the Paleogene, Neogene, and Quarternary (Pleistocene and Holocene) are represented

iB.4 Do you value different Earth Sciences disciplines present in your (a)UGGp? (for example geomorphology, sedimentology, paleontology, ecology, geohydrology,.. Please give details)
Yes. Besides geology in a broad sense (incl. geomorphology, morphodynamics, sedimentology, geophysics, paleoclimatology, applied geology etc.) many other Earth Sciences disciplines contribute, separately or in interdisciplinary combinations, to the understanding of the landscape and its evolution in the (a)UGGp Scheldt Delta. Examples are remote sensing (aerial photography, LIDAR-based DTM's, INSAR, airborne electromagnetic surveys etc.), soil science, surface water hydrology and hydrography, marine science, geoarchaeology, historical geography and cartography, human and physical geography, geoinformatics (GIS), environmental science, landscape ecology, biogeography, meteorology and climatology.

International Geodiversity Day on LinkedIn

iB.5 Do you promote the geodiversity of your (a)UGGp to the public? (Please give details)
The (a)UGGp supports and promotes the geodiversity of the different sites in the (a)UGGp area in our educational and promotional material as well as in our communication. For example on the website where the geology of each geosite individually is explained. In the context of International Geodiversity Day (6 October), the (a)UGGp highlighted via social media the high geodiversity of the area and its relationship with biodiversity and restoration of biodiversity in the area. In addition to showcasing geodiversity at the various geosites, we connect geodiversity to culture, heritage, biodiversity, climate change and sustainability through thematic storylines
By means of excursions in the geosites, educational programmes at the various geosites but also in schools, the geopark training module for Host of the Landscape and the stimulation of geotourism, the awareness of the importance of geodiversity is continuously raised. In addition, through fieldwork and field trips, students from various universities are familiarized with the geodiversity of and subsequent research in the (a)UGGp.

A. GENERAL INFORMATION

TABLE List of Geopark geosites

Geosite nr	Geosite	Geomorphology	Sedimentology	Paleontology	Stratigraphy	geological period	scenic	cultural or historical	archaeological	natural	industrial or economic	Main geological interest	scientific interest	educational interest	(geo)tourist interest	Teaching equipment	Type of pressure	Significance
		Geological interest(s)				Geosite interest(s)												
1	Kop van Schouwen	X	X			Q	X	X	X	X		Coastal and coastal dune morphology and processes	X	X	X	1, 2, 3, 4, 5	I, C, S	i
2	Dintelse Gorzen	X	X			Q	X			X		Morphology and pedology of tidal flats and salt marshes, recently 'fossilized' and undergoing desalinization after removal of the tides		X	X	1, 2, 3, 4, 5	I	p
3	Eastern Scheldt	X	X	X	X	Q	X	X	X	X	X	Estuarine morphology, morphodynamics, sedimentology	X	X	X	1, 2, 3, 4, 5	E, C, W, S	i
4	Pluimpot tidal channel remnant	X				Q		X		X		Tidal channel morphology (embanked), relief inversion		X		2, 4	I, E	n
5	Veerse Meer and Schenge	X	X			Q	X	X		X		Embanked tidal channel with 'fossilized' estuarine morphology		X	X	2, 3, 4, 5	I, E, S	n
6	Dune complex Oranjezon and the Manteling	X	X	X		Q	X	X	X	X		Coastal and coastal dune morphology and processes	X	X	X	1, 2, 3, 4, 5	I, C, S	n
7	Beach ridge of Walcheren	X				Q		X	X			Coastal morphology	X		X	4	L, S	p
8	Creek ridges and pool grounds of Walcheren	X	X			Q	X	X	X			Morphology of impoldered tidal channel and salt marsh landscape with relief inversion features ('creek ridges')	X	X	X	4, 5	L, C, S	p
9	Coastal dunes of southwest Walcheren	X	X			Q	X	X	X	X		Coastal and coastal dune morphology and processes	X	X	X	4, 5	I, C, W, S	n
10	Oudland area De Poel	X				Q	X	X	X	X		Morphology of impoldered salt marsh landscape on peat with relief inversion of small tidal channels ('creek ridges')	X	X	X	1, 2, 4, 5	C, L	n
11	Kolk lakes of Zuid-Beveland	X	X	X		Q	X	X		X		Morphology and genesis of kolk lakes resulting from historical dike breaches along former tidal channels		X	X	1, 2, 3, 4, 5	E	p
12	Yerseke and Kapelse Moer	X				Q	X	X	X	X		Morphology of impoldered salt marsh landscape with features of historical peat extraction	X	X	X	2, 4, 5	I, L, C	n
13	Markiezaat	X	X			Q		X	X	X		Morphology and pedology of tidal flats and salt marshes 'fossilized' and undergoing desalinization after recent embankment	X	X	X	1, 2, 3, 4,	E, C, S	n
14	Smalle Beek Valley	X				Q	X	X	X	X		Fluvial morphology of small stream valley eroded during the Quaternary		X	X	4	E, L, C, S	n
15	Brabant Escarpment - Kalmthoutse Heide	X	X	X	X	Q	X	X	X	X	X	Quaternary fluvial cliff face erosion in exposed Lower Pleistocene estuarine deposits; Late Quaternary inland dune morphology, stratigraphy and genesis	X	X	X	1, 2, 3, 4, 5	I, L, C	i
16	Drowned Land of Saeftinghe	X	X			Q	X	X	X	X		Brackish-water tidal flat and marsh morphology, sedimentology and processes	X	X	X	1, 2, 3, 4, 5	I, E, C, W	i
17	Western Scheldt	X	X	X	X	Q	X	X	X	X	X	Estuarine morphology, morphodynamics, sedimentology	X	X	X	2, 3, 4, 5	E, L, C, W	i
18	Drowned Zwarte Polder	X	X	X		Q	X	X	X	X		Coastal morphology and processes (small tidal inlet with tidal flats and salt marshes)	X	X	X	2, 4, 5	I, C	n
19	Zwin	X	X			Q	X	X	X	X		Coastal, coastal dune and tidal flat and salt marsh morphology and processes	X	X	X	1, 2, 3, 4, 5	I, C	i
20	Zwin creek remnants and Passageule	X				Q	X	X	X	X		Morphology of dammed and impoldered tidal channel and creek system	X	X	X	3, 4, 5	E, L	n
21	Zwin polders near Damme	X				Q	X	X	X			Morphology of impoldered tidal landscape with relief inversion of former tidal channels and creeks	X	X		2, 3, 4, 5	E, L	n

UNESCO GLOBAL **GEOPARK CANDIDATE'S APPLICATION**

Geosite nr	Geosite	Geomorphology	Sedimentology	Pedology	Stratigraphy	geological period	scenic	cultural or historical	archaeological	natural	industrial or economic	Main geological interest	scientific interest	educational interest	(geo)tourist interest	Teaching equipment	Type of pressure	Significance
		Geological interest(s)				Geosite interest(s)												
22	Creek and coversand area Sint-Margriete - Aardenburg	X	X			Q	X	X	X	X		Morphology of impoldered tidal landscape with remnants of tidal channels and creeks breaching eolian coversand ridges of Late Weichselian age	X	X	X	1, 2, 3, 4, 5	E,L,C,S	n
23	Braakman region	X				Q		X	X	X		Morphology of impoldered large and long-lived tidal channel and creek system		X	X	1, 2, 3, 4, 5	E,L	p
24	Otheense Kreek	X				Q		X	X	X		Morphology of impoldered well-preserved tidal channel and creek system and surrounding tidal landscape			X	4	E,L,S	n
25	Coversand area Sint Jansteen	X	X			Q	X	X	X	X		Morphology of impoldered tidal landscape with remnants of tidal channels and creeks breaching eolian coversand ridges of Late Weichselian age	X	X	X	2,4,5	I,C,S	n
26	Oudland area De Putting	X				Q	X	X	X	X		Morphology of impoldered salt marsh landscape with features of historical peat extraction and relief inversion of small tidal channels		X		4	L,C	p
27	Nieuw-Namen	X	X	X	X	N, Q	X	X	X			Inselberg morphology of Pliocene deposits in Holocene polder landscape; sedimentology, paleontology, stratigraphy and pedology of exposed Pliocene and Quaternary deposits	X	X	X	2, 3, 4, 5	I,R	i
28	Waasland Scheldt Polders	X	X	X		Q	X	X	X	X	X	Morphology of impoldered tidal landscape with features of reclamation and flooding history; the harbour works temporarily exposed sections in Neogene to Quaternary deposits	X	X	X	1,2,4,5	L,S	n
29	Brackish tidal marshes of the Scheldt	X	X			Q		X		X	X	Estuarine morphology, morphodynamics and sedimentology	X	X		1,2,5	E,C,L	i
30	Freshwater tidal area and polders of the Scheldt	X	X			Q	X	X	X	X	X	Estuarine and fluvial morphology, sedimentology and processes	X	X	X	1, 2, 3, 4, 5	C,L,W	i
31	Durme Valley	X				Q	X	X	X	X		Estuarine and fluvial morphology and processes	X	X	X	1, 2, 3, 4, 5	C,L,W,S	n
32	Boom cuesta	X	X	X	X	P, Q		X	X		X	Morphology and structural geology (cuesta); sedimentology, paleontology, stratigraphy and economic geology (Paleogene deposits, brick industry)	X	X	X	1, 2, 3, 4, 5	E	i
33	Rupel Valley	X				Q			X	X	X	Estuarine and fluvial morphology and processes		X		2, 3, 4	E,C,W,S	n
34	Barbierbeek Valley	X				Q	X	X	X	X		Fluvial morphology and processes		X	X	4,5	E,C,L,W,S	p
35	Waasland cuesta	X	X	X	X	P, Q	X	X	X	X	X	Morphology and structural geology (cuesta); sedimentology, paleontology, stratigraphy and economic geology (Paleogene deposits, brick industry)	X	X	X	1, 2, 3, 4, 5		i
36	Paleomeanders Kalkense Meersen and Berlare	X	X	X		Q	X	X	X	X		Fluvial morphology, sedimentology and paleohydrology of Weichselian Lateglacial meanders	X	X	X	1, 2, 3, 4, 5	I,C,W	n
37	Moervaart depression and coversand ridge	X	X	X	X	Q	X	X	X	X		Fluvial and aeolian morphology, sedimentology, paleohydrology, paleoecology and stratigraphy of Weichselian Lateglacial lake deposits	X	X	X	2, 3, 4, 5	E,W,L	i
38	Steengelaag clay quarry	X	X		X	P	X	X		X	X	Morphology and structural geology (cuesta); sedimentology, stratigraphy and economic geology (Paleogene deposits)		X	X	2, 4, 5		p
39	Paleovalley of the Oude Kale	X	X			Q	X	X	X	X		Fluvial and eolian morphology and sedimentology	X	X	X	2, 3, 4,5	C	p
40	Oedelem-Zomergem cuesta	X	X	X	X	P, Q	X	X	X	X		Morphology and structural geology (cuesta); sedimentology, paleontology and stratigraphy (Paleogene deposits)	X	X	X	1, 2, 3, 4, 5	I,E,C,S	n

Legenda

Geological Period
- Q Quaternary
- N Neogene
- P Paleogene

Teaching Equipment
- 1 Visitors Center
- 2 Excursions/guided tours
- 3 Educational material
- 4 Unguided walking and cycling route
- 5 Other (e.g. infopanels)

Pressure
- I Intensive entry
- E Environmental damage
- R Removal or looting
- C Climate change
- L Leveling and excavation
- W Water safety measures
- S Spatial development

Significance
- i international
- n national
- p provincial

Cleaning the banks and beaches of the Scheldt Delta

iC Geological site conservation

iC.3 Do you have an active geological sites' database for monitoring the sites in the entire (a)UGGp? (Please give details)
The (a)UGGp has an active geological sites' database. Besides all the basic information on the geological features and scientific importance, this database also contains the relevance in terms of tourism, education, research, protection and the vulnerabilities being monitored from the (a)UGGp and partners. The presence of (a)UGGp information panels and their state of maintenance are also monitored. This database also includes the policy plans for maintenance, cleaning, non-destructive on-site implementations, intervention measures and regulations of the sites. These plans are composed by our partners responsible for managing and maintaining the geosites. However, when they create a new plan the regulations about the (a)UGGp sites are updated in the database.

iC.4 Do you have a list of geological sites that clearly identifies their use (e.g., education, tourism, recreation)? (Please provide a list)
Yes. This is also part of the geological sites' database (question iC.3). The table of geosites from the Candidate's Application also highlights these specific issues. This table is reproduced below.

iC.6 Do you have an (a)UGGp map indicating the geological sites? (Please give details)
Yes, we have several maps showing the geosites (e.g. on the website and in a brochure). As an example, below is the map from Annex 4 of the Candidate's Application which also shows all the geosites in relation to other aspects in the (a)UGGp.

iC.7 Do you monitor and assure the enforcement of general regulations (directly or indirectly) to prevent misuse and damage of the entire (a)UGGp? (Please give details)
The entire (a)UGGp area is subject to legal regulations around public order and safety (supervision and enforcement of undesirable behaviour, vandalism, pollution). There are also regulations around spatial planning that prevent unauthorized spatial developments in the area. The (a)UGGp government partners have a role in this in terms of licensing, monitoring, supervision and enforcement based on their own legal position and responsibility. This applies both on land and on water in the entire (a)UGGp. The site management organizations, (a) UGGp partners, monitor and assure the enforcement of general regulations to prevent misuse and damage. In this matter, they have to compare a policy plan which describes all of these activities. These organizations share their policy plans with the (a) UGGp regularly so when there is an update in these the (a)UGGp organization is aware of these updates. The policy plans about monitoring and assuring are included in the (a)UGGp database. The (a)UGGp website also describes the code of conduct. This code of conduct is aimed at preventing misuse and damage of the park. Next to this, the partners provide panels on the sites indicating the vulnerability and rules of the area to visitors.

iC.8 Do you inform visitors about the regulations to prevent misuse and damage of individual sites in the (a)UGGp (in situ)? (Please give details)
Yes, the (a)UGGp organization informs visitors about regulations to prevent abuse and damage to individual sites. This is done through the website where the code of conduct is displayed. Rules of conduct are also displayed on leaflets. At geosites and nature reserves, signs display the rules of conduct, commandments and prohibitions. In these areas, forest rangers and supervisors also check for undesirable behaviour, e.g. checks on mountain bikers cycling outside the designated paths and thus damaging geological heritage and natural values (or a positive attitude towards good behaviour). On excursions led by guides and foresters, attention is also paid to these aspects in order to gain an understanding of the vulnerability of the areas. The various visitor centers at sites also pay attention to this.

iC.10 Do you organize regular maintenance and cleaning of sites? (Please give details on how often they are checked, etc.)
The site management organizations, (a)UGGp's partners, organize the maintenance and cleaning of the sites. In this matter, they have to compare a policy plan which describes all of these activities. These organizations share their policy plans with the (a)UGGp regularly so when there is an update in these the (a)UGGp organization is also up-to-date. The policy plans about cleaning and maintenance are included in the (a)UGGp database. For site management organizations, removing (litter) is part of the daily routine. After all, litter in geosites and nature reserves, apart from being a very disturbing sight and the risk of soil and groundwater pollution, is also hugely dangerous for animals. This also applies to maintenance of infrastructure in the areas such as fencing, benches, tables to ensure the safety of people, animals and the area.

On several Saturdays a year (early spring and early autumn), hundreds of volunteers clean the banks and beaches of the Scheldt Delta. They do this by picking up stranded litter during the annual 'Clean Scheldt' clean-up operations. Over 30 partners have signed the Clean Scheldt cooperation covenant with a common goal: reducing litter in and around the Scheldt. This way, we ensure visibly cleaner water and cleaner banks and reduce the flow of litter into the North Sea. To tackle the litter problem at source, cooperation is essential. The more organizations and people are active and feel responsible for the problem, the more awareness will be created and people will be reached. The covenant encourages this cooperation. A particularly important partner in the cooperation is (a)UGGp partner Rijkswaterstaat. Among other things, it monitors the waters and banks for pollution, facilitates the collection and disposal of litter after clean-up operations and helps communicate and teach about the problem of litter.

iC.13 Is destroying and removing parts of the geological heritage prohibited? (Please give details)
The code of conduct prohibits the disturbance and removal of geological heritage. The legal basis for this is provided by laws and regulations in the Netherlands and Belgium. Our selection of geosites have legal protection as an area of geological value, nature reserve, cultural area or protected landscape. There is therefore a comprehensive set of different legal instruments relating to the protection of geosites and the geological heritage within them. In the Dutch part, geosites are protected from the Earth Heritage Policy and many geosites also by Natura 2000 legislation. An important legal instrument that prevents unwanted excavation of geological heritage is the Earth Removal Act. This is a law that forces excavation activities, where soil material is removed, to go through a permit process including an assessment on impact, utility and necessity. Additional Dutch legal instruments for some geosites are the Nature Network, PMV Environmental Protection Area, Groundwater Protection Area, Archaeological National Monument, Provincially Valuable Landscape or National Landscape.

For Belgian geosites, in addition to nature legislation such as Natura-2000, the legal instruments are the status of protected landscape (a derivative of the connection between geology, geomorphology, nature and heritage), protected village or townscape (landscape zones in which no uncontrolled disturbances are allowed) or protected archaeological zones. Geosites in the coastal zone are protected by the Dune Decree. This decree protects the dunes from excavation and disturbance.

iD Education

iD.6 Have you produced educational tools explaining the geological heritage of your (a)UGGp? (Please provide a list)

- Geological Map
- Elevation Map explaining the relation between geology, geomorphology en hydrology
- 3D visualization showing from an equal vantage point for different locations in the (a)UGGp the development over time of the landscape through geological history
- Movie of the geological and geomorphological history of the (a)UGGp
- Various brochures and leaflets
- Descriptions of the geosites within the (a)UGGp
- Information panels at geosites
- The website of the (a)UGGp
- An education teaching package for primary schools
- Presentations on the geological origins and development of the area
- A Geopark teaching module for the Hosts of the Landscape course
- A training module for guides

Educational presentation on the geological origins and development of the Eastern Scheldt

Six educational Storylines of the (a)UGGp

iD.7 Have you produced educational tools linking geological heritage to natural, cultural and intangible cultural heritage? (Please provide a list)

- Movie, 3D experience and platform concerning the drowned villages as a metaphor for climate change and sea level rise
- 3D visualization showing from an equal vantage point for different locations in the (a)UGGp the development over time of the landscape through geological history
- Six Story Lines addressing six themes that address the (a) UGGp's heritage (natural, cultural and intangible)
- Various brochures and leaflets
- Information panels at geosites
- The website of the (a)UGGp
- Descriptions of cultural sites (that have a strong link with geology) within the (a)UGGp
- Artistic photos of Rem van den Bosch of the series 'Here Comes The Flood' and 'Zeeuws Meisje (Zeeland Girl)'
- Partnered with various museums to exhibit this topic
- The Archaeology Days brings attention to this topic
- An education teaching package for primary schools
- The Geoweek

iD.8 Have you developed activities or educational tools focused on environmental good practices in the area? (Please provide a list)

- The Geoweek
- Flemish and Dutch Archaeology Days
- An education teaching package for primary schools
- Teaching box 'Energy Transition' (energietransitie)
- A Geopark teaching module for the Hosts of the Landscape course
- Lecture '(a)UGGp Schelde Delta' for inhabitants
- Educational material at Fabriek Energiek (energy and climate)
- Educational material at De Kaaihoeve (biodiversity, soil, food)
- Educational material at Bastion VIII (biodiversity, climate)
- A variety of teaching packages on sustainability, environment, nature, water and landscape (Nature and Environment Education ((a)UGGp partners)

iD9. Do you organize educational programmes on geohazards and disaster risk reduction? (Please provide a list)

- The Watersnoodmuseum (Flood Museum), (a)UGGp partner addresses the phenomenon of floods and storm surges and the creation of safety against these natural disasters. There are education programmes around this theme for different age groups. The museum carries a penetrating and poignant message that contributes to the awareness of continuous attention to water safety.
- In February 2023, it will be 70 years since a large part of the area of the (a)UGGp faced a disastrous flood disaster that killed thousands of people. In 2023, the Watersnoodmuseum (Flood Museum) will pay extensive attention to this event but also to the prevention of new flood disasters. The (a)UGGp is closely involved in the development of the plans.
- A (a)UGGp lesson plan for primary schools on the theme "Here comes the flood" which focuses on raising awareness about our vulnerability and concern for water safety and climate change.

iD.10 Do you organize educational programmes on climate change? (Please provide a list)

A key objective of the (a)UGGp is to show, from the line past-present-future, that the area has constantly had to deal with climate changes and sea level changes in its geological history, but also how, over the past 2,000 years, man has dealt with this and actually turned the area into one big living laboratory. We want to highlight the principles, mistakes, successes and lessons to a wide audience through experience and education. By doing so, we raise awareness and draw attention to the accelerated climate change that we are now facing, and provide them with lessons from the past to be inspired to face the future. This concept is embedded in many of our activities and educational resources.

- The Geoweek.
- Flemish and Dutch Archaeology Days (show the traces of climate change).
- An education teaching package for primary schools.
- A Geopark teaching module for the Hosts of the Landscape course.
- Lecture '(a)UGGp Schelde Delta' for inhabitants.
- Movie, 3D experience and platform concerning the drowned villages as a metaphor for climate change and sea level rise
- Artistic photos of Rem van den Bosch of the series 'Here Comes The Flood'.
- A (a)UGGp lesson plan for primary schools on the theme "Here comes the flood" which focuses on raising awareness about our vulnerability and concern for water safety and climate change.

Here Comes the Flood

iE Research

iE.1 Do you have a formal partnership with a scientific institution or university? (Please provide a list)

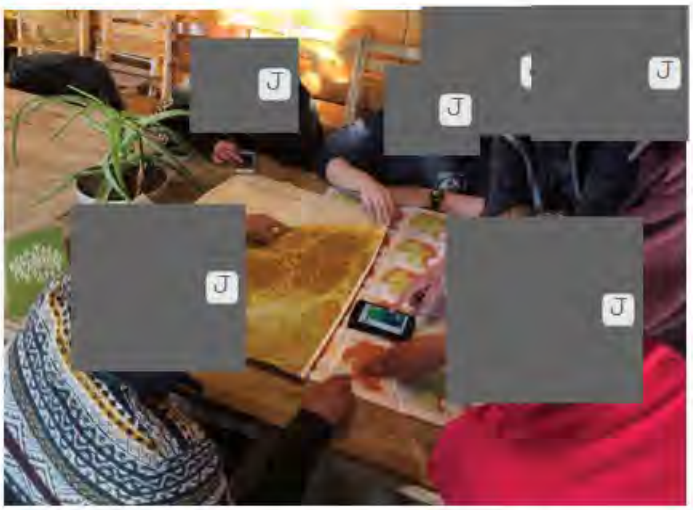
The following scientific institutions or universities are official partners of (a)UGGp Schelde Delta:

- Arteveld University of Applied Sciences Ghent
- Belgium Society of Paleontology (Belgische vereniging voor Paleontologie vzw)
- Breda University of Applied Sciences, Academy for Tourism
- CILUE + VU Amsterdam (The interfaculty Research Institute for Culture, Cognition, History and Heritage)
- Geological Survey of Belgium (Belgisch Geologische Dienst)
- Geological Survey of the Netherlands (Geologische Dienst Nederland - TNO)
- HZ University of Applied Sciences and Delta Platform
- Royal Netherlands Institute for Sea Research (Koninklijk Nederlands Instituut voor Onderzoek der Zee - NIOZ)
- UCR University College Roosevelt, Middelburg
- University of Antwerp
- University of Ghent
- VU Amsterdam, Earth Sciences and Humanities
- Workgroup Geology of the Royal Zeeuwsch Society of Sciences (Koninklijk Zeeuwsch Genootschap der Wetenschappen)

iE.2 Are you informed about active research taking place in your (a)UGGp in the fields of geology, ecology, culture, social and human sciences and/or sustainable development, climate change? (Please provide a list)

The (a)UGGp has a 'scientific board of advisors'. This board consists of 31 scientists from both the Netherlands and Belgium, who help to create and judge all informative products that are being made for the (a)UGGp on scientific accuracy. Most of these members are connected to scientific institutions and are active

researchers on the different scientific disciplines in the (a)UGGp.
- The scientific board of advisors hosts, exchanges and reports on ongoing research and research programmes within various scientific disciplines relevant to the (a)UGGp.
- The bibliography of scientific publications related to the field of (a)UGGp is kept up-to-date by the scientific board of advisors
- The Royal NIOZ currently has a PhD position for the (a)UGGp. Research is taking place to model and visualize the post Roman peat development in the Scheldt Delta and the gradual drowning and transition to an intertidal area. This to identify principles around peat development that may be applicable to stimulate future peat development in making the area climate-proof
- Together with the (a)UGGp partners VU Amsterdam, NIOZ, WAD and the province of Zeeland research take place to reconstruct the peat development in the lower parts of (a)UGGp Schelde Delta.



Field resaerch to reconstruct the peat development in the lower parts of (a)UGGp Schelde Delta.

iE.3 Do universities use your (a)UGGp for camps or field work activities in any of these fields of study? (Please provide a list)
HZ University of Applied Sciences - Water management: Educational field research 2019 and 2020 (before COVID-19): module Read the Landscape for first-year students (3 days camp)
Result: a vision statement / future perspective for the (a)UGGp Schelde area supported by a written report that addresses the research (sub)questions and a presentation that offers good visuals of the opportunities in the area (like maps, impressions, drawings, etc.)
- Dune complex Oranjezon and the Manteling (geosite)
- Plan Tureluur (nature-site area of the geosite Eastern Scheldt)
- Dintelse Gorzen (geosite)
- Brabant Escarpment - Kalmthoutse Heide (geosite)
- Kaloot Strand (beach part with fossils of geosite Western Scheldt)
- Drowned Land of Saeftinghe (geosite)
- Durme Valley (geosite)
- Paleomeanders Kalkense Meersen and Berlare (geosite)
- Freshwater tidal area and polders of the Scheldt (geosite)
- Coversand area Sint Jansteen (geosite)

Field Research Minor Peat Development lower parts (a)UGGp Schelde Delta for third-years students Earth SciencesVU Amsterdam, 2022
Together with the (a)UGGp parters VU Amsterdam, NIOZ, WAD and the province of Zeeland, a Minor is being designed for 3rd year earth-sciences students to reconstruct the peat development in the lower parts of (a)UGGp Schelde Delta. A 3 days field work is included.
- Creek ridges and pool grounds of Walcheren (geosite)

Breda University of Applied Sciences, Academy for Tourism
Develop a new, memorable concept for a chosen geosite in the (a)UGGp Schelde Delta (including field work):
- Oosterscheldemuseum (Eastern Scheldt Museum) and surrounding area (part of geosite Eastern Scheldt)
- Museum Rupelklei and surrounding area (part of geosite Boom Cuesta)

Visit of students Eastern Scheldt Museum

Design a prototype for an (online and/or offline) event (or a series of activities) for a selected target group of this location/Geosite to make the target group aware of the challenges around climate change, and increase visibility, perception and accessibility of the area. The concept is sustainable and can be used in the long term and for each of the chosen sites. Translate this into a creative concept for an event and a marketing communication campaign to inform people about the battle against water.

For the media part of this assignment, the goal is to create a marketing communication campaign that achieves the stated goals of the campaign. In order to guide the development of the marketing communication campaign, develop a campaign document to promote the developed concept/event including a teaser video. This campaign document is the foundation of your creative project, which includes all the necessary information for its development.

Field-excursion for students Department of Physical Geography University Utrecht
- Brabant Escarpment - Kalmthoutse Heide (geosite)
- Western Scheldt (geosite)
- Drowned Land of Saeftinghe (geosite)

Artevelde University of Applied Sciences Ghent – professional bachelor secondary education
Bachelor thesis on teachers programs or visitor access to several geosites or cultural sites (including field work)

- Moervaart depression and coversand ridge (geosite)
- Freshwater tidal area and polders of the Scheldt (geosite)
- Paleomeanders Kalkense Meersen and Berlare (geosite)

HZ University of Applied Sciences - Water management and Civil Engineering: The Integrated Coastal Challenge 2022, A research assignment with fieldwork for 4th year students
Develop a strategy for sustainable development of the case area in the (a)UGGp in view of climate change and sea level rise by using knowledge of natural processes, geological developments and lessons from past human activities

- Western Scheldt (geosite)

iF Sustainable economic development

iF.1.a Do visitors to your area easily recognize and understand that they are in an (a)UGGp? (Please give details)
Visitors recognize and understand that they are in a (a)UGGp, as the (a)UGGp Scheldt Delta logo can be found on information panels in the area (including geosites, nature reserves). The recognition and visibility of the (a)UGGp is the main function of the Entrance Points (visitor centers, museums) as they are used to explore the whole area from there. In addition, the partners and the Hosts of the Landscape (hospitality and recreation entrepreneurs) have a sticker, shield and/or flag of the (a)UGGp Scheldt Delta logo at the entrance of their buildings and also leaflet displays of the (a)UGGp are also present at the visiting points.

Of course, there is also the (a)UGGp website that is quickly found when people do a search regarding this area. Partners also point to the (a)UGGp in general and for specific activities. The tourist organizations that provide an important interface/portal for tourists and recreationists through their websites are made aware of the (a)UGGp.

The placement of entrance signs next to roads is problematic for the time being. This is due to a strict policy on signage by national governments in the Netherlands and Belgium. For instance, a very strict rule is that signs of an internationally known labels for areas can only be placed if the status has actually been obtained. The (a)UGGp, together with UGGp De Hondsrug, the National UNESCO Commission, the Netherlands Marketing Bureau and the Bureau of National Parks, is lobbying the national government to adopt a more generous placement policy for signs of internationally prominent area labels.

iF.2.a Do you have panels or other systems providing information on the (a)UGGp sites? (Please give details)
The (a)UGGp has panels and other systems providing information on the sites. These information panels provide a diverse range of information (geology, nature, cultural heritage, climate change) and are spread across the whole area of the (a)UGGp (e.g. geosites, nature reserves, cultural sites, walking network information boards).

Information displays with leaflets of the (a)UGGp can be found at information points, partners and Hosts of the Landscape around the geosites. At a number of museums, specific (a)UGGp products such as animations, 3D visualizations and VR experiences can be found.

Of course, at geosites and nature reserves there are also signs from the partners with the rules of conduct applicable there. Here below are some examples of these information panels:

Information panel of the (a)UGGp

Information panels about the walking networks in a part of the (a)UGGp area. The QR-code provides the same information in other languages

iF.3.e Do you have leaflets, publications, etc., presenting your (a)UGGp? (Please provide a list)
Yes:

- The storylines Z-cards with the top 40 geosites
- The Storylines book dispersed to all of our partners and those interested
- The Brand Guideline Book dispersed to all of our partners
- A folder presenting the (a)UGGp, 10 geosites and their origin
- Generic and area-specific leaflets for the generic and area-specific leaflets for in the leaflet display at Hosts of the Landscape, visit points and partners
- A brochure with lots of in-depth background information on the earth heritage in the coastal plain region (marine clay region with polders) of the (a)UGGp
- A tourism brochure presenting the (a)UGGp in an attractive way

iF.3.h Do you actively use social media tools dedicated to the (a)UGGp? (Please provide a list)

Yes:

- The LinkedIn Schelde Delta page is used to share scientific topics, interesting developments and activities and communicate with the professional relations of the (a)UGGp
- The Schelde Delta YouTube Channel is used to share and document movie clips of activities and impressions of geosites
- The Facebook Schelde Delta profile is used rather to share events, walks and communicate with the inhabitants, and in a next phase with the tourists
- The Instagram Schelde Delta account is made so people can share the pictures of their visit in our (a)UGGp and hashtag them '#Scheldedelta'

(a)UGGp and social media

iF.3.i Have you developed a mobile application dedicated to your (a)UGGp? (Please give details)

Yes:

- The (a)UGGp website is set up for use on smartphones/
- VR experiences have been created that can be viewed with smartphone with or without portable VR glasses

iF.5.b Do you have formal partnerships and agreements with them defining clear common commitments? (Please provide a list)

The (a)UGG has formal partnership agreements by means of a letter of intent. Following partners have made common commitments by signing the agreement:

Initiators

- Europese Groepering voor Territoriale Samenwerking (EGTC) Linieland van Waas en Hulst
- Province of Antwerp
- Province of Oost-Vlaanderen
- Province of Noord-Brabant
- Province of West-Vlaanderen
- Province of Zeeland

Municipalities

- Municipality Aalter
- Municipality Assenede
- Municipality Bergen Op Zoom
- Municipality Berlare
- Municipality Beveren
- Municipality Boom
- Municipality Bornem
- Municipality Borsele
- Municipality Buggenhout
- Municipality Damme
- Municipality Dendermonde
- Municipality Destelbergen
- Municipality Eeklo
- Municipality Essen
- Municipality Evergem
- Municipality Ghent
- Municipality Goes
- Municipality Hamme
- Municipality Hemiksem
- Municipality Hulst
- Municipality Kalmthout
- Municipality Kapelle
- Municipality Kapellen
- Municipality Kaprijke
- Municipality Knokke-Heist
- Municipality Kruibeke
- Municipality Laarne
- Municipality Lochristi
- Municipality Lokeren
- Municipality Lovendegem (Lievegem)
- Municipality Maldegem
- Municipality Middelburg
- Municipality Moerbeke
- Municipality Niel
- Municipality Noord-Beveland
- Municipality Reimerswaal
- Municipality Roosendaal
- Municipality Rumst
- Municipality Schelle
- Municipality Schouwen-Duiveland
- Municipality Sint- Amands Puurs
- Municipality Sint Gillis Waas
- Municipality Sint Laureins
- Municipality Sint Niklaas
- Municipality Sluis
- Municipality Stabroek
- Municipality Steenbergen
- Municipality Stekene
- Municipality Temse
- Municipality Terneuzen
- Municipality Tholen
- Municipality Veere
- Municipality Vlissingen
- Municipality Waarschoot (Lievegem)
- Municipality Waasmunster
- Municipality Wachtebeke
- Municipality Wetteren
- Municipality Wichelen
- Municipality Willebroek
- Municipality Woensdrecht
- Municipality Zele
- Municipality Zomergem (Lievegem)
- Municipality Zwijndrecht

Water authorities
- Waterschap Brabantse Delta

Economics, transport and infrastructure
- Havenbedrijf Antwerpen
- North Sea Port
- Rijkswaterstaat Zee en Delta

Universities, universities of applied sciences and knowledge institutions
- Artevelde University of Applied Sciences Ghent
- Geological Survey of Belgium (BGD)
- Geological Survey of the Netherlands (TNO)
- Breda University of Applied Sciences
- CLUE and Vrije Universiteit Amsterdam
- Delta Platform
- HZ University of Applied Sciences
- NIOZ Royal Netherlands Institute for Sea Research
- Pontes Scholengroep breed
- Scalda
- UCR University College Roosevelt
- University of Antwerp
- University of Ghent
- Vrije Universiteit Amsterdam – Earth sciences
- Vrije Universiteit Amsterdam – Humanities studies

Intermunicipal partnerships
- Intergemeentelijk Samenwerkingsverband DDS (Oost-Vlaanderen)
- Intergemeentelijk Samenwerkingsverband van het Land van Waas
- Veneco

Nature parks, landscape parks and area partnerships
- Grenspark Kalmthoutse Heide
- Landschapspark Borsele
- Oosterschelde National Park
- Regionaal Landschap Schelde Durme
- Stichting De Brabantse Wal
- Streekorganisatie Brabantse Wal
- Waterpoort

Nature, environmental and landscape organizations and site management organizations
- Natuurpunt Rupelstreek
- Staatsbosbeheer
- Stad Damme
- Stichting Landschapsbeheer Zeeland
- Stichting Het Zeeuws Landschap
- Vereniging Natuurmonumenten
- Zeeuwse Milieufederatie

Education
- NME Zeeland
- Outward Bound Nederland
- Stichting IVN Natuureducatie
- Stichting Natuurpodium de Brabantse Wal

Tourism and recreation
- Toerisme Klein-Brabant – Scheldeland vzw
- Toerisme Meetjesland vzw
- Toerisme Oost-Vlaanderen
- Toerisme Scheldeland vzw
- Toerisme Vlaanderen
- Toerisme Waasland vzw
- Toeristisch Ondernemend Zeeland
- Visit Damme

Geology, paleontology, heritage and cultural (history) Belgische vereniging voor Paleontologie vzw
- Centrum voor Beeldende Kunst Zeeland
- Erfgoed Zeeland
- Erfpunt
- Huis van de Evolutie
- Museum voor Natuur en landschap Terra Maris
- Oosterschelde Museum (Museum of the Eastern Scheldt)
- SteM Sint-Niklaas – Mercatormuseum
- Stichting Gidsenteam Zeeuws-Vlaanderen
- Walcherse Archeologische Dienst
- Watersnoodmuseum en Nationaal Kennis- en Herinngeringscentrum Watersnood 1953
- Werkgroep Geologie van het Koninklijk Zeeuws Genootschap der Wetenschappen
- Zeeuws maritiem MuZEEum
- Zeus Arts – Rem van den Bosch
- Zeeuws Archief

iF.5.d Do you have initiatives to showcase and promote the marketing of local products / food? (Please give details)
Yes. The (a)UGGp supports and promotes the use of locally sourced products and food. Amongst the different narratives that are composed for the (a)UGGp is the storyline 'Briny and sweet'. Thanks to the geology and natural conditions, the (a) UGGp offers a great range of possibilities for the processing of regional produce with a diversified taste. Whenever the (a)UGGp organizes a (public) meeting, the goal is to always offer at least one or more regional products to the attending public. Next to that, the narrative 'Briny and sweet is strictly intertwined with (protected) cultural heritage in the (a)UGGp, like the beer brewing (bierbrouwen), anchovy culture (weervisserij), specific method for preserving herring (haringkaken) , traditional stew from the Rupel region (Boomse Schep). Specific shellfish products from the estuaries are also promoted. By (a)UGGp ambassador Rem van den Bosch, the so-called mussel burger has been developed as a specific product from the Scheldt Delta. This product scores maximum as a sustainable product with low carbon footprint. Several Hosts of the Landscape have a farm shop where fresh regional products are sold to residents and tourists or who serve sustainable regional dishes prepared from local produce in their restaurant.

Characteristic of the De Bevelanden region in the (a)UGGp, because of the sandy creek ridges, is fruit cultivation (including apples, pears, blackcurrants). The Fruit Growing Museum pays specific attention to this and also ensures that old knowledge about pruning, caring for fruit trees and old fruit varieties is passed on to future generations.

Fresh asparagus from the Brabant Escarpment

The (a)UGGp also work with a Food Archaeologist. Using archaeological research, he reconstructs traditional dishes from centuries ago and also prepares them for the purpose of (historical) events and tastings.

(a)UGGp Schelde Delta is a participant in the IGCP-726 project on GEOfood. It is being investigated whether the GEOfood quality mark can be applied as an additional label alongside the regional quality marks in the Scheldt Delta when the UGGp status is obtained in order to link the Scheldt Delta internationally with products from other UGGp's.

iF.5.e Do you actively promote local sustainable and/or organic food and gastronomy? (Please give details)
Yes. The (a)UGGp aims to promote the use and consumption of locally sourced products and gastronomy. One of the five narratives of the (a)UGGp is all about 'Briny and sweet'. This storyline explains the great diversity of foods that can be grown in the (a)UGGp and relates this to the diverse geological conditions of the soil that make this great variety possible. Also, the (a)UGGp promotes the 'short-chain'. Thanks to the great variety of products that can be grown in the (a)UGGp, it is relatively easy to establish short food chain networks throughout the (a)UGGp. Within the Interreg project "(Be)leefbare Schelde", it is currently being explored whether the transport of regional sustainable products within the (a)UGGp can be done with traditional sailing ships that are simultaneously used for transporting tourists. For more, see also at iF.5.d.

iF.6.a Have you created a basic general tourism strategy for at least the next four years or is the (a)UGGp embedded within an overarching local tourism strategy? (Please give details)
The (a)UGGp has described its tourism strategy in the management plan "Future Image and Lines of Force Geopark Scheldt Delta 2030". This strategy is an elaboration and particularization of the tourism strategies developed for the area from the tourism organizations (partners (a)UGGp). For instance, for the province of Zeeland, the tourism vision "Zeeland Destination 2030" has been formulated that focuses on sustainable tourism development (tourism as a means for sustainable development and not as an end in itself), pays attention to climate adaptation and puts natural and cultural heritage in the foreground. The (a)UGGp is also part within this vision. Tourism East Flanders calls for using tourism as a means to create a better society and also calls for putting natural and cultural heritage in the foreground. The national tourism visions ("Perspective 2030" -The Netherlands and "Travel to Tomorrow" - Belgium) have the same approach. This allows us to see from the national level the regional translations and an elaboration from the (a)UGGp in an interrelationship that can be put under one heading of Leisure for a better Society.

Within the (a)UGGp Interreg Netherlands - Flanders project (Be) leefbare Schelde, work will be done over the next 4 years to actually implement this strategy with a 10 million euro investment agenda.

Screenshot from the website of the tourism strategic vision Bestemming Zeeland 2030 in which the (a)UGGp is part of

iF.6c Do you have promotional material available for visitors? (Please provide a list)
Yes:
- The storylines Z-cards with the top 40 geosites
- The Storylines book dispersed to all of our partners and those interested
- A folder presenting the (a)UGGp, 10 geosites and their origin
- Generic and area-specific leaflets for the generic and area-specific leaflets for in the leaflet display at Hosts of the Landscape, visit points and partners
- A tourism brochure presenting the (a)UGGp in an attractive way
- A brochure with lots of in-depth background information on the earth heritage in the coastal plain region (marine clay region with polders) of the (a)UGGp

iF.7.a Do you organize a range of events that help promote and celebrate the natural, cultural and intangible cultural heritage of the (a)UGGp? (Please explain)
The (a)UGGp Scheldedelta is shaped by an extensive partner network in which individual partners have their own activities or bundled joint activities that are profiled under the (a)UGGp label if applicable. This creates a large offering in terms of nature experience and culture (history)/heritage throughout the area. The (a)UGGp also organizes events that take place simultaneously throughout the area. Geoweek and Archaeology Days are examples of this.

Geoweek is aimed at primary and secondary school classes aged 10 to 15. Through guest lessons and field expeditions, they are introduced to geological, geomorphological, soil and hydrological phenomena in their own living environment. The Archaeology Days target young and old through public activities

on archaeology throughout the area. Important events in which the (a)UGGp is involved are the so-called experience weeks in three areas in the (a)UGGp: the Eastern Scheldt, the Grevelingen and the Zwin. These experience weeks focus on nature, cultural history, culture, regional products and sustainability

iF7a Celebrating the Archaeology Days

iF.7.d Do you organize and/or support cultural and social events within your (a)UGGp in a sustainable way? (Please explain)
The (a)UGGp is closely involved in various cultural/art projects in which artists, experts, tutors, entrepreneurs and residents work closely together to create value for an area from sustainability, togetherness and quality thinking.

- In 2021, (a)UGGp was closely involved in the project "Saeftinghe 2021 Vast and Intimate". An activity programme that was dedicated to the beauty of the landscape in the Saeftinghe area (geosite). Local landscape and human elements come together in the landscape and inspiring young artists in a 3-in-1 Masterclass - Workshop - Residence. Due to the involvement of the (a)UGGp, the Dutch National UNESCO Commission was so impressed that it attached its patronage to the project.
- A new art and culture project is currently being set up in cooperation with the (a)UGGp: "Border Cases, four scenarios for water safety, their implications for broad welfare and what if things do turn out differently". With this, we hope to initiate a social dialogue around scenario thinking on climate change.
- (a)UGGp participated in the art/photo project "Zeeland Girl" in which, in an appropriate setting, residents from the area were photographed in traditional dress but with prints referring to social themes. The whole thing was captured in a booklet which also focused on the (a)UGGp. The photos are very popular in the area because they really capture the imagination.
- In addition, the (a)UGGp participates in the photography project "Here Comes the Flood". Models in an alarm red costume pose on so-called vulnerability ladders and indicate with their hand how high the water gets at the moment there is no sea wall or the sea wall would collapse. Photographer Rem van den Bosch is an ambassador of the (a)UGGp and dispatched by us from there to take pictures all over the low-lying parts of the Netherlands and Flanders in familiar places. This has resulted in a series of exhibitions surrounded by dialogue meetings and guest lectures in the Netherlands and Flanders including in the centre of Amsterdam and at Schiphol Airport. We also received an invitation from the United Nations to exhibit this work at its headquarters in New York, which we consider a special honor!
- A special social activity of the (a)UGGp is the creation of a VR image bank for the benefit of elderly and infirm people. Loneliness is common among the elderly, especially at a time when mobility is severely restricted. Under the motto "when people can no longer enjoy nature and landscape outside, we bring it to them", the production of a VR experience for people with low mobility and dementia has begun. A VR experience is hugely stimulating for social interaction. Together with the care sector, a plan de campaign is now being set up to create an image bank of VR material from the (a)UGGp. Volunteers and staff from care organizations are being worked on for this purpose.

Criterion ii: (ii) UNESCO Global (a)UGGps should use that heritage, in connection with all other aspects of that area's natural and cultural heritage, to promote awareness of key issues facing society (iiA) in the context of the dynamic planet we all live on, including but not limited to increasing knowledge and understanding of: geoprocesses; geohazards; climate change (iiB); the need for the sustainable use of Earth's natural resources (iiC); the evolution of life and the empowerment of indigenous peoples.

iiA.1 Other natural heritage - biotic

iiA.1.a Are you aware of the designated natural heritage (international, national, local level like for example a UNESCO Biosphere Reserve, a Ramsar site, World Heritage site, National Park, Natura 2000 site,...) present in your (a)UGGp? (Please give details)
Within the boundaries of the (a)UGGp most of the natural heritage is recognized and designated by international, regional or local institutions. The different types of natural heritage can be easily accessed by open access GIS- Viewers: https://www.geopunt.be/ (Flanders) and https://geocontent.rvo.nl/Natura2000/ (the Netherlands). On an international level, a large part of the (a)UGGp Schelde Delta is designated by European Natura2000-area. The (a)UGGp encompasses iconic natural reserves, including existing Ramsar areas, transnational Nature reserves and National Parks. For Flanders and the Netherlands the most important natural designations are the Flemish Ecological Network (VEN) and the Nature Network Zeeland and Brabant which covers the most valuable and delicate nature.

Biodiversity-rich wetlands along the Eastern Scheldt

Some of the areas around the Flemish Ecological Network are designated as Nature Improvement and Nature Connection Areas (IVON). Other important designations are the Dune decree, the historic permanent grasslands (HPL), areas covered by nature management plans, landscape relicts and "landschappelijke gehelen". The scientific board of advisors of the (a)UGGp Schelde Delta made a selection of natural sites that are representative for the area. For example, because of characteristic delta nature. For this purpose experts of partnered nature organizations were surveyed. In fact there are two lists: a longlist consisting of natural sites that have an in-depth relation with the (a)UGGp and a shortlist consisting of the most important and representative sites.

iiA.1.b Have you identified, or started to identify the non-designated natural heritage in your (a)UGGp territory in an inventory? (Please give details)
As stated in Criterion iiA.1 the most part of the natural heritage within the (a)UGGp is designated and described by the governments as the (a)UGGp is intensively researched. For example the geosites are almost completely designated. On a detail level there can be small parts which aren't part of any designations as private terrains. For the remaining natural heritage there is no systematic territorial inventory system within the (a)UGGp. Each city or nature association is responsible for the registration of their non- natural heritage on local level. These areas are known to the various nature organizations. As soon as opportunities arise for acquiring these pieces of nature through purchase or land exchange, these areas will be added to the network of nature reserves with a view to creating more robust ecological connecting zones.

iiA.1.c Do you communicate and promote your natural heritage? (Please give details)
The (a)UGGp focuses its communication and promotion on the natural heritage related to the thematic storylines of the (a)UGGp and does so through its local partners, as well as through its own communication strategy. The territory has a well-established leisure and tourism offer which is promoted by the regional tourism associations. The (a)UGGp Schelde Delta strengthens this and adds additional things to see, learn and experience. We collaborate with the regarding local and regional partners to achieve this goal. Natural heritage is promoted by the individual site-managing organizations such as Natuurpunt, Agency for Nature and Forest (Agentschap voor Natuur en Bos – ANB), Staatsbosbeheer, Natuurmomumenten, het Zeeuwse Landschap, het Brabantse Landschap, Stichting Landschapsbeheer Zeeland and local NGO's such as Stichting de Brabantse Wal. Amongst others, the offer can be found online via:
https://www.zeeland.com/nl-nl/visit/wat-te-doen/natuur-in-zeeland
https://www.natuurpunt.be/
https://www.natuurenbos.be/activiteiten
https://www.brabantslandschap.nl/actueel/activiteiten/

iiA.1.e Has your (a)UGGp developed formal partnership agreements with institutions / communities / NGOs operating in your aUGGp territory in the field of natural heritage? (Please provide a list)
Following institutions or regional landscape parks related to natural heritage signed the letter of intent as a formal partnership agreement:

Nature parks, landscape parks and area partnerships
- Grenspark Kalmthoutse Heide
- Landschapspark Borsele
- Oosterschelde National Park
- Regionaal Landschap Schelde Durme
- Stichting De Brabantse Wal
- Streekorganisatie Brabantse Wal
- Waterpoort

Nature, environmental and landscape organizations and site management organizations
- Natuurpunt Rupelstreek
- Staatsbosbeheer
- Stad Damme
- Stichting Landschapsbeheer Zeeland
- Stichting Het Zeeuws Landschap
- Vereniging Natuurmonumenten
- Zeeuwse Milieufederatie

Education
- NME Zeeland
- Outward Bound Nederland
- Stichting IVN Natuureducatie
- Stichting Natuurpodium de Brabantse Wal

iiA.1.g Do you have activities (education, tourism, etc.) connecting geological heritage with aspects of the natural heritage? (Please give details)
Yes. Certain excursions hosted by site-managing organizations connect geological heritage with aspects of natural heritage. Those activities can be found on several geosites throughout the (a)UGGp territory, like in the 'drowned Land of Saeftinghe', the 'quarry Nieuw-Namen', in the 'Yerseke Moer', in the Rupelstreek and in 't Landschapspark Drongengoed, amongst others. In addition, we developed educational tools to connect the geological heritage with the natural heritage as the 3D visualizations showing the development over time of the landscape through geological history.

Important annual activities in which geology, nature and cultural history are jointly celebrated are the experience weeks. During these weeks, excursions, educational activities and lectures are organized. The experience weeks currently take place in three areas within the (a)UGGp:
- The Eastern Scheldt
- The Grevelingen
- The Zwin

Activity in which both nature and geology are central to the (a)UGGp

iiA.2 Tangible cultural heritage

iiA.2.a Are you aware of the designated cultural heritage (international, national, local level like for example a UNESCO World heritage site, national protected monument, recognized archeological sites..) present in your (a)UGGp territory? (Please give details)

Within the boundaries of the (a)UGGp most of the cultural heritage is designated. The cultural heritage in the area is recognized, covered and maintained by local, regional or national governmental institutions. The (a)UGGp overlaps with two UNESCO World Heritage sites: the Flemish Beguinage of Dendermonde and the Flemish Belfries of Dendermonde and Eeklo.

Several cultural history and archaeological organizations are represented within the partnership and the scientific board of advisors.

The (a)UGGp has many thousands of monuments protected at the national to municipal level. Budget is made available from the government for maintenance of monuments. The (a)UGGp Schelde Delta is characterised by very rich and omnipresent elements of cultural heritage that can be classified according to the thematic storylines. The scientific board of advisors of the (a) UGGp Schelde Delta made a selection of cultural sites that are representative for the area. For this purpose experts of partnered heritage organizations were surveyed. In fact there are two lists: a longlist consisting of cultural sites that have an thorough relation with the (a)UGGp and a shortlist consisting of the most important and representative sites. For example topsites that are related to the storyline 'rich grounds to sustain' are Huysman Farm (Eeklo), the medieval villages of Tieringe (municipality of Kapelle) and the Abbey Sint Bernardus (Hemiksem).

Important archaeological sites have protection as archaeological monuments. A well-known example within the (a)UGGp is the archaeological site of the Drowned City of Reimerswaal (eastern part of the Eastern Scheldt). Led by the municipality of Tholen, the (a)UGGp is working here to make the city contours visible again in combination with social tasks in the area. This is how we are working on a living cultural heritage in a sustainable way.

Tangible Cultural Heritage such as the monumental brickmaking site in the Rupel region

iiA.2.b Have you identified, or started to identify the non-designated cultural heritage in your (a)UGGp territory in an inventory, ? (Please give details)

The (a)UGGp consists of a wide array of cultural heritage and has many thousands of monuments protected at the national to municipal level. Most of the known monuments, landscapes and archaeological heritage sites are designated by the government (Flanders Heritage Agency and Cultural Heritage Agency, the Dutch National Cultural Heritage Agency and the municipalities in the Netherlands). For the remaining cultural heritage there is no systematic territorial inventory system within the (a)UGGp. Each city or heritage association is responsible for the registration of their non- designated cultural heritage on local level. However, the non-designated cultural heritage is known and if an opportunity arises for purchase or conservation in consultation with the owner, it is seized, depending on the financial position of the municipality or other organizations involved. Also within nature organizations and landscape management organizations, (a)UGGp partners, especially in the rural area, a close eye is kept on whether there are opportunities for preserving farmers' heritage that has not been designated as a monument. This includes characteristic buildings on farms, cultural-historical elements in the landscape but also historical farmland paths. The water boards are very keen on the preservation of old hydraulic works that are so characteristic of the Scheldt Delta area.

iiA.2.g Do you communicate and promote your cultural heritage? (Please give details)

In the (a)UGGp, geology, landscape and cultural history are very much intertwined. If you want to read the landscape you will have to include cultural-historical developments in addition to geological processes. This integrated approach belongs to (a)UGGp Scheldt Delta and is also reflected everywhere in eductive material, information panels, brochures, website, excursions and activities. The (a)UGGp focuses its communication and promotion on the cultural heritage related to the thematic storylines of the (a)UGGp and does so through its local partners, as well as through its own communication strategy. The territory has a well-established leisure and tourism offer which is promoted by the regional tourism associations. The (a)UGGp Schelde Delta strengthens this and adds additional things to see, learn and experience. We collaborate with the regarding local and regional partners to achieve this goal. Examples are:

- Open Monument Day
- Archaeology Days
- Geoweek

Important annual activities in which geology, nature and cultural history are jointly celebrated are the experience weeks. During these weeks, excursions, educational activities and lectures are organized. The experience weeks currently take place in three areas within the (a)UGGp:

- The Eastern Scheldt
- The Grevelingen
- The Zwin

Furthermore we support events of our partners through newsletters, social media and our website.

Excursion to a the drowned village of Nieuwelande during the Eastern Scheldt experience week

iiA.2.h Do you have activities (education, tourism, etc.) connecting geological heritage with aspects of the cultural heritage? (Please give details)

If possible the (a)UGGp proposes to connect the geological heritage with aspects of cultural heritage. We believe that each cultural heritage site has its own individual history and requires a different approach to unlock this history to the audience. Therefore we prefer to work with pilot projects for individual sites which we roll out, and adapt where necessary, to other sites in a larger area. In some cases we do not need to emphasize its geological features but we provide correct information on these features so that they can be included in educational or promotional activities.

An example is the in 1646 re-erected farm on the Drongengoed and pigeon tower which is used as an entrance gate to the (a) UGGp. Geological features of the area in which this farm and tower are located take a prominent role in the exposition 'the secret of the cuesta' and its related educational activities. In contrast, the connection to geological heritage can be made more subtly by, for example, merely providing correct background information as we did for the guides active in the Zwin geosite. Another example is the theme of the Drowned Villages. Storm surges and dike breaches caused the loss of 250 villages in the Scheldt Delta region. Geology, geomorphology and cultural history go hand in hand in the stories here. What we saw in recent years was that attention to the drowned villages was taken up in a fragmented way by often local initiators. The (a) UGGp has therefore established a Platform Drowned Villages that since 2021 stimulates and activates the cooperation between tourist organizations, local initiatives, archaeological partners and knowledge institutes. For example, they are now working together on a common research agenda and strategy around telling the stories about and making the Drowned Villages visible and experienceable.

iiA.3 Intangible cultural heritage

iiA.3.a Are you aware of the designated intangible heritage (international, national, local level, like for example Intangible Cultural Heritage of UNESCO, nationaly protected intangible cultural heritage and traditions, ..) present in your (a)UGGp territory? (Please give details)

The main part of the intangible heritage in both the Netherlands and in Flanders is listed in a database. For the Netherlands: https://www.immaterieelerfgoed.nl/ and for Flanders: https://immaterieelerfgoed.be/nl. Both countries have intangible cultural heritage listed on UNESCO's List of Intangible Cultural Heritage of Humanity which is not exclusively linked with (a)UGGp Schelde Delta, but very relevant. For example, the craft of the miller operating windmills and watermills (the Netherlands) and the beer culture (Belgium). Other adequate examples of designated intangible heritage are the craft of the shipbuilding, duck cage techniques, fishing weirs, oyster beds and mussel farming and the annual riding over the beach and through the sea with farm horses. The origin of these intangible cultural heritage and old crafts can be traced to the natural features (geology, geomorphology, soil conditions, hydrology) of the area. There is a lot of attention to this in the area from (a)UGGp partners such as museums and cultural heritage organizations. Every year there are also many activities in which the intangible heritage is central, such as the mill day, ring stabbing on farm horses and with with farmers' carriages, tourist markets with old crafts, the mussel days in which the shellfish culture is central, traditional costume events, etc.

Ring stabbing with with farmers' carriages with traditional costumes

iiA.3.f Do you communicate and promote your intangible cultural heritage? (Please give details)

One of the six storylines of the (a)UGGp promotes and communicates the intangible cultural heritage: the storyline 'Briny and sweet'. The (a)UGGp has a rich culinary heritage with special savory and sweet stews. In addition, there is a rich history of old crafts, trades and traditions as legends and folk games that have developed on and around the Scheldt and the tributaries (see iiA.3.e). This living heritage can be experienced at events, in museums and in workshops. Amongst others an example of the promotion and communication of intangible cultural heritage is

the shipyard of Baasrode. On this location the craft of shipbuilding is extensively exhibited and promoted.
Famous is the medieval story of the Fox Reinaerde that is said to have taken place on the border of Zeeland Flanders and the Waasland and Meetjesland regions. Many places in the area pay attention to this fable.

Statue of the medieval story of the Fox Reinaerde at Hulst

iiA.3.g Do you have activities (education, tourism, etc.) connecting geological heritage with aspects of the intangible heritage? (Please give details)
The storyline 'Briny and sweet' explains the great diversity of foods that can be grown in the (a)UGGp and relates this to the diverse geological conditions of the soil that makes this great variety possible. The Scheldt estuary culinary history is intertwined with soil and nature. The rich and varied landscapes produce the ingredients for countless regional dishes. Soil which has been reclaimed from the water enables the production of unique produces which in ancient times could only grow in this territory, such as produce of water and briny land. Examples are: briny crops such as glasswort and sea lavender, fishery, mussel-farming, oysters, asparagus, eel and anchovies. A concept of "heritage cuisine" is currently being developed with partners. A mobile setup where, during workshops or meetings, experiments can be made to create tasty dishes with area-specific products that allow people to learn to appreciate the taste of the area more at a time when food is becoming increasingly global.
There is also a rich history of old crafts, trades and traditions that developed on and around the Scheldt and its tributaries and are exhibited by partners in visitor centers, craft sites, museums, folklore markets and workshops.

iiB Topics related to geoprocesses, climate change, natural hazards and renewable energies

iiB.1 Do you implement climate change mitigation and adaptation initiatives in your (a)UGGp? (Please give details)
The strength of the (a)UGGp is that developments and processes of climate change and sea-level change through geologic time, as well as how humans have dealt with them throughout history in the area, are displayed throughout the area at geosites, at lectures, on field trips, in student assignments and studies, and in other activities. Understanding the processes, the impact in the past, the resilience of the area and the system, how people have dealt with it through trial and error provide lessons and inspiration toward the future. That's why we also call this (a)UGGp a Climate Living Lab. It has been so far back in history and will certainly remain so toward the future. We show the line past - present - future, we make it experienceable. In this way we stimulate and inspire residents and visitors to enter a sustainable future with knowledge of the past.
In the coming years we will continue to develop this. Climate awareness is an important theme within the (a)UGGp Interreg Netherlands - Flanders project (Be)leefbare Schelde.
The (a)UGGp Schelde Delta is one of the most vulnerable areas for climate change worldwide, due to its combined characteristics of lowlands, dense population and strong economic activities. Its rich tradition and knowledge of coping and living with the tides and omnipresent water make it an international front-runner on dealing with climate change and sea-level rise. Due to the acceleration of human-made climate change, its effects will become increasingly manifest in the coming decades. It is clear that when it comes to the climate we are facing major challenges. The (a)UGGp wants us to move 'on the tides of time and climate'. We take initiatives for example, through the art/photography/education/dialogue project "Here Comes the Flood" by the artist and ambassador of the (a)UGGp Rem van den Bosch (https://www.remvandenbosch.com/herecomestheflood). Operating closely with local organizations and authorities involved with water awareness, Rem seeks to open up candid discussions about the consequences of the rising water – and what we can do about it.

In addition the (a)UGGp network consists of at least five institutional partners as provinces and all other local authorities (e.g., municipalities, water board) which all have strategies on climate adaptation and mitigation. Work in progress to implement the strategies into local projects. An example of this is the living lab of Schouwen-Duiveland Work in progress to put all of this plans together and discuss further actions on scale of the entire (a)UGGp boundaries and stimulate co-operation.

The (a)UGGp is currently working on the so-called "Deltarium". This will be a mobile installation in which the line past - present - future is strongly visualized and in which visitors can visualize the impact of actions towards the future through scenarios. This Deltarium will travel through the entire area and is aimed at education, awareness and making policy choices.

iiB.2 Do you support climate change mitigation and adaptation initiatives delivered by your partners or stakeholders? (Please give details)
Yes. In our 'Vision for the Future' we describe our core values and state that all initiatives from the network (including all local authorities that signed our intention declaration) are supported by the management body. The Climate Living Lab is one of the core values as the (a)UGGp area has functioned as a Climate Living Lab for centuries. It draws on knowledge about the geological, landscape past, cultural history and dealing with water to find inspiration for new initiatives in water management and climate adaptation, in education and teaching, (applied) scientific research, and tourism.

Because the (a)UGGp consists of a partnership, the initiatives and aspects from iiB.1 are also implemented jointly with and by the partners.

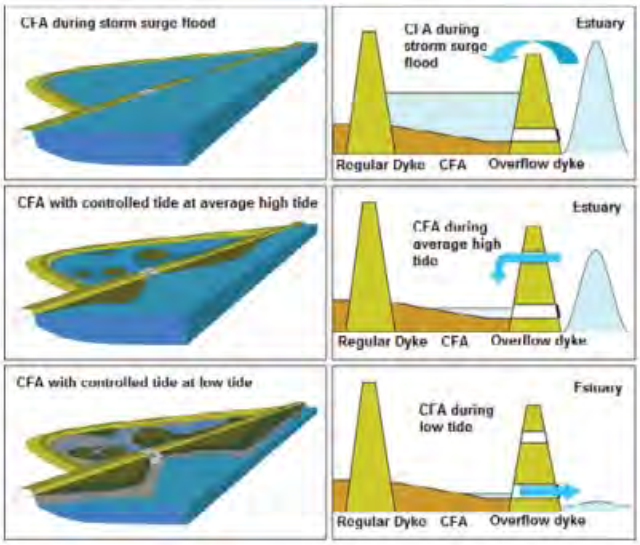
Action line 2: Developments in the Geopark

The aspiring Geopark Scheldt Delta is committed to the Geopark as a Climate Living Lab: knowledge of the Geopark contributes to sustainable climate solutions. Appropriate principles include working with nature, circular construction, densification and the right function at the right (geological) location (and no cost experiments). The Climate Living Lab contributes to the awareness that resilience and working with climate change towards the future offers more perspective than social engineering and rigidity.

iiB.5 Do you implement natural hazard mitigation initiatives in your (a)UGGp? (Please give details)

Five regional governments are at the base of the Geopark network. All of these governments have a climate adaptation and mitigation plan. For example, for the province of Antwerp this plan is called Plan Today 2021-2030. The plan does not only focus on the adaptation and mitigation of the organization itself, but it also unites all the adaptation and mitigation initiatives of territory of the province of Antwerp. For the Scheldt estuary water is a natural hazard. Our network includes partners working together in order to deal with water issues.

Along the estuaries and rivers, continuous efforts are being made for water safety and flood protection. With this, floods are avoided as much as possible. Lessons from the past are very important in this regard. Due to the long history of dike construction since the Middle Ages, an enormous amount of knowledge has been accumulated in the area on how to build dikes robustly but also sustainably. Functional combinations through nature development along the foreshores such as salt marshes and the overflow areas with a large stimulation of biodiversity in the Sigma areas of Flanders show how actively natural hazards are being avoided in the Scheldt Delta.



The operation of a controlled flood area (CFA) of the Sigma Plan

A relatively new natural- hazard that has manifested itself with increasing frequency in the last decade is drought. Due to the changing climate, precipitation and temperature patterns are changing resulting in high precipitation deficit in summer, drying out and warming of soils with low groundwater levels and a major impact on natural and agricultural areas. Besides the mitigation policies in the area of using more sustainable energy (the energy transition) from the governments in the (a)UGGp in order to work on an attenuation of the current climate change, the (a)UGGp partners are also working on avoiding drought and drought damage. Freshwater strategies are being developed and implemented (for example, the Zeeland Delta Plan Freshwater). For example by buffering excess precipitation in the winter for use in the summer, by encouraging creekridge-freshwaterinfiltration in order to stimulate freshwater storage in a predominantly brackish water area but also by re-mandering and water buffering projects of streams giving water more time to infiltrate again (for example at the Smalle Beek Valley near Wouw).

iiC Needs for sustainable use

iiC.2 Do you promote a greater awareness and understanding of the need for the sustainable use of natural resources in your (a)UGGp? (Please give details)

Our sustainable ambitions are described in our intention declaration, our vision of the future and are mentioned on our website. We encourage our partners to only develop activities that contribute to the sustainable development of the region. Otherwise they can no longer be part of the network. Setting up an official framework for this is work in progress and a process of co-operation with all of our partners.

For example, the (a)UGGp embraces the concept of circular construction. This is applied to space aricultations at various geosites. We encourage the use of bicycles and for walking through the area's extensive bicycle and walking network. The Geopark is consistently committed to sustainability: all activities take into account the "Sustainable Development Goals" (SDGs). For example routes and sights in the Geopark are connected to public transport where possible. The descriptions of routes and sights include references to accessibility by public transport.

iiC.3 Do you promote a greater awareness and understanding of your (a)UGGp's water resources and their limitations? (Please give details)

Yes. All provinces within the (a)UGGp have produced strategies on the topic of fresh water and climate adaptation (see also iiB.5). Various European Interegg projects in the border regions of the Netherlands and Belgium have been implemented on the topic of water resources. Apart from that, in the Dutch parts of the (a)UGGp, the provinces of Zeeland and Noord-Brabant are cooperating together within the region of the Southwestern Delta (Zuidwestelijke Delta, https://www.zwdelta.nl/), where they collectively produce strategies and programs, as part of the national Delta Program.

The drinking water companies and water board in the area encourage the economical use of drinking water through campaigns towards the population. This on the one hand from sustainability considerations but also from a necessity due to the increasingly frequent occurrence of drought in the summer months whereby the drinking water supply comes under pressure.

Special attention from the authorities in the area is also given to the recreational sector in order to make the use of materials, consumption of water and energy more sustainable and to stimulate sustainable tourist mobility. Because the number of tourists visiting the area far exceeds the number of inhabitants, sustainability and drinking water measures in this sector have a major impact.

Attention to the scarcity of water in the (a)UGGp. Note the traditional peasant costume with a print of parched soil

iiC.4 Do you deliver or support initiatives to encourage your partners to use water more sustainably? (Please give details)
For the (a)UGGp area where on the one hand in the low coastal plain the groundwater is predominantly brackish, and on the other hand on the higher sandy soils there is a high sensitivity to drought, the sustainable management of water and water availability is essential. Five regional governments are at the base of the Geopark network. All of these governments have a plans to use water more sustainable. For the province of East- Flanders this plan is called 'Climate Action Plan 2021-2025' and for the province of Zeeland this plan is called "The Zeeland Delta Plan Freshwater". This plan incorporates different aspects of climate change but regarding to water it attacks challenges as the use and reuse of water, retention, infiltration, ground water levels and the captation of water. This plan describes a general policy and actively encourages extern partners to use water more sustainably. For the province of North Brabant, the advisory report "Without water, no later" was recently released.

Criterion iii: (iii) UNESCO Global (a)UGGps should be areas with a management body having legal existence recognized under national legislation (iiiA). The management bodies should be appropriately equipped to adequately address the area of the UNESCO Global (a)UGGp in its entirety (iiiB).

iiiA Management body

iiiA.1 Do local decision-makers have a role to play in the (a) UGGp management? (Please give details)
Local decision-makers play a role in the management of the (a) UGGp Scheldt Delta. About three times a year, the (a)UGGp organizes a partner community meeting. This sounding board group includes representatives of more than 140 local and regional organizations and authorities. All partners listed in Criterion iF.5.b are invited to this meeting. This means that representatives of all municipalities and provinces in the area of the global (a)UGGp Scheldt Delta are involved in the activities of the (a)UGGp.

The executive board includes representatives from the 5 provinces involved, each of which ensures alignment with the regional administrative policy and objectives of the (a)UGGp. The steering committee of the (a)UGGp includes administrators from the provinces involved.

Many municipalities and policy officers of organizations are represented in the working groups and in the Interreg Netherlands-Flanders project (Be)leefbare Schelde, which is aimed at realization and strategy, and they work together on the interpretation and development of the (a)UGGp.

iiiA.3 Is there a plan to secure the budget for the (a)UGGp for at least four years? (Please give details)
The organization of the UGGp Schelde Delta is founded and carried out by no less than five powerful and institutional partners, i.e. the regional governments of the five provinces included in the territory of the (a)UGGp Schelde Delta. The five provinces are committed by an agreement to invest together 210.000 euro per year to support the further development of the aspiring (a)UGGp in communication, management and network activities. Each of the provinces also assures at least 1 FTE to carry out the work that needs to be done. The partner agreement states that until no other legal body is founded, it is EGTS Linieland van Waas en Hulst that fulfills this role until the (a)UGGp label has been received. Until the label has been granted, the provinces together with the broad network of involved partners, stated in the intention declaration, will further explore the most suitable legal body.

In the administrative determination of the submission of the Candidate's Application (a)UGGp Schelde Delta, it was also stated that the current line of financial and personnel involvement will be continued in terms of size. Based on the principle of Reliable Government, which is a guiding principle in the Netherlands and Flanders, by agreeing to an application for UGGp status, the five provinces guarantee good governance of the (a)UGGp with associated resources.
In addition to this the five provinces wrote successfully a European project in the Interreg Netherlands – Flanders programme to further boost the development of the (a)UGGp of at least 10.000.000 euro overall cost (with a duration of 2023-2026). The further exploration of our governance model

is included in this project but the project also invests in further development of the entry points to the (a)UGGp, and the connection between these entry points by storytelling and investments in the missing links in our physical network.

iiiA.5 Does the (a)UGGp management body have official partnerships with national, regional and local authorities? (Please give details)

The (a)UGGp Schelde Delta management body has official partnerships with the following national, regional, and local authorities:

National authorities

- Rijkswaterstaat Zee en Delta
- Geological Survey of Belgium (BGD)
- Geological Survey of the Netherlands (TNO)
- Belgium Society of Paleontology
- Royal Netherlands Institute for Sea Research (NIOZ)
- Staatsbosbeheer
- Vereniging Natuurmonumenten

Regional authorities

- Europese Groepering voor Territoriale Samenwerking (EGTC) Linieland van Waas en Hulst
- Province of Antwerp
- Province of Oost-Vlaanderen
- Province of Noord-Brabant
- Province of West-Vlaanderen
- Province of Zeeland
- Erfgoed Zeeland
- Waterschap Brabantse Delta
- Zeeuwse Milieufederatie
- Intergemeentelijk Samenwerkingsverband DDS (Oost-Vlaanderen)
- Intergemeentelijk Samenwerkingsverband van het Land van Waas (Interwaas)
- Veneco

Local authorities

- Municipality Aalter
- Municipality Assenede
- Municipality Bergen Op Zoom
- Municipality Berlare
- Municipality Beveren
- Municipality Boom
- Municipality Bornem
- Municipality Borsele
- Municipality Buggenhout
- Municipality Damme
- Municipality Dendermonde
- Municipality Destelbergen
- Municipality Eeklo
- Municipality Essen
- Municipality Evergem
- Municipality Ghent
- Municipality Goes
- Municipality Hamme
- Municipality Hemiksem
- Municipality Hulst
- Municipality Kalmthout
- Municipality Kapelle
- Municipality Kapellen
- Municipality Kaprijke
- Municipality Knokke-Heist
- Municipality Kruibeke
- Municipality Laarne
- Municipality Lochristi
- Municipality Lokeren
- Municipality Lovendegem (Lievegem)
- Municipality Maldegem
- Municipality Middelburg
- Municipality Moerbeke
- Municipality Niel
- Municipality Noord-Beveland
- Municipality Reimerswaal
- Municipality Roosendaal
- Municipality Rumst
- Municipality Schelle
- Municipality Schouwen-Duiveland
- Municipality Sint- Amands Puurs
- Municipality Sint Gillis Waas
- Municipality Sint Laureins
- Municipality Sint Niklaas
- Municipality Sluis
- Municipality Stabroek
- Municipality Steenbergen
- Municipality Stekene
- Municipality Temse
- Municipality Terneuzen
- Municipality Tholen
- Municipality Veere
- Municipality Vlissingen
- Municipality Waarschoot (Lievegem)
- Municipality Waasmunster
- Municipality Wachtebeke
- Municipality Wetteren
- Municipality Wichelen
- Municipality Willebroek
- Municipality Woensdrecht
- Municipality Zele
- Municipality Zomergem (Lievegem)
- Municipality Zwijndrecht

Partner	Name	Type	Function	Skill	% time	Gender	Steering Committee	Executive Board	Scientific Board of advisors	Communication, Partner Events, Education	Application UNESCO (bidbook, selfevaluation, meetings UNESCO)	Internal activation partners within own organization	External activation partners	Total (hours a week)
East-Flanders	[redacted]	permanent	Project Leader	Heritage	40%	f	1	2		2,5	1,5	4	4	15
East-Flanders		permanent	Communicator	Communications	50%	m		2		9			8	19
East-Flanders		permanent	Content Expert	Heritage/Archeology	80%	m	0	2,5	2	6,5	7	6	8	32
Antwerp		permanent	Project Leader	International Cooperation	85%	f	3	8		1	7	4	7	33
Zeeland		permanent	Project Leader	Physical Geography	90%	m	1	8	0,5	6,5	4	1,5	15,5	36
Zeeland		permanent	Administration	Administration	40%	f	2	5,5	0,5	2,5	3,5	1	1	16
Zeeland		permanent	Content Expert	Quartair Geology	20%	f		1,5	4,5		1,5			7,5
Zeeland		permanent	Content Expert	Archeology	20%	m							8	8
North-Brabant		permanent	Project Leader	Tourism and Recreation	75%	m	0,5	4		4,5	7	8	4	28
North-Brabant		permanent	Administration	Administration	50%	f		4		3,5	4	4	4	20
EGTS		permanent	General Secretary	Projectmanagement	25%	m	1,5	6		0,5	1	0,5		9,5
West-Flanders		permanent	Project Leader	Heritage/Communications	45%	m	2	6		2	3	4		17
West-Flanders		permanent	Content Expert	Archeology	20%	m			8					8
West-Flanders		permanent	Content Expert	Area-Oriented Operation	15%	m							6	6

Overview of the staff

iiiB Appropriate equipment

iiiB.1 Is there a permanent and professional team dedicated to the (a)UGGp? (Please give details)
Staff members are employed by the initiating partners dedicated to the (a)UGGp. The composition of the permanent staff is as follows:

iiiB.3 Does your (a)UGGp directly employ a multidisciplinary team (education, culture, tourism, marketing, etc.)? (Please give details)
The (a)UGGp has a multidisciplinary team with expertise from a wide range of relevant disciplines as shown in table at criterion iiiB.1.

iiiB.4f Does your (a)UGGp team include staff dedicated to: other activities?
Almost all the staff of the (a)UGGp are participating in various work groups from the (a)UGGp. One of the best examples of such a work group is the so-called scientific board of advisors. This board consists of 31 scientists from both the Netherlands and Belgium, who help to create and judge all informative products that are being made for the (a)UGGp on scientific accuracy. This work group is coordinated by four staff members. Also, some staff members are involved in helping with special national days, like the Geoweek, the Open Monuments Day in the Netherlands and Flanders and the Archaeology Days in the Netherlands and Flanders

The (a)UGGp team is also involved in tourism and recreation activities. Specifically because of the cross-border (a)UGGp and its functioning in an international network of UGGps, the team also has knowledge of international cooperation.

iiiB.5 Is there any formal agreement(s) with partners to provide multidisciplinary staff for your (a)UGGp? (Please give details)
The contribution of staff and financial means is stated in the agreement between the five regional government and the EGTS Linieland van Waas en Hulst.

iiiB.12 Do you count visitors? (Please give details on methodology and numbers)
Yes, Various sources are used by tourism services, (a)UGGp partners, for insights into visitor numbers. A distinction is made between day visits and residential visits.

Residential visit
The national statistics databases provide insights into the number of guests and overnight stays in registered lodging accommodations in the area, per month and per type of accommodation. In 2021, according to the Netherlands Central Bureau of Statistics, the number of registered overnight stays in the Zeeland region of the (a)UGGp reached 11.1 million, which is roughly equal to 2019, the last pre-corona year. This approach leaves out some of the overnight stays, such as small (often private) accommodation providers, permanent guests (people with their own vacation accommodation such as a second home or a mobile home on a vacation park) and water sports. In order to provide a more complete picture, HZ Kenniscentrum Kusttoerisme (a)UGGp partner, with the consent of the municipalities, annually plots the number of overnight stays using figures from the tourist tax and commuter tax (second homes). For municipalities that do not levy a tourist tax or water tourism tax, the number of overnight stays is estimated based on the size of the available accommodation offer and overnight stay figures in comparable municipalities. Based on these data, HZ

Knowledge Center for Coastal Tourism estimates the total number of overnight stays in 2021 to be approximately 18.8 million. This is 14.7% more than in 2020 and 0.5% less than in 2019. In the Flemish part of the (a)UGGp, this is estimated at about 3 million. This implies that the (a)UGGp has more than 20 million tourist overnight stays annually.

Day visitors
The annual number of day visits is estimated at about 43 million. Measuring day visitation is complex because most day visitors do not register anywhere. HZ Knowledge Center for Coastal Tourism is committed to providing better insights about day tourism. In the project 'Day Visitor Data Development', for example, the methods for finding out more about day visitors at destination level have been mapped out. Consider, for example, their (spatial) behavior, socio-demographic characteristics, spending and satisfaction. Also, a pilot is currently underway in which the number of Dutch visitors to a self-determined area can be counted based on location data collected via smart phone apps. The Netherlands Board of Tourism and Conventions (NBTC) is currently conducting research on inbound day visitors. Within the Geopark Interreg Netherlands - Flanders project (Be)leefbare Schelde there will also be specific research about this.

The museums in the (a)UGGp keep track of the annual visitor numbers. For the small regional museums the number of visitors is a few thousand per year. For the larger museums, such as the Watersnoodmuseum, this number is around 100,000 visitors per year.

iiiB.13 Do you evaluate where your visitors are coming from? (Please give details)
Yes, in for this we mainly use figures from the national statistical databases (CBS) when it comes to the country of origin of guests. For example, we know that for the Dutch part of the (a)UGGp Germany and Belgium are by far the most important countries of origin of foreign visitors. For the Belgian part of the (a)UGGp these are the Netherlands, Germany and the United Kingdom. For the (a)UGGp, the number of tourists from abroad (55%) is higher than the number of tourists from the home country (45%).
In the corona period a decrease in the number of foreign visitors occurred, but it was compensated by a higher number of visitors from home country. There is a trend of growth in the number of overnight stays by domestic tourists.
In addition to figures from the national static databases, we also try to gain insight into the origin of visitors through other means, including the following:

- This year we started an ongoing Zeeland-wide visitor survey in the Zeeland region of the (a)UGGp that asks visitors about their country of origin.
- Data from the RESONO system provide insight into the origin of visitors by zip code.

iiiB.15 Do you analyze the socio-economic profile of your (a) UGGp visitors? (Please give details)
Yes, the tourism partners are actively looking at the target groups that visit our regions. This is usually done using segmentations based on preferences, rather than segmentations on socio-demographic characteristics alone. This is because demographic characteristics such as age and family composition, while relatively easy to interpret, do not tell us everything about the guest's wishes and needs. In order to respond even better to these wants and needs, the Knowledge Center for Coastal Tourism has published the handbook 'Meet Your Target Group' in 2019. This publication provides insight into the main target groups based on lifestyles. Meanwhile, further development is taking place towards the Leefstijlvinder and Glocalities. Tourism Flanders is working in a similar way with a lifestyle finder.

The lifestyle finder is currently being further developed with the goal of increasing the reach of the segmentation model and more thematic knowledge, for example about how different target groups experience nature, cultural history and landscape, which is extremely valuable and helpful for the (a)UGGp.

At the same time, investments are being made at the national level to further develop and enrich, among other things, the Glocalities segmentation model, which can be used to attract international visitors. This can also look at how to attract relevant target groups for the (a)UGGp, which contributes to developing the (a)UGGp area as a sustainable destination. The data from the model has already been enriched in 2021 with information on vacations and day trips and is currently being further supplemented by additional studies.

Criterion iv: (iv) in the case where an applying area overlaps with another UNESCO designated site, such as a World Heritage Site or Biosphere Reserve, the request must be clearly justified and evidence must be provided for how UNESCO Global (a)UGGp status will add value by being both independently branded and in synergy with the other UNESCO designations (ivA.1). (Not applicable for intangible cultural heritage, but applicable for non UNESCO international designations such as RAMSAR, Natura 2000, etc. (ivA.2)).

ivA1 Overlapping with UNESCO designated sites

ivA.1.a Does your (a)UGGp overlap with or encompass any other UNESCO designated site(s).
The (a)UGGp overlaps with two little UNESCO World Heritage sites: the Flemish Beguinage of Dendermonde and the Flemish Belfries of Dendermonde and Eeklo. There is no Biosphere Reserve present within the (a)UGGp. The Béguines were women who dedicated their lives to God without retiring from the world. In the 13th century they founded the béguinages, enclosed communities designed to meet their spiritual and material needs.

The Flemish béguinages are architectural ensembles composed of houses, churches, ancillary buildings and green spaces, with a layout of either urban or rural origin and built in styles specific to the Flemish cultural region. They are a fascinating reminder of the tradition of the Béguines that developed in north-western Europe in the Middle Ages. The beguinage of Dendermonde is the only one located within the (a)UGGp.

The Flemish Belfries are highly significant tokens of the winning of civil liberties and are built between the 11th and 4th century. While Italian, German and English towns mainly opted to build town halls,

in part of north-western Europe, greater emphasis was placed on building belfries. Compared with the keep (symbol of the seigneurs) and the bell-tower (symbol of the Church), the belfry, the third tower in the urban landscape, symbolizes the power of the aldermen. Over the centuries, they came to represent the influence and wealth of the towns. In total there are 32 Belgian belfries an 23 in the north of France. Two of these belfries are located within the (a)UGGp (Dendermonde and Eeklo).

UNESCO World Heritage the Flemish Beguinage of Dendermonde

ivA.1.b Is there a complementarity between your (a)UGGp and the other UNESCO designated sites within the territory? (Please give details)

The themes of the overlapping UNESCO World Heritage Sites are described in the above question (ivA.1.a). There is no direct or indirect relationship between the thematic of the (a)UGGp and the World Heritage Sites of Dendermonde and Eeklo. In these sense we consider that both are complementary. The (a)UGGp covers completely different subjects witch aren't intertwined whit the core values of the Flemish beguinages and the belfries.

ivA.1.f Is there a clear justification for how the UGGp status will add value to the territory by being independently branded ? (Please give details)

Yes. As a (a)UGGp, you will have an opportunity to showcase and learn the public all about the area and landscape they come to visit or live in, highlighting various topics within the realms of geology, geomorphology, sedimentology, archaeology and cultural history. With the area being branded as an independent (a)UGGp, this area will spark the interest of geotourists from all over the world as well as scientific researchers. New research projects, the production of educational tools, informative books and brochures about the (a)UGGp, along with the help of all partners involved, really promotes the (a)UGGp for its uniqueness as a region and gives it the attention that it otherwise never would have gotten. Not to this extent, at least.

The strength of the (a)UGGp is that developments and processes of climate change and sea-level change through geologic time, as well as how humans have dealt with them throughout history in the area, are displayed throughout the area at geosites, at lectures, on field trips, in student assignments and studies, and in other activities. Understanding the processes, the impact in the past, the resilience of the area and the system, how people have dealt with it through trial and error provide lessons and inspiration toward the future. That's why we also call this (a)UGGp a Climate Living Lab. It has been so far back in history and will certainly remain so toward the future. We show the line past - present - future, we make it experienceable. In this way we stimulate and inspire residents and visitors to enter a sustainable future with knowledge of the past.

We want to celebrate the beauty of the earth and, from there, we also want to give sight to a sustainable future.

ivA2 Overlapping with other (non UNESCO) international designated areas and/or nominations (RAMSAR, Natura 2000, etc.)

ivA.2.a Does your (a)UGGp overlap or encompass any other international designated site(s)? If yes, please provide the official name(s) of these designations. If no, please select not applicable and go to criteria v

Yes. On international level, a large part of the (a)UGGp Schelde Delta is covered by European Natura 2000-areas. In addition there are several RAMSAR sites (wetlands) present within the (a) UGGp.

ivA.2.b Is there a relationship and/or complementarity between your (a)UGGp and the other international designated sites within the territory? (Please give details)

There is a strong relationship between on one hand the (a) UGGp Schelde Delta and on the other hand the Natura 2000 and RAMSAR sites that fall within the boundaries of the (a)UGGp. These designated areas are related to the geosites and they are managed by partners that are part of the (a)UGGp partner network and from that role also take care of the management and conservation of the Natura2000 and RAMSAR areas in the geosites of the (a)UGGp. There is close cooperation and coordination, with the provision of information, education and excursions being of central importance. By drawing the attention of the site management organizations to the geology and geomorphology of the Natura 2000 and RAMSAR areas, the (a)UGGp Schelde Delta is working towards harmonising the management of the conservation objectives with the geological values of the (a)UGGp Schelde Delta.

Information panel focusing on nature from the Natura2000 status and landscape aspects from the (a)UGGp creating added value

ivA.2.f Is there a clear justification for how the UGGp status will add value to the territory by being independently branded ? (Please give details)
As mentioned in question ivA.1.f the (a)UGGp aims to showcase and learn the public all about the area and landscape they come to visit or live in, highlighting various topics within the realms of geology, geomorphology, sedimentology, archaeology and cultural history. The (a)UGGp uses a branding approach, described in the "Inspiration Guide for using the Quality mark", which brings together individual partners on both sides of the border and works towards a joint profile and create a regional identity. The joint highlighting of the genesis, formation of the landscape and human actions therein by means of learning to read the landscape thus justifies an own profile as (a)UGGp Schelde Delta. The RAMSAR and Natura 2000 sites are very important for the protection of the geological heritage but their branding strategy is rather subtle and covers a much larger area. Thus we believe that the (a)UGGp will add value to the territory by being branded as an independent (a)UGGp. The area will spark the interest of geotourists from all over the world as well as scientific researchers. New research projects, the production of educational tools, informative books and brochures about the (a)UGGp, along with the help of all partners involved, really promotes the (a)UGGp for its uniqueness as a region and gives it the attention that it otherwise never would have gotten. Not to this extent, at least.

ivA.2.g Do you organize common meetings with the other international designated sites management and exchange experiences? (Please give details)
The area of the aspiring (a)UGGp covers a lot of other international designated sites such as Natura 2000 and RAMSAR. Most of the operators of these areas are a partner of the (a)UGGp which means that there are close contacts with these sites and that regular meetings take place. During these meetings we exchange experiences and help each other where necessary. In the area of the coastal plain of the (a)UGGp where the largest Natura2000 areas and Ramsar wetlands are located and where there is a distinctive "Delta nature" in an important place along the international routes of many migratory birds, all the nature management organizations, (a)UGGp partners have long been working closely together in the areas of nature education, branding and marketing, alignment of supply. Joint campaigns are conducted with much public attention. The (a)UGGp has been an integral part of this since 3 years, which is seen by the nature management organizations as a great enrichment and deepening because in addition to natural values now also landscape and history of origin provide much more context to the whole of the offer and attention.

ivA.2.j Do you develop common infrastructure to facilitate field activities? (Please give details)
The (a)UGGp is a network organization that can only exist through it' s partners. The management organizations of the geosites are partner of the (a)UGGp and have infrastructure available that can be used to inform, educate, organize events or explore the (a)UGGp. Examples of joint infrastructure are the visitor centers, entrance gates and information panels at the geosites. Furthermore field activities are promoted on our website. Partners are encouraged to incorporate the landscape, geology and climate story within their existing excursions wherever possible. From (a)UGGp this will be facilitated by a Geopark training module for guides and the provision of scientifically sound and at the same time publicly accessible descriptions of geosites/nature reserves.

ivA.2.n Do you develop common promotion and communication activities featuring both logos (press conferences, participation in tourist fairs, etc.) with the other international designated sites? (Please give details)
The (a)UGGp develops promotion and communication activities with the Geopark and the Natura 2000 area's logos. For example, the activity Oosterscheldeweek (Eastern Scheldt week). This week is organized by the Oosterschelde National Park and thus by a Natura 2000 site management organization. The promotion and communication for this activity consisted of both the Oosterschelde National Park and the (a)UGGp Schelde Delta logos.

In the area of the coastal plain of the (a)UGGp where the largest Natura2000 areas and Ramsar wetlands are located and where there is a distinctive "Delta nature" in an important place along the international routes of many migratory birds, all the nature management organizations, (a)UGGp partners have long been working closely together in the areas of nature education, branding and marketing, alignment of supply. Joint campaigns are conducted with much public attention. The (a)UGGp has been an integral part of this since 3 years, which is seen by the nature management organizations as a great enrichment and deepening because in addition to natural values now also landscape and history of origin provide much more context to the whole of the offer and attention. Key campaigns include the "Always Open" campaign that encouraged people during the COVID-19 pandemic to safely enjoy nature outside and recharge during a stressful time for many. There are also seasonal campaigns that point people to beautiful areas seasonally. And there is the collaborative "Short Walks" campaign that reminds people that outside of large and sometimes fragile natural areas, very surprising and beautiful walks can be taken that include a high nature and landscape experience. The logo of the (a)UGGp is also used in this regard.

Example of the Always Open campaign

Criterion v: (v) UNESCO Global (a)UGGps should actively involve local communities (vA) and indigenous peoples (vB) as key stakeholders in the (a)UGGp. In partnership with local communities, a co-management plan needs to be drafted and implemented that provides for the social and economic needs of local populations, protects the landscape in which they live and conserves their cultural identity. It is recommended that all relevant local and regional actors and authorities be represented in the management of a UNESCO Global (a)UGGp. Local and indigenous knowledge, practice and management systems should be included, alongside science, in the planning and management of the area.

vA Local communities

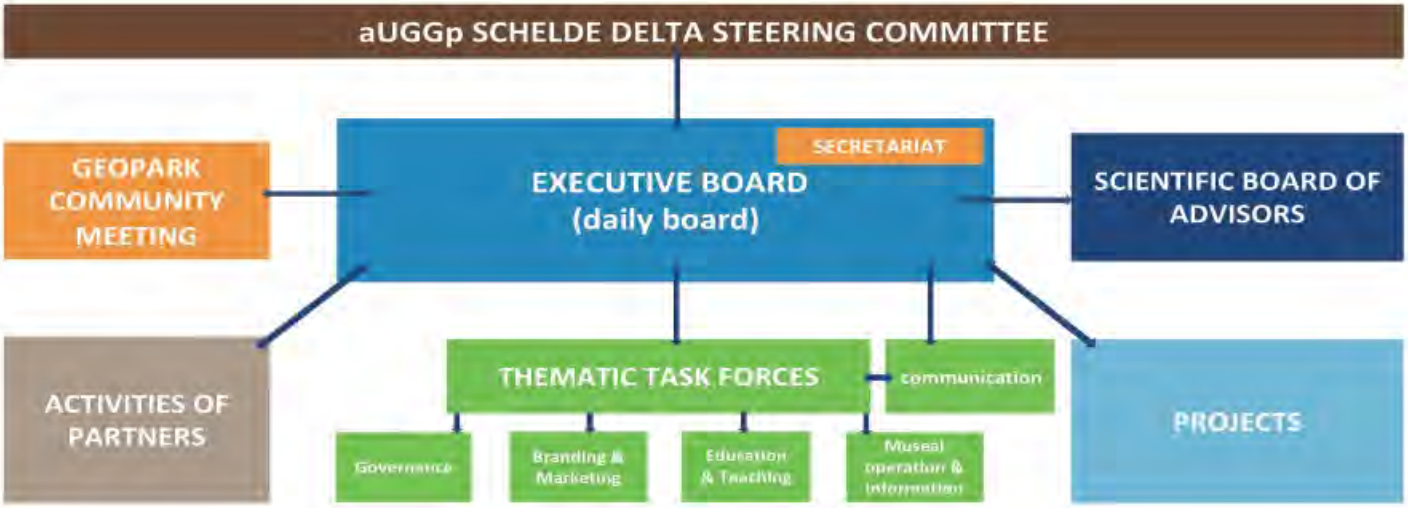
vA.1 Are the local community and local leaders formally and actively involved in your (a)UGGp? (Please give details)
The local community and local leaders are formally and actively involved in our (a)UGGp. Approximately three times a year the (a)UGGp organizes a community meeting. This is the sounding board group which includes representatives from more than 140 local and regional organizations and authorities. All listed partners mentioned in the list of Criterion IF.5.b are invited to this meeting. This means that representatives of all municipalities and provinces in the (a)UGGp Schelde Delta's area play a role in the operations of the (a)UGGp.

Corona-proof partner meeting spring 2022

the (a)UGGp encourages the local community to be actively involved in the (a)UGGp. Many municipalities but also local parties such as local history societies and village councils now ask for advice from the (a)UGGp team to realise issues around nature, landscape and geological values perception in their areas. Together, they look for the right experts to advise and see how financial resources can be obtained, e.g. through subsidies. A good example of how the local community is involved is the extensive Interreg Netherlands-Flanders project (Be)leefbare Schelde, in which municipalities, small and large museums, local initiators work together with knowledge partners to realise ambitions in their own environment and also connect them to one another.

vA.4 Does your (a)UGGp management plan include proposals from local authorities / communities? (Please explain)
The (a)UGGp has included in its management plan the following proposals from local authorities / communities in its ambition agenda:

- Further development of the Manteling van Walcheren area with museum Terra Maris.
- Making the Drowned City of Reimerswaal experienceable and linking this to objectives concerning water quality, biodiversity, water safety and climate change.
- Development of the "Zak van Zuid-Beveland" area with walking and cycling opportunities across many kilometres of dike landscape, fruit orchards, meadows, De Zwaakse Weel, an outdoor classroom at the Natuurmonumenten information point, sustainable lead-free fishing site, old farms, rich history of land reclamation, embankments and the history of the tidal channel Het Zwake, B&Bs, tea gardens and the mediaeval hedge landscape of Nisse
- A quality boost as an entry point and protection against erosion of the Groeve Nieuw-Namen. Geological and archaeological heritage protected in combination with sustainable energy generation and area design together with inhabitants of Nieuw-Namen/Kieldrecht
- Development of the Saeftinghe/Groot-Saeftinghe area. The primal experience par excellence and also new nature where the processes of sedimentation and schor formation can be followed live. Visit the panorama hill in the former Hedwigepolder and survey the area of nature, agriculture and harbours coming together in an exciting landscape
- Development of Groeve Boudewijn, a former sand quarry on the outskirts of a village redeveloped into a nature area with hiking trails and an educational route around geology and biodiversity.
- Revive the old craft of shipbuilding in the provincial heritage site shipyards Baasrode (Dendermonde).
- Redevelopment of the Rupelklei museum in Rumst. A quality and impact impulse to bring to life the rich geological and cultural-historical past of the Rupel region
- Quality impulse by adding geological storyline in the visitor centre Puyenbroek - Moervaartvallei. Revisit the landscape as a former lake from the late ice age and the shifting sand ridge as one of the causes of the changed runoff of the Scheldt.
- Donkmeer - Kalken, story of Kalken's lakes. Nowhere do you experience the erosion and displacement of the various Scheldt runs like in Berlare, where meandering ridges shape the landscape and Donkmeer reflects the extent of the late-glacial Scheldt. Clarification can be found in the information point as well as the long-extinct animals that will soon make their appearance in the Nieuwdonk recreation area.
- Further development of the Drongengoed and Maldegem field. Where tight lanes shape the gently undulating ancient landscape of the cuesta, unsuitable for agriculture.
- Accentuate geological story of the Zwinstreek . A concept full of history and biology, where ou get to know the evolution of the salt marshes and creek area.



Schematic overview of the organizational structure

vA.11 Does your (a)UGGp management body include relevant organizations and institutions to ensure all aspects of your geological, natural and cultural heritage are represented. (Please provide a list and organigram)

Schematic overview of the present organizational structure:
The following organizations dealing with the themes of geology, nature, cultural history and education and experience thereof are partners within (a)UGGp Schelde Delta

Scientific institutions or universities
- Arteveld University of Applied Sciences Ghent
- Belgium Society of Paleontology (Belgische vereniging voor Paleontologie vzw)
- Breda University of Applied Sciences, Academy for Tourism
- CLUE+ VU Amsterdam (The Interfaculty Research Institute for Culture, Cognition, History and Heritage)
- Geological Survey of Belgium (Belgisch Geologische Dienst)
- Geological Survey of the Netherlands (Geologische Dienst Nederland - TNO)
- HZ University of Applied Sciences and Delta Platform
- Royal Netherlands Institute for Sea Research (Koninklijk Nederlands Instituut voor Onderzoek der Zee - NIOZ)
- UCR University College Roosevelt
- University of Antwerp
- University of Ghent
- VU Amsterdam, Earth Sciences and Humanities
- Workgroup Geology of the Royal Zeeuwsch Society of Sciences (Koninklijk Zeeuwsch Genootschap der Wetenschappen)

Regional landscape parks or network organizations
- Grenspark Kalmthoutse Heide
- Oosterschelde National Park
- Regionaal Landschap Schelde Durme (Rivierpark Scheldevallei)
- Stichting Brabantse Wal
- Streekorganisatie de Brabantse Wal
- Landschapspark Borsele
- Waterpoort

Organizations related to nature, environment or landscape
- Natuurpunt Klein-Brabant
- Natuurpunt Rupelstreek
- Verenigde Natuurmonumenten
- Staatsbosbeheer
- Zeeuwse Milieufederatie
- Stichting Het Zeeuws Landschap
- Stichting Natuurpodium Brabantse Wal
- NME Zeeland
- Stichting IVN Natuureducatie
- Stichting Landschapsbeheer Zeeland

Education
- Stichting Natuurpodium Brabantse Wal
- NME Zeeland
- Stichting IVN Natuureducatie

Tourism and recreation
- Toerisme Klein-Brabant – Scheldeland vzw
- Toerisme Oost-Vlaanderen
- Toerisme Meetjesland vzw
- Toerisme Scheldeland vzw
- Toerisme Waasland vzw

Geology, paleontology and cultural heritage
- Erfgoed Zeeland
- Erfpunt
- Eastern Scheldt museum
- Museum voor Natuur en Landschap Terra Maris
- Watersnoodmuseum en Nationaal Kennis- en Herinneringscentrum Watersnood 1953
- Belgische vereniging voor Paleontologie vzw
- Huis van de Evolutie
- Werkgroep Geologie van het Koninklijk Zeeuwsch Genootschap der Wetenschappen
- Walcherse Archeologische Dienst
- SteM Sint-Niklaas - Mercatormuseum
- Stichting Landschapsbeheer Zeeland

vA.12 Does your (a)UGGp management body include representatives of the local university, museums, geological surveys, research institutes, and any other relevant scientific institutions? (Please give a list)

Yes. As mentioned in CriterionvA.11. Furthermore we wish to give an overview of the members of the scientific board of advisors of the (a) UGGp Schelde Delta:

Name	Gender	Land	Occupation	Expertise
	M	NL	Historical Geographer	Historical Geography: History of the Dutch cultural landscapes and water management; Climate of the last 600 years
	M	NL	Associate professor, VU Amsterdam	Geosciences: Quaternary Geology, Geomorphology and Sedimentology of deltaic, fluvial and aeolian environments
	M	BE	Researcher, University of Antwerp and University of Ghent	Geosciences, Historical Geography: Geology, Heritage Studies
	F	BE	Researcher, Royal Belgian Institute of Natural Sciences	Geosciences: Quaternary geology: Sedimentology of fluvial, aeolian, estuarine and coastal environments
	M	BE	Heritage coordinator, municipality of Nieuwpoort	History, Cultural Heritage: Industrial Archaeology, Adaptive reuse of ancient buildings, Abbeys (Cist)
	M	BE	Heritage counselor, Erfgoed	Archaeology, Cultural Heritage: Architectural and landscape heritage
	M	BE	Post-doctoral researcher, University of Ghent/Geoarchaeologist, Gate bvba	Geoarchaeology: Landscape Archaeology, Environmental Archaeology, Applied Geophysics, Prehistoric Archaeology
	F	BE	Head of department Heritage, Province of Antwerp	Archaeology, Cultural Heritage
	M	NL	Historical Geographer/Demographer	Historical Geography: Historical development of the landscape with the role of humans included
	M	BE	Archaeologist	Archaeology, Cultural Heritage
	F	NL	Provincial Archaeologist and Project leader Grenspark Groot Saeftinghe, Province of Zeeland	Archaeology, Cultural Heritage
	M	BE	Emeritus professor, KU Leuven	Geosciences: Geology, Applied Geology, Stratigraphy
	M	NL	Senior Geologist, Geological Survey of The Netherlands TNO/Chairman scientific board of advisors	Geosciences: Quaternary Geology, Geomorphology, Fluvial, estuarine and sea-level research, Geomodelling and Geological mapping
	M	NL	Associate professor in Geomorphology and Quaternary Geology, Utrecht University	Geosciences: Impact of past climate change on landscape and vegetation
	M	BE	Professor, University of Ghent	Archaeology: Prehistory of NW Europe
	M	NL	Professor, VU Amsterdam and TNO - Geological Survey of the Netherlands	Geosciences: Quaternary Geology, Geomorphology, Neotectonics
	M	NL	Advisor, Ministery of Infrastructure and Water Management	Water management: Coast and Waterway Development, Building with Nature, Relation Space-Economy-Environment
	M	NL	Associate professor in Geoarchaeology and Anthropocene Studies, VU Amsterdam	Geoarchaeology: Applying Earth Sciences to Archaeology in interdisciplinary research and teaching, with emphasis on the Anthropocene
	M	BE	Professor Medieval History and Ecological History, University of Antwerp	Environmental History, Landscape History (Floods)
	M	NL	Senior policy maker Nature and Project leader Geopark, Province of Zeeland	Geosciences
	F	NL	Policy maker Soil and subsurface, Province of Zeeland	Geosciences
	M	BE	Professor in Historical Archaeology, University of Ghent	Archaeology, History: Historical Archaeology in NW Europe from Roman to Modern times
	F	NL	Advising senior KNA Archaeologist/Policy maker Cultural History and Archaeology, municipalities of Terneuzen, Sluis and Hulst	Archaeology, Cultural Heritage: Maritime and Landarchaeology, Senior KNA Archaeologist Specialism Watersoils and Senior KNA Underwater archaeologist Ma
	M	NL	Special professor of History, UCR University College Roosevelt	History: Cultural history of the Low Countries, history of the Scheldt Estuary region, World history, social history of knowledge
	M	BE	Professor, University of Ghent/Freelance Senior Geologist, Geological Survey of Belgium	Geoarchaeology: Provenance analysis of natural & decorative lithic materials, Geoheritage and Outreach
	M	NL	Senior Scientist, NIOZ/Honorary professor, University of Groningen	Ecology: Spatial Ecology, Ecosystem complexity, Landscape formation
	F	BE	Palaeoecologist, GATE Archeology	Geosciences: Palaeoecology
	M	BE	Project coördinator Archaeology, Department Heritage, Province of West-Vlaanderen	Archaeology
	M	BE	Heritage counselor Archaeology, Province of Oost-Vlaanderen	Archaeology

vA.14 Is your (a)UGGp working towards transferring traditional knowledge, practices and management systems to the younger generation? (Please give details)
Along with its partners, the (a)UGGp is actively involved in transferring traditional knowledge and practices through several different practices. For example, through organizing miller courses, heritage associations revive and honor the traditional craftsmanship of millers.

Another good practice is the reconstruction and use of traditional baking ovens by the provincial monument guards. Their active policy is to sustain monumental history through workshops and demonstrations of these ovens. Young people are also involved by (a)UGGp partner Stichting Landschapsbeheer Zeeland in maintaining the landscape including maintaining and pruning old wooded banks and maintaining other landscape elements. This preserves the craft of traditional farmland management. In the Fruit growing (Fruitteelt) museum, (a)UGGp partner, the region-specific craft of traditional fruit growing is kept alive through workshops and demonstrations. Special educational programmes are aimed at young people to familiarise them with this craft. (a)UGGp partner Outward Bound specialises in organising outdoor team building activities for youth groups

The (a)UGGp is committed to engaging young people. In consultation with education partners, Geopark internships (orientation internships and graduation internships) are offered within the (a)UGGp with partners. This is where knowledge is transferred to the younger generation. Places are also offered for graduation research and traineeships.

vA.15 Does your (a)UGGp support research and inventories on traditional knowledge and culture? (Please give details)
The (a)UGGp has the ambition to actively promote and support research and inventories on traditional knowledge and culture in close contact with partners for the purpose of deepening the thematic narratives of the (a)UGGp.

Several partners in the (a)UGGp network are engaged in research and dissemination of traditional knowledge and culture. Examples include archives, thematic museums, historical societies and cultural heritage foundations. These institutions often work separately. Since the (a)UGGp initiative got off the ground, a greater need for cooperation in this area also arose. Thus, under the leadership of the (a)UGGp in 2021, a Platform was established in which cooperation in the field of knowledge preservation, knowledge development and knowledge transfer on the drowned villages is being established. In 2022, a Platform was established in the field of knowledge preservation, knowledge development and knowledge transfer of maritime underwater heritage (shipwrecks) and currently a Platform on forts and defence lines in the (a)UGGp is being worked on. The demand for this comes from groups of partners themselves in the need to cooperate more and also achieve more together

Several partners in the (a)UGGp network have an organizational assignment in research and dissemination of traditional knowledge and culture by themselves. Examples are the archives, historical societies and cultural heritage foundations. These institutions work separately, yet in close contact to each other. The (a)UGGp as entity has the aspiration to actively promote and support research and inventories on traditional knowledge and culture in close contact with the partners for the benefit of deepening the thematic storylines of the (a)UGGp.

Young people are also involved by (a)UGGp partner Stichting Landschapsbeheer Zeeland in maintaining the landscape including maintaining and pruning old wooded banks

Platform Drowned Villages

Criterion vi: (vi) UNESCO Global (a)UGGps are encouraged to share their experience and advice and to undertake joint projects within the GGN (ViA). Membership of GGN is obligatory.

viA Networking

viA.1 If an UGGp exists in your country, have you met its management team and visited its territory? (Please give a list)

UGGp	Country	Management contact	Territory visit
Famenne-Ardenne	Belgium	Yes	Yes
De Hondsrug	Netherlands	Yes	Yes

Management en Territory visit UGGp Famenne Ardenne

viA.2 Have you visited an UGGp in another country and met its management team? (Please give a list)

Before and after the Covid-19 pandemic lockdown			
UGGp	**Country**	**Management contact**	**Territory visit**
Muskauer-Faltenbogen	Germany - Poland	Yes	No
Vulkaneifel	Germany	No	Yes
Adamella-Brenta	Itali	No	Yes
Alpi-Apuane	Itali	No	Yes
Magma (a)UGGp	Norway	Yes	Yes
Sesia Val Grande	Itali	No	Yes
During the Covid-19 pandemic lockdown			
UGGp	Country	Management contact	Territory visit
Percé	Canada	Yes	No
Stonehammer	Canada	Yes	No
Odsherred	Denmark	Yes	No
Haute Provence	France	Yes	No
TERRA.vita	Germany	Yes	No
Vulkaneifel	Germany	Yes	No
Muskauer-Faltenbogen	Germany - Poland	Yes	No
English Riviera	United Kingdom	Yes	No
Waitaki-Whitestone (aUGGP)	New Zealand	Yes	No
Working together in projects			
Project	Initiative of UGGP	Planning phase	In progress
Quarternary Transect	Odsherred	Yes	
IGCP project 726- GEOfood for sustainable development	Magma		Yes
Scouting and UGGP	De Hondrug - Schelde Delta	Yes	

viA.3 Has your (a)UGGp Team participated in national, regional or international (a)UGGp related meeting(s)? (Please explain)

Participation by a delegation from (a)UGGp Scheldt Delta in the following national, regional and international (a)UGGp-related meetings:

- 6th International Conference on UNESCO Global (a)UGGps, Stonehammer UNESCO Global (a)UGGp, Canada, 2014
- 14th European (a)UGGps Conference, Azores UNESCO Global (a)UGGp, Portugal, 2017
- 8th International Conference on UNESCO Global (a)UGGps, Adamello Brenta UNESCO Global (a)UGGp, Italy, 2018
- 15th European (a)UGGps Conference, Sierra Norte de Sevilla UNESCO Global (a)UGGp, Andalucia, Spain, 2019
- EGN Spring meeting, De Hondsrug UNESCO Global (a)UGGp and Terra Vita UNESCO Global (a)UGGp, The Netherlands/ Germany, 2022
- 16th European (a)UGGps Conference, Sesia Val Grande UNESCO Global (a)UGGp, Italy, 2022

Criterion vii: (vii) A UNESCO Global (a)UGGp must respect local and national laws relating to the protection of geological heritage. The defining geological heritage sites within a UNESCO Global (a)UGGp must be legally protected in advance of any application (ViiA). At the same time, a UNESCO Global (a)UGGp should be used as leverage for promoting the protection of geological heritage locally and nationally. The management body must not participate directly in the sale of geological objects such as fossils, minerals, polished rocks and ornamental rocks of the type normally found in so-called "rock-shops" within the UNESCO Global (a)UGGp (regardless of their origin) and should actively discourage unsustainable trade in geological materials as a whole (ViiB). Where clearly justified as a responsible activity and as part of delivering the most effective and sustainable means of site management, it may permit sustainable collecting of geological materials for scientific and educational purposes from naturally renewable sites within the UNESCO Global (a)UGGp. Trade of geological materials based on such a system may be tolerated in exceptional circumstances, provided it is clearly and publicly explained, justified and monitored as the best option for the Global (a)UGGp in relation to local circumstances. Such circumstances will be subject to approval by the UNESCO Global (a)UGGps Council on a case by case basis.

viiA Protection of geological heritage

viiA.1 Does the entire territory have legal protection because of its geological value? (Please give details)

Not the whole (a)UGGp is listed as an area of geological value, but all Dutch geosites are specifically protected for their geological valueas mentioned in Criterion viiA.2.

Informal preliminary discussion of project Quarternary Transect with other (a)UGGP

viiA.2 Are parts of the area protected by law for its geological interest? (Please refer to which part and why)

Yes. The Dutch geosites of the (a)UGGp are protected by law as provincial area of geological value:

CODE	Geosite	Geological interest
G-01	Kop van Schouwen	Coastal and coastal dune morphology and processes
G-02	Dintelse Gorzen	Morphology and pedology of tidal flats and salt marshes, recently 'fossilized' and undergoing desalinization after removal of the tides
G-03	Eastern Scheldt	Estuarine morphology, morphodynamics, sedimentology
G-04	Pluimpot tidal channel remnant	Tidal channel morphology (embanked), relief inversion
G-05	Veerse Meer and Schenge	Embanked tidal channel with 'fossilized' estuarine morphology
G-06	Dune complex Oranjezon and the Manteling	Coastal and coastal dune morphology and processes
G-07	Beach ridge of Walcheren	Coastal morphology
G-08	Creek ridges and pool grounds of Walcheren	Morphology of impoldered tidal channel and salt marsh landscape with relief inversion features ('creek ridges')
G-09	Coastal dunes of southwest Walcheren	Coastal and coastal dune morphology and processes
G-10	Oudland area De Poel	Morphology of impoldered salt marsh landscape on peat with relief inversion of small tidal channels ('creek ridges')
G-11	Kolk lakes of Zuid-Beveland	Morphology and genesis of kolk lakes resulting from historical dike breaches along former tidal channels
G-12	Yerseke and Kapelse Moer	Morphology of impoldered salt marsh landscape with features of historical peat extraction
G-13	Markiezaat	Morphology and pedology of tidal flats and salt marshes 'fossilized' and undergoing desalinization after recent embankment

G-14	Smalle Beek Valley	Fluvial morphology of small stream valley eroded during the Quaternary
G-15	Brabant Escarpment - Kalmthoutse Heide	Quaternary fluvial cliff face erosion in exposed Lower Pleistocene estuarine deposits; Late Quaternary inland dune morphology, stratigraphy and genesis
G-16	Drowned Land of Saeftinghe	Brackish-water tidal flat and marsh morphology, sedimentology and processes
G-17	Western Scheldt	Estuarine morphology, morphodynamics, sedimentology
G-18	Drowned Zwarte Polder	Coastal morphology and processes (small tidal inlet with tidal flats and salt marshes)
G-20	Zwin creek remnants and Passageule	Morphology of dammed and impoldered tidal channel and creek system
G-23	Braakman region	Morphology of impoldered large and long-lived tidal channel and creek system
G-24	Otheense Kreek	Morphology of impoldered well-preserved tidal channel and creek system and surrounding tidal landscape
G-25	Coversand area Sint Jansteen	Morphology of impoldered tidal landscape with remnants of tidal channels and creeks breaching eolian coversand ridges of Late Weichselian age
G-26	Oudland area De Putting	Morphology of impoldered salt marsh landscape with features of historical peat extraction and relief inversion of small tidal channels
G-27	Nieuw-Namen	Inselberg morphology of Pliocene deposits in Holocene polder landscape; sedimentology, paleontology, stratigraphy and pedology of exposed Pliocene and Quaternary deposits

viiA.3 Are the most important geological sites of your (a)UGGp already legally protected? (Please give a list)

The most important geological sites, the 40 so-called geosites are protected by law by various legal instruments. Internationally large parts of the (a)UGGp are protected by the international Natura-2000 and RAMSAR legislation. Additional Dutch legal instruments for some geosites are the Natuurnetwerk, PMV environmental protection area, Groundwater protection area, Provincially valuable landscape, Archeologisch Rijksmonument, or Nationaal landschap. In the case of the Belgian geosites, besides Natura-2000 and RAMSAR, legal instruments are the status of protected landscape (a derivative of the coherence between geology, geomorphology, nature and heritage), protected village- or cityscape or listed archeological zones.

Meeting with the management team of UGGp Mëllertall (Luxembourg) during the 16th EGN Conference 2022

	Geosite	Protection status
1.	Kop van Schouwen	Natuurnetwerk Zeeland, Natura-2000, provincial geologically valauble area, PMV environmental protection area; Southwestern part of Kop van Schouwen: groundwater protection area, Archeologisch Rijksmonument, provincially valuable landscape
2.	Dintelse Gorzen	Natuurnetwerk Brabant, Natura-2000, provincial geologically valuable area, quiet zone
3.	Eastern Scheldt	Provincial geologically valuable area, Natuurnetwerk Nederland, Natura-2000, geological important area; In the Voordelta: some areas Voordelta Rustgebieden, PMV environmental protection area; Verdronken Stad Reimerswaal: Archeologisch Rijksmonument
4.	Pluimpot tidal channel remnant	Provincial geologically valuable area; Southern area: Natuurnetwerk Zeeland, Natura-2000, PMV environmental protection area, provincially valuable landscape
5.	Veerse Meer and Schenge	Provincial geological important area; Plates in Veerse Meer en creek structure Schenge: Natuurnetwerk Zeeland; Veerse Meer: Natura-2000; Plates in Veerse Meer: PMV environmental protection area; Creek structure Schenge: provincially valuable landscape
6.	Dune complex Oranjezon and the Manteling	Natuurnetwerk Zeeland, Natura-2000, provnical geologically valuable area, Nationaal Landschap Zuidwest-Nederland-deelgebied Walcheren, PMV environmental protection area; Oranjezon: groundwater protection area, provincially valuable landscape
7.	Beach ridge of Walcheren	Provincial geologically valuable area, Nationaal Landschap Zuidwest-Nederland-deelgebied Walcheren
8.	Creek ridges and pool grounds of Walcheren	Provincial geologically valuable area; Parts of Westkapelse Kreek: Natuurnetwerk Zeeland, Nationaal Landschap Zuidwest-Nederland-deelgebied Walcheren
9.	Coastal dunes of southwest Walcheren	Provincial geologically valuable area, Natuurnetwerk Zeeland, Nationaal Landschap Zuidwest-Nederland-deelgebied Walcheren, provincial valuable landscape
10.	Oudland area De Poel	Provincial geologically valuable area, Natuurnetwerk Zeeland; PMV environmental protection area, provincially valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied Zak van Zuid-Beveland
11.	Kolk lakes of Zuid-Beveland	Provincial geologically valuable area, Natuurnetwerk Zeeland, provincial landscape points of interest; Nationaal Landschap Zuidwest-Nederland-deelgebied Zak van Zuid-Beveland
12.	Yerseke and Kapelse Moer	Provincial geologically valuable area, Natuurnetwerk Zeeland, Natura-2000, provincially valuable landscape
13.	Markiezaat	Natuurnetwerk Brabant, Natura-2000, provincial geologically valuable area, cultural-historical valuable area
14.	Smalle Beek Valley	AHS Landschap, NLRE landschap, provincial geologically valuable area, Natuurnetwerk Brabant, ecological connection zone; Groenblauwe Mantel
15.	Brabant Escarpment – Kamlthoutse Heide	Natuurnetwerk Brabant, Natura-2000, provincial geologically valuable area, cultural-historical valuable area, quiet zone, PMV water storage reservering, water catchment area, groundwater protection management
16.	Drowned Land of Saeftinghe	Provincial geologically valuable area, Natuurnetwerk Nederland, Natura-2000; PMV environmental protection area
17.	Western Scheldt	Provinciaal geologically valuable area, Natuurnetwerk Nederland, Natura-2000; Plates in the Western Scheldt and Voordelta: PMV environmenal protection area; Drowned Land of Valkenisse: Archeologisch Rijksmonument
18.	Drowned Zwarte Polder	Provincial geologically valuable area, Natuurnetwerk Nederland; Natura-2000; PMV environmental protection area, provincial valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied West Zeeuws-Vlaanderen
19.	Zwin	Natura 2000 Zwin: protected cultural-historical landscape; Part in Zeeland: provincial geologically valuable area, Natuurnetwerk Zeeland, PMV environmental protection area, provincially valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied West Zeeuws-Vlaanderen
20.	Zwin creek remnants and Passageule	Provincial geologically valuable area; Passageule: Natuurnetwerk Zeeland, provincial valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied West-Zeeuws Vlaanderen; Zwin creek remnants: Natuurnetwerk Zeeland
21.	Zwinpolders around Damme	Natura 2000; Creek area Lapscheure: protected cultural-historical landscape; Blauwe Sluis: protected cultural-historical landscape, protected monument; Damme: protected town or village scape, established archaeological zone
22.	Creek and conversand area Sint-Margriete - Aardenburg	Belgian part: Natura-2000; Graaf Jansdijk: protected cultural-historical landscape; Dutch part: provincial geologically valauble area Zeeland, Natuurnetwerk Zeeland, provincial valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied West-Zeeuws-Vlaanderen
23.	Braakman region	Belgian part: Natura 2000, protected cultural-historical landscape; Dutch part: provincial geologically valuable area, Natuurnetwerk Zeeland; Northern part of Braakman: PMV environmental protection area, provincial valuable landscape
24.	Otheense Kreek	Provincial geologically valuable area, Natuurnetwerk Zeeland, provincially valuable landscape
25.	Coversand area Sint Jansteen	Provincial geologically valuable area, Natuurnetwerk Zeeland, PMV environmental protection area; Forests at Clinge and Sint-Jansteen: groundwater protection area, provincial valuable landscape
26.	Oudland area De Putting	Provincial geologically valuable area, Natuurnetwerk Zeeland, provincially valuable landscape
27.	Nieuw-Namen	Provincial geologically valuable area; Quarry: Natuurnetwerk Zeeland, Gemeentelijk Geologische monument Huist
28.	Waasland Scheldt Polders	Natura 2000; Kreek De Grote Geule: protected cultural-historical landscape; Vrasenepolder: established archaeological zone; Zeeland (Hewdwigepolder): Natuurnetwerk Zeeland
29.	Brackish tidal marsches of the Scheldt	Natura 2000

30.	**Freshwater tidal area and polders of the Scheldt**	Natura 2000; Domain d'Ursel: protected cultural-historical landscape; Salt marshes of Drumte: protected cultural-historical landscape; Scheldeschorren near Moerzeke-Kastel: protected cultura-historical landscape; Pastoor-Huveneersheuvel: protected archeological site; Polder and castle estate of Hingene: established landscape atlas relict; Landscape of the Old Scheldt: established landscape atlas relict; Willow tree and willow taxa: protected monument; Tidal water mill and miller's house: Rupelmonde: protected monument; Wissekerke castle: protected monument; Tidal water mill and miller's house Rupelmonde: protected monument; Kapel and Grayentoren with environment: protected town or village scape
31.	**Durme Valley**	Natura 2000; Molsbroek: protected cultural-historical landscape; Durmeschorren near Meulendijk: protected cultural-historical landscape
32.	**Boom cuesta**	Walenhoek: Vlaams Ecologisch Netwerk; District Noeveren: protected town or village scape; Steenbakkerij Frateur: established architectural heritage
33.	**Rupel Valley**	Natura 2000; Het Moer: protected cultural-historical landscape; Zennegat-Battenbroek: protected cultural-historical landscape
34.	**Barbierbeek Valley**	Protected cultural-historical landscape
35.	**Waasland cuesta**	Waasland cuesta: protected cultural-historical landscape; Fort Steendorp: protected monument
36.	**Paleomeanders Kalkense Meersen and Berlare**	Natura 2000; Het Broek: protected cultural-historical landscape; Turfput: protected cultural-historical landscape; Puddels of Overmere-Donk: protected cultural-historical landscape
37.	**Moervaart depression and conversand ridge**	Southern part of the site and Heidebos: Natura 2000; Moervaart depression: established landscape atlas relict; Prehistorical site complex in alluvial context of the Moervaart depression: established archeological zone
38.	**Steengelaag clay quarry**	The Steengelaag: protected cultura-historical landscape
39.	**Paleovalley of the Oude Kale**	Established landscape atlas relict; Windmill of Vlaanderensmolen and environment: protected town or village scape
40.	**Oedelem-Zomergem cuesta**	Maldegemveld: established landscape atlas relict; Eastern and western part: Natura 2000; Drongengoed: established cultural-historical landscape

viiA.5 Does your (a)UGGp undertake initiatives to promote the protection of geological heritage locally and nationally? (Please give details)

The (a)UGGp promotes the protection of geological heritage by emphasizing the unique geological, natural and cultural value of the area. By creating awareness of this value the visitors as well as the inhabitants and policymakers will become conscious and proud of the geological heritage. As a result they will be more committed and take better care of their heritage. This indirect measure is reinforced by the inventory of the geosites and the presented natural and cultural sites. Furthermore this criterion is stated on our website as a code of conduct in the (a)UGGp (https://www.scheldedelta.eu/en/node/143). Rules of conduct are also displayed on leaflets. At geosites and nature reserves, signs display the rules of conduct, commandments and prohibitions. In these areas, forest rangers and supervisors also check for undesirable behaviour, e.g. checks on mountain bikers cycling outside the designated paths and thus damaging geological heritage and natural values (or a positive attitude towards good behaviour). On excursions led by guides and foresters, attention is also paid to these aspects in order to gain an understanding of the vulnerability of the areas. The various visitor centers at sites also pay attention to this.

The (a)UGGp, through the Dutch provinces involved, is represented in the Earth Heritage Working Group of the National Service for Cultural Heritage (RCE) which is part of the Dutch Ministry of Education, Culture and Science. In addition, both the national geological surveys of the Netherlands and Belgium are partners of the (a)UGGp.

ANNEX 2
SECTION E1.1 GEOLOGICAL HERITAGE AND CONSERVATION

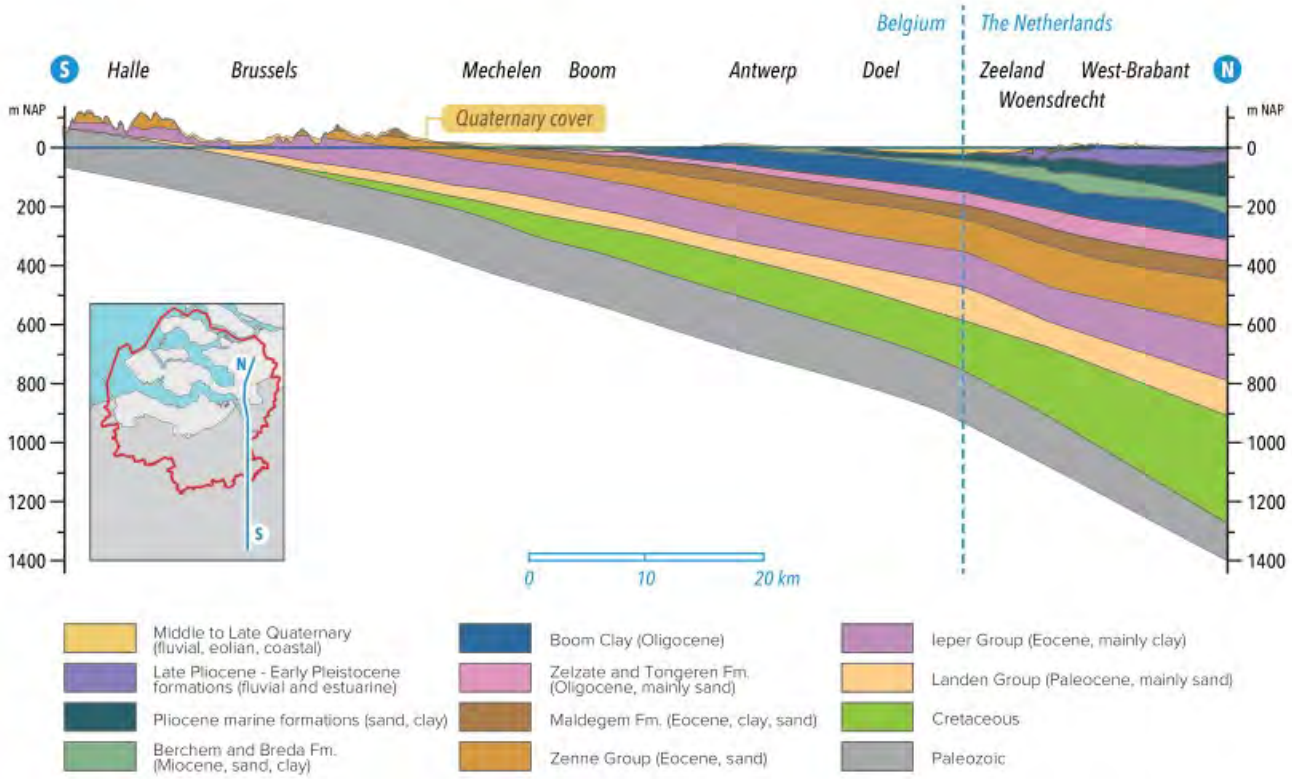


Figure 1. Tilted post-Paleozoic sequence on the eastern side of the aspiring Geopark and farther south. The cumulative thickness of the units increases northward. In the same direction, (near-) surface units become progressively younger.

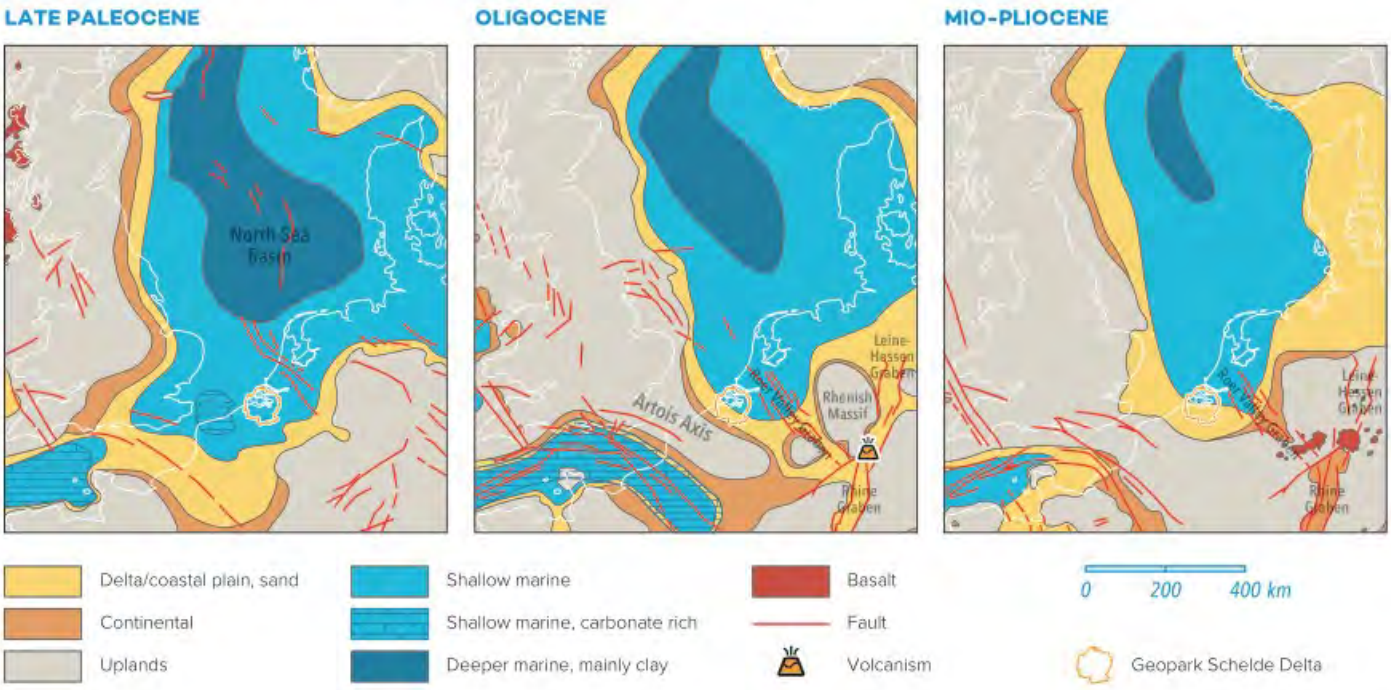


Figure 2. Long-term change between 50 and 5 million years ago from a relatively deep subtropical sea, with deposition of carbonaceous clay, to a shallowing sea and sandy coastal plain.

Geological summary

The Geopark Schelde Delta is located at the southern edge of the North Sea Basin, where it transitions into the London-Brabant Massif. Southern uplift has caused stratigraphic units to gently tilt, with a cumulative Paleogene, Neogene and Pleistocene thickness. Over time, marine transgressions and regressions have raised and lowered base levels in the area, enabling rivers to fill or deepen existing valleys in the coastal plain. The Pleistocene marked the onset of fluvial and aeolian activity in the area, modifying the former marine landscape and create a highly dynamic estuary. Tidal action eroded some parts and left deposits of sand and mud in others. Adaptions of the landscape by human hands started around the Roman Period, when peatlands were actively drained to build settlements, create arable land and dig up fuel, causing the land to subside. This made the lower parts of the Geopark sensitive to marine flooding and erosion.

Fifty million years of change

The transnational aspiring UNESCO Global Geopark Schelde Delta takes its name from a regional, tidally influenced river that dominates the modern landscape. Upstream, it dissects and exposes tilted marine strata formed long ago in warm Paleogene and temperate Neogene seas, ridges of windblown sediment accumulated in Weichselian polar deserts, and undulating plateaus composed of late Pliocene to early Pleistocene river sand. Downstream, it has left an abundance of tidal deposits on top of these older sediments and carved many estuarine channels, shaping an area that is aptly named Zeeland or Sea-land, home to one of Europe's main estuaries.

The aspiring Geopark Schelde Delta tells a 50-million-year-long story of subsidence and uplift, sea-level rise and fall, climate change, tidal waters and rivers. It also showcases alternating lead and supporting roles for natural processes and human influence. Each of these actors has left its mark, by itself or cumulatively. Land has been taken, lost, modified and given back by tides, waves, river floods and humans. The lowlands, protected by dikes, are starved from sediment. Where left alone, they seem almost frozen in time.

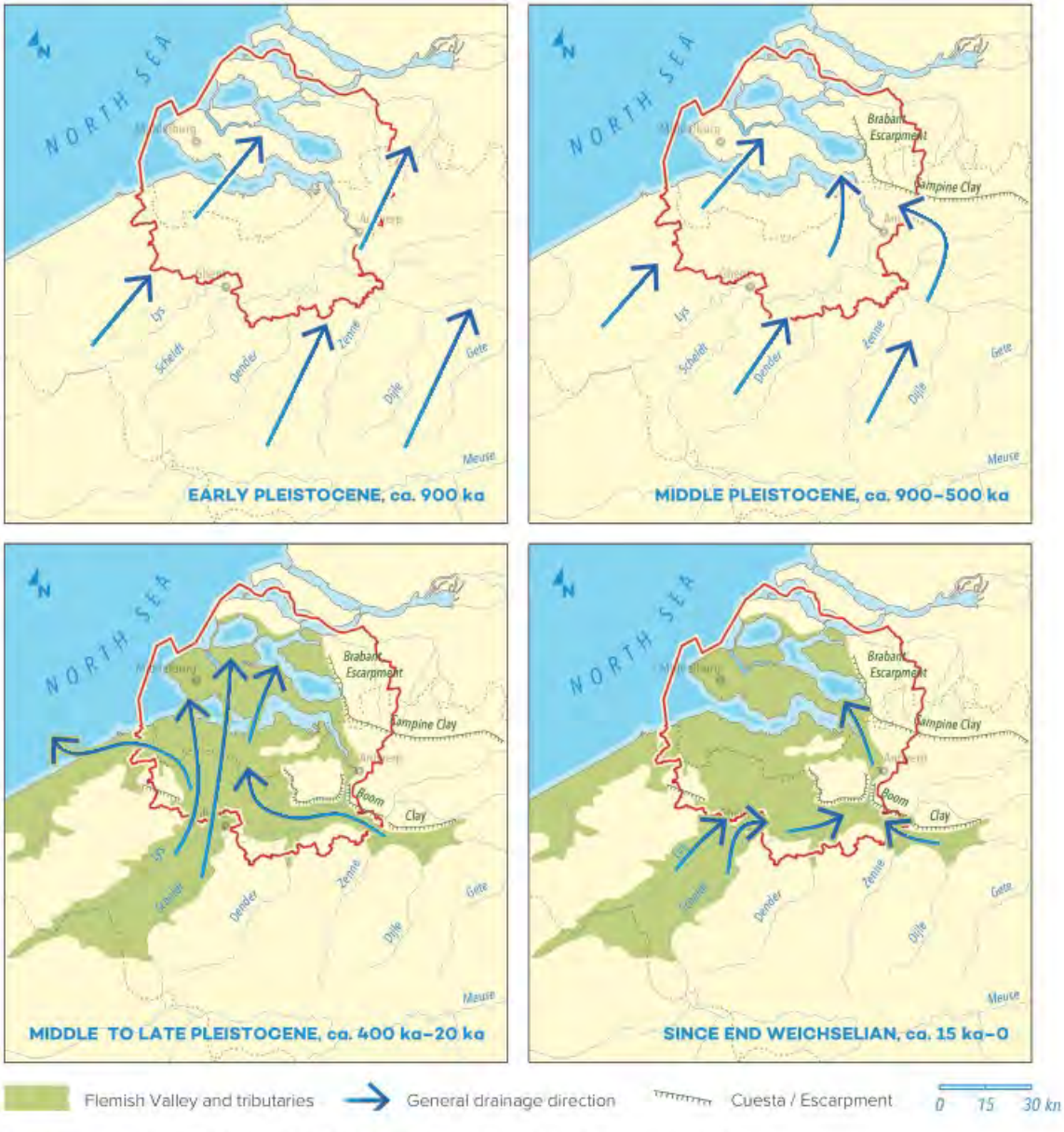


Figure 3. Fluvial configuration during the second half of the Pleistocene, including development of the Flemish Valley and its major river, the Scheldt.

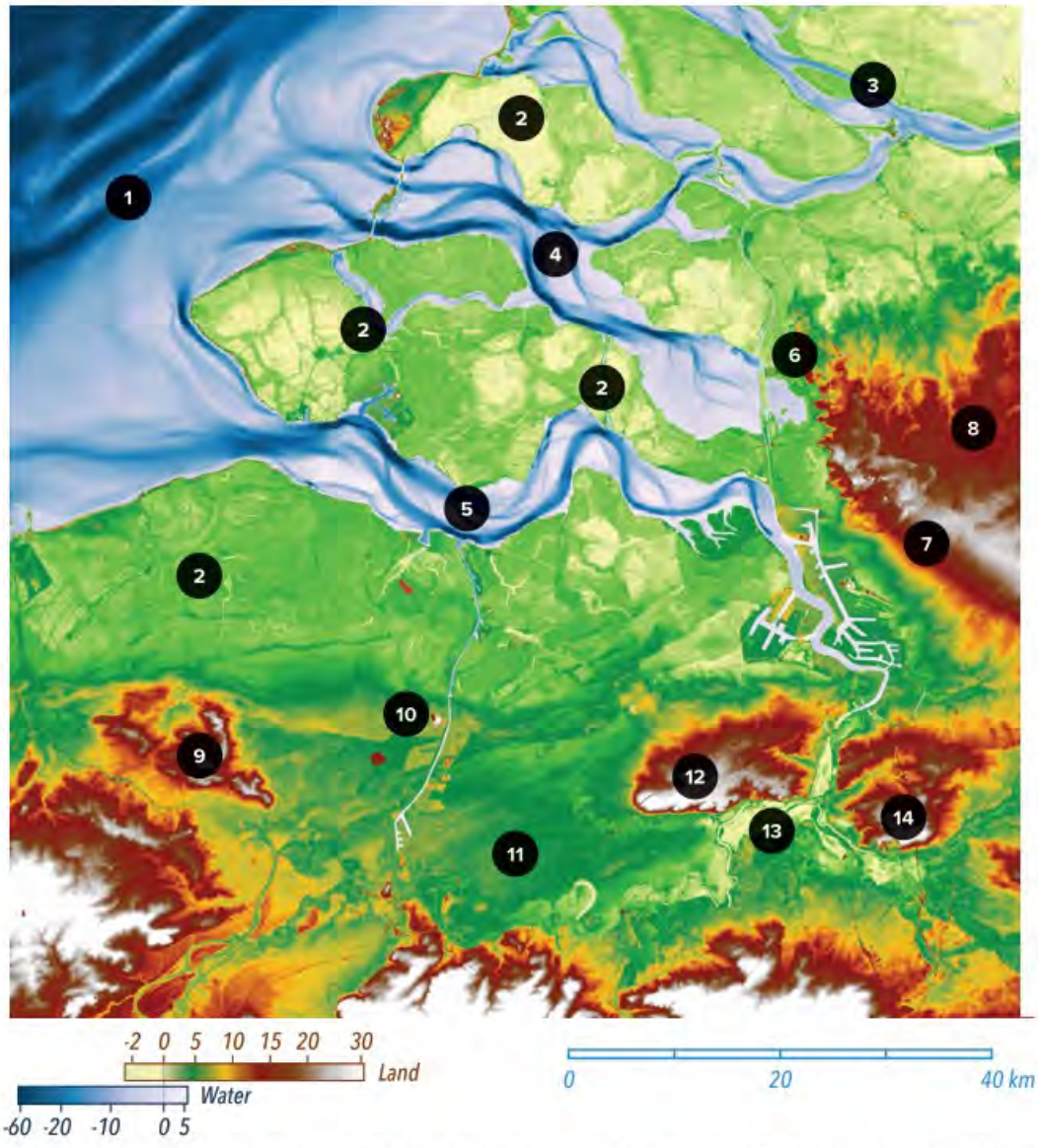
Where heavily managed, as in most places, reminders of their fascinating geological history are much more subtle.

Northward tilting

Located at the southern edge of the **North Sea Basin**, where it transitions into the London-**Brabant** Massif that surfaces in central Belgium, the aspiring Geopark area has experienced a far-field tug-of-war between the colliding African and European plates, causing southern uplift, and the widening Atlantic Ocean, resulting in northern subsidence. Over millions of years, this process has gradually tilted horizontally deposited stratigraphic units toward the **north-northeast**. This is most obvious for pre-Quaternary layers. Their gentle but consistent dip translates into a cumulative Paleogene, Neogene and Pleistocene thickness that increases from near-zero just south of the park margins to almost 1 km at its northeastern edge (Figure 1). The tilting itself is way too slow to be noticeable, but there is plenty of visible indirect evidence. Where exposed, fragments of the pre-Quaternary sequence, including the **Rupelian stratotype**, become younger from south-southwest to north-northeast.

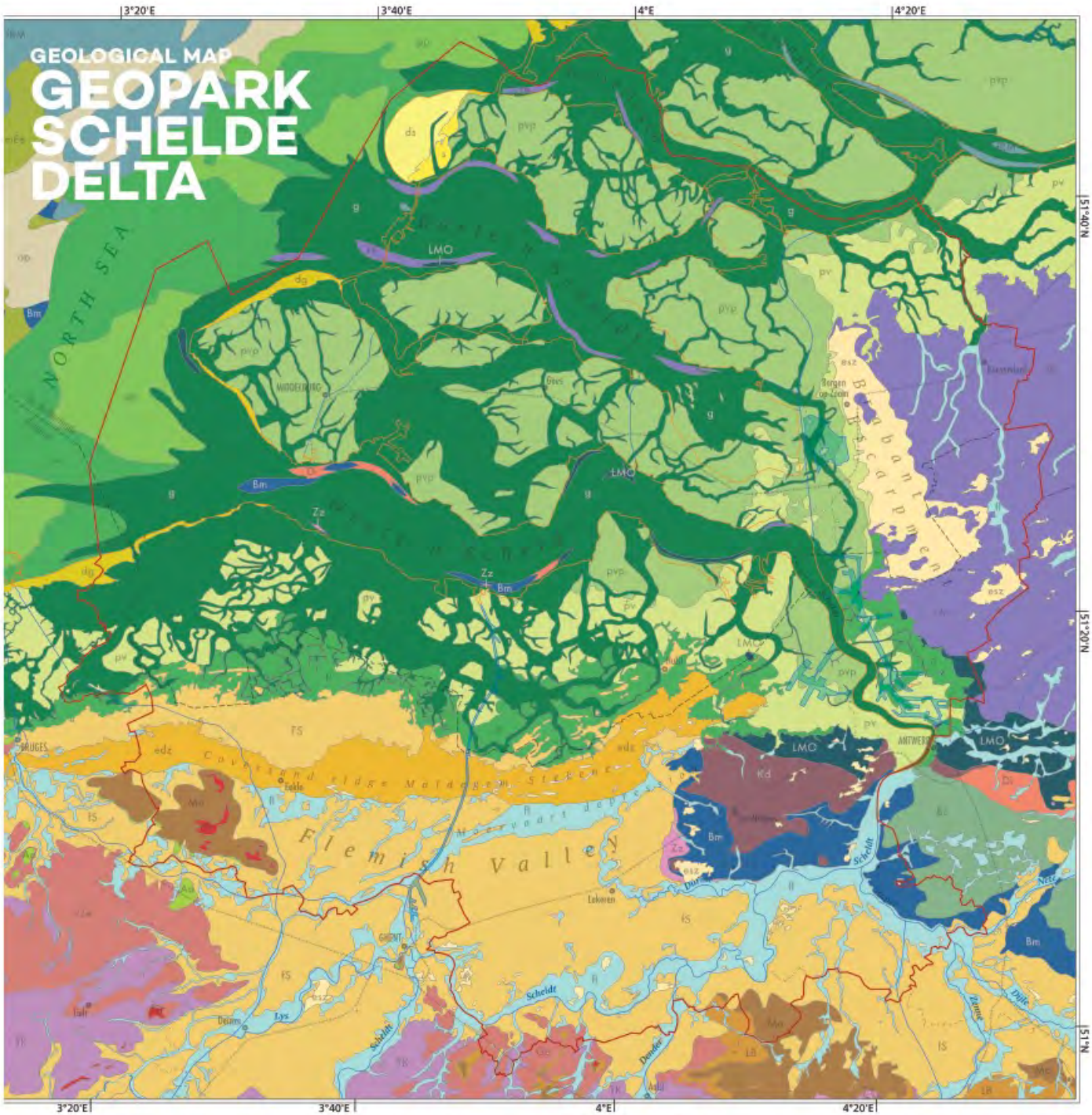
Transgressions and regressions

Superimposed on and reflected in this tilting landscape are the effects of numerous marine transgressions and regressions. Time and again, the North Sea and its precursors flooded and exposed the aUGGp Schelde Delta partly or entirely. The gradual cooling from **subtropical** conditions 50 million years ago to **alternating temperate and glacial** conditions during the Quaternary caused sea level to change with ups and downs. During the warmest periods, especially early on, **clayey deposits** accumulated in relatively **deep and calm** waters. Up to about 15 million years ago, **sandy sediment** ended up and moved around in **shallow-marine** waters where tidal currents and storm waves could reach the seabed. Toward the more temperate end of the Neogene, some 5 million years ago, we see the first clear evidence of the coast passing by, with **coastal-deltaic** and eventually terrestrial conditions taking over (Fig 2). The Pleistocene marked the onset of **fluvial** and **eolian** activity modifying the now increasingly exposed former marine landscape, especially during lowstands. From that time onward, only the basin side of the aUGGp Schelde Delta was still periodically transgressed by the North Sea,



1 North Sea
2 Coastal plain
3 Meuse river
4 Eastern Scheldt
5 Western Scheldt
6 Brabant Escarpment
7 Campine Clay cuesta
8 West-Brabant or Campine Plateau
9 Oedelem-Zomergem cuesta
10 Coversand ridge Maldegem-Stekene
11 Flemish Valley
12 Waasland cuesta
13 Scheldt river
14 Boom cuesta

Figure 4. Digital elevation model showing the contrast between pre-Quaternary and Pleistocene upland (in red and white; dissected by river valleys), Holocene coastal lowland (in green; partly fronted by coastal dunes), and estuarine as well as marine waters (in blue).



HOLOCENE (last 11700 years)

- ds — Coastal dune deposits on beach deposits
- dg — Coastal dune deposits on young tidal deposits
- s — Beach deposits
- g — Young tidal channel deposits
- p — Young tidal flat deposits
- pv — Young tidal flat deposits on peat
- pvp — Young tidal flat deposits on peat on old tidal deposits
- pp — Young tidal flat deposits on old tidal flat deposits
- op — Old tidal flat deposits
- fl — River, brook and lake deposits (partly Late Pleistocene)

PLEISTOCENE (11700 to 2.58 million years ago)

- esz — River dune and drift sand deposits (Late Pleistocene and Holocene)
- edz — Coversand ridge Maldegem-Stekene (Late Pleistocene)
- IS — Deposits of the river Scheldt and tributaries (Middle and Late Pleistocene)
- RMV — Rhine-Meuse deposits (Kreftenheye Formation)
- mEe — Marine deposits (Eem Formation)
- TT — River terrace deposits (coarse sand and gravel)
- Tk — Fluvial and estuarine deposits (Stramproy, Waalre, Weelde, Malle and Merksplas Fm, Early Pleistocene and Late Pliocene)

NEOGENE — PALEOGENE (2.58 to 66 million years ago; mainly marine deposits)

- LMO — Lillo, Maassluis and Oosterhout Fm (upper part) (sand and clay)
- Kd — Kattendijk and Oosterhout Fm (lower part) (sand)
- Di — Diest and Breda Fm (upper part) (sand and clayey sand)
- Be — Berchem and Breda Fm (lower part) (sand)
- Bm — Boom Fm (clay) (NL: Rupel Fm)
- Zz — Zelzate Fm (sand and clay) (NL: Tongeren Fm)
- Ma — Maldegem Fm (sand and clay)
- Lb — Lede and Brussel Fm (sand and calcareous sandstone)
- Aa — Aalter Fm (sand and clay)
- Ge — Gentbrugge Fm (sand and clay)
- Tk — Tielt and Kortrijk Fm (clay, silt and sand)

- Geopark boundary
- Coastline
- Inland waterway
- National boundary
- Provincial boundary
- Railway

The map units are (combinations of) formations (Fm), members and profile types. Where the uppermost unit is thinner than 2 m (mainly coversand, sandy loam), the underlying unit is shown.

COLOPHON

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EDITOR P. Kiden

Figure 5. Bipartition of the aUGGp Schelde Delta's geology, with old, fluvially dissected marine deposits dominating the upland and young tidal deposits dominating the estuarine coastal plain. Almost imperceptibly, fluvial and tidal erosion removes more and more of the Paleogene to Pleistocene landscape

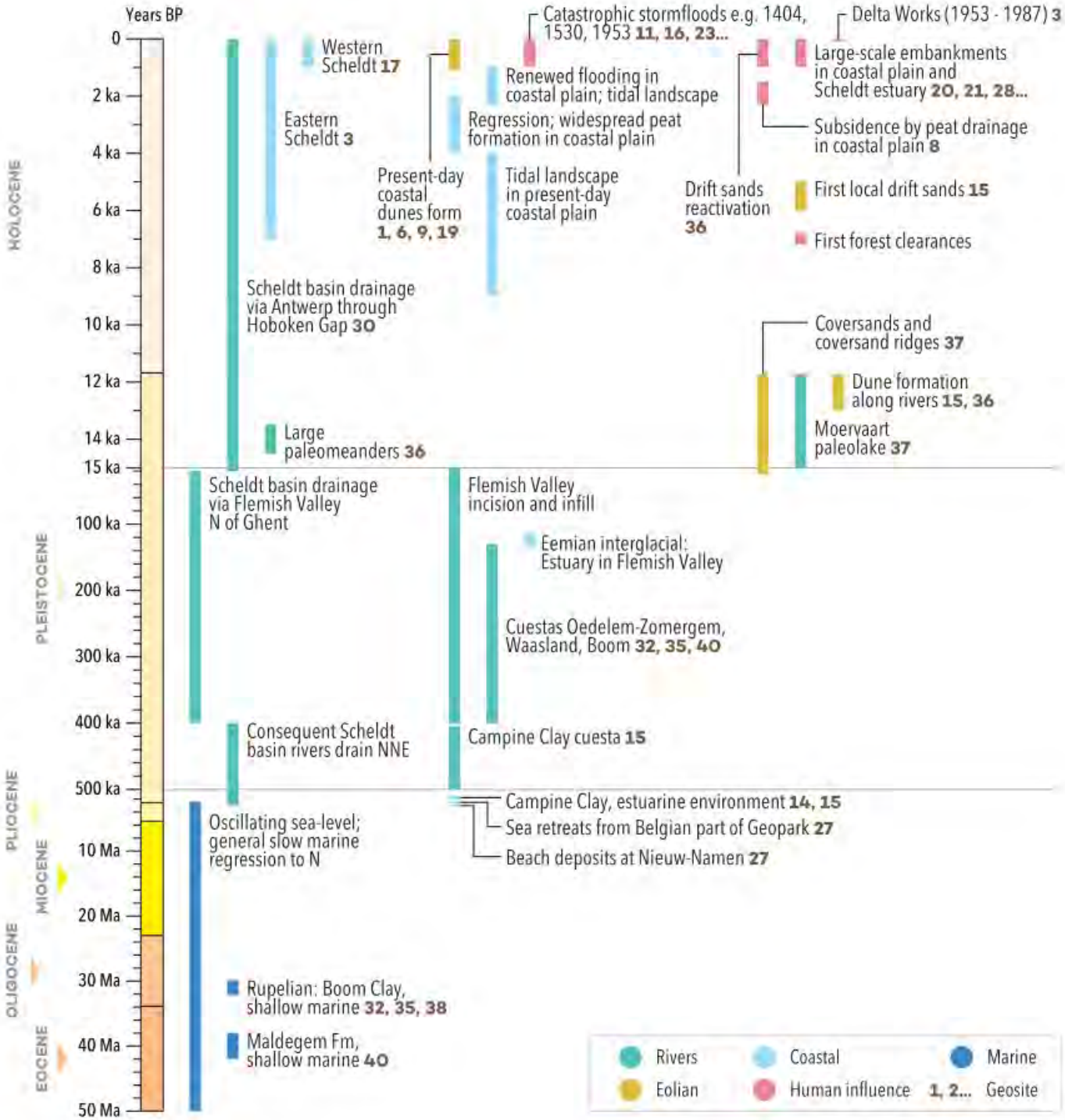

Figure 6. Main events and processes that shaped the geology and present landscape of the Geopark. To adequately represent deep geological time, the time axis is non-linear, with scale changes at 500 and 15 ka BP (thousands of years Before Present). Ma is millions of years

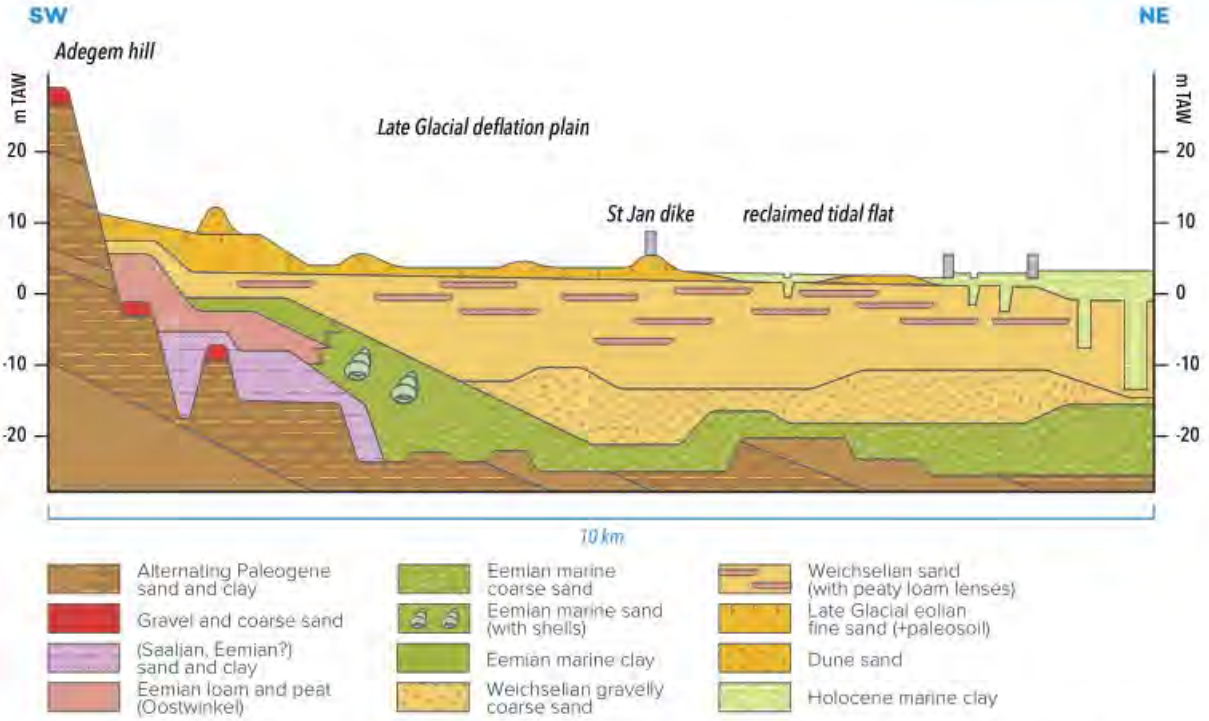

Figure 7. Pleistocene sediments of the Flemish Valley abutting a cuesta formed in Paleogene sediment. Multiple phases of erosion and deposition exposed and covered the cuesta flank between the Saalian and Weichselian

exclusively during interglacial times. Around 9000 years ago, the **Holocene North Sea** began to flood the lowest parts of the aspiring Geopark. At an initial rate of almost a meter per century, in line with the most pessimistic IPCC scenarios for the 21st century, submergence was quick and extensive. To people at the time, resistance was futile. They had to adjust.

River activity in the Qauternary

As the seas came and went, they also raised and lowered **base levels**, enabling rivers to fill or deepen existing valleys in the coastal plain. **Erosive power** was strongest during **cold periods**, although the area was never glaciated. **Polar deserts** and **tundras** exposed plenty of sand and silt to the combined action of frost, braided rivers and winds. **Sedimentation** prevailed during **warmer times**, when base levels were high and stabilizing **vegetation** was plentiful. The **Scheldt** changed course on more than one occasion, abandoning old and carving new valleys both upstream and downstream (Fig 3). Its fresh and saline waters continue to sculpt the landscape, bringing about annual, daily and even hourly changes that are best visible in **intertidal areas**. In these transitional areas, you can see tidal and fluvial currents, waves and wind at work. Here, the aspiring Geopark is a living **sedimentological field laboratory,** with the best biotic-abiotic interactions you can imagine. Here, you best see the interplay of gradual processes, extreme events and human influence. Here, you find **Eocene fossils** eroded from the aspiring Geopark's oldest sediments entrained in its youngest deposits. Recycling at its best: everything is being reused.

Earth and climate dynamics made visible

The international importance of the aspiring UNESCO Global Geopark Schelde Delta relates mostly to these dynamics. **Tectonics, landscape, environment, sea level and people** have interacted to create enough visible geological, morphological and cultural-historical reminders of our vulnerability to **climate change** to learn all the lessons needed for changing our ways. Spanning 50 million years, they also allow us to see changes beyond the realm of our collective experience. There can be times when sea level is even higher, storm power even greater, rivers and brooks wider and wilder, and terrestrial sand much more mobile than monitored by our modern-day instrumentation. The impacts of such exceptional conditions can be experienced throughout the aspiring Geopark, from **glauconitic marine sands** in fragmented **cuestas** and huge abandoned **meanders** in the present-day Scheldt valley to **windblown coversand ridges** obstructing the former Scheldt valley and remnants of **drowned villages** flooded daily by the Western Scheldt tides (Figure 4).

Geology exposed

The position of the aspiring Geopark in the transitional area between the **subsiding North Sea Basin and the uplifting London-Brabant Massif** provides a unique setting in which pre-Quaternary and Pleistocene units are being eroded and exposed while thick Holocene units have been accumulating only a short distance away. This bipartition is clearly visible on the **geological map** (Figure 5). On the basin side, the dominant **Holocene deposits** are exclusively marine and coastal in nature. Rare outcrops of older, partially fluvial units are limited to the deepest estuarine channels and thus hidden from sight. On the upland side, **Pleistocene and pre-Quaternary units** are near-ubiquitous, traversed only by much more recent fluvial deposits from the Scheldt and its tributaries. The usually thin Holocene cover elsewhere does little to mask what is left of the older geology. Here, these ancient times and key parts of the resulting stratigraphic sequence (Figure 6) can be studied and enjoyed.

TABLE List of Geopark geosites

Geosite nr	Geosite	Geomorphology	Sedimentology	Paleontology	Stratigraphy	geological period	scenic	cultural or historical	archaeological	natural	industrial or economic	Main geological interest	scientific interest	educational interest	(geo)tourist interest	Teaching equipment	Type of pressure	Significance
		Geological interest(s)				Geosite interest(s)												
1	Kop van Schouwen	X	X			Q	X	X	X	X		Coastal and coastal dune morphology and processes	X	X	X	1, 2, 3, 4, 5	I, C, S	i
2	Dintelse Gorzen	X	X			Q	X			X		Morphology and pedology of tidal flats and salt marshes, recently 'fossilized' and undergoing desalinization after removal of the tides		X	X	1, 2, 3, 4, 5	I	p
3	Eastern Scheldt	X	X	X	X	Q	X	X	X	X	X	Estuarine morphology, morphodynamics, sedimentology	X	X	X	1, 2, 3, 4, 5	E, C, W, S	i
4	Pluimpot tidal channel remnant	X				Q		X		X		Tidal channel morphology (embanked), relief inversion		X		2, 4	I, E	n
5	Veerse Meer and Schenge	X	X			Q	X	X		X		Embanked tidal channel with 'fossilized' estuarine morphology		X	X	2, 3, 4, 5	I, E, S	n
6	Dune complex Oranjezon and the Manteling	X	X	X		Q	X	X	X	X		Coastal and coastal dune morphology and processes	X	X	X	1, 2, 3, 4, 5	I, C, S	n
7	Beach ridge of Walcheren	X				Q		X	X			Coastal morphology	X		X	4	L, S	p
8	Creek ridges and pool grounds of Walcheren	X	X			Q	X	X	X			Morphology of impoldered tidal channel and salt marsh landscape with relief inversion features ("creek ridges")	X	X	X	4, 5	L, C, S	p
9	Coastal dunes of southwest Walcheren	X	X			Q	X	X	X	X		Coastal and coastal dune morphology and processes	X	X	X	4, 5	I, C, W, S	n
10	Oudland area De Poel	X				Q	X	X	X	X		Morphology of impoldered salt marsh landscape on peat with relief inversion of small tidal channels ("creek ridges")	X	X	X	1, 2, 4, 5	C, L	n
11	Kolk lakes of Zuid-Beveland	X	X	X		Q	X	X		X		Morphology and genesis of kolk lakes resulting from historical dike breaches along former tidal channels		X	X	1, 2, 3, 4, 5	E	p
12	Yerseke and Kapelse Moer	X				Q	X	X	X	X		Morphology of impoldered salt marsh landscape with features of historical peat extraction	X	X	X	2, 4, 5	I, L, C	n
13	Markiezaat	X	X			Q		X	X	X		Morphology and pedology of tidal flats and salt marshes 'fossilized' and undergoing desalinization after recent embankment	X	X	X	1, 2, 3, 4,	E, C, S	n
14	Smalle Beek Valley	X				Q	X	X	X	X		Fluvial morphology of small stream valley eroded during the Quaternary		X	X	4	E, L, C, S	n
15	Brabant Escarpment - Kalmthoutse Heide	X	X	X	X	Q	X	X	X	X	X	Quaternary fluvial cliff face erosion in exposed Lower Pleistocene estuarine deposits; Late Quaternary inland dune morphology, stratigraphy and genesis	X	X	X	1, 2, 3, 4, 5	I, L, C	i
16	Drowned Land of Saeftinghe	X	X			Q	X	X	X	X		Brackish-water tidal flat and marsh morphology, sedimentology and processes	X	X	X	1, 2, 3, 4, 5	I, E, C, W	i
17	Western Scheldt	X	X	X	X	Q	X	X	X	X	X	Estuarine morphology, morphodynamics, sedimentology	X	X	X	2, 3, 4, 5	E, L, C, W	i
18	Drowned Zwarte Polder	X	X	X		Q	X	X	X	X		Coastal morphology and processes (small tidal inlet with tidal flats and salt marshes)	X	X	X	2, 4, 5	I, C	n
19	Zwin	X	X			Q	X	X	X	X		Coastal, coastal dune and tidal flat and salt marsh morphology and processes	X	X	X	1, 2, 3, 4, 5	I, C	i
20	Zwin creek remnants and Passageule	X				Q	X	X	X	X		Morphology of dammed and impoldered tidal channel and creek system	X	X	X	3, 4, 5	E, L	n
21	Zwin polders near Damme	X				Q	X	X	X			Morphology of impoldered tidal landscape with relief inversion of former tidal channels and creeks	X	X		2, 3, 4, 5	E, L	n

Table with list of geosites

Geosite nr	Geosite	Geomorphology	Sedimentology	Paleontology	Stratigraphy	geological period	scenic	cultural or historical	archaeological	natural	industrial or economic	Main geological interest	scientific interest	educational interest	(geo)tourist interest	Teaching equipment	Type of pressure	significance
		Geological interest(s)				Geosite interest(s)												
22	Creek and coversand area Sint-Margriete - Aardenburg	X	X			Q	X	X	X	X		Morphology of impoldered tidal landscape with remnants of tidal channels and creeks breaching eolian coversand ridges of Late Weichselian age	X	X	X	1, 2, 3, 4, 5	E,L,C,S	n
23	Braakman region	X				Q		X	X	X		Morphology of impoldered large and long-lived tidal channel and creek system		X	X	1, 2, 3, 4, 5	E,L	p
24	Otheense Kreek	X				Q		X	X	X		Morphology of impoldered well-preserved tidal channel and creek system and surrounding tidal landscape			X	4	E,L,S	n
25	Coversand area Sint Jansteen	X	X			Q	X	X	X	X		Morphology of impoldered tidal landscape with remnants of tidal channels and creeks breaching eolian coversand ridges of Late Weichselian age	X	X	X	2,4,5	I,C,S	n
26	Oudland area De Putting	X				Q	X	X	X	X		Morphology of impoldered salt marsh landscape with features of historical peat extraction and relief inversion of small tidal channels		X		4	L,C	p
27	Nieuw-Namen	X	X	X	X	N, Q	X	X	X			Inselberg morphology of Pliocene deposits in Holocene polder landscape; sedimentology, paleontology, stratigraphy and pedology of exposed Pliocene and Quaternary deposits	X	X	X	2, 3, 4, 5	I,R	i
28	Waasland Scheldt Polders	X	X	X		Q	X	X	X	X	X	Morphology of impoldered tidal landscape with features of reclamation and flooding history; the harbour works temporarily exposed sections in Neogene to Quaternary deposits	X	X	X	1,2,4,5	L,S	n
29	Brackish tidal marshes of the Scheldt	X	X			Q		X		X	X	Estuarine morphology, morphodynamics and sedimentology	X	X		1,2,5	E,C,L	i
30	Freshwater tidal area and polders of the Scheldt	X	X			Q	X	X	X	X	X	Estuarine and fluvial morphology, sedimentology and processes	X	X	X	1, 2, 3, 4, 5	C,L,W	i
31	Durme Valley	X				Q	X	X	X	X		Estuarine and fluvial morphology and processes	X	X	X	1, 2, 3, 4, 5	C,L,W,S	n
32	Boom cuesta	X	X	X	X	P, Q		X	X		X	Morphology and structural geology (cuesta); sedimentology, paleontology, stratigraphy and economic geology (Paleogene deposits, brick industry)	X	X	X	1, 2, 3, 4, 5	E	i
33	Rupel Valley	X				Q			X	X	X	Estuarine and fluvial morphology and processes		X		2, 3, 4	E,C,W,S	n
34	Barbierbeek Valley	X				Q	X	X	X	X		Fluvial morphology and processes		X	X	4,5	E,C,L,W,S	p
35	Waasland cuesta	X	X	X	X	P, Q	X	X	X	X	X	Morphology and structural geology (cuesta); sedimentology, paleontology, stratigraphy and economic geology (Paleogene deposits, brick industry)	X	X	X	1, 2, 3, 4, 5		i
36	Paleomeanders Kalkense Meersen and Berlare	X	X	X		Q	X	X	X	X		Fluvial morphology, sedimentology and paleo-hydrology of Weichselian Lateglacial meanders	X	X	X	1, 2, 3, 4, 5	I,C,W	n
37	Moervaart depression and coversand ridge	X	X	X	X	Q	X	X	X	X		Fluvial and aeolian morphology, sedimentology, paleohydrology, paleoecology and stratigraphy of Weichselian Lateglacial lake deposits	X	X	X	2, 3, 4, 5	E,W,L	i
38	Steengelaag clay quarry	X	X		X	P	X	X		X	X	Morphology and structural geology (cuesta); sedimentology, stratigraphy and economic geology (Paleogene deposits)		X	X	2, 4, 5		p
39	Paleovalley of the Oude Kale	X	X			Q	X	X	X	X		Fluvial and eolian morphology and sedimentology	X	X	X	2, 3, 4,5	C	p
40	Oedelem-Zomergem cuesta	X	X	X	X	P, Q	X	X	X	X		Morphology and structural geology (cuesta); sedimentology, paleontology and stratigraphy (Paleogene deposits)	X	X	X	1, 2, 3, 4, 5	I,E,C,S	n

Legenda

Geological Period
- Q Quaternary
- N Neogene
- P Paleogene

Teaching Equipment
- 1 Visitors Center
- 2 Excursions/guided tours
- 3 Educational material
- 4 Unguided walking and cycling route
- 5 Oher (e.g. infopanels)

Pressure
- I Intensive entry
- E Environmental damage
- R Removal or looting
- C Climate change
- L Leveling and excavation
- W Water safety measures
- S Spatial development

Significance
- i international
- n national
- p provincial

Listing & description of geological sites

As stated earlier, the aUGGp Schelde Delta has identified **40 sites of geological scientific interest on which this application for UNESCO Global Geopark is based**. This list is based on prior scientific evaluation in collaboration with the scientific board. These geosites constitute the **backbone to the discovery and understanding** of the aspiring Geopark as they showcase its exceptional heritage. The aspiring Geopark also contains other sites with cultural and natural interest, some of which have an overlap with the 40 geosites.

One of the main objectives of the aUGGp Schelde Delta is **to explore, develop and celebrate the linkage between geological heritage** and all other aspects of the natural, cultural and intangible heritage of the region. This was also the principle for the selection of the geosites of the aUGGp Schelde Delta. Due to this interaction between geology and humans at the transitions of land and water, high and low, fresh and salt, sand and clay an **enormous wealth of geomorphology, landscapes, cultural history (material and intangible) and nature** has been created. These are displayed and can be experienced at the many sites and activities in the area. Detailed descriptions of all geosites are in Annex 7.

Cuestas and escarpments

Stratigraphically, the deposits exposed in the aUGGp Schelde Delta cover the last 50 million years of geological time, from Eocene to Quaternary. They have recorded even minor sea-level fluctuations in lithological variations, resulting in a **classic siliciclastic sedimentary sequence** which was already studied in detail in the 19th century. Quaternary erosion modelled the dipping alternating sand and clay layers in a series of cuestas and escarpments.

The Oedelem-Zomergem cuesta

The distribution of all eleven Paleogene and Neogene units within and around the aspiring Geopark boundaries reflects their north-northeasterly dip (Figure 5). Their west-northwesterly along-strike orientation is highlighted by a series of **asymmetric hills** and broad intervening river valleys. The **Oedelem-Zomergem** cuesta in the southwesternmost part of the aUGGp Schelde Delta (geosite 40) is one of only two locations in Belgium and the Netherlands with outcrops of **late Lutetian and Bartonian** sediment. These outcrops are important for research on a time of massive carbon input and ocean acidification, during the **Paleocene-Eocene Thermal Maximum**. A cyclical sequence of glauconitic sand and clay of the **Maldegem Formation**, the oldest unit of the aspiring Geopark, points to deposition in a **warm continental** shelf setting with slow rates of accumulation, high rates of continental weathering and fluctuating water depths. The entire aUGGp Schelde Delta was submerged by the sea, at times up to about 100 km away from the closest shoreline (Figure 2). Only 60 years ago, the ancient clay was still extracted commercially in a local quarry.

The cuesta itself it is a prominent geomorphological feature that shows the long-term interplay of Cenozoic tectonics, Pleistocene fluvial erosion and Pleistocene valley fill. It was formed or at least further sculpted during the **Saalian**, when the braided Scheldt river occupied a broad fluvial plain flanking the eroding ridge (Figure 7). **The cohesive Asse Clay** in the Maldegem Formation was relatively resistant to erosion and stood out. At its peak, the cuesta was almost 50 m high. From the **Eemian** onward, the adjacent valley was filled with fluvial, estuarine, coastal-marine and windblown sediment, covering the oldest cuesta units and reducing its height above the aggrading valley floor by tens of meters.

The Waasland and Boom cuestas

The Waasland and Boom cuestas (geosites 35 and 32) are similar in origin but carved from fully **marine Oligocene units**. On the south side of these highs, the **Scheldt** and its main tributaries **Durme** and **Rupel** flow right next to the **stratotype of the Rupelian**. Introduced as a lithological unit in 1850 by the godfather of Belgian geology, André Hubert Dumont, it became a formal age in the 20th century. Its best-known unit, the **Boom Formation**, has been studied in detail for its environmental record and given its potential as a long-term storage option for

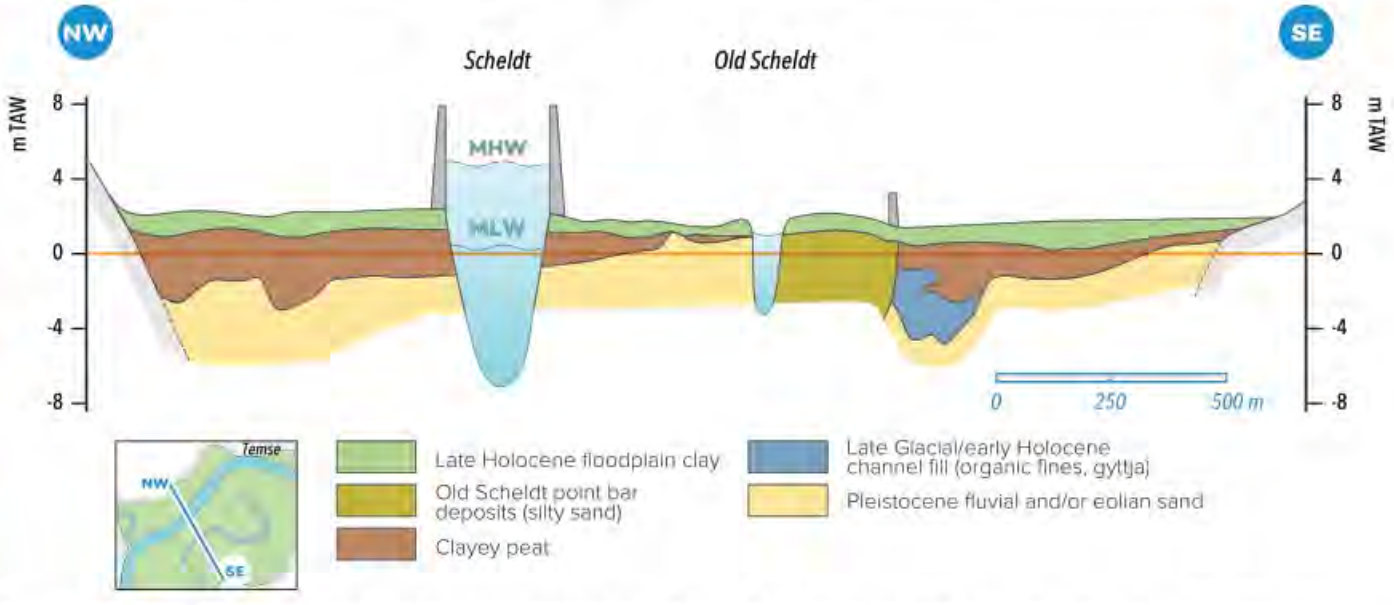

Figure 8. Transition from a natural to an embanked and stabilized river channel. As the floodplain is no longer fed with sediment, it becomes increasingly vulnerable. The Late Glacial/early Holocene channel fills and overlying Holocene peaty, sandy and clayey floodplain and point bar deposits cover older fluvial and eolian facies filling the Flemish Valley

radioactive waste. In the firm clay, fossil hunters find **gastropods, bivalves and fishbones,** and mineral collectors uncover plenty of **septarian nodules and pyrite crystals**. Perhaps most importantly, this 30-million-year-old marine clay supllies a brick **industry** that has shaped the local landscape as well as the built environment. North of the Boom cuesta and surrounded by tidal deposits, a small former quarry at Nieuw-Namen (geosite 27) shows a unique exposure of **Pliocene iron-cemented beach deposits** overlain by Pleistocene coversand. Here, on an isolated outlier up to 5 m above present sea level, visitors can witness the oldest non-marine sediments of the aspiring Geopark, part of the **Lillo/Oosterhout Formation.** About **3 million years ago**, the shallowing sea was giving way to a coastal-terrestrial environment once and for all. The Netherlands '**oldest beach**' is home to washed-up **sea urchins and scallops**, conveniently concentrated by the waves of the time. Cooler climates were about to make their mark. Rivers and wind would soon take over.

The Brabant Escarpment

Situated on the western margin of an extensive plateau of **late Pliocene and early Pleistocene (Tiglian) fluvial and estuarine sand and intercalated clay,** the Brabant Escarpment (geosite 15) dominates the northeastern side of the Geopark. It marks yet another transition from old and high to young and low. The escarpment continues southeastward into the **Campine Clay cuesta**. It was originally formed by northward-flowing rivers from the Scheldt basin, which eroded sediment from the adjacent high. Given its base at some 15 m below sea level, the original surface was lowered by at least several tens of meters. The plateau to the east of the Brabant Escarpment remained outside the influence of the Rhine and Meuse (and later the Scheldt) for much of the Pleistocene, enabling the development of a **peneplain in early Pleistocene units**. This long-term erosional setting is rare for the Netherlands, a country characterized by rapid sedimentation. The plateau's subsurface is exposed in the partly filled **former quarries Boudewijn and De Bunt**. With **1.8-million-year-old tidal deposits of the Waalre Formation**, they show some of the oldest

Figure 9. Development of the main Scheldt branch though time. The orientations of both the Eastern and Western Scheldt appear to be in line with the overall tectonic setting. Their positions and depths are probably influenced by differential substrate erodibility

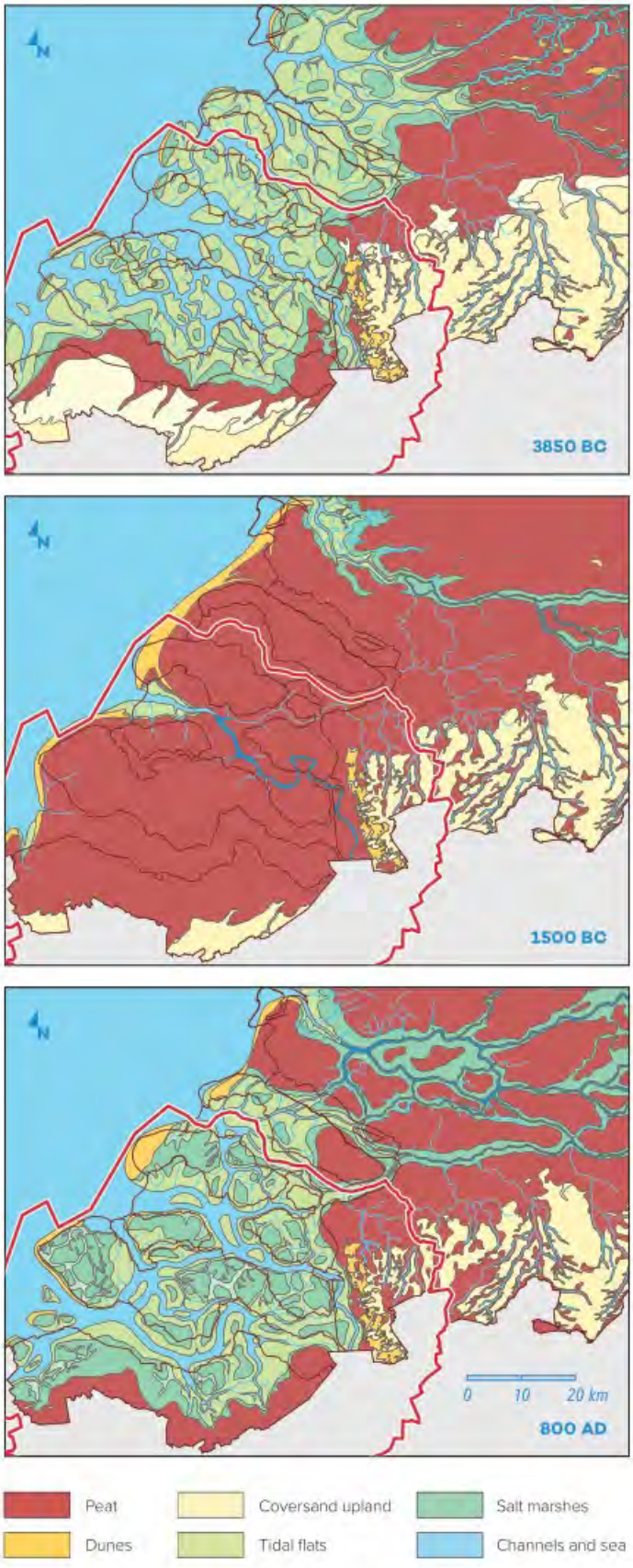

Figure 10. Natural and human-influenced phases in the development of the coastal plain. The only constant during this entire time period was the Eastern Scheldt, which remained active and more or less in place. Red: swamps, orange: dunes, yellow: other upland; light green: tidal flats, bluish green: salt marshes, blue: channels and open sea

Pleistocene deposits in the Netherlands and Belgium. Elsewhere, the visible geology is mostly limited to a cover of mobile drifting sand (Figure 5), interrupted by scattered wetlands. Close to the escarpment edge, older **eolian sand** has accumulated, sourced in part from the exposed **Scheldt valley at the end of the last ice age.** These windblown units postdate the formation of the escarpment. Small-scale erosion by local brooks (geosite 14) shows how the Pleistocene landscape is still being modified today.

River valleys and coversand

The Flemish Valley

One of the main geological domains of the aspiring Geopark, the **Flemish Valley,** is of Pleistocene signature. The large dimensions of this **incised valley system**, now mostly filled, are testament to deep erosion of the landscape during the second half of the **Quaternary**. It is clearly oversized for today's rivers, showing the lasting imprint of **periglacial conditions and low base levels** during glacial times. Smaller-scale evidence of this cold-climate setting, such as sand-filled frost wedges and other cryogenic structures, is harder to find without having to dig. It is only visible in a few remaining quarries.

The morphology of the Flemish Valley reflects how dramatically the **drainage pattern in the Scheldt river basin** has changed over time (Figure 3). Prior to ca. **900,000 years ago**, rivers followed north-northeasterly paths on the gentle **regression surface** left behind as the Neogene sea receded. Many tributaries of the modern Scheldt still show this original orientation, following the most efficient route from high to low. In due time, the sloping paleosurface was incised and **terraces of coarse deposits** were created. Small patches of the highest terrace have survived on top of the **Oedelem-Zomergem cuesta** (Figs. 5 and 7). As they developed, the extensive lows at the foot of the cuesta escarpments became ideal thruways for a new, **east-west-oriented drainage network**. The resulting valley, more than 30 km wide, captured the water of many north-northeastward-flowing rivers. By **300,000 years ago**, most of the drainage of the Scheldt basin had become oriented toward the northwest. During both the **Saalian** and **Weichselian** glacials, the valley was initially cut to **tens of meters** below present sea level but subsequently filled with sandy sediments by **aggradational braided rivers** (Figure 7). Remnants of these fills extend almost all the way to the northern edge of the aspiring Geopark in the Netherlands. During the **Eemian** interglacial, the broad valley transformed into an increasingly intricate **estuary** as sea level rose and marine waters moved in much farther than at present. At its maximum extent, the estuary reached well south and east of the aUGGp Schelde Delta. In the meantime, the Scheldt had connected to an additional, hydrologically advantageous outlet along the present Belgian coastal plain between Zeebrugge and Ostend (Figure 3).

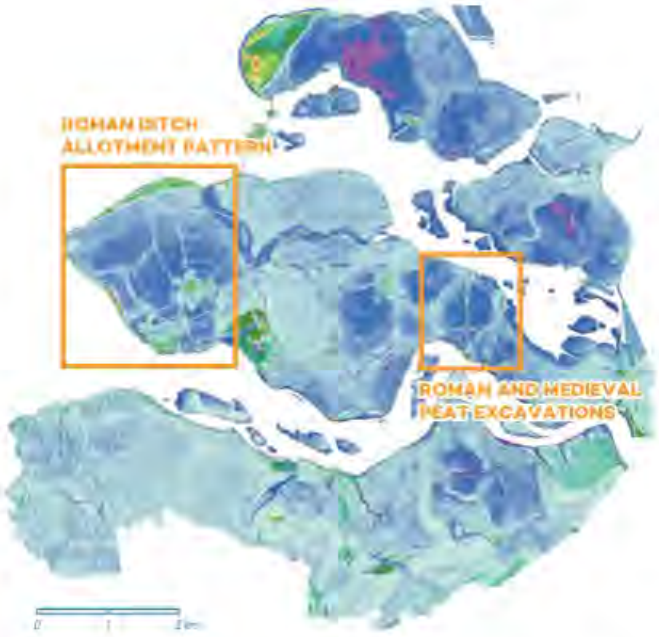

Figure 11. Relatively sandy fills of rectangularly patterned Roman ditches and excavation pits are less sensitive to compaction than adjacent clay-peat grounds. In the modern landscape, they form inversion ridges that are hard to see in the field but can easily be identified in digital elevation models (relief of decimeters). A more prominent inversion ridge (relief of meters) is Pluimpot (geosite 4), a former tidal channel that used to bipartition the island Tholen.

Out of the ice age

The **end of the Weichselian** brought another dramatic **reorientation of the drainage network**. Around the **Last Glacial Maximum**, some **20,000 years ago**, cold and dry conditions were perfect for the transport and deposition of **windblown sand**. North of Ghent, an expanding **coversand ridge at Maldegem-Stekene** (geosite 37) choked the downstream part of the Flemish Valley, diverting river flow. By the start of the **Late Glacial**, 5000 years later, the drainage direction of the Scheldt and its western tributary Lys had been **diverted to the east** through the **Hoboken Gap**, south of Antwerp between the Waasland and Boom cuestas. From that time onward, the Scheldt basin rivers would enter the coastal plain along this narrow pathway (Figure 3).

As the river system shifted, floodplains within the valley broadened and narrowed, occupying varying proportions of the available space. A set of **Late Glacial paleomeanders** near the southern margin of the aspiring Geopark, at Kalkense Meersen and Berlare (geosite 36), shows the mobility of the Pleistocene rivers. Here, well-preserved **point bars** and partly excavated, originally **peat-filled oxbow lakes** have stood the test of time, forming a unique archive of **rapid late Pleistocene and early Holocene environmental change.** Peat sequences in the alluvial plain blocked by the coversand ridge of geosite 37 are equally valuable. At the Scheldt polders in Waasland (geosite 28), intact coversand surfaces are sealed underneath Holocene peat and tidal clastics. These surfaces are some of the **best-preserved and most thoroughly studied prehistoric landscapes** in northwestern Europe. A good example of an undersized meandering channel is the upstream part of the Scheldt tributary **Durme** (the **Oude Kale**, geosite 39). It is dwarfed by its surroundings. Even the current **floodplain of the Scheldt** itself occupies only a small part of the Flemish Valley. Its most remarkable characteristic today is that it is **several meters below high tide** in the embanked modern river (Figure 8). A still visible fragment of the abandoned natural river shows how the Scheldt was once able to nourish the entire floodplain with overbank sediments.

The coastal plain

Rising sea and drowning land

The coastal plain of Zeeland, the largest domain of the aspiring Geopark, came into existence during the **Holocene**. Rising sea level transformed a vast swath of terrestrial lowland into a highly dynamic estuary. Tidal action eroded some parts and left thick deposits of sand and mud in others. **Early and middle Holocene** tidal deposits are either under water or covered by **younger peat and clay layers**. All that visibly reminds us of these early times is the **Eastern Scheldt** (geosite 3). Even this main estuarine branch didn't come into existence until about **7000 years ago** (Figure 9). Once formed, it was never fully abandoned.

The rate of sea-level rise has had an enormous influence on landscape development (Figure 10). Early on, the **accommodation space** created by extremely rapid rise far exceeded sediment supply. **Open tidal basins** raced inland. When this rate dropped

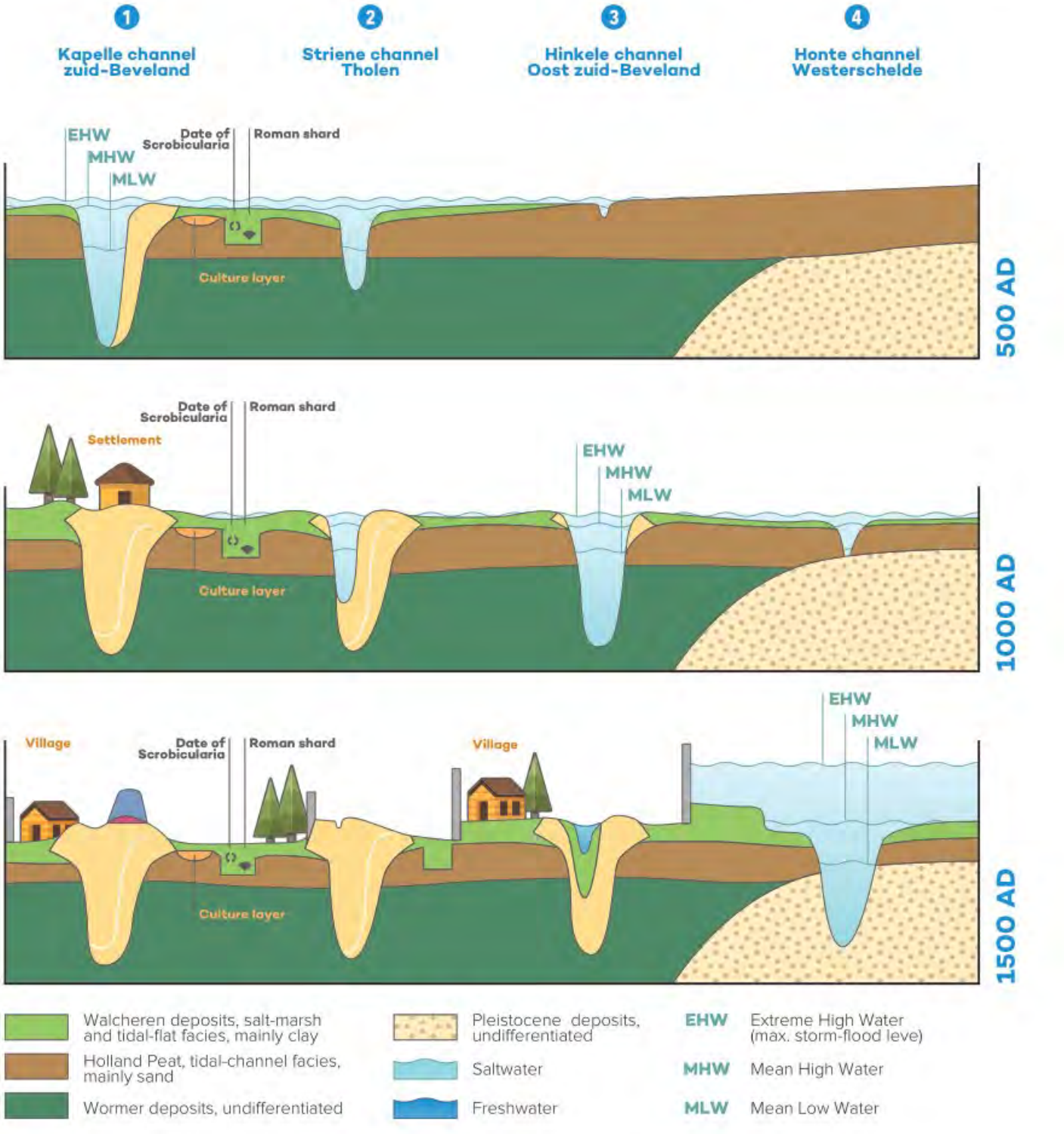

Figure 12. Influence of humans on the development of the aspiring Geopark coastal plain during the Middle Ages. The price paid for protection by increasingly high dikes is a lack of sedimentation. Polders can't keep up with sea-level rise. The older, the lower

below a critical threshold, about **4500 years ago, sedimentation** became the dominant force. As tidal basins began to silt up, channels and inlets shrank and natural drainage of the hinterland worsened. Within 2000 years, **vast swamps** had conquered almost the entire coastal plain. **Peat** formed in these swamps cannot be seen directly. You need a hand auger to discover it.

Peat and people

During the **Roman Period**, the landscape changed radically again. This time, people made all the difference. About **2000 years ago**, peatlands were actively **drained** (Figure 11) to build settlements, create arable land and dig up fuel. When thick layers of organic material are dewatered, they oxidize. As peat turned into greenhouse gas, the **subsiding land surface** became sensitive to **marine flooding and erosion**. Ditches and pits dug by humans made it easy for the sea to enter and to start its self-reinforcing **destruction of precious peatland**. In less than 500 years, the coastal plain reverted to a **landscape of tidal flats** and migrating channels, leaving a cover of young tidal deposits. As clastic deposition raised the level of newly formed tidal flats, it only took a few hundreds of years before **salt marshes** were able to establish themselves (Figure 10). Located in the highest places, these vegetated areas accreted up to a point where they were no longer flooded. Permanently dry areas were once again **populated by humans**. In the meantime, the isolated Honte tidal channel had connected to the river Scheldt, giving it an alternative way out to sea (Figure 9). Many centuries later, this pathway would develop into the **Western Scheldt**.

Large-scale embankments: polders

For their own safety, people **embanked** most of the salt marshes from the **11th to the 13th century**. Inherited dewatering patterns made or modified by man are still visible at **De Poel** (geosite 10) and at **Yerseke and Kapelse Moer** (geosite 12), authentic pieces of island core that have escaped reparceling and leveling. Obviously, tidal waters needed to be kept out, but newly created **polders** also put an end to natural sedimentation. With continued sea-level rise, the geologically malnourished land behind the dikes became ever more prone to flooding. History repeated itself (Fig 12).

Storm surges and floods

Periodic flooding, usually associated with extreme events, has dominated the well-documented period from the **late Middle Ages to modern times**. The impact of these events on today's landscape is inescapable. **Storm surges** in the early 1530s, for example, were decisive in the establishment of the **Western Scheldt** as the main estuarine branch. A low-lying polder area on the landward side of the **Eastern Scheldt**, including its 15 towns, was swallowed by the sea in a timespan of a few years, tipping the scales in favor of the southern branch. As tidal-current velocities decreased in the north, the Western Scheldt channel deepened in the south.

Once a dike was breached, water would plunge into a polder with great force, creating **scour holes** and triggering tidal flow that tended to strengthen during subsequent ebb-flood cycles. The resulting loss of land was entirely man-made and not seldomly irreversible. Because of high current velocities in newly formed channels, it proved hard to repair major dike breaches and reclaim entire polders at once. The **14th-century Braakman tidal system** (geosite 23) provides an example of step-by-step post-storm polder reclamation. Each newly embanked area is higher than the previous one, reflecting increased cumulative **tidal sedimentation** outside the dike through time. Other silent witnesses of repaired storm-surge damage are circular ponds marking **breach-related scour holes** adjacent to characteristic non-linear dike sections (geosite 11). Layers of clastic sediment and organic matter, accumulated in these ponds following dike repair, form useful **records of climate change, flooding history and vegetation**.

Not all land loss has been induced by storm surges. Saeftinghe (geosite 16) was flooded on purpose during the **16th-century Siege of Antwerp**. Today, this submerged land is home to one of the largest **brackish-water marshes** in Europe. Natural tidal processes take place without disturbance by humans, burying the remains of lost villages under a fresh layer of sand and mud. Here, renewed sedimentation has raised land levels that had no longer been able to keep up with sea-level rise to unprecedented levels. The channels supplying this sediment are remarkably similar to near-waterless versions frozen in modern polders (Figure 13).

The large estuaries

For environmental and safety reasons, the exceptionally dynamic **Eastern and Western Scheldt** have been intensely monitored since the **1953 storm surge**. Their channels and tidal flats are still adjusting to **major engineering works**. Newly formed salt marshes and ever-changing drowned polders have **high ecological, cultural and landscape value**. Strong **gradients** in salinity and flooding frequency have resulted in a highly varied flora and fauna. There have been unexpected bycatches as well. For example, the sedimentary structures found in the construction pits of the Storm Surge Barrier in the Eastern Scheldt and studied by numerous sedimentologists have become the reference standard for tidal deposits in an estuarine/deltaic setting.

The Western Scheldt, still fully connected to the North Sea, shows a landward transition from **fully marine** environmental conditions near its inlet to highly valuable **brackish-water tidal areas** just north of Antwerp (geosite 29). Even farther upriver, wetlands mark **rare freshwater tidal areas** that have been heavily influenced by humans (geosites 30 and 31). Few rivers in northwestern Europe are subjected to tidal action as far inland as the Scheldt. The presence of tides has had a strong impact on land use, best reflected in today's landscape along the freshwater tidal reach of the Scheldt and its Durme tributary.

Many scientists consider the Western Scheldt to be one of the **best laboratories for geology in action.** Its **large tidal range** amplifies the power, speed and extent of morphological and sedimentological processes alike. It is perfect for teaching and discovering. Migrating and deepening channels erode substrates that are uniquely **rich in fossils**. More than 600 Paleogene to Pleistocene species, covering the **tropical to glacial conditions that shaped the aUGGp Schelde Delta,** have been found on

Figure 13. Spitting images: an easily accessible former tidal channel in a present polder (Dintelse Gorzen, geosite 2) and a now-flooded former polder (Saeftinghe, geosite 16). Photographer: Patrick Kiden

a single easily accessible Western Scheldt beach. They are as important to amateur collectors as to academic researchers.

Coastal features

Another **dynamic inlet**, infinitely smaller and just south of the mouth of the Western Scheldt, isn't presently connected to a sizable tidal basin but just as relevant. The **Zwin** (geosite 19) shows how tidal channels may lose power over time as competing estuarine branches become more prominent. **Megaripples, windblown sand** and degrading **salt marshes** in the subtidal, intertidal and supratidal still look different each day, month and year. Tidal flats and channels have come and gone within decades or centuries. Most importantly, this **oldest Flemish nature** reserve shows how **Bruges** lost its crucial connection to the sea. Tides and wallets are connected.

Aside from the Eastern Scheldt, **coastal dunes** have been the most consistent and resilient morphosedimentary feature of the coastal plain. Various **island heads** (geosites 1, 6 and 9) are occupied by a diverse range of **dune types of different age and maturity**, from recent **embryo dunes** to some of the highest **mobile foredunes** and most well-developed **parabolic dunes**. Fossil ridges stabilized by vegetation are home to **coastal oak forests**. Effects of vegetation type and cover, heavily managed by humans, are evident. They play a key role in **coastal erosion and accretion**, helping us to keep the coastline in place.

The human factor in geology

Human action as a geological force is the single-most distinctive characteristic of aUGGp Schelde Delta. Whether we were fighting, using or building with nature, our past actions have had numerous **intended and unintended consequences** for **landscape** and the **sedimentary record**. For millennia, willful erosion and deposition have been used for military, political, economic, environmental and safety reasons. Even today, we create and manage exciting new depositional environments while destroying them elsewhere. Balancing the good and the necessary in this dynamic landscape is difficult, and warrants all the attention that a Geopark status provides.

Acknowledgements

- TNO – Geological Survey of the Netherlands: Sytze van Heteren, Patrick Kiden and Peter Vos
- Maps production by TNO - Geological Survey of the Netherlands: Nik Trabucho Alexandre and Reinder Reindersma.

ANNEX 3A
LETTER OF SUPPORT FROM NETHERLANDS AND FLEMISH COMMISSION FOR UNESCO

unesco Netherlands Commission

unesco Flemish Commission Belgium

[redacted]
Chief of Earth Sciences and Geoparks Section
Natural Sciences Sector
UNESCO
7 place de Fontenoy
F-75352 Paris 07 SP
FRANCE

Your reference	Direct number	Date	Email
[Your reference]	+31 6 [redacted]	Nov 15, 2022	[redacted]@unesco.nl [redacted]@vlaanderen.be

Our reference	Subject
UNESCO-2022-SD1	Letter of Recommendation aUGGp Schelde Delta

Dear [redacted]

The Flemish Commission for UNESCO in Belgium and the Netherlands Commission for UNESCO take honour and pleasure in expressing their support for the candidature of aspiring UNESCO Global Geopark Schelde Delta.

Schelde Delta comprises a transboundary territory, and is inspired by the geological heritage created by the river Scheldt towards its estuary. The river delta across the Belgian-Dutch border is unique due to the intense interaction of natural processes and cultural heritage, boasting forty geological sites of national or international importance.

The initiative for this aspiring UNESCO Global Geopark is headed by two Dutch and three Flemish provinces, as well as the European Grouping of Territorial Cooperation 'Linieland van Waas en Hulst'. It involves 61 local councils and over a hundred stakeholders such as higher education and research institutions, heritage and nature associations, civil society and local enterprises.

Aspiring UNESCO Global Geopark Schelde Delta is not merely based on its intriguing, extensively researched geology. The initiative is also grounded in true cross-border cooperation, with a bottom-up approach including many partners and integrating several sites and projects in one overarching narrative. Furthermore, the park acts as a 'living climate lab', linking local geology with the global challenge of climate change and the UN's Sustainable Development Goals.

The estuary has been changing for over millions of years, and that evolution will not cease due to global warming and rising sea levels. By looking to the past, geopark stakeholders, visitors and inhabitants are learning how to deal with the climate and water challenges of today and tomorrow, true to the initiative's tagline 'on the tides of time and climate'. Through research, education, workshops and events the aspiring geopark aims to inform the public, raise awareness and actively contribute to solutions.

The Flemish Commission for UNESCO in Belgium and the Netherlands Commission for UNESCO have consulted independent experts from Flanders and the independent experts of the Netherlands National Geopark Committee. The assessment of these experts was unanimously positive, praising the initiative's innovative nature, and highlighting its originality within its international context. In their verdict, the experts lauded the dossier of aspiring

unesco Netherlands Commission

unesco Flemish Commission Belgium

UNESCO Global Geopark Schelde Delta for the quality of its content: its coherent and sophisticated language, and its appealing layout.

The Flemish Commission for UNESCO in Belgium and the Netherlands Commission for UNESCO can corroborate the appraisal of the independent experts. As a result, both Commissions wholeheartedly support the formal candidacy of aspiring UNESCO Global Geopark Schelde Delta.

Yours sincerely,

[redacted]
Chair
Netherlands Commission for UNESCO

[redacted]
Chair
Flemish Commission for UNESCO
in Belgium

ANNEX 3B
COOPERATION AGREEMENT FROM INITIATORS AND LETTER OF INTENT FROM PARTNERS

INITIATIEFNEMERS

Oost-Vlaanderen | Provincie Noord-Brabant | Provincie Zeeland | Provincie Antwerpen

Op weg naar een grensoverschrijdend Geopark Schelde Delta

SAMENWERKINGSOVEREENKOMST GEOPARK SCHELDE DELTA
28 NOVEMBER 2019

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ASPIRING GLOBAL GEOPARK

"Samenwerkingsovereenkomst Geopark Schelde Delta"

Ondergetekenden,

1. De Provincie Antwerpen, rechtsgeldig vertegenwoordigd door gedeputeerde, de heer L. Caluwé, handelend ter uitvoering van het besluit van de deputatie d.d. 14 november 2019, verder te noemen: "de Provincie Antwerpen";

2. De Provincie Oost-Vlaanderen, rechtsgeldig vertegenwoordigd door gedeputeerde, mevrouw A. Charlier, en provinciegriffier, [redacted] handelende ter uitvoering van het besluit van de deputatie d.d. 21 november 2019, onder opschortende voorwaarde van goedkeuring door de provincieraad,
verder te noemen: "de Provincie Oost-Vlaanderen";

3. De Provincie Zeeland, rechtsgeldig vertegenwoordigd door gedeputeerde, mevrouw drs. A. Pijpelink, gemachtigd door de Commissaris van de Koning d.d. 26 november 2019 (kenmerk 19432258) handelende ter uitvoering van het besluit van gedeputeerde staten d.d. 26 november 2019 (kenmerk 19431177),
verder te noemen: "de Provincie Zeeland";

4. De Provincie Noord-Brabant, rechtsgeldig vertegenwoordigd door programmamanager Milieu en Gezondheid, [redacted] handelende ter uitvoering van het besluit van gedeputeerde staten d.d. 19 november 2019 bevoegd op grond van de Regeling mandaat Gedeputeerde Staten van Noord-Brabant 2018,
verder te noemen: "de Provincie Noord-Brabant";

5. De Europese Groepering voor Territoriale Samenwerking Linieland van Waas en Hulst, rechtsgeldig vertegenwoordigd door voorzitter de heer J.F. Mulder en directeur de heer R. Meersschaert, gemachtigd door de Linieraad d.d. 23 oktober 2019, bevoegd op grond van de EGTS-statuten d.d. 15 juni 2011,
verder te noemen: "de EGTS Linieland van Waas en Hulst";

Hierna tezamen te noemen: "Partijen", ook wel ieder afzonderlijk te noemen: "Partij"

Preambule

Het Geopark Schelde Delta i.o. zet het gebied van de Vlaams-Nederlandse Schelde Delta (inter)nationaal op de kaart en benadrukt de bijzondere geologische en landschappelijke kwaliteiten van het gebied. Het gebied laat 50 miljoen jaar aan geologische geschiedenis zien. Waarbij ook zeer recente geologie aanwezig is van slechts enkele honderden jaren oud. Het vertelt het verhaal van een uniek gebied dat is ontstaan door de wisselwerking tussen land, zee en de rivier de Schelde met

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haar getij en de mens die in de laatste paar duizend jaar van dit natuurlijke landschap een volledig cultuurlandschap heeft gemaakt. Een gebied met estuarium dat bij uitstek gevoelig is voor de gevolgen van klimaatverandering. Het Geopark zorgt voor bewustwording bij bewoners, recreanten en ondernemers van de bijzondere ontstaansgeschiedenis van het gebied en draagt bij aan de identiteit van het gebied en haar bewoners.

In 2014 is door de provincies Noord-Brabant i.s.m. Stichting De Brabantse Wal, Streekorganisatie De Brabantse Wal (Brabantse Wal) en Zeeland het initiatief genomen om te komen tot een Geopark Schelde Delta. In 2016 is het projectgebied uitgebreid met het gebied van de Vlaamse Vallei in Oost-Vlaanderen en met een deel van de Rupelstreek en Klein-Brabant in de provincie Antwerpen. Deze vier provincies samen met de EGTS Linieland van Waas en Hulst vormen het projectteam dat het Geopark Schelde Delta in de steigers zet en in gezamenlijkheid bouwt aan het internationale netwerk- en samenwerkingsverband Geopark Schelde Delta. De initiatiefnemers zien het Geopark als een kans om samen te werken en door middel van (wetenschappelijke)studie naar de geologie en de daarmee samenhangende geschiedenis de bijzondere geologische en landschappelijke waarde in relatie tot cultuurhistorie en natuur van de Schelde Delta (inter)nationaal zichtbaar en beleefbaar te maken. En daarbij de identiteit van het grensoverschrijdende gebied en zijn bewoners verder te ontwikkelen en de regionale economie, met toerisme als belangrijke economische sector, te stimuleren.

In 2023 kan het gebied van de Schelde Delta zich als Unesco Global Geopark laten erkennen. Deze status vormt een keurmerk voor de bijzondere geologische en landschappelijke kwaliteiten van het gebied. Om dit mogelijk te maken dient het Geopark Schelde Delta i.o. zich in oktober 2021 bij Unesco in Parijs kandidaat te stellen op basis van een zogenaamd bidbook (aanvraagdossier). In dat bidbook wordt het gebied met haar bijzondere geologie, landschap, cultuurhistorie en natuur gepresenteerd en wordt (wetenschappelijk) onderbouwd dat men aan de kwaliteitsvoorwaarden van UNESCO Global Geoparken voldoet.

Om de kandidaatstelling te ondersteunen dienen voldoende betrokken stakeholders dit initiatief te omarmen. Een Geopark kan niet bestaan zonder de steun, betrokkenheid en inzet van tal van lokale, regionale en nationale stakeholders (maatschappelijke organisaties, ondernemers, overheden en onderwijs en wetenschap). Partijen kunnen daar binnen het eigen netwerk als ambassadeur een belangrijke bijdrage aan leveren. Partijen wensen deze intentie uit te spreken en vast te leggen en de afspraken over de internationale samenwerking nader vast te leggen in een samenwerkingsovereenkomst.

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Overwegende dat:

- Naast de intentieverklaring met partners, de samenwerkende provincies en de EGTS een samenwerkingsovereenkomst wensen aan te gaan om de samenwerking in het kader van het Geopark Schelde Delta i.o. formeel vast te leggen en daartoe nadere afspraken te maken;
- Het doel van deze samenwerkingsovereenkomst is bewerkstelligen dat het Schelde Delta gebied zich in 2021, op basis van een aanvraagdossier (bidbook), kandidaat kan stellen om de status van Unesco Global Geopark te verwerven per 2023;
- Het Geopark Schelde Delta i.o. een grensoverschrijdend initiatief is tussen Vlaanderen en Nederland;
- De begrenzing van het Geopark Schelde Delta door de betrokken Vlaams-Nederlandse Wetenschapskamer van een wetenschappelijke onderbouwing wordt voorzien, waarbij op advies van UNESCO, ook rekening wordt gehouden met de bestuurlijke complexiteit van het gebied;
- De status van UNESCO Global Geopark een kwaliteitskeurmerk is voor de bijzondere geologische en landschappelijke kwaliteiten van het gebied en geen zelfstandig merk;
  Met het verkrijgen van dit keurmerk de eigen identiteit, merknamen en doelstellingen van organisaties en netwerken behouden blijven;
- Dit UNESCO Global Geopark keurmerk een wereldwijd gewaardeerd keurmerk is dat aan bekendheid wint en niet verward mag worden met het werelderfgoed keurmerk;
- Geoparken een belangrijke bijdrage leveren aan de Sustainable Development Goals van de UN;
- De geologie, cultuur(historie) en natuur samen de identiteit van het gebied bepalen;
- Binnen het Geopark lokaal draagvlak belangrijk is en educatie, duurzaam (geo)toerisme en duurzame regionale ontwikkeling centraal staan;
- Het verhaal van de geologie en geomorfologie benut kan worden voor een extra laag in de storytelling en in de diversie projecten van partijen;
- Deelname aan dit keurmerk zorgt voor extra kansen voor grensoverschrijdende samenwerking op het gebied van onder meer wetenschap, toerisme en recreatie en educatie;
- Deelname aan dit keurmerk tevens bijdraagt aan meer (inter)nationale bekendheid;
- Het keurmerk een bijdrage kan leveren aan meer wetenschappelijke focus op het gebied van het Geopark Schelde Delta;
- De status van UNESCO Global Geopark, bij een positieve beoordeling wordt verkregen voor de periode van 4 jaren en het Geopark iedere 4 jaar weer opnieuw wordt beoordeeld vanuit UNESCO;
- De status van UNESCO Global Geopark geen beschermde status voor het gehele gebied inhoudt, maar bestaande belangen erkent en geen belemmeringen opwerpt;
- De geologische top-sites(een 40-tal sites van geologisch internationale waarde) opgenomen in het bidbook wel een bepaalde vorm van bescherming nodig hebben;
- In die vorm van bescherming in de meeste gevallen al wordt voorzien door bestaande beschermingsvormen zoals onder meer de ligging in beschermde natuurgebieden (Natura 2000);
- De status van UNESCO Global Geopark voor het gebied geen gevolgen heeft voor economische activiteiten zoals die van het Havenbedrijf Antwerpen en North Sea Port;
- Vanuit Unesco de voorwaarde wordt gesteld dat het Geopark voor de indiening van het bidbook een jaar als Geopark heeft gefunctioneerd en bij indiening van het bidbook ondergebracht is bij een duurzame en bestendige entiteit met rechtspersoonlijkheid;

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- In die entiteit de belangrijkste stakeholders vertegenwoordigd moeten zijn voor voldoende lokaal draagvlak;
- Geopark Schelde Delta hier invulling aangeeft door de belangrijkste stakeholders een plek in het Partnerberaad te geven en daarnaast een Vlaams-Nederlandse Wetenschapskamer is opgericht;
- Partijen op 28 november 2019 daartoe een intentieverklaring hebben gesloten met de belangrijkste stakeholders;
- Partijen op basis van een uitgevoerde verkenning naar mogelijke samenwerkingsvormen verdere stappen wensen te zetten in het onderbrengen van het Geopark bij een nieuw op te richten entiteit met rechtspersoonlijkheid uiterlijk per oktober 2021; de EGTS bereid is om, in samenspraak met partijen en UNESCO, nader te verkennen of het Geopark indien nodig onder de bestaande EGTS als projectorganisatie opgenomen kan worden uiterlijk per oktober 2021 (fall back scenario);
- Voor dit fall back scenario de goedkeuring nodig is van de leden van de EGTS (onder andere provincie Oost-Vlaanderen en Zeeland) en de instemming van de provincies Antwerpen en Noord-Brabant omdat deze geen lid zijn van de EGTS;
- De periode tot aan indiening van het bidbook in oktober 2021 gebruikt kan worden om tot een toekomstbestendige organisatie met rechtspersoonlijkheid te komen.

Verklaren als volgt te zijn overeengekomen:

Artikel 1 Begrippenlijst

a) Geopark Schelde Delta: een gebied met bijzonder aardkundig erfgoed (geologisch en/of geomorfologisch) welke voldoet aan de voorwaarden die Unesco stelt aan de status van een Unesco Global Geopark, hierna te noemen Geopark.
b) Stuurgroep Geopark Schelde Delta: coördinerend overleg gevormd door een afvaardiging van de bestuurlijke vertegenwoordigers van Partijen. Iedere Partij heeft één stemgerechtigde vertegenwoordiger in de stuurgroep.
c) Kernteam: uitvoeringsorganisatie bedoeld voor het coördineren van werkzaamheden om te komen tot een Geopark Schelde Delta, voorzien in 2023.
d) Gebied van het Geopark Schelde Delta: zie kaart (bijlage 1).
e) Jaarplan: het plan met activiteiten en projecten dat jaarlijks door de stuurgroep wordt vastgesteld.
f) Plan van aanpak: werkplan dat door het kernteam is opgesteld en een beschrijving geeft van zowel het programma als de organisatie om te komen tot een Geopark.
g) Programma: projecten en activiteiten bedoeld om de doelstellingen zoals verwoord in artikel 2 van deze samenwerkingsovereenkomst te realiseren

Artikel 2 Doel en reikwijdte

a) Deze samenwerkingsovereenkomst is bedoeld om de samenwerking tussen Partijen te structureren om te komen tot een Geopark Schelde Delta en de onderlinge afspraken te formaliseren.
b) Deze samenwerkingsovereenkomst draagt bij aan het realiseren van het Geopark Schelde Delta, dat voldoet aan de voorwaarden die UNESCO stelt aan UNESCO Global Geoparken (zie de Operational Guidelines for UNESCO Global Geoparks).

Artikel 3: Activiteiten/Projecten

In het jaarplan (bijlage 2) is een lijst van projecten opgenomen en activiteiten beschreven die ten tijde van de ondertekening van deze samenwerkingsovereenkomst bekend zijn. Een nadrukkelijke taak van de Partijen is om in gezamenlijkheid te bepalen of en zo ja welke projecten nog moeten worden geïnitieerd en toegevoegd behoren te worden aan de lijst van projecten van bijlage 2, om de in artikel 2 gedefinieerde doelstellingen te behalen.

Artikel 4 Sturing en programmering

a) De samenwerking tussen Partijen kent:
   - Een stuurgroep (afvaardiging van Partijen). De stuurgroep stuurt de activiteiten aan ter uitvoering van deze samenwerkingsovereenkomst;
   - Een voorzitter aangesteld door de stuurgroep, voor de zittingstermijn van 1 jaar, op voordracht van de zittende voorzitter;
   - Een secretaris van de stuurgroep, tevens voorzitter van het kernteam;
   - Een kernteam;
   - Projectmanager, coördinator van het kernteam;
   - Een jaarplan;
   - Plan van aanpak;
   - Werkgroepen zoals ingesteld door het kernteam.
b) De benodigde financiële middelen en benodigde personele inzet (FTE) leggen Partijen vast in een uitvoeringsbudget met een looptijd overeenkomstig de duur van deze samenwerkingsovereenkomst, waarmee Partijen zich conformeren aan het uitvoeringsbudget zoals vastgelegd in bijlage 3 bij deze samenwerkingsovereenkomst.
c) In de jaarlijkse programmering van de uitvoering wordt een kostenraming (begroting) van voorgenomen projecten opgenomen inclusief de huisvestingskosten en overige operationele kosten om het kernteam te laten functioneren.
d) Jaarlijks wordt bij het opstellen van de programmering geëvalueerd of de prestaties en middelen (nog) in evenwicht zijn.

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Artikel 5 Stuurgroep

a) De stuurgroep is samengesteld uit één vertegenwoordiger per Partij geflankeerd door een deskundig beleidsmedewerker. De stuurgroep neemt strategische en organisatorische besluiten en is het hoogste orgaan voor wat betreft bevoegdheid. De stuurgroep overlegt ieder jaar tenminste twee keer met de secretaris en de projectmanager over de voortgang van de activiteiten volgens het Jaarplan. De stuurgroep heeft als taak om de voortgang van de afgesproken doelstellingen te bewaken en het (door de projectmanager opgestelde) Jaarplan vast te stellen.
b) Binnen de stuurgroep worden afspraken gemaakt over de taakverdeling en verantwoordelijkheden.

Artikel 6 Kernteam

a) Partijen stellen gezamenlijk een kernteam samen, welke de uitvoering van alle benodigde werkzaamheden coördineert om te komen tot een Geopark.
b) Het kernteam legt jaarlijks verantwoording af over de geleverde prestaties en bijbehorende uitgaven aan de stuurgroep.
c) Het kernteam beschikt over een uitvoeringsbudget (opgenomen in bijlage 3 bij deze samenwerkingsovereenkomst) voor de uitvoering van gezamenlijke maatregelen en projecten waarbij meerdere Partijen betrokken zijn, waaronder ook ondersteunende activiteiten zoals communicatie en evenementen.
d) Tot de taken van het kernteam behoort de jaarlijkse vertegenwoordiging van het Geopark tijdens de European en Global Geoparks Network conferentie;
e) De projectmanager:
    1. treedt op als coördinator van het kernteam en formuleert voorstellen om te komen tot uitvoering van de werkzaamheden;
    2. maakt het plan van aanpak, inclusief personele inzet en capaciteit van het kernteam, en het jaarplan.
f) Voor de uitwerking van onderdelen samen met stakeholders worden thematische werkgroepen ingesteld onder trekkerschap van het kernteam.

Artikel 7 EGTS Linieland van Waas en Hulst

a) De EGTS stemt in met het fall back scenario inhoudende dat, indien nodig, het Geopark (tijdelijk) als projectorganisatie ondergebracht wordt bij de EGTS;
b) De bijdrage van de EGTS bestaat uit de begeleiding van het Geopark naar de UNESCO Global Geopark status door de inzet van expertise op het gebied van governance en organisatie onder meer in de vorm van de inzet van de EGTS directeur als secretaris van de stuurgroep en voorzitter van het kernteam.

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Artikel 8 Veranderingen en nieuwe partners

a) Partijen houden elkaar zowel ambtelijk als bestuurlijk op de hoogte van ontwikkelingen rondom projecten, prestaties en/of programma's die van invloed zijn op deze samenwerkingsovereenkomst.
b) Op het moment dat er voorziene dan wel onvoorziene ontwikkelingen zijn, die de afspraken en werkwijze in deze samenwerkingsovereenkomst sterk veranderen, treden Partijen met elkaar in overleg over een oplossing.
c) In 2021 evalueren Partijen de ingestoken werkwijze van deze overeenkomst, waaronder ook de eventuele toetreding van derden. Over toetreding tot deze samenwerkingsovereenkomst zal in 2021 worden besloten bij de evaluatie of indien gewenst tussentijds, zulks op voordracht van de stuurgroep.
d) Partijen spreken de wens uit om de samenwerking met derden (overheden, maatschappelijke organisaties, universiteiten, kennis- en onderwijsinstellingen en ondernemers) verder vorm te geven via partnerovereenkomsten.

Artikel 9 Uitvoering en mandatering

a) Partijen spannen zich in om de afspraken uit deze samenwerkingsovereenkomst zoveel mogelijk in de eigen beleidsplannen, verordeningen en besluiten in te bedden.
b) In de personele capaciteit wordt voorzien in het plan van aanpak zoals bedoeld in artikel 6, onder d, tweede lid, van deze overeenkomst.
c) Partijen stemmen in met het doen van uitgaven uit het gezamenlijk budget door het kernteam voor zover passend binnen het jaarplan. Uitgaven die de aanbestedingsdrempel voor enkelvoudige onderhandse gunning overschrijden, worden vooraf besproken in het kernteam.
d) Partijen dienen er zorg voor te dragen dat het benodigde budget ten behoeve van de uitvoering van deze overeenkomst in de eigen begroting is opgenomen.

Artikel 10 Looptijd

1. Deze overeenkomst treedt in werking na ondertekening ervan door alle Partijen op 28 november 2019; en
2. eindigt op het moment dat of:
   a) ten behoeve van het Geopark een nieuwe entiteit met rechtspersoonlijkheid is opgericht; of
   b) het Geopark is opgenomen in een bestaande entiteit met rechtspersoonlijkheid;
      op voorwaarde dat de (nieuwe) statuten daarvan voorzien in vastlegging van de gemaakte afspraken in en de tenuitvoerlegging van deze samenwerkingsovereenkomst;
   c) dan wel er een nieuwe samenwerkingsovereenkomst opgesteld is.

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Artikel 11 Communicatie

a) Om de gezamenlijke uitstraling als Geopark vorm te geven en te verbeteren wordt een logo (beeldmerk) en huisstijl gebruikt als basis voor de communicatie-uitingen, zowel digitaal als in print
b) Bij communicatie over het Geopark maken Partijen gebruik van de huisstijl en beeldmerk als bedoeld in het vorige lid van dit artikel.
c) De communicatie rondom projecten zal uitstralen dat Partijen zich gezamenlijk inspannen voor het Geopark.

Artikel 12 Verbindendheid en toepasselijk recht

Met deze samenwerkingsovereenkomst worden geen in rechte afdwingbare rechten en verplichtingen in het leven geroepen.

Artikel 13 Wijzigingen, geschillen en opzegging

a) Partijen houden het gezamenlijke doel van deze samenwerkingsovereenkomst voor ogen, namelijk het komen tot een UNESCO Globale Geopark.
b) Wijzigingen van één of meer bepalingen van deze overeenkomst zijn slechts geldig indien zij uitdrukkelijk schriftelijk tussen Partijen zijn overeengekomen. Deze wijziging leggen Partijen vast in een addendum.
c) Partijen zullen zich inspannen om te voorkomen dat er geschillen ontstaan over de totstandkoming, uitleg of uitvoering van deze overeenkomst.
d) Een geschil tussen twee of meer Partijen aangaande deze overeenkomst wordt binnen een maand besproken tijdens een bijzonder gezamenlijk overleg, na schriftelijk kenbaar te zijn gemaakt aan de niet bij het geschil betrokken Partijen.
e) Tussentijdse opzegging door één van de deelnemende Partijen kan pas worden geëffectueerd na een schriftelijke aanzegging hiertoe aan de overige deelnemende Partijen, waarna Partijen in een bijzonder gezamenlijk overleg de reden voor deze opzegging hebben besproken en zich tot het uiterste hebben ingespannen om deze in de geest van de overeenkomst op te lossen.

Aldus opgemaakt in enkelvoud te Antwerpen op 28 november 2019

1. De Provincie Antwerpen

2. De Provincie Oost-Vlaanderen

3. De Provincie Zeeland

4. De Provincie Noord-Brabant

5. De Europese Groepering voor Territoriale Samenwerking Linieland van Waas en Hulst

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"Intentieverklaring Geopark Schelde Delta "

Versie 2022 ingevolge de goedkeuring van de Stuurgroep Geopark Schelde Delta i.o. d.d. 6-12-2021 (toevoeging van provincie West-Vlaanderen als initiatief nemende partij)

1. De Provincie Antwerpen, rechtsgeldig vertegenwoordigd door gedeputeerde, mevrouw Kathleen Helsen, en provinciegriffier [redacted] handelend ter uitvoering van het besluit van de deputatie d.d. 14 november 2019,
verder te noemen: "de Provincie Antwerpen";

2. De Provincie Oost-Vlaanderen, rechtsgeldig vertegenwoordigd door gedeputeerde, mevrouw An Vervliet, en provinciegriffier [redacted] handelend ter uitvoering van het besluit van de deputatie d.d. 21 november 2019 en de provincieraad d.d. 18 december 2019,
verder te noemen: "de Provincie Oost-Vlaanderen";

3. De Provincie Noord-Brabant, rechtsgeldig vertegenwoordigd door programmamanager Milieu en Gezondheid, [redacted], handelende ter uitvoering van het besluit van gedeputeerde staten d.d. 19 november 2019 bevoegd op grond van de Regeling mandaat Gedeputeerde Staten van Noord-Brabant 2018,
verder te noemen: "de Provincie Noord-Brabant";

4. De Provincie Zeeland, rechtsgeldig vertegenwoordigd door gedeputeerde, mevrouw A. Pijpelink, gemachtigd door de Commissaris van de Koning d.d. 26 november 2019 (kenmerk 19432258) handelende ter uitvoering van het besluit van gedeputeerde staten d.d. 26 november 2019 (kenmerk 19431277),
verder te noemen: "de Provincie Zeeland";

5. De Europese Groepering voor Territoriale Samenwerking Linieland van Waas en Hulst, rechtsgeldig vertegenwoordigd door voorzitter de heer J.F. Mulder en directeur de heer R. Meersschaert, gemachtigd door de Linieraad d.d. 23 oktober 2019, bevoegd op grond van de EGTS-statuten d.d. 15 juni 2011,
verder te noemen: "de EGTS Linieland van Waas en Hulst";

A.

De Provincie West-Vlaanderen, rechtsgeldig vertegenwoordigd door gedeputeerde, de heer Jean de Béthune , en provinciegriffier, [redacted] handelende ter uitvoering van het besluit van de deputatie d.d. 21 november 2019, onder opschortende voorwaarde van goedkeuring door de provincieraad,
verder te noemen: "de Provincie West-Vlaanderen";

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Gemeenten en Waterschappen

6. De gemeenten Sluis, Terneuzen, Hulst, Vlissingen, Middelburg, Veere, Borsele, Goes, Kapelle, Reimerswaal, Tholen, Noord-Beveland en Schouwen-Duiveland te dezen op basis van een daartoe strekkende volmacht rechtsgeldig vertegenwoordigd door mevrouw J.S. van Egmond, burgemeester van Reimerswaal en vicevoorzitter van de Vereniging van Zeeuwse Gemeenten, verder te noemen: de Vereniging van Zeeuwse Gemeenten;

7. De gemeente Bergen op Zoom, te dezen op basis van een daartoe strekkende volmacht rechtsgeldig vertegenwoordigd door wethouder de heer E.M.L. Weys, handelende ter uitvoering van het besluit van burgemeester en wethouders d.d. 19 november 2019,
verder te noemen: "de gemeente Bergen op Zoom";

8. De gemeente Woensdrecht, te dezen op basis van een daartoe strekkende volmacht rechtsgeldig vertegenwoordigd door wethouder de heer J.P.M. de Waal, handelende ter uitvoering van het besluit van burgemeester en wethouders d.d. 12 november 2019,
verder te noemen: "de gemeente Woensdrecht";

9. De gemeente Steenbergen, rechtsgeldig vertegenwoordigd door wethouder, mevrouw E.M.J. Prent, handelende ter uitvoering van het besluit van burgemeester en wethouders d.d. 12 november 2019,
verder te noemen: "de gemeente Steenbergen";

10. De gemeente Roosendaal, rechtsgeldig vertegenwoordigd door wethouder, de heer C. Lok, handelende ter uitvoering van het besluit van burgemeester en wethouders d.d. 5 november 2019,
verder te noemen: "de gemeente Roosendaal";

11. Waterschap Brabantse Delta, rechtsgeldig vertegenwoordigd door lid van het dagelijks bestuur en 2de loco dijkgraaf, de heer K. de Jong, handelende ter uitvoering van het besluit van het dagelijks bestuur van het waterschap d.d. 29 oktober 2019,
verder te noemen: "Waterschap Brabantse Delta";

Economie, transport en infrastructuur

12. Havenbedrijf Antwerpen nv van publiek recht, rechtsgeldig vertegenwoordigd door chief corporate affairs, [redacted] J
verder te noemen: "Havenbedrijf Antwerpen";

13. North Sea Port, rechtsgeldig vertegenwoordigd door directeur de heer D. Schalck,
verder te noemen: "North Sea Port";

14. De Minister van Infrastructuur en Waterstaat, handelend als bestuursorgaan en als vertegenwoordiger van de Staat der Nederlanden, rechtsgeldig vertegenwoordigd door de hoofdingenieur – directeur Rijkswaterstaat Zee en Delta, ir. Th.F.J. van de Gazelle,
verder te noemen 'Rijkswaterstaat';

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Universiteiten, Hogescholen en kennisinstellingen

15. Vrije Universiteit Amsterdam, rechtsgeldig vertegenwoordigd door [redacted] decaan VU/Faculteit de Geesteswetenschappen,
verder te noemen: "VU Amsterdam Geesteswetenschappen";

16. Vrije Universiteit Amsterdam Afdeling Aardwetenschappen, rechtsgeldig vertegenwoordigd door hoofddocent [redacted] J,
verder te noemen: "VU Amsterdam Aardwetenschappen";

17. CLUE+ Vrije Universiteit Amsterdam, rechtsgeldig vertegenwoordigd door universitair docent CLUE+ VU Amsterdam, [redacted] J
verder te noemen: "CLUE+ VU Amsterdam";

18. Universiteit Gent, openbare instelling met rechtspersoonlijkheid, opgericht ingevolge het bijzonder decreet d.d. 26 juni 1991 betreffende de Universiteit Gent en het Universitair Centrum Antwerpen (B.S. 29 juni 1991), zoals later gewijzigd, met bestuurszetel te 9000 Gent, Sint-Pietersnieuwstraat 25 en ondernemingsnummer 0248.015.142, vertegenwoordigd door de rector, voor wie [redacted] J, voorzitter vakgroep Archeologie, faculteit Letteren en Wijsbegeerte optreedt bij delegatie ingevolge de beslissing van de Raad van Bestuur van 1 december 2017,
verder te noemen: "Universiteit Gent";

19. Universiteit Antwerpen, een publiekrechtelijke autonome onderwijsinstelling, opgericht bij Vlaams decreet van 4 april 2003, Prinsstraat 13, 2000 Antwerpen, België, rechtsgeldig vertegenwoordigd door vice rector, [redacted] J
verder te noemen: "Universiteit Antwerpen";

20. Arteveldehogeschool Gent, rechtsgeldig vertegenwoordigd door opleidingsdirecteur mevrouw H. Meysman,
verder te noemen: "Arteveldehogeschool Gent";

21. Breda University of Applied Sciences, rechtsgeldig vertegenwoordigd door director Academy for Tourism de heer J. van der Sterren.,
verder te noemen: "Breda University of Applied Sciences";

22. HZ University of Applied Sciences en het Delta Platform, rechtsgeldig vertegenwoordigd door directeur de heer W.A.M. den Ouden,
verder te noemen: "HZ University of Applied Sciences en het Delta Platform";

23. Koninklijk Nederlands Instituut voor Onderzoek der Zee, rechtsgeldig vertegenwoordigd door directeur de heer H. Brinkhuis,
verder te noemen: "Koninklijk Nederlands Instituut voor Onderzoek der Zee";

24. TNO - Geologische Dienst Nederland, rechtsgeldig vertegenwoordigd door research manager Geologische Data & IT, [redacted]

verder te noemen: "TNO";

25. Belgische Geologische Dienst, rechtsgeldig vertegenwoordigd door directeur de heer Y. Vanbrabant,
verder te noemen: "Belgische Geologische Dienst";

Intergemeentelijke samenwerkingsverbanden

26. Intergemeentelijk Samenwerkingsverband van het Land van Waas afgekort tot "Interwaas", rechtsgeldig vertegenwoordigd door directeur de heer B. Casier,
verder te noemen: "Interwaas";

Natuur- en landschapsparken en gebiedssamenwerkingsverbanden

27. Grenspark Kalmthoutse Heide, rechtsgeldig vertegenwoordigd door voorzitter de heer M. Groffen,
verder te noemen: "Grenspark Kalmthoutse Heide";

28. Nationaal Park Oosterschelde, rechtsgeldig vertegenwoordigd door lid dagelijks bestuur mevrouw I. von Harras,
verder te noemen: "Nationaal Park Oosterschelde";

29. Regionaal Landschap Schelde Durme (Rivierpark Scheldevallei), rechtsgeldig vertegenwoordigd door voorzitter mevrouw R. Gillis,
verder te noemen: "Regionaal Landschap Schelde Durme";

30. Stichting De Brabantse Wal, rechtsgeldig vertegenwoordigd door voorzitter de heer W. de Weert,
verder te noemen: "Stichting De Brabantse Wal";

31. Streekorganisatie Brabantse Wal, rechtsgeldig vertegenwoordigd door voorzitter de heer J.P.M. de Waal,
verder te noemen: "Streekorganisatie Brabantse Wal";

32. Stichting Landschapspark Borsele, rechtsgeldig vertegenwoordigd door secretaris, [redacted] J
verder te noemen: "Landschapspark Borsele";

33. Waterpoort, rechtsgeldig vertegenwoordigd door bestuurslid Waterpoort de heer E.M.L. Weys,
verder te noemen: "Waterpoort";

Natuur, milieu- en landschapsorganisaties en terrein beherende organisaties

34. Natuurpunt Rupelstreek, rechtsgeldig vertegenwoordigd door voorzitter de heer E. de [redacted] J
verder te noemen: "Natuurpunt Rupelstreek";

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35. Vereniging Natuurmonumenten, rechtsgeldig vertegenwoordigd door provinciaal ambassadeur Zeeland, de heer F. van Zijderveld,
verder te noemen: "Vereniging Natuurmonumenten";

36. Staatsbosbeheer rechtsgeldig vertegenwoordigd door provinciaal adviseur [redacted],
verder te noemen: "Staatsbosbeheer";

37. Zeeuwse Milieufederatie, rechtsgeldig vertegenwoordigd door directeur mevrouw I. von Harras,
verder te noemen: "Zeeuwse Milieufederatie";

38. Stichting Het Zeeuws Landschap, rechtsgeldig vertegenwoordigd door directeur de heer A. Bolomey,
verder te noemen: "Stichting Het Zeeuws Landschap";

Educatie

39. Stichting Natuurpodium Brabantse Wal, rechtsgeldig vertegenwoordigd door directeur de heer R. Deliën,
verder te noemen: "Stichting Natuurpodium de Brabantse Wal";

40. NME Zeeland, rechtsgeldig vertegenwoordigd door coördinator Natuur&Zo, [redacted]
verder te noemen: "NME Zeeland";

41. Stichting IVN Natuureducatie, rechtsgeldig vertegenwoordigd door regiodirecteur mevrouw D. Teeling,
verder te noemen: "Stichting IVN Natuureducatie";

Toerisme en recreatie

42. Toeristisch Ondernemend Zeeland, rechtsgeldig vertegenwoordigd door programmamanager, [redacted]
verder te noemen: "Toeristisch Ondernemend Zeeland";

43. VVV Zeeland, rechtsgeldig vertegenwoordigd door destinatiemarketeer [redacted]
verder te noemen : "VVV Zeeland".

44. Toerisme Klein-Brabant - Scheldeland vzw, rechtsgeldig vertegenwoordigd door voorzitter mevrouw A. Morel,
verder te noemen: "Toerisme Klein-Brabant – Scheldeland vzw";

45. Toerisme Oost-Vlaanderen vzw, rechtsgeldig vertegenwoordigd door voorzitter en Oost-Vlaams gedeputeerde voor toerisme, mevrouw L. Grillaert, en algemeen manager en secretaris, [redacted]
verder te noemen: "Toerisme Oost-Vlaanderen";

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46. Toerisme Meetjesland vzw, rechtsgeldig vertegenwoordigd door voorzitter V. Laroy en secretaris [redacted]
verder te noemen: "Toerisme Meetjesland vzw"

47. Toerisme Scheldeland vzw, rechtsgeldig vertegenwoordigd door secretaris, [redacted] en voorzitter de heer D. Mannaert,
verder te noemen: "Toerisme Scheldeland vzw";

48. Toerisme Waasland vzw, rechtsgeldig vertegenwoordigd door secretaris, [redacted] en voorzitter de heer R. Suy,
verder te noemen: "Toerisme Waasland vzw"

Geologie, paleontologie, erfgoed en cultuur(historie)

49. Erfgoed Zeeland, rechtsgeldig vertegenwoordigd door directeur drs. W.H.P. Scholten,
verder te noemen: "Erfgoed Zeeland";

50. Erfpunt, waarin de gemeenten Beveren, Kruibeke, Sint-Gillis-Waas, Stekene, Temse, Waasmunster, Moerbeke en Stad Sint-Niklaas vertegenwoordigd zijn, rechtsgeldig vertegenwoordigd door voorzitter de heer J. Smet ,
verder te noemen: "Erfpunt";

51. OosterscheldeMuseum, rechtsgeldig vertegenwoordigd door voorzitter de heer A. Boone,
verder te noemen: "OosterscheldeMuseum";

52. Museum voor Natuur en Landschap Terra Maris, rechtsgeldig vertegenwoordigd door interim-directeur de heer A. Bolomey,
verder te noemen: "Museum voor Natuur en Landschap Terra Maris";

53. Watersnoodmuseum en Nationaal Kennis- en Herinneringscentrum Watersnood 1953, rechtsgeldig vertegenwoordigd door directeur mr. S.J. Louwerse,
verder te noemen: "Watersnoodmuseum en Nationaal Kennis- en Herinneringscentrum Watersnood 1953";

54. Belgische vereniging voor Paleontologie vzw, rechtsgeldig vertegenwoordigd door beheerder [redacted]
verder te noemen: "Belgische vereniging voor Paleontologie vzw";

55. Huis van de Evolutie, rechtsgeldig vertegenwoordigd door conservator [redacted]
verder te noemen: "Huis van de Evolutie";

56. Werkgroep Geologie van het Koninklijk Zeeuwsch Genootschap der Wetenschappen, rechtsgeldig vertegenwoordigd door secretaris [redacted]
verder te noemen: "Werkgroep Geologie van het Koninklijk Zeeuwsch Genootschap der Wetenschappen";

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57. Walcherse Archeologische Dienst, rechtsgeldig vertegenwoordigd door beleidsarcheoloog, de [redacted]
verder te noemen: "Walcherse Archeologische Dienst"

58. SteM Sint-Niklaas - Mercatormuseum, rechtsgeldig vertegenwoordigd door schepen van cultuur van de stad Sint-Niklaas, de heer F. Baeyens,
verder te noemen "SteM Sint-Niklaas - Mercatormuseum";

Hierna allen tezamen te noemen: "Partijen", ook wel ieder afzonderlijk te noemen: "Partij"

Getekend vanaf 1 januari 2022 tot 1 november 2022:

Gemeenten Antwerpen:

59. Gemeente Boom, getekend door burgemeester Jeroen Baert en algemeen directeur wrnd. Lize van Dijck

60. Gemeente Bornem

61. Gemeente Essen, getekend door burgemeester Gaston Van Tichelt en algemeen directeur Ivan Kockx,

62. Gemeente Hemiksem, getekend door burgemeester Luc Bouckaert en algemeen directeur wrnd. Nele Moortgat

63. Gemeente Kalmthout, getekend door burgemeester Lukas Jacobs en algemeen directeur Vincent Gabriëls

64. Gemeente Kapellen

65. Gemeente Niel, getekend door burgemeester Tom De Vries en algemeen directeur Jo Briers

66. Gemeente Rumst, getekend door burgemeester Jurgen Callaerts en algemeen directeur Veerle De beuckeleer

67. Gemeente Schelle, getekend door burgemeester Rob Mennes

68. Gemeente Sint- Amands Puurs, getekend door burgemeester Koen van den Heuvel en algemeen directeur Raoul Paridaens

69. Gemeente Stabroek, getekend door burgemeester Rik Frans en algemeen directeur Sandra Denis

70. Gemeente Willebroek,

71. Gemeente Zwijndrecht

Gemeenten Oost-Vlaanderen:

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72. Gemeente Aalter, getekend door burgemeester Pieter de Crem en algemeen directeur Luc Jolie
73. Gemeente Assenede, getekend door
74. Gemeente Berlare, getekend door
75. Gemeente Beveren getekend door burgemeester Marc Van de Vijver en algemeen directeur Jo Van Duyse
76. Gemeente Buggenhout, getekend door de voorzitter van de gemeenteraad Jan Stevens en Algemeen directeur Wouter Vermeiren
77. Gemeente Dendermonde, getekend door burgemeester Piet Buyse en algemeen directeur Wouter van der Vurst
78. Gemeente Destelbergen, getekend door [redacted]
79. Gemeente Eeklo, getekend door burgemeester Luc Vandeveld en algemeen directeur Meike Van Grembergen
80. Gemeente Evergem, getekend door burgemeester Joeri De Maertelaere en algemeen directeu Danny Coene
81. Gemeente Gent, getekend door schepen Filip Watteeuw en algemeen directeur Mieke Hullebroeck
82. Gemeente Hamme, getekend door burgemeester Herman Vijt en algemeen directeur Andre Reuse
83. Gemeente Kaprijke, getekend door burgemeester Pieter Claeys en algemeen directeur Karine Goegebeur
84. Gemeente Kruibeke
85. Gemeente Laarne
86. Gemeente Lievegem
87. Gemeente Lochristi
88. Gemeente Lokeren
89. Gemeente Maldegem, getekend door burgemeester Koenraad De Ceuninck en secretaris Koen Cromheecke
90. Gemeente Moerbeke

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91. Gemeente Sint Gillis Waas, getekend door burgemeester Maaike De Rudder
92. Gemeente Sint Laureins, getekend door burgemeester Franki Van de Moere en algemeen directeur Melina Van Audenaerde
93. Gemeente Sint Niklaas, getekend door burgemeester Lieven Dehandschutter en algemeen directeur Johan Verhulst
94. Gemeente Stekene, getekend door burgemeester Stanny de Rechter en algemeen directeur Dirk de Vette
95. Gemeente Temse, getekend door burgemeester Luc De Rck en algemeen directeur Nele de Cleen
96. Gemeente Waasmunster
97. Gemeente Wachtebeke, getekend door burgemeester Rudy Van Cronenburg en wrnd. Algemeen directeur Cindy Kenis
98. Gemeente Wetteren
99. Gemeente Wichelen
100. Gemeente Zele, getekend door burgemeester Hans Knop en algemeen directeur Robert Ivens
101. Zeus Arts - [redacted] getekend door [redacted]
102. Centrum voor Beeldende Kunst Zeeland, getekend door [redacted]
103. DDS, getekend door [redacted]
104. Outward Bound Nederland, getekend door [redacted]
105. Pontes Scholengroep breed, getekend door [redacted]
106. Scalda, getekend door [redacted]
107. Stichting Gidsenteam Zeeuws Vlaanderen, getekend door [redacted]
108. Stichting Landschapsbeheer Zeeland, getekend door [redacted]
109. Toerisme Vlaanderen, getekend door [redacted] Administrateur-generaal
110. UCR University College Roosevelt, getekend door [redacted]
111. Veneco, getekend door [redacted]

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112. VZW Durme

113. Zeeuws maritiem MuZEEum, getekend door directeur bestuurder Onno Bakker

114. Zeeuws Archief, getekend door [redacted]

115. Stad Damme, getekend door [redacted]

116. Visit Damme, getekend door [redacted]

117. Zeeuwse Bibliotheek (ZB), getekend door [redacted]

118. Het Polderhuis, getekend door [redacted]

119. Stichting Musea De Bevelanden, getekend door [redacted] Directeur Stichting Musea de Bevelanden

120. Museum Het Bolwerk, getekend door [redacted] Voorzitter museum Het Bolwerk IJzendijke

121. Museum Het Belfort, getekend door [redacted] Museumcoördinator Gemeente Sluis

122. Stichting Cultureel Erfgoed HET WARENHUIS, getekend door [redacted], Voorzitter Stichting Cultureel Erfgoed HET WARENHUIS

123. Stichting Visserijmuseum Breskens, getekend door [redacted]

- De begrenzing van het Geopark Schelde Delta door de betrokken Vlaams-Nederlandse Wetenschapskamer van een wetenschappelijke onderbouwing wordt voorzien, waarbij op advies van UNESCO, ook rekening wordt gehouden met de bestuurlijke complexiteit van het gebied;
- De status van UNESCO Global Geopark een kwaliteitskeurmerk is voor de bijzondere geologische en landschappelijke kwaliteiten van het gebied en geen zelfstandig merk;
- Met het verkrijgen van dit keurmerk de eigen identiteit, merknamen en doelstellingen van organisaties en netwerken behouden blijven;
- Dit UNESCO Global Geopark keurmerk een wereldwijd gewaardeerd keurmerk is dat aan bekendheid wint en niet verward mag worden met het UNESCO Werelderfgoed keurmerk;
- UNESCO Global Geoparken een belangrijke bijdrage leveren aan de Sustainable Development Goals van de UN;
- De geologie, cultuur(historie) en natuur samen de identiteit van het gebied bepalen;
- Binnen het Geopark lokaal draagvlak belangrijk is en educatie, duurzaam (geo)toerisme en duurzame regionale ontwikkeling centraal staan;

[1] Sinds 6-12-2021 uitgebreid naar vijf provincies na toetreding van provincie West-Vlaanderen

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Preamble

The aspiring Geopark Schelde Delta puts the Flemish-Dutch Scheldt Delta area on the (inter)national map and highlights its special geological and landscape qualities. The area boasts 50 million years of geological history which includes very recent geology of only a few hundred years old. It tells the story of a unique area created by the interaction between land, sea and the River Scheldt with its tides, and man who, in the last few thousand years, has turned this natural setting into a complete cultural landscape. An area estuary that is eminently sensitive to the effects of climate change. The Geopark creates awareness among residents, recreationists and entrepreneurs of the area's special genesis and contributes to the identity of the area and its inhabitants.

In 2014, the provinces of Noord-Brabant in cooperation with Stichting De Brabantse Wal, Streekorganisatie De Brabantse Wal (Brabantse Wal) and Zeeland took the initiative to establish Geopark Schelde Delta. In 2016, the project was expanded to include the area of the Flemish Valley in East Flanders (Oost-Vlaanderen) and part of the Rupelstreek and Klein-Brabant in the province of Antwerp. These five provinces[1] together with the EGTC "Linieland van Waas en Hulst" form the project team that is launching the Geopark Schelde Delta and jointly building the international networking and cooperation Geopark Schelde Delta. The initiators see the Geopark as an opportunity to make the special geological and scenic value (inter)nationally visible and perceptible as it relates to the cultural history and nature of the Schelde Delta (inter)nationally visible and perceptible through (scientific) study of geology and the related history; and in doing so, to develop further the identity of the cross-border area and its inhabitants and to stimulate the regional economy, with tourism as an important economic sector.

The Scheldt Delta region can be recognized as a UNESCO Global Geopark in 2023. This status is a hallmark for the area's special geological and scenic qualities. To make this possible, the Geopark Schelde Delta must apply to UNESCO in Paris in October 2021 on the basis of what is known as a bid book (application file).

The area and its special geology, landscape, cultural history and nature are presented and in that bid book, and (scientific) evidence is provided that the quality conditions of UNESCO Global Geoparks are met.

A sufficient number of the stakeholders involved should embrace this initiative in support of the application. A Geopark cannot exist without the support, involvement and commitment of numerous local, regional and national stakeholders (civil society organizations, entrepreneurs, governmental authorities and representatives from education and science). The parties, which can make an important contribution to this from their own network as ambassadors, wish to express and record this intention.

[1] From 6-12-2021 this inculdes five provinces as the Province of West-Vlaanderen also joined.

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Whereas:

- The purpose of this statement of intent is the joint expression of support for the Geopark Schelde Delta initiative by interested organizations;
- The Scheldt Delta area can submit a bid book in 2022 for UNESCO Global Geopark status; by 2024 or later;
- The aspiring Geopark Schelde Delta is a cross-border initiative covering an area of the provinces of Zeeland, Noord-Brabant, Oost-Vlaanderen, West-Vlaanderen and Antwerp as shown on the map in Annex 1;
- Geopark Schelde Delta is delimited by the relevant Flemish-Dutch Scientific Board of Advisors with scientific support, taking the administrative complexity of the area also into account on the advice of UNESCO. UNESCO Global Geopark status is a quality hallmark for the special geological and landscape qualities of the area, not an independent brand;
- Obtaining this hallmark preserves the own identity, brand names and objectives of organizations and networks;
- Appreciated globally, this UNESCO Global Geopark hallmark is gaining prominence and should not be confused with the World Heritage hallmark;
- UNESCO Global Geoparks make a significant contribution to the UN's Sustainable Development Goals;
- Geology, (the history of) culture and nature together determine the identity of the area. Local support is important while education, sustainable (geo)tourism and sustainable regional development take centre stage in the Geopark;
- The story of the geology and geomorphology can be used for an extra layer in the narrative and in the various projects of the Parties;
- Participation in this quality hallmark entails additional opportunities for cross-border cooperation in areas such as science, tourism and recreation and education; it also contributes to greater (inter)national exposure;
- The hallmark can contribute to more scientific focus in the field of the Scheldt Delta Geopark;
- In case of a positive assessment, UNESCO Global Geopark status is obtained for the period of 4 years and the Geopark is reassessed every 4 years by UNESCO;
- The UNESCO Global Geopark status does not entail protected status for the entire area. It recognizes existing interests and does not create barriers;
- The top geological sites (some 40 sites of international geological value) included in the bid book do require some form of protection;
- That form of protection is in most cases already provided for by existing forms such as being located in protected nature reserves (Natura 2000). UNESCO Global Geopark status for the area does not obstruct economic activities such as those of the Antwerp Port Authority and North Sea Port;
- UNESCO requires that the Geopark must have operated as such for one year before submitting the bid book and that it must be accommodated in a sustainable and durable entity with legal personality;
- The main stakeholders are represented in that entity for sufficient local consensus;
- Aspiring Geopark Schelde Delta is proceeding accordingly by giving the most important stakeholders a place in the Partner Council while a Flemish-Dutch Chamber of Science has also been established;
- In addition to this statement of intent, the cooperating provinces and the EGTC will enter into a cooperation agreement inter alia so as to make arrangements for bringing the Geopark under an

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

existing or new entity with legal personality, whereby further affiliated Parties have no role and (financial) obligations;
- The period up to the time when the bid book is submitted can be used to arrive at a future-proof organization with legal personality by the four cooperating provinces and the EGTC.

It is hereby agreed as follows:

Commitments of the Parties

- The Parties shall endeavour to have the Scheldt Delta area recognized as a UNESCO Global Geopark in 2024 for its special geological, scenic, ecological and cultural-historical qualities and shall support the application in 2022. The Parties shall moreover support each other as much as possible to this end in light of this statement;
- Support can be provided inter alia in the form of ambassadorship with regard to the Geopark Schelde Delta and by actively involving the constituency;
- The Parties shall take part in the Partner Council (approximately 3 times a year) in which knowledge and experiences are to be shared across borders and the network is to be built.
- When organizing activities such as lectures, seminars, field excursions and events, the Parties shall use of the Geopark Schelde Delta logo (and upon obtaining UNESCO Global Geopark status the UNESCO logo), the network and available knowledge in addition to their own logo (where possible);
- The Parties shall endeavour to make the story of the origin of the Scheldt Delta Geopark area more visible, perceptible and understandable for residents and visitors with regard to the priority sites (geological sites included in the bid book) in the area;
- The Parties shall endeavour to propagate this story through education, tourism, recreation and communication, where possible also linking it to climate change and adaptation; they may venture according to their own ambitions, to develop non-priority sites of geological, landscape, ecological and cultural-historical value for educational and tourist-recreational purposes;
- The Parties shall endeavour to work together so as to provide good information in the area, including through information panels, signposting and information stands. They recognize the special geo(morpho)logical values and shall actively share the available (scientific) knowledge and information about them and use it in projects to enrich them;
- The universities and other knowledge institutions involved shall endeavour to contribute to the bid book;
- The universities and other knowledge institutions involved shall endeavour to promote scientific research into geo(morpho)logical phenomena, oceanography, marine and estuarine processes, archaeology and the consequences of climate change and adaptation in the Scheldt Delta region;
- The colleges involved shall endeavour to contribute actively, along with their students, to opening up the area by conducting studies on education; The cooperation shall be evaluated after a period of 2 years (January 2022);
- By signing this statement of intent, the parties shall endeavour to maintain the status of Geopark permanently."

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

General provisions

- This Statement of Intent shall enter into force on 28 November 2019 upon being signed by the Parties and shall expire if the Geopark functions for some years with UNESCO Global Geopark status for the Scheldt Delta area, but in any case on 31 December 2030;
- This Statement of Intent is intended to be purely effort-based and not legally enforceable;
- This statement is without prejudice to each party's own administrative and private-law powers and responsibilities;
- Each of the Parties shall bear its own costs and shall be responsible and liable for any activities carried out by its own organization in the light of this statement;
- If unforeseen circumstances arise with regard to the implementation of this Statement of Intent, the Parties shall consult with each other to see to what extent the contents thereof require adjustment;
- The Parties shall endeavour to prevent disputes arising in connection with the establishment, interpretation or implementation of this Statement of Intent;
- Disputes between the Parties shall be discussed within one month during a special joint consultation after they have been notified in writing to the other Parties;
- Early unilateral termination by one of the Parties can only be effected in writing by notifying the other Parties.

Drawn up in one original in Antwerp on 28 November 2019

1. Namens de provincie Antwerpen

2. Namens de provincie Oost-Vlaanderen

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

3. Namens de provincie Noord-Brabant

[redacted]

4. Namens de provincie Zeeland

[redacted]

5. Namens de EGTS Linieland van Waas en Hulst

[redacted]

6. Namens de Vereniging van Zeeuwse Gemeenten

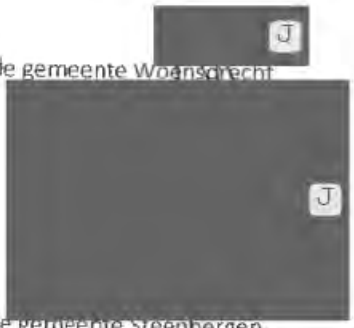
[redacted]

7. Namens de gemeente Bergen op Zoom

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

8. Namens de gemeente Woensdrecht



9. Namens de gemeente Steenbergen

10. Namens de gemeente Roosendaal

11. Namens Waterschap Brabantse Delta

12. Namens Havenbedrijf Antwerpen

ANNICK DE RIDDER

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

13. Namens North Sea Port

14. Namens Rijkswaterstaat

15. Namens de VU Amsterdam Geesteswetenschappen

16. Namens VU Amsterdam Aardwetenschappen

17. Namens CLUE + VU Amsterdam

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

18. Namens Universiteit Gent

19. Namens Universiteit Antwerpen

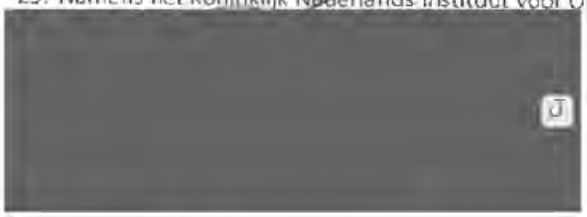
20. Namens Arteveldehogeschool Gent

21. Namens Breda University of Applied Sciences

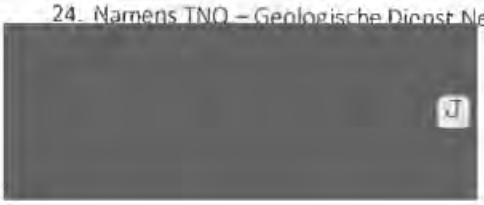
22. Namens HZ University of Applied Sciences en het Delta Platform

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

23. Namens het Koninklijk Nederlands Instituut voor Onderzoek der Zee



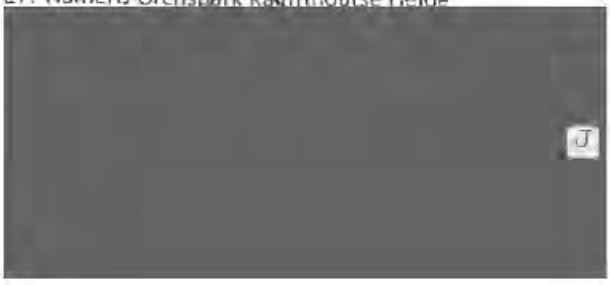
24. Namens TNO – Geologische Dienst Nederland



25. Belgische Geologische Dienst

26. Namens Interwaas

27. Namens Grenspark Kalmthoutse Heide



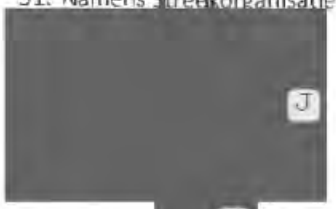
SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

28. Namens Nationaal Park Oosterschelde

29. Namens Regionaal Landschap Schelde Durme (Rivierpark Scheldevallei)

30. Namens Stichting De Brabantse Wal

31. Namens Streekorganisatie Brabantse Wal



32. Landschapspark Borsele

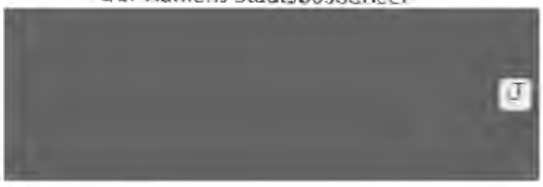
SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

33. Namens Waterpoort

34. Namens Natuurpunt Rupelstreek

35. Vereniging Natuurmonumenten

36. Namens Staatsbosbeheer



37. Namens de Zeeuwse Milieufederatie

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

38. Namens de Stichting Het Zeeuws Landschap

39. Stichting Natuurpodium Brabantse Wal

40. Namens NME Zeeland

41. Namens Stichting IVN Natuureducatie

42. Namens Toeristisch Ondernemend Zeeland

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

43. Namens VVV Zeeland

44. Namens Toerisme Klein-Brabant – Scheldeland vzw

45. Namens Toerisme Oost-Vlaanderen vzw

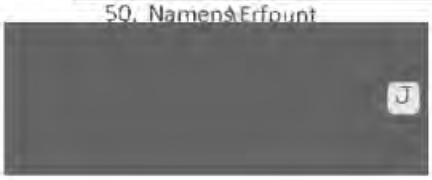
46. Namens Toerisme Meetjesland vzw

47. Namens Toerisme Scheldeland vzw

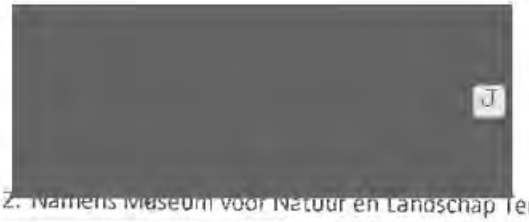
48. Namens Toerisme Waasland vzw

49. Namens Erfgoed Zeeland

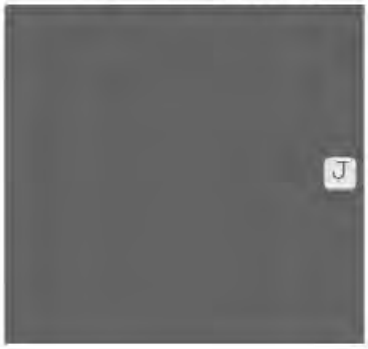
50. Namens Erfpunt



51. Namens het OosterscheldeMuseum



52. Namens Museum voor Natuur en Landschap Terra Maris



SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

53. Namens Watersnoodmuseum en Nationaal Kennis- en Herinneringscentrum Watersnood 1953

vzw

55. Namens het [illegible] evolutie

56. Namens de Werkgroep Geologie van het Koninklijk Zeeuwsch Genootschap der Weteschappen

57. Namens de Walcherse Archeologische Dienst

58. Namens SteM Sint-Niklaas - Mercatormuseum

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

59. Getekend namens gemeente Boom,

[redacted]

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

61 Getekend namens gemeente Essen

Ivan Kockx
algemeen directeur

Gaston Van Tichelt
burgemeester

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

62. Getekend namens gemeente Hemiksem,

Waarnemend directeur

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

63. Namens Kalmthout - Heide (Beschermd cultuurhistorisch landschap)

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

66. Getekend namens gemeente Rumst

Jurgen Callaerts
Burgemeester

Veerle De Beuckeleer
Algemeen Directeur

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

67. Namens Laarkapel (Beschermd Bouwkundig Erfgoed)

Gemeente Schelle - Prov. Antwerpen -

[redacted]

Burgemeester Rob Arenes

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

68 Getekend namens gemeente Puurs-Sint-Amands

Algemeen Directeur
Raoul Paridaens

[redacted]

Burgemeester
Koen Van den Heuvel

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Namens Kasteel Ravenhof (Beschermd monument en dorpsgezicht)

6g. Stabroek, 26 oktober 2021.

Intentieverklaring medewerking realisatie Geopark Scheldedelta,

Goedgekeurd in de gemeenteraad van 14 december 2020.

Raadsbesluit in bijlage.

Namens het Lokaal Bestuur Stabroek,

[redacted]

Sandra Denis,

Algemeen directeur.

[redacted]

Rik Frans,

Burgemeester.

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

72. Getekend namens gemeente Aalter

Namens het college,

De algemeen directeur, De burgemeester

Pieter De Crem

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

13 Ondertekenpagina bij Intentieverklaring (versie november 2019) Geopark Schelde Delta in

Voor de gemeente Assenede,

Getekend namens

Burgemeester, Philippe De Coninck

[redacted]

Secretaris, Algemeen directeur wnd., Peter Van Staveren

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

7S. Gemeente Beveren

Getekend namens [redacted] J

[redacted] J

76. Gemeente Buggenhout

Getekend namens College van bestuur Buggenhout

[redacted] J

Wouter Vermeiren
Algemeen directeur

[redacted] J

Jan Sleeus
Voorzitter gemeenteraad

GEMEENTEBESTUUR BUGGENHOUT
O.-VL.

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

77 Namens het college van burgemeester en schepenen
In opdracht

w.g. Wouter Van der Vurst
algemeen directeur

w.g. Marius Meremans
schepen-voorzitter

Datum:

VOOR EENSLUIDEND AFSCHRIFT

[redacted]

Wouter Van der Vurst
algemeen directeur

[redacted]

Piet Buyse
burgemeester

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

- ieder der Partijen draagt de eigen kosten en is zelf verantwoordelijk en aansprakelijk voor eventuele activiteiten die in het licht van deze verklaring zullen worden uitgevoerd door de eigen organisatie;
- indien zich onvoorziene omstandigheden voordoen met betrekking tot de uitvoering van deze intentieverklaring treden Partijen met elkaar in overleg om te bezien in hoeverre de inhoud van deze intentieverklaring aanpassing behoeft;
- Partijen zullen zich inspannen om te voorkomen dat er geschillen ontstaan ter zake van de totstandkoming, uitleg of uitvoering van deze intentieverklaring;
- Geschillen tussen Partijen zullen binnen een maand besproken worden tijdens een bijzonder gezamenlijk overleg na schriftelijk kenbaar te zijn gemaakt naar de andere Partijen.
- Tussentijdse eenzijdige opzegging door een der Partijen kan slechts schriftelijk geschieden door mededeling aan de overige Partijen.

Alnus opgemaakt in 2 -voud te [...plaatsnaam...] op 28 november 2019

7 8.

[redacted] J

[redacted] J

.

Sofie Vandelannoote
Algemeen directeur

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

79. Gemeente Eeklo

Getekend namens

Luc Vandevelde, burgemeester

[redacted]

Meike Van Grembergen, algemeen directeur

[redacted]

DATUM 8/11/21
OVERGEMAAKT AAN

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

80. Gemeente Evergem

Getekend namens

Burgemeester Joeri De Maertelaere

J

Algemeen Directeur Danny Coene

J

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Ondertekenpagina bij Intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting:

81 Stad Gent

Getekend namens

Algemeen Directeur, Mieke Hullebroeck

Elektronisch ondertekend op
26/04/2022 om 11:01:01 (GMT+02:00)
door
Mieke Hullebroeck, algemeen directeur
stad en OCMW Gent

Schepen van Mobiliteit, Publieke Ruimte en Stedenbouw, Filip Watteeuw

Voor de burgemeester
bij delegatiebesluit van 3 januari 2022

Elektronisch ondertekend op
23/04/2022 05:34:43 (GMT+02:00) door
Filip Watteeuw, Schepen van Mobiliteit,
Publieke Ruimte en Stedenbouw

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

03 DEC. 2021
Coo
20216923

02. Gemeente Hamme

Get[redacted]nd namens

Herman Viit, burgemeester

[redacted]

André Reuse, algemeen directeur

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Addendum intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting

03. Gemeente Kaprijke

Getekend namens

Burgemeester, Pieter Claeys

Algemeen directeur, Karine Goegebeur

[redacted]

Digitally signed by Karine Goegebeur (Signature)
Date: 2022.03.08 16:00:19 +01:00

[redacted]

Digitally signed by Pieter Claeys (Signature)
Date: 2022.03.02 10:57:18 +01:00

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Addendum Intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting

06. Gemeente Lievegem

Getekend namens

Eddy D
Algem[illegible]ecteur

[redacted]

Gemeentebestuur LIEVEGEM - Oost-Vlaanderen -

Tony Vermeire
Burgemeester

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Ondertekenpagina bij Intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting:

Voor de gemeente Maldegem,

Getekend namens

Burgemeester,

Secretaris,

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Addendum Intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting

gl. Gemeente Sint-Gillis-Waas

Getekend namens

Burgemeester,

[redacted]

Algemeen directeur,

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Ondertekenpagina bij intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting:

92. Sint-Laureins

Getekend namens

Burgemeester, Franki Van de Moere

Algemeen directeur, Melina Van Audenaerde

Ondertekeningspagina behorend tot document
2022 Sint-Laureins ondertekenblad intentieverklaring.pdf

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www.cipalschaubroeck.be/intellistamp
met code: 5x2bv9-ef9r9q-h7wf22-yw

Ondertekend door Melina Van Audenaerde (Signature)
Datum: 2022.05.03 10:45:30 CEST
Functie: Algemeen directeur
Locatie: SINT-LAUREINS

Ondertekend door Carlos Bonamie (Signature)
Datum: 2022.05.03 17:37:51 CEST
Functie:
Locatie: SINT-LAUREINS

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Addendum Intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting

93. Gemeente Sint-Niklaas 02/03/2022

Getekend namens

Burgemeester,

[redacted]

Algemeen directeur,

[redacted]

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Addendum Intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting

94.

Gemeente Stekene

Gete[redacted] J

Burge[redacted] 21 MRT 2022

STANY DE [redacted] J

Algemeen directeur [redacted]

DIRK DE VETTER J

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Addendum Intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting

95. Gemeente Temse

1 MAART 2022

Getekend namens

Burgemeester,

[redacted]

J

Algemeen directeur,

[redacted]

J

WELE DE CLEEN

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Addendum Intentieverklaring (versie november 2019) Geopark Schelde Delta in oprichting

97. Gemeente Wachtebeke

Getekend namens

Burgemeester,

[redacted]

BURGEMEESTER
Rudy Van Cronenburg

Algemeen directeur,

[redacted]

Cindy Kenis
Waarnemend
Algemeen Directeur

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

100. Addendum Intent everklaring (versie november 2019) Geopark Schelde Delta in oprichting

Gemeente Zele

Getekend namens

Burgemee

J

Algemeen directeur

J

Gemeentebestuur Zele - Oost-Vlaanderen -

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

101. Getekend namens Zeus Art Projects

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

103. DDS ~~Verlo~~

[redacted]

Getekend namens [redacted]

Kris Doons
Alg. Dir. DOS
17/3/2022

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

104. Namens Outward Bound Nederland

Jgm Kastelein - van Koppen

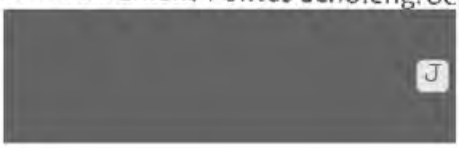
[redacted] J

Burgh-Haamstede

1 november 2021

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

105. Getekend namens Pontes Scholengroep



:2 K.G. Terlage
Voorzitter College van Bestuur

106. Getekend namens Scalda

H.J. Oosthoek

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

107. Namens Stichting Gidsenteam Zeeuws Vlaanderen

Ans van Rooijen

voorzitter

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

109. Getekend namens Toerisme Vlaanderen

Peter De Wilde, Administrateur-generaal Toerisme Vlaanderen

Getekend door:Peter De Wilde (Signature
Getekend op:2022-07-08 12:18:54 +02:0
Reden:Ik keur dit document goed

[redacted] J

08/07/22

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

110 Namens UCR University College Roosevelt

Prof. dr. H.H.A. van den Berg

2 NOVEMBER 2021

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

113. Namens Zeeuws maritiem museum MuZEEum,

Unno Bakker
Directeur-bestuurder Zeeuws maritiem muZEEum

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

114. Namens Zeeuws Archief

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

115. Namens Stad Damme

[redacted]

Schepen
Mevrouw Directeur
Stad Damme

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

116. Namens Visit Damme

[redacted]

J

[redacted]

J

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

118. Getekend namens Polderhuis Westkapelle,

Jan van Beekhuizen, voorzitter Stichting Polderhuis museum

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

119. Getekend namens Stichting Musea De Bevelanden,

[redacted]

Wilco Stiekema - Directeur St. Musea de Bevelanden

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

123. Getekend namens stichting Visserijmuseum Breskens,

ir. H.P. Klooster

bestuurslid, belast met het beheer van de collectie

ANNEX 3C 1
TRANSLATION OF THE COOPERATION AGREEMENT

The undersigned,

1. The province of Antwerp, lawfully represented by deputy Mister L. Caluwé, acting on executing the decision of the deputation dated on 14th of november 2019,
   hereby mentioned as 'the Province of Antwerp';

2. The province of East-Flanders, lawfully represented by deputy Madam A. Charlier and county clerk Mister A. de Smet, acting on executing the decision of the deputation dated on 29th of november 2019, hereby mentioned as 'the Province of East-Flanders;

3. The province of Antwerp, lawfully represented by deputy Phd. A. Pijpelink, authorized by the Commissioner of the King dated 26th of november 2019 (reference 19431177),
   hereby mentioned as 'the Province of Zeeland;

4. The province of North-Brabant, lawfully represented by programme manager Environment and Health Madam N. Wester, acting on executing the decision of the deputation dated on 19th of november 2019, authorised by Regulation Mandate Deputy States of North-Brabant 2018,
   hereby mentioned as 'the Province of North-Brabant';

5. The European Grouping of Territorial Cooperation (EGTC) of Waas and Hulst, lawfully represented by chairman mister J.F. Mulder and director mister R. Meersschaert, authorised by Linieraad dated 23rd of October 2019, authorized by the statutes of the EGTC dated the 15th of June 2011,
   hereby mentioned as 'EGTC Linieland Waas en Hulst;

Together called 'the Parties', seperatly referred to as 'Party'

Preamble

The aspiring Geopark Schelde Delta puts the Flemish-Dutch Scheldt Delta area on the (inter)national map and highlights its special geological and landscape qualities. The area boasts 50 million years of geological history which includes very recent geology of only a few hundred years old. It tells the story of a unique area created by the interaction between land, sea and the River Scheldt with its tides, and man who, in the last few thousand years, has turned this natural setting into a complete cultural landscape. An area estuary that is eminently sensitive to the effects of climate change. The Geopark creates awareness among residents, recreationists and entrepreneurs of the area's special genesis and contributes to the identity of the area and its inhabitants.

In 2014, the provinces of Noord-Brabant in cooperation with Stichting De Brabantse Wal, Streekorganisatie De Brabantse Wal and Zeeland took the initiative to establish Geopark Schelde Delta. In 2016, the project was expanded to include the area of the Flemish Valley in East Flanders and part of the Rupelstreek and Klein-Brabant in the province of Antwerp. These five provinces[1] together with the EGTC "Linieland van Waas en Hulst" form the project team that is launching the Geopark Schelde Delta and jointly building the international networking and cooperation Geopark Schelde Delta. The initiators see the Geopark as an opportunity to make the special geological and scenic value (inter)nationally visible and perceptible as it relates to the cultural history and nature of the Schelde Delta (inter)nationally visible and perceptible through (scientific) study of geology and the related history; and in doing so, to develop further the identity of the cross-border area and its inhabitants and to stimulate the regional economy, with tourism as an important economic sector.

The Scheldt Delta region can be recognized as a UNESCO Global Geopark in 2024. This status is a hallmark for the area's special geological and scenic qualities. To make this possible, the Geopark Schelde Delta must apply to UNESCO in Paris in November 2022 on the basis of what is known as a bid book (application dossier).

The area and its special geology, landscape, cultural history and nature are presented and in that bid book, and (scientific) evidence is provided that the quality conditions of UNESCO Global Geoparks are met.
A sufficient number of the stakeholders involved should embrace this initiative in support of the application. A Geopark cannot exist without the support, involvement and commitment of numerous local, regional and national stakeholders (civil society organizations, entrepreneurs, governmental authorities and representatives from education and science). The parties, which can make an important contribution to this from their own network as ambassadors, wish to express and record this intention.

[1] *From 6-12-2021 this incuides five provinces as the Province of West-Flanders also joined.*

Whereas:

- In addition to the Statement of Intent with partners, the cooperating provinces and the EGTC wish to enter into a cooperation agreement to formalize the cooperation under the Geopark Schelde Delta Geopark in formation and to make further arrangements to that end;
- The aim of this cooperation agreement is to ensure that the Scheldt Delta area can submit a bid book in 2022 to acquire UNESCO Global Geopark status by 2024;
- The aspiring Geopark Schelde Delta is a cross-border initiative by and between Flanders and the Netherlands;
- Geopark Schelde Delta is delimited by the Flemish-Dutch Chamber of Science involved with scientific support, whereby the administrative complexity of the area is also taken into account on the advice of UNESCO;
- The UNESCO Global Geopark status is a hallmark of quality for the special geological and landscape qualities of the area, not an independent brand;
- Obtaining this hallmark preserves the own identity, brand names and objectives of organizations and networks;
- Appreciated globally, this UNESCO Global Geopark hallmark is gaining prominence and should not be confused with the World Heritage hallmark;
- Geoparks make a significant contribution to the UN Sustainable Development Goals;
- Geology, (the history of) culture and nature together determine the identity of the area.
- Local support is important while education, sustainable (geo)tourism and sustainable regional development take centre stage in the Geopark;
- The story of geology and geomorphology can be used for an extra layer in the storytelling and in the various projects of the parties involved;
- The story of the geology and geomorphology can be used for an extra layer in the narrative and in the various projects of the parties involved;
- Participation in this quality hallmark also contributes to greater (inter)national awareness;
- The hallmark can contribute to more scientific focus in the field of the Geopark Schelde Delta;
- In case of a positive assessment, UNESCO Global Geopark status is obtained for the period of 4 years and the Geopark is reassessed every 4 years by UNESCO;
- UNESCO Global Geopark status does not entail protected status for the entire area. It recognizes existing interests and does not create barriers;
- The top geological sites (some 40 sites of international geological value) included in the bid book do require some form of protection;
- That form of protection is in most cases already provided for by existing forms such as being located in protected nature reserves in particular (Natura 2000);
- UNESCO Global Geopark status for the area does not obstruct economic activities such as those of the Antwerp Port Authority and North Sea Port;
- UNESCO requires that the Geopark must have operated as such for one year before submitting the bid book and that it must be accommodated in a sustainable and durable entity with legal personality;
- The main stakeholders are represented in that entity for sufficient local consensus;
- Geopark Schelde Delta is proceeding accordingly by giving the most important stakeholders a place in the Partner Council while a Flemish-Dutch Chamber of Science has also been established;
- On 28 November 2019, the parties agreed on a statement of intent to this end with the main stakeholders;
- On the basis of an exploratory study into possible forms of cooperation, the parties wish to take further steps towards incorporating the Geopark in a new entity to be established with legal personality by October 2021 at the latest; the EGTC is prepared, in consultation with parties and UNESCO, to explore further whether the Geopark can, if necessary, be incorporated under the existing EGTC as a project organization by October 2021 at the latest (fall-back scenario);
- This fall-back scenario requires the approval of the members of the EGTC (including the provinces of East Flanders and Zeeland) and the consent of the provinces of Antwerp and North Brabant as they are not members of the EGTC;
- The period up to the time when the bid book is submitted in October 2021 can be used to arrive at a future-proof organization with legal personality.

It is hereby agreed as follows:

Artikel 1 Definition

a. Geopark Schelde Delta: an area with special geographical (geological and/or geomorphological) heritage which meets the conditions set by UNESCO for UNESCO Global Geopark status, hereinafter referred to as Geopark.
b. Geopark Schelde Delta Steering Committee: coordinating consultation formed by a delegation of the administrative representatives of the Parties. Each Party has one voting representative in the steering committee.
c. Core team: implementing organization intended to coordinate work to establish the Geopark Schelde Delta, envisaged in 2023.
d. Geopark Schelde Delta area: see map (Annex 1).
e. Annual plan: the plan of activities and projects adopted annually by the Steering Committee.
f. Plan of action: work plan drawn up by the core team describing both the programme and the organization to establish a Geopark.
g. Programme: projects and activities intended to attain the objectives set in Article 2 of this cooperation agreement.

Artikel 2 Object and scope

a. This agreement is intended to structure the cooperation by and between Parties so as to arrive at a Geopark Schelde Delta and to formalize the arrangements between them.
b. This cooperation agreement is to contribute to the establishment of Geopark Schelde Delta, which meets the conditions set by UNESCO for UNESCO Global Geoparks (see the Operational Guidelines for UNESCO Global Geoparks).

Artikel 3 Activities/Projects

The Annual Plan (Annex 2) shall comprise a list of projects and describes activities known at the time of signing this cooperation agreement. An explicit task of the Parties is to determine jointly whether and if so which projects still need to be initiated and should be added to the list of projects in Annex 2, in order to achieve the objectives defined in Article 2.

Artikel 4 Steering and programming

a. The cooperation by and between the Parties shall comprise:
- A steering committee (delegation of the Parties). The steering committee shall direct the activities to implement this cooperation agreement;
- A chairman appointed by the steering committee, for a 1-year term, on the recommendation of the sitting chairman;
- A secretary to the steering committee, who also shall also as the chairman of the core team;
- A core team;
- A project manager, coordinator of the core team;
- An annual plan;
- A plan of action;
- Workgroups set up by the core team.

b. The required financial resources and personnel deployment (FTE) shall be laid down by Parties in an implementation budget with a term in accordance with the duration of this cooperation agreement, with which the Parties shall conform to the implementation budget as laid down in Annex 3 to this cooperation agreement.
c. The annual programming of the implementation shall include a cost estimate (budget) of intended projects including accommodation costs and other operational costs to allow the core team to function.
d. An annual assessment of whether performance and resources are (still) in balance shall be conducted when the programming is prepared.

Artikel 5 Steering committee

a. The steering committee shall be composed of one representative per Party flanked by an expert policy officer. It shall strategic and organizational decisions and shall be the highest body in terms of authority. The steering committee shall meet at least twice a year with the secretary and the project manager on the progress of activities according to the Annual Plan. It shall be asked with monitoring the progress of the agreed objectives and with adopting the Annual Plan (prepared by the project manager).
b. Within the steering committee, agreements shall be made on the division of tasks and responsibilities.

Artikel 6 Core team

a. The parties shall jointly set up a core team to coordinate the conduct of all necessary activities to establish a Geopark.
b. The core team shall render account for its performance and associated expenditure annually to the steering committee.
c. The core team shall have an implementation budget (included in Annex 3 to this cooperation agreement) for the implementation of joint measures and projects involving multiple parties, including supporting activities such as communication and events.
d. The tasks of the core team shall include the annual representation of the Geopark at the European and Global Geoparks Network conference;
e. The project manager shall:
   1. act as the coordinator of the core team and draw up proposals to implement the work;
   2. draw up the plan of action, including staff deployment and capacity of the core team, and the annual plan.
f. Thematic workgroups shall be set up to develop components together with stakeholders under the leadership of the core team.

Artikel 7 EGTC "Linieland van Waas en Hulst"

a. The EGTC agrees to the fall-back scenario according to which the Geopark will be (temporarily) hosted by the EGTC as a project organization, if necessary;
b. The EGTC's contribution shall consist of guiding the Geopark to UNESCO Global Geopark status by deploying expertise on governance and organization in particular by appointing the EGTC director to serve as secretary of the steering committee and chairman of the core team.

Artikel 8 Changes and new partners

a. The parties shall keep each other informed administratively and officially of developments around projects, achievements and/or programmes that affect this cooperation agreement.
b. At such time as foreseen or unforeseen developments occur that significantly change the arrangements and working methods in this cooperation agreement, the Parties shall consult with each other about a solution.
c. The Parties shall assess the working method of this agreement, including the possible accession of third parties in 2021. Accession to this cooperation agreement shall be decided in 2021 during the assessment or in the interim if so desired, on the recommendation of the steering committee.
d. The parties express the desire to give further shape to the cooperation with third parties (governmental authorities, social organizations, universities, knowledge and educational institutions and entrepreneurs) through partner agreements.

Artikel 9 Performance and delegation

a. The parties shall endeavor to embed the arrangements from this cooperation agreement in their own policy plans, regulations and decisions as much as possible.
b. Personnel capacity shall be provided in the plan of action as referred to in Article 6 (d) second paragraph of this agreement.
c. The parties agree to incur expenses from the joint budget by the core team to the extent appropriate within the annual plan. Expenditures exceeding the procurement threshold for single private award shall be discussed in advance in the core team.
d. The parties shall ensure that the budget required for the implementation of this agreement is included in their own budgets.

Artikel 10 Term

1. This Agreement shall enter into force after it has been signed by all the Parties on 28 November 2019; and
2. shall end at such time as:
   a. a new entity with legal personality is established for the purpose of the Geopark; or
   b. the Geopark is incorporated into an existing entity with legal personality; provided that its (new) articles of association provide for the recording of the arrangements made in and the implementation of this cooperation agreement; or
   c. a new cooperation agreement has been drawn up.

Artikel 11 Communication

a. A logo (logotype) and house style shall be used as a basis for the communication statements, both digital and in print so as to give shape to and improve the joint image as a Geopark.
b. In communications about the Geopark, the parties shall use the house style and logo as referred to in the previous paragraph of this article.
c. The communication around projects will show that the Parties are making a joint effort for the Geopark.

Artikel 12 Binding nature and applicable law

This cooperation agreement does not create any legally enforceable rights and obligations.

Artikel 13 Amendments, disputes and termination

a. The Parties shall bear the joint objective of this cooperation agreement in mind, i.e. to establish a UNESCO Global Geopark.
b. Amendments to one or more provisions of this agreement shall be valid only if expressly agreed in writing by and between the Parties. The Parties shall put such an amendment in writing in an addendum.
c. The Parties shall endeavor to prevent disputes about the formation, interpretation or implementation of this agreement.
d. A dispute between two or more Parties concerning this Agreement shall be discussed within one month at a special joint consultation, after having been communicated in writing to the Parties not involved in the dispute.
e. The agreement may be terminated early by one of the participating Parties only subject to prior written notice served to the other participating Parties, and once the Parties have discussed the reason for such termination during a special joint consultation and have made every effort to resolve it in the spirit of the agreement.

Thus drawn up in one original counterpart at Antwerp on the 28th of November 2019

ANNEX 3C 2
TRANSLATION OF THE LETTER OF INTENT

SCHELDE DELTA
ASPIRING GLOBAL GEOPARK

Preamble
The aspiring Geopark Schelde Delta puts the Flemish-Dutch Scheldt Delta area on the (inter)national map and highlights its special geological and landscape qualities. The area boasts 50 million years of geological history which includes very recent geology of only a few hundred years old. It tells the story of a unique area created by the interaction between land, sea and the River Scheldt with its tides, and man who, in the last few thousand years, has turned this natural setting into a complete cultural landscape. An area estuary that is eminently sensitive to the effects of climate change. The Geopark creates awareness among residents, recreationists and entrepreneurs of the area's special genesis and contributes to the identity of the area and its inhabitants.

In 2014, the provinces of Noord-Brabant in cooperation with Stichting De Brabantse Wal, Streekorganisatie De Brabantse Wal (Brabantse Wal) and Zeeland took the initiative to establish Geopark Schelde Delta. In 2016, the project was expanded to include the area of the Flemish Valley in East Flanders (Oost-Vlaanderen) and part of the Rupelstreek and Klein-Brabant in the province of Antwerp. These five provinces[1] together with the EGTC "Linieland van Waas en Hulst" form the project team that is launching the Geopark Schelde Delta and jointly building the international networking and cooperation Geopark Schelde Delta. The initiators see the Geopark as an opportunity to make the special geological and scenic value (inter) nationally visible and perceptible as it relates to the cultural history and nature of the Schelde Delta (inter)nationally visible and perceptible through (scientific) study of geology and the related history; and in doing so, to develop further the identity of the cross-border area and its inhabitants and to stimulate the regional economy, with tourism as an important economic sector.

The Scheldt Delta region can be recognized as a UNESCO Global Geopark in 2023. This status is a hallmark for the area's special geological and scenic qualities. To make this possible, the Geopark Schelde Delta must apply to UNESCO in Paris in October 2021 on the basis of what is known as a bid book (application file).

The area and its special geology, landscape, cultural history and nature are presented and in that bid book, and (scientific) evidence is provided that the quality conditions of UNESCO Global Geoparks are met.

A sufficient number of the stakeholders involved should embrace this initiative in support of the application. A Geopark cannot exist without the support, involvement and commitment of numerous local, regional and national stakeholders (civil society organizations, entrepreneurs, governmental authorities and representatives from education and science). The parties, which can make an important contribution to this from their own network as ambassadors, wish to express and record this intention.

[1] From 6-12-2021 this inculdes five provinces as the Province of West-Vlaanderen also joined.

Whereas:

- The purpose of this statement of intent is the joint expression of support for the Geopark Schelde Delta initiative by interested organizations;
- The Scheldt Delta area can submit a bid book in 2022 for UNESCO Global Geopark status; by 2024 or later;
- The aspiring Geopark Schelde Delta is a cross-border initiative covering an area of the provinces of Zeeland, Noord-Brabant, Oost-Vlaanderen, West-Vlaanderen and Antwerp as shown on the map in Annex 1;
- Geopark Schelde Delta is delimited by the relevant Flemish-Dutch Scientific Board of Advisors with scientific support, taking the administrative complexity of the area also into account on the advice of UNESCO. UNESCO Global Geopark status is a quality hallmark for the special geological and landscape qualities of the area, not an independent brand;
- Obtaining this hallmark preserves the own identity, brand names and objectives of organizations and networks;
- Appreciated globally, this UNESCO Global Geopark hallmark is gaining prominence and should not be confused with the World Heritage hallmark;
- UNESCO Global Geoparks make a significant contribution to the UN's Sustainable Development Goals;
- Geology, (the history of) culture and nature together determine the identity of the area. Local support is important while education, sustainable (geo)tourism and sustainable regional development take centre stage in the Geopark;
- The story of the geology and geomorphology can be used for an extra layer in the narrative and in the various projects of the Parties;
- Participation in this quality hallmark entails additional opportunities for cross-border cooperation in areas such as science, tourism and recreation and education; it also contributes to greater (inter)national exposure;
- The hallmark can contribute to more scientific focus in the field of the Scheldt Delta Geopark;
- In case of a positive assessment, UNESCO Global Geopark status is obtained for the period of 4 years and the Geopark is reassessed every 4 years by UNESCO;
- The UNESCO Global Geopark status does not entail protected status for the entire area. It recognizes existing interests and does not create barriers;
- The top geological sites (some 40 sites of international geological value) included in the bid book do require some form of protection;
- That form of protection is in most cases already provided for by existing forms such as being located in protected nature reserves (Natura 2000). UNESCO Global Geopark status for the area does not obstruct economic activities such as those of the Antwerp Port Authority and North Sea Port;
- UNESCO requires that the Geopark must have operated as such for one year before submitting the bid book and that it must be accommodated in a sustainable and durable entity with legal personality;
- The main stakeholders are represented in that entity for sufficient local consensus;
- Aspiring Geopark Schelde Delta is proceeding accordingly by giving the most important stakeholders a place in the Partner Council while a Flemish-Dutch Chamber of Science has also been established;
- In addition to this statement of intent, the cooperating provinces and the EGTC will enter into a cooperation agreement inter alia so as to make arrangements for bringing the Geopark under an existing or new entity with legal personality, whereby further affiliated Parties have no role and (financial) obligations;
- The period up to the time when the bid book is submitted can be used to arrive at a future-proof organization with legal personality by the four cooperating provinces and the EGTC.

It is hereby agreed as follows:

Commitments of the Parties

- The Parties shall endeavor to have the Scheldt Delta area recognized as a UNESCO Global Geopark in 2024 for its special geological, scenic, ecological and cultural-historical qualities and shall support the application in 2022. The Parties shall moreover support each other as much as possible to this end in light of this statement;
- Support can be provided inter alia in the form of ambassadorship with regard to the Geopark Schelde Delta and by actively involving the constituency;
- The Parties shall take part in the Partner Council (approximately 3 times a year) in which knowledge and experiences are to be shared across borders and the network is to be built.
- When organizing activities such as lectures, seminars, field excursions and events, the Parties shall use of the Geopark Schelde Delta logo (and upon obtaining UNESCO Global Geopark status the UNESCO logo), the network and available knowledge in addition to their own logo (where possible);
- The Parties shall endeavor to make the story of the origin of the Scheldt Delta Geopark area more visible, perceptible and understandable for residents and visitors with regard to the priority sites (geological sites included in the bid book) in the area;
- The Parties shall endeavor to propagate this story through education, tourism, recreation and communication, where possible also linking it to climate change and adaptation; they may venture according to their own ambitions, to develop non-priority sites of geological, landscape, ecological and cultural-historical value for educational and tourist-recreational purposes;
- The Parties shall endeavor to work together so as to provide good information in the area, including through information panels, signposting and information stands. They recognize the special geo(morpho)logical values and shall actively share the available (scientific) knowledge and information about them and use it in projects to enrich them;
- The universities and other knowledge institutions involved shall endeavor to contribute to the bid book;
- The universities and other knowledge institutions involved shall endeavor to promote scientific research into geo(morpho) logical phenomena, oceanography, marine and estuarine processes, archaeology and the consequences of climate change and adaptation in the Scheldt Delta region;
- The colleges involved shall endeavor to contribute actively, along with their students, to opening up the area by conducting studies on education; The cooperation shall be evaluated after a period of 2 years (January 2022);
- By signing this statement of intent, the parties shall endeavor to maintain the status of Geopark permanently."

General provisions

- This Statement of Intent shall enter into force on 28 November 2019 upon being signed by the Parties and shall expire if the Geopark functions for some years with UNESCO Global Geopark status for the Scheldt Delta area, but in any case on 31 December 2030;
- This Statement of Intent is intended to be purely effort-based and not legally enforceable;
- This statement is without prejudice to each party's own administrative and private-law powers and responsibilities;
- Each of the Parties shall bear its own costs and shall be responsible and liable for any activities carried out by its own organization in the light of this statement;
- If unforeseen circumstances arise with regard to the implementation of this Statement of Intent, the Parties shall consult with each other to see to what extent the contents thereof require adjustment;
- The Parties shall endeavor to prevent disputes arising in connection with the establishment, interpretation or implementation of this Statement of Intent;
- Disputes between the Parties shall be discussed within one month during a special joint consultation after they have been notified in writing to the other Parties;
- Early unilateral termination by one of the Parties can only be effected in writing by notifying the other Parties.

Drawn up in one original in Antwerp on 28 November 2019

ANNEX 4
MAP aUGGp

Annex 4 contains a large scale map of the aUGGp showing a clearly defined boundary and marking a lot of interesting points such as the 40 geosites, tourism facilities and museums.

Also, the protected areas are indicated on the map. As the aspiring UNESCO Global Geopark Schelde Delta covers an area of 5,467 km2 the 1:50,000 scale map is too large to insert here. Therefore, this is the reason that this mandatory annex is added to our application document as a separate file.

ANNEX 5
GEOLOGICAL SUMMARY

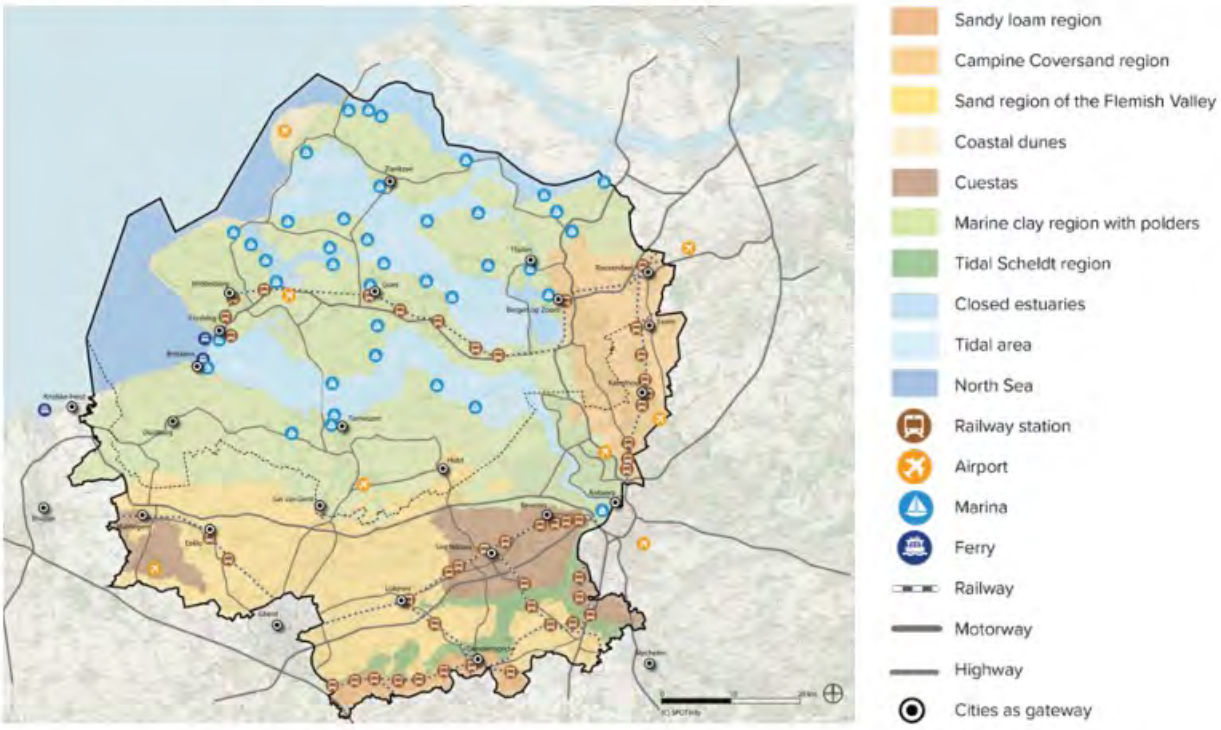
United Nations Educational, Scientific and Cultural Organization · UNESCO Global Geoparks

Applicant UNESCO Global Geopark

Geopark Schelde Delta, Belgium and The Netherlands

geographical and geological summary

The location of the Aspiring UNESCO Global Geopark Schelde Delta in Europe.



General map of the Aspiring UNESCO Global Geopark Schelde Delta.

1. Physical and human geography

The transnational Geopark Schelde Delta is situated at the south-western part of the Netherlands and the north-western part of Belgium, bordering the North Sea. It surrounds the tidal zone of the Scheldt and the geological features around this estuary, covering an area of 5.467 km^2. The Geopark falls within 2 countries, 5 provinces and 63 municipalities. The 5 provinces involved are: Zeeland (NED), Noord-Brabant (NED), Antwerpen (BE), Oost-Vlaanderen (BE) and West-Vlaanderen (BE). Through a cross-border cooperation, this Geopark strengthens the relationship between both countries.

Due to interaction between geology, natural processes and mankind at the transitions of land and water, an enormous wealth and variation of geomorphology, landscapes, cultural history (material and intangible) and nature has been created over time. This can all be experienced at the many sites and activities within the Geopark. The area can roughly be divided into 3 different landscape characteristics:

- The southern part of the Geopark in the Belgian provinces, surfacing pre-Quaternary sequences in cuestas and the Flemish Valley.
- The lower, north-western part in the Province of Zeeland, covering the marine clay and tidal region of the Scheldt.
- The north-eastern part, covering the sandy region of the Flemish Valley along with the Brabant Escarpment in the Province of Noord-Brabant.

The Geopark has a moderate maritime climate. This type of climate generally features mild winters and cool summers. Precipitation is common all year round.

With more than 1.5 million inhabitants, this Geopark has a high population density: 274 inhabitants per km^2. The transport infrastructure facilitates mobility in the region, together with highly-active businesses.

2. Geological features and geology of international significance

The position of the Geopark in the transitional area between the subsiding North Sea Basin and the uplifting Brabant Massif provides a unique setting in which near-ubiquitous Pleistocene and pre-Quaternary units with a north-northeastern dip are being exposed, eroded and traversed by much more recent fluvial deposits from the Scheldt and its tributaries on the upland side, whilst thick Holocene deposits of marine and coastal nature have been accumulating on the basin side.

The Oedelem-Zomergem cuesta is one of only two locations in Belgium and the Netherlands with outcrops of late Lutetian and Bartonian sediments. The Waasland and Boom cuestas are similar in origin, but carved from marine Oligocene units. North of the Boom cuesta and surrounded by tidal deposits, a former quarry at Nieuw-Namen shows a unique exposure of Pliocene iron-cemented beach deposits overlain by Pleistocene coversand.

The Brabant Escarpment is situated on the western margin of an extensive plateau of late Pliocene and early Pleistocene (Tiglian) fluvial and estuarine sand, and intercalated clay. The plateau's subsurface is exposed in the partly filled former quarries Boudewijn and De Bunt. With 1.8-million-year-old tidal deposits, they show some of the oldest Pleistocene deposits in the Netherlands and Belgium.

At the Scheldt polders in Waasland, intact coversand surfaces are sealed underneath Holocene peat and tidal clastics, which are some of the best-preserved and most thoroughly studied prehistoric landscapes in north-western Europe. On the Holocene coastal plain of Zeeland, tidal action eroded some parts and left thick deposits of sand and mud in others. Early and middle Holocene tidal deposits are either under water or covered by younger peat and clay layers.

In-depth summary

The transnational Geopark Schelde Delta is situated at the south-western part of the Netherlands and the north-western part of Belgium, telling a 50-million-year-long story of subsidence and uplift, sea-level rise and decline, tidal waters and rivers, and climate change. This Geopark also showcases a transformation of the landscape by both natural processes and human influence.

Located at the southern edge of the North Sea Basin, where it transitions into the London-Brabant Massif that surfaces in central Belgium, the Geopark area has experienced southern uplift due to the collision of the African and Eurasian plates. Over millions of years, this process has gradually tilted horizontally deposited stratigraphic units towards the north-northeast. Their gentle, but consistent dip translates into a cumulative Paleogene, Neogene and Pleistocene thickness that increases from near-zero just south of the Geopark boundary to almost 1 km at its north-eastern edge. The Oedelem-Zomergem cuesta in the south-western part of the Geopark is one of only two locations in Belgium and the Netherlands with outcrops of late Lutetian and Bartonian sediment.

Over the course of time, the landscape of the Geopark has been exposed to numerous marine transgressions and regressions, due to changes in climate: going from subtropical conditions in the Late Paleocene to alternating temperate and glacial conditions during the Quaternary. Up to about 15 million years ago, sandy sediments found their way to shallow-marine waters where tidal currents and storm waves could reach the seabed. Towards the more temperate end of the Neogene, coastal-deltaic and eventually terrestrial conditions were starting to take over. The Pleistocene marked the onset of fluvial and aeolian activity, modifying the now increasingly exposed former marine landscape, especially during lowstands. From that time onward, only the basin side of the Geopark was still periodically transgressed by the North Sea, exclusively during interglacial times.

The area was never glaciated, but during both the Saalian and Weichselian glacials, the Flemisch valley was initially cut to tens of meters below present sea level and subsequently filled with sandy sediments by aggradational braided rivers. By the start of the Late Glacial, the drainage direction of the Scheldt had been diverted to the east through the Hoboken Gap, south of Antwerp between the Waasland and Boom cuestas. From that time onward, the Scheldt basin rivers would enter the coastal plain along this narrow pathway.

Around 9000 years ago, the Holocene North Sea began to flood the lowest parts of the Geopark. As the sea continued to fluctuate in level, it also raised and lowered base levels, enabling rivers to fill or deepen existing valleys in the coastal plain. In colder times, polar deserts and tundras exposed plenty of sand and silt to the combined action of frost, braided rivers and winds. Sedimentation prevailed during warmer times, when base levels were high and stabilizing vegetation was plentiful.

Although the Scheldt has changed its course many a time, to this day, its fresh and saline waters continue to sculpt the landscape, bringing annual, daily and even hourly changes that are best visible in intertidal areas. In these transitional areas, interactions are happening between biotic and abiotic processes, tidal and fluvial currents, and waves, wind and sedimentation. Rising sea level transformed a vast swath of terrestrial lowland into a highly dynamic estuary. Tidal action eroded some parts and left thick deposits of sand and mud in others.

Adaptions of the natural landscape by human hands started around the Roman Period. About 2000 years ago, peatlands were actively drained to build settlements, create arable land and dig up fuel, causing the land to subside. This made the lower parts of the Geopark sensitive to marine flooding and erosion. Human influence as a geological force is the distinctive characteristic of the Geopark. Whether we were fighting nature, using nature or building with nature, our past actions have had numerous intended and unintended consequences for our landscape and the sedimentary record.

The international importance of Geopark Schelde Delta relates mostly to the following dynamics: tectonics, climate, sedimentation, fluvial and tidal forces, sea level fluctuations and human influences. Throughout time, these factors have interacted with each other and created visible geological, morphological and cultural-historical reminders of our vulnerability to climate change and lessons from the past we need to remember for our future.

ANNEX 6
BIBLIOGRAPHY AUGGP SCHELDE DELTA

P. Kiden, 25/10/2022

1. Explanatory notes

General approach

The area of the aUGGp Schelde Delta is densely populated and economically important and has a long history of detailed research in many aspects of earth sciences and related disciplines. An exhaustive bibliography of this research would encompass probably many thousands if not tens of thousands of academic and more general publications, books, reports etc. We have therefore limited ourselves at this stage to a selection of the most important publications on geology and related earth sciences in a broad sense. The 'most important publications' are those that are the most relevant and the most widely and longest used and/or cited, also internationally.

Selection criteria

Thematic criteria:

In the aUUGp Schelde Delta both geology and human influence are important for the understanding of the genesis of the present landscape. The thematic selection criteria are therefore relatively broad and cover the following themes:

- **Geology and Earth Sciences:** in addition to geology in the broad sense this includes geomorphology, hydrography, hydrology and morphodynamics of rivers and estuaries, marine science, soil science, biogeomorphology, remote sensing etc.
- **Humans as geological factor:** the past and present interaction of humans with geological and environmental conditions, including the role of humans as a factor in geological events and natural hazards with (large) environmental impact (such as land subsidence and large-scale catastrophic flooding). This subject draws on various disciplines such as historical geography and cartography, geoarchaeology, cultural and economic history, landscape ecology, meteorology, and climatology etc.

Geographical criteria:

The selected publications are either (1) geographically limited to the aUGGp area or (2) overlap partly with it. In the second case, the publication is included in the bibliography if the aUGGp area forms an important part of the study. This may comprise publications with global reach but in which aspects of the aUGGp Schelde Delta are referred to or play an important role. Examples are:

- International comparisons of estuaries in which e.g., the Western or Eastern Scheldt are included, thus demonstrating the international recognition of these aUGGp sites.
- IA study on the Boom Clay (with type area within the aUGGp but Europe-wide occurrence), in which some observation come from within the aUGGp, or results are relevant for the Boom Clay within the aUGGp (e.g., a paleogeographical reconstruction).
- IA study on the Holocene paleogeography of the Netherlands of which a part deals with the aUGGp area in the SW part of the country.

Geological maps and models

Except in a few cases, geological maps and their explanatory notes have not been included in the bibliography. The production of large scale 'classic' paper geological maps has been stopped in both Belgium and the Netherlands over the past 10 to 20 years. They are replaced by digital geological models which can be consulted and downloaded from the following sites:

- Belgium (Flanders): Databank Ondergrond Vlaanderen (https://www.dov.vlaanderen.be/)
- The Netherlands: TNO – Geological Survey of the Netherlands (https://www.geologischedienst.nl/producten/)

These sites allow various ways of detailed visualization of the geological models, including e.g., interactive construction of geological cross sections. Furthermore, borehole and other data such as grain size and geochemical analyses can be consulted and downloaded. Older geological maps as well as other types of maps (geomorphological, pedological...) are also available in digital format.

Software

The bibliography is maintained in the free and open-source reference manager Zotero (https://www.zotero.org). This is database software specifically designed for the collection, management and exchange of bibliographic references which enables fast filtering and querying and automatic generation of reference lists in different formats.

The bibliography

The bibliography of the aUGGp Schelde Delta at present (25/10/2022) contains 500 publications which have been subdivided in two categories, according to their academic ranking:

1. **Peer reviewed international (283 publications):** Articles published in peer reviewed international journals and international special publications, books from international academic publishers and chapters therein.
2. **National and regional publications (217):** Articles published in journals and books with national or regional audience (expert or general), colloquia, field guides, PhD and MSc theses, maps, books, and reports.

Category 1 is almost exclusively limited to English-language publications, especially for relatively recent work (since ca. 1980-1990). Some older publications in French are also present (e.g., studies on the Scheldt basin and Flemish Valley in Belgium before the 1970's)

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ANNEX 7
GEOSITES DESCRIPTIONS

Geosite n°01	**Kop van Schouwen** Vast and very diverse dune area under influence of humans and the Eastern Scheldt (Oosterschelde).
 Fig. 01.1: Map of Geopark Schelde Delta. Kop van Schouwen is number 1.	**Scientific importance** The extensive dune area on the Kop van Schouwen is unique because of its large diversity of dune forms of different ages at a short distance from each other. Both stable (fossil) and active dunes are present. Humans have had a clear impact on the landscape: the effect of (the lack of) vegetation and the type of plants on the dune behaviour is significant. Kop van Schouwen is also the largest legally protected national archaeological monument of the Netherlands, in which finds from prehistoric times up to the late Middle Ages are preserved. The geosite is a geologically valuable area of the Province of Zeeland with international importance.
Municipality	Schouwen-Duiveland
Province and country	Zeeland, the Netherlands
Protection status	Natuurnetwerk Zeeland, Natura-2000, provincial geologically valuable area, PMV environmental protection area; Southwestern part of Kop van Schouwen: groundwater protection area, Archeologisch Rijksmonument, provincially valuable landscape
Site management organizations	Staatsbosbeheer, Natuurmonumenten, Natuurcollectief Zeeland, Waterschap Scheldestromen, Municipality Schouwen-Duiveland
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes which can be walked independently
Relevance for education	- Excursions/guided tours - Educational programme for school classes/children - Routes which can be walked independently
Teaching equipment	Guided educational activities and activities you can experience on your own, for example nature and geological excursions, bat-detecting, podcast and thematic walks, experience path and expedition programmes for children and information panels.
Code	**Significance**
G-01	International

Geological interest(s)
Palaeontology: not applicable.
Stratigraphy: not applicable.
Geomorphology: This extensive coastal dune area comprises a large diversity of eolian landforms (e.g. primary dunes, dune ridges, parabolic dunes up to 38 m above sea level, blowouts) of different ages at only a short distance apart, including both stable (fossil) and active dunes, and showing an evident relationship between a.o. dune types, dune formation, human influence and vegetation type and cover.
Sedimentology: The relationship between wind and weather, tide level, sea state, groundwater level and vegetation, and the coastal and eolian processes of erosion, sediment transport and deposition in the formation and destruction of dunes can be observed and studied in semi-natural field conditions, as well as the results of these sedimentary processes e.g. different dune types and sizes, eolian bedforms and sedimentary structures.
DETAILED DESCRIPTION 1. **Location** This geosite concerns an extensive dune area northwest of the line Westenschouwen – Burg-Haamstede – Renesse. Within this area, several smaller dune areas are discerned, such as the Meeuwenduinen, Het Zeepe, the Verklikkerduinen and the Vroongronden. The area varies in elevation from sea level to 38 m + NAP. The highest parts are the tops of the parabolic dunes in the inland part at the west side of the area. The inland behind the higher dune tops is at ca. 3 to 6 m + NAP. 2. **Landscape formation** <u>Origin of the landscape</u> Due to the sea level rise that started at the beginning of the Holocene, the sea invaded Zeeland from the northwest and formed a tidal area with salt marshes, tidal flats, tidal channels and shoals, that covered the most of Zeeland ca. 6300 years ago. The sea supplied sand that was deposited at the sea side of the salt marshes. As a result, protective beach ridges were built up at some locations. The first beach ridges were located far west of the current coastline. Due to the continuously rising sea level, they were cleared away and new beach ridges formed further east (landward). During the Holocene, the speed of sea level rise decreased. Around 3800 years ago, an almost uninterrupted beach ridge had formed more or less at the position of the current coastline, which protected the area behind it against sea breaches. At the location of the current Eastern Scheldt, however, an opening remained, which at the time formed the mouth of the river Scheldt. As a result of onshore winds, low dunes first formed at Schouwen – the Oude Duinen (Old Dunes). From about a thousand years ago, the coastal erosion became stronger, possibly as a result of an increase in the number of storms. Sand became available again to form new dunes. The formation of these Jonge Duinen (Young Dunes) proceeded in two phases at Schouwen, under the influence of humans and the development of the Eastern Scheldt (Oosterschelde). <u>Young Dunes: first formation phase</u> The first phase of drifting took place between 900 and 1300 AD and was possibly caused in part by a decrease in vegetation as a result of grazing livestock and harvesting marram grass. Erosion shifted the coastline inland, with the wind blowing the eroded beach and dune sand inland. The Oude Duinen at the west side of Schouwen, which had been formed several millennia before and were meanwhile cultivated, got covered by drift sand from the 10th century onwards. During the 12th century, dune activity accelerated and parabolic dunes formed under influence of the dominant south-westerly winds, and moved inland at a rate of up to 25 metres per year.

During this phase, the Zeepe dunes formed, which extend to over 3 kilometers east of the current coastline. In the 13th century, the eastern and southern sides of the dune area were once again stabilized by man through vegetation. The inner dune edge was plated with marram grass that captured the dune sand to prevent the dune from drifting further inland. This created the still remarkably high inner dune edge northwest of Burgh-Haamstede.

Young Dunes: second formation phase

The second phase of drifting started around 1600 AD and continued into the 19th century. This phase of dune formation is linked to changes in the tidal regime of the Eastern Scheldt. In previous centuries, the Western Scheldt (Westerschelde) had become more important as a drain for the river Scheldt. The nature of the Eastern Scheldt changed from an estuary to a tidal inlet.

Storm surges in the first half of the 17th century caused a lot of land loss further inland along the Eastern Scheldt. As a result, the inlet was able to hold more water, and tidal currents in the inlet increased. This caused the creation of the Hammen channel, which eroded the southern part of Schouwen. Due to erosion, the Banjaard tidal flat, west of Schouwen, fell apart into several islands, thus creating the Krabbengat channel. Coastal erosion once more made a lot of sand available for drifting. Drifting eventually decreased because humans structurally planted marram grass and straw on land, which captured and retained the dune sand. That is why the dunes slower and less far inland during this phase than during the first drifting phase, but did become much higher.

The Meeuwenduinen and the Verklikkerduinen, among others, were created in this second dune formation phase. On the west side of Schouwen, the Jonge Duinen from the second phase cover those from the first phase. On the north side they cover the Oude Duinen.

Dune formation and dune structures

In the initial stage of coastal dune formation, low dunes are formed on the beach from blown-up beach sand (such as on the Verklikkerstrand). Above the spring tide mark, such small primary dunes form a low, continuous dune ridge. With sufficient sand supply, it grows into a dune ridge of up to several tens of metres height. In case of an expanding coast, a new dune ridge can arise seaward of the dune ridge. The sand supply to the older dune ridge then decreases sharply and the younger, more seaward dune ridge grows.

Both in the front dunes as in the more inland dunes, wind locally gets grip in the dunes. This can happen as a result of coastal erosion by a storm surge, or as a result of reduced vegetation, for instance by human activity. Wind erosion takes place until the sand can no longer be picked up, for instance when a more solid layer in the subsoil or the groundwater has been reached. This is how dune slacks are created in the dune landscape. The sand that is picked up by the wind, is redeposited behind the original dune. This process often gives rise to parabolic dunes (Verklikkerduinen, Meeuwenduinen). The orientation of the parabolic dunes on Schouwen towards the northeast is caused by the dominant wind direction from the southwest. The rate of parabolic dune formation and its final height depend on the wind force and the vegetation. The width depends on the amount of variation in wind direction. With drifting and covering of all vegetation, in combination with sufficient sand supply, a larger dune field can arise (Zeepe duinen, Vroongronden). On the landward side of the dune area, where sand is blown in over a broad front from a large blowout depression, a compound parabolic dune with multiple windward arms, resembling the shape of a comb, can arise. This happened at the northeast side of the Zeepe duinen.

Coastal erosion and accretion

The west coast of the Kop van Schouwen consists of an erosional coast, where the base of the dune is affected by storm surges. On the north coast, coastal accretion does take place. This is how

the Verklikkerstrand was formed. From the 16th century onward, an elongated beach developed here, that was attached to land on the south-west side and ended in the sea on the north-east side: a hook-shaped spit. On this beach, a new ridge of continuous primary dunes was formed. Between these primary dune ridge and the older primary dune ridge along the older beach behind the spit, lies a primary dune valley. In case of continuing coastal accretion, this process can repeat itself several times, creating a landscape with alternating dune ridges and valleys.

Relation with other geosites

- Eastern Scheldt estuary and later tidal inlet, which strongly influenced dune formation.
- Schelphoek, Plompetoren, Koudekerkse inlaag area, drowned area immediately south of Schouwen – strong coastal erosion on the south side of Schouwen from the Middle Ages onward.
- Drowned Land of Zuid-Beveland – large-scale land loss in the 16th century led to an increase of tidal currents and erosion along the mouth of the Eastern Scheldt.
- Dune Complex Oranjezon and the Manteling – Young and Old Dunes and coastal expansion on Walcheren.
- Southwest Walcheren – very high and narrow ridge of Jonge Duinen on Walcheren.

Fig. 01.2. Location map of the area.

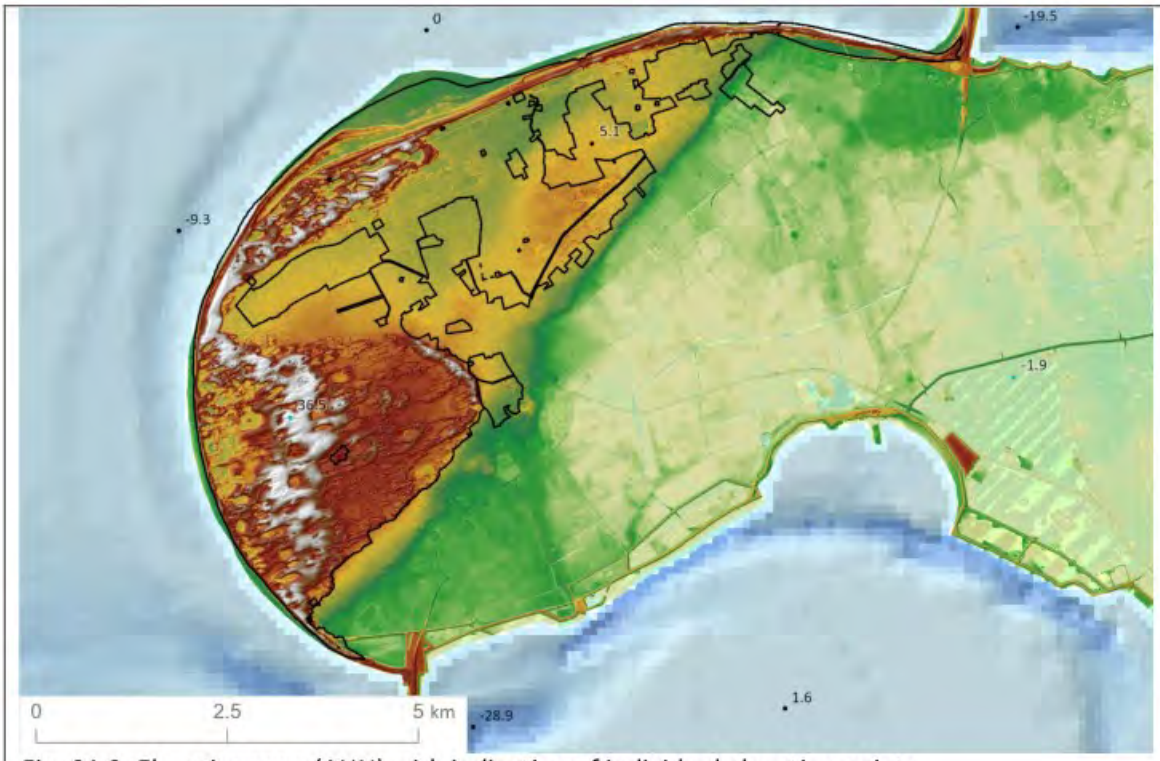

Fig. 01.3. Elevation map (AHN) with indication of individual elevation points.

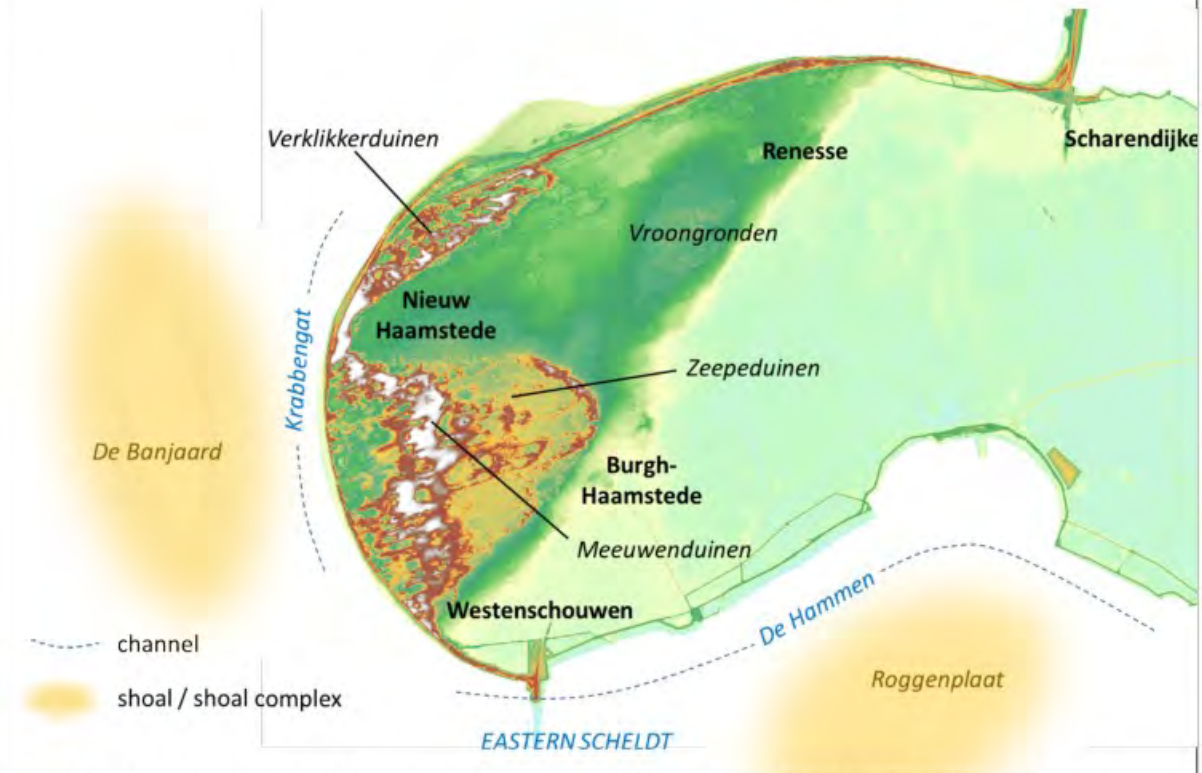

Fig. 01.4. Overview map with toponyms, outer-dike channels and shoals, very schematically drawn on the elevation image (AHN).

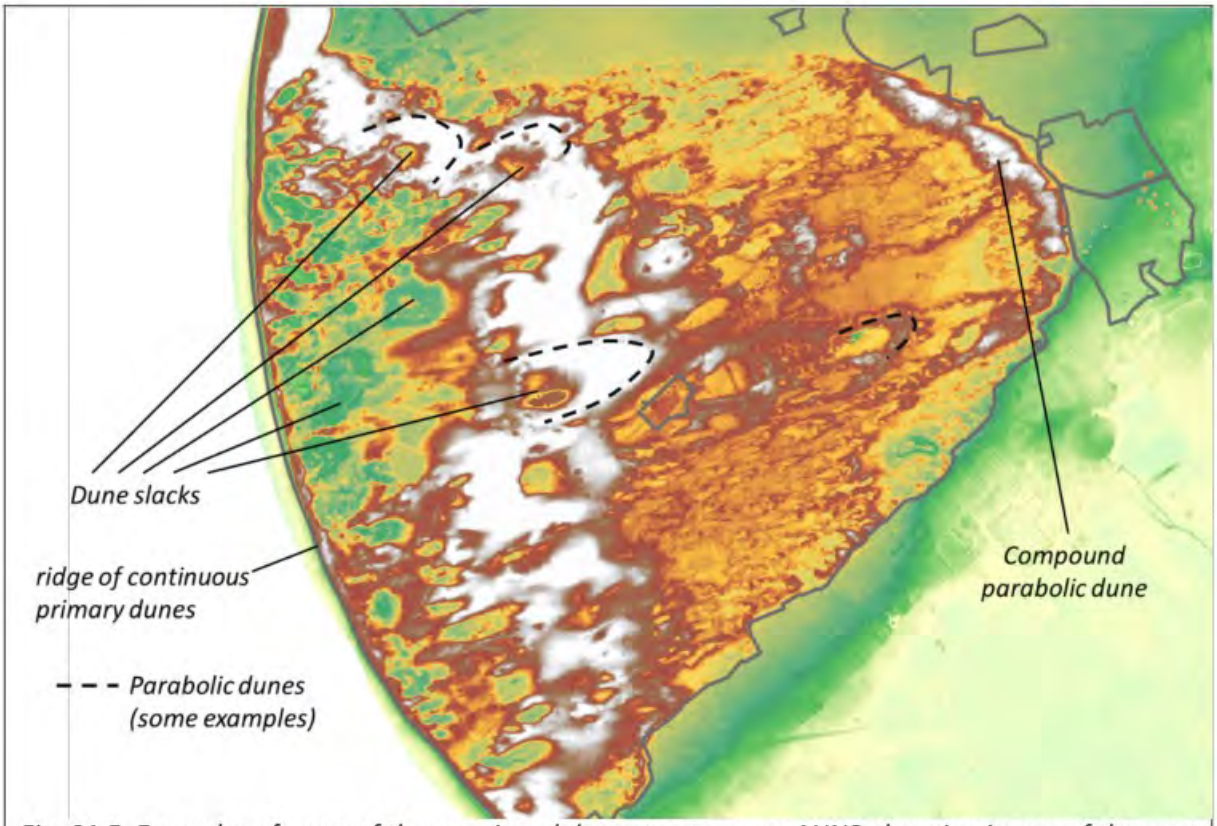

Fig. 01.5. Examples of some of the mentioned dune structures on AHN2 elevation image of the west side of Schouwen. Only some of the dune slacks and parabolic dunes are indicated as an example.

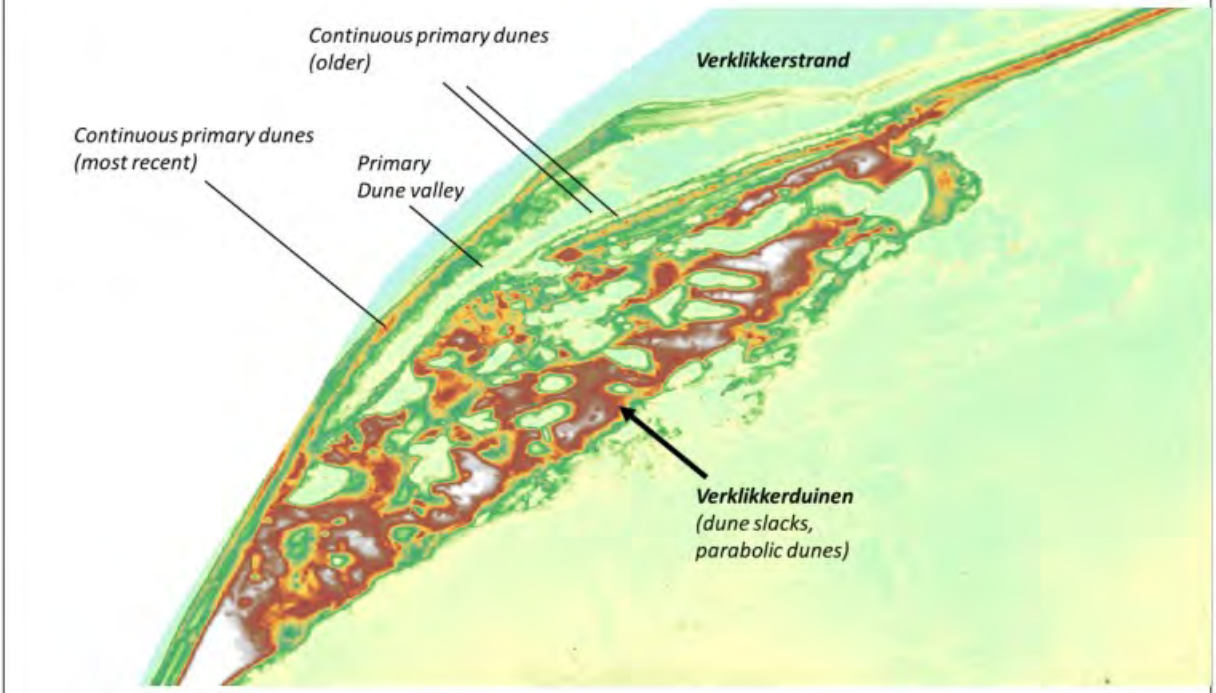

Fig. 01.6. Examples of some of the mentioned dune structures on AHN2 elevation image of the Verklikkerduinen and the Verklikkerstrand, with emphasis on coastal accretion and formation of new primary dune ridges and valleys.

Documentation en resources

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Geosite n°02	**Dintelse Gorzen** From salt to fresh: a frozen tidal landscape.
 Fig. 02.1: Map of Geopark Schelde Delta. Dintelse Gorzen is number 2.	**Scientific importance** The geosite is a geologically valuable area of the Province of Noord-Brabant. The former tidal landscape with patterns of former tidal channels and creeks is now considerably more accessible to the general public, than it was when it was still under tidal influence. The area can serve as a 'field laboratory' to study the consequences of the removal of tides for the development of a former tidal area, not only on a geomorphological level, but also for instance on an ecological and pedological level.
Municipality	Steenbergen
Province and country	Noord-Brabant, the Netherlands
Protection status	Natuurnetwerk Brabant, Natura-2000, provincial geologically valuable area, quiet zone
Site management organizations	Vereniging Natuurmonumenten
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Educational programme for children - Routes that one can travel independently
Teaching equipment	OERRR programme Natuurmonumenten (for children), (theme) excursions and an information panel at Natuurmonumenten in Beneden Sas.

Code	**Significance**
G-02	Provincial
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: Although tidal influence has stopped due to human intervention, the former tidal landscape retains many features of its active state such as tidal channels and creeks dissecting the former salt marshes. Moreover, the area is now considerably better accessible to the general public than it was when still under tidal influence.	
Sedimentology: The area can serve as a 'field laboratory' to demonstrate and study the effects of the removal of tides and brackish water influence on the development of a former tidal area, not	

only related to its geomorphology but also to a range of dynamic sedimentological, pedological and ecological processes taking place during this evolution.

DETAILED DESCRIPTION

1. Location

The geosite is located in the outer-dike area along the Volkerak at the mouth of the former tidal channel Steenbergsche Vliet. On the west side, the area is bordered by the Scheldt-Rhine Canal. The tidal flats of Heen are located west of this canal. The easternmost boundary of the geosite is a few kilometers west of Dinteloord. The area is about 10 kilometers long and has a maximum width of 1 kilometre. The area contains a west-east oriented levee with a height of ca. 2 m + NAP. The part of the geosite south of this ridge mostly consists of former salt marsh and is at ca. 1.5 m + NAP. North of the ridge is a former tidal flat area at an elevation of ca. 1.3 m + NAP. Originally the Dintelse Gorsen were part of a brackish water tidal area, but tidal activity has disappeared from the area since the Volkerak and Eastern Scheldt (Oosterschelde) were dammed.

NB. The Dintelse Gorzen are therefore not located, as the name suggests, at the mouth of the Dintel, which flows east of the area, but at the mouth of the Steenbergsche Vliet.

2. Landscape formation

Origin of the landscape

At the end of the last ice age, the region consisted of a sandy landscape that was part of a vast polar desert. The drainage of this frozen landscape took place along streams that flowed from south to north towards the sea. At the location of the Steenbergsche Vliet there may already have been a stream valley as well.

As a result of groundwater and sea level rise in the Holocene, the near-coastal part changed from a barren sandy landscape into a coastal swamp (peatland), which gradually spread inland while being covered by tidal deposits on the seaward side. About 6300 years ago, most of Zeeland was part of this tidal landscape. At the pinnacle of expansion, the Dintelse Gorzen were located on the border between coastal swamp and tidal area.

As the rate of sea level rise slowed, a row of coastal ridges arose more or less at the position of the current coastline. Around 3800 years ago, an almost uninterrupted barrier of beach ridges had formed, which protected the area behind it against sea breaches. As a result, almost the whole of Zeeland turned into a vast swamp area, in which a thick layer of peat formed. The peat near the Dintelse Gorzen also expanded again, over the thin cover of tidal deposits.

Since a few centuries BC, the protective coastal barrier was locally breached and the influence of the sea increased again. The far inland area of the Dintelse Gorzen was only reached again by the sea during the Middle Ages. At that time, the tide penetrated 10 to 15 kilometers further inland via the Steenbergsche Vliet. The previously formed peat in and around the channel was eroded. Outside the channel, the sea again deposited sand and clay on the peat, and a tidal landscape of salt marshes, tidal flats, tidal channels and shoals was formed.

Impoldering/Land reclamation

The peat area south of the Dintelse Gorzen has been reclaimed by humans around the year 1000. Villages were built in long ribbons along the banks of ditches that cut elongated parcels of the wetland. Due to the lowering of the surface as a result of peat extraction, drainage and the ensuing decay of the peat, the area was subject to subsidence. Over time, it thus became more and more prone to flooding. Storm surges in the fifteenth and sixteenth centuries led to the destruction of villages and farmland. Between the 17th and 20th century, the area south of the geosite was re-embanked.

Salt marshes, tidal flats, tidal channels and shoals

In a tidal zone, sediment (sand and clay) is brought in from the tidal inlets twice a day during high tide and is partly left behind in the coastal plain. Since sand is heavier and is only transported by fast-flowing water, it is mainly deposited in and along the tidal channels. Between those channels are flats that get flooded during high tide. During each flood, a thin layer of sand can be deposited here. The finer and lighter clay particles can also be transported at lower flow velocities and are mostly deposited during the turning of the tide, from high to low tide. The flats are therefore covered with an alternation of thin layers of sand and clay. Flats that are connected to the mainland or to islands are called tidal flats. The higher parts consist of salt marshes, that are only flooded during very high water (spring tide and storm surge). Here, the water is supplied and discharged through a branched system of small gullies. The main deposit on these salt marshes is clay. The marshes are often grown with halophytes (salt-tolerant plants). The part of a tidal area that is only flooded during spring tide is called *gors* in this area, hence the name Dintelse Gorzen.

Levees and salt marsh ridges

There are also elevation differences within the salt marsh. For instance, so-called levees can form parallel to channels that overflow during high tide. This happens because the flow velocity of the water that floods the banks suddenly decreases. As a result, the water no longer has enough energy to transport sand, and the sand gets deposited on the bank. This process forms a slightly higher zone along the channel. Further away from the channel, lighter and finer material is deposited. As a result, depressions filled with clay are formed at a distance from the channel.

A similar process takes place on the edge of a salt marsh. Here again, the water depth at high tide is lower than above the adjacent tidal flat, and the sand brought in by the tide settles as soon as the water floods the salt marsh. The edge that develops along the salt marsh as a result is called a salt marsh ridge.

Dynamic area

The development of a tidal area is a continuous process, in which channels are cut out and shoals, tidal flats and salt marshes are covered with sediment. Though, not all flats are eventually raised to form salt marshes. Channels shift and can erode previously formed shoals and tidal flats and even salt marshes. In this way, the tides can rework the coastal plain over and over again.

This process of continuous reworking of the tidal area ends when the tidal influence is taken away. Usually, this happens by impoldering a part of the salt marsh, thus preventing the seawater from reaching the area behind the dikes, as is the case in the area immediately south of the Dintelse Gorzen. By contrast, in the Dintelse Gorzen area itself, the tidal influence has been removed by the damming of the Eastern Scheldt and the Volkerak.

Frozen landscape

As part of the Delta Works, after the storm surge disaster of 1953, dams have been constructed on a large scale along the Zeeland inlets. The Brouwershaven inlet (now the Grevelingenmeer) was dammed by means of the Grevelingendam (1965) and the Brouwersdam (1971). The Haringvliet was dammed in 1971. Since the construction of the Philipsdam in the Volkerak in 1987, the natural tidal effect on the Dintelse Gorzen completely disappeared. The erosion and sedimentation by the tide has stopped, causing the development of salt marshes, tidal flats, channels and shoals to end. In a sense, the morphology, the shape of the landscape, is as it were frozen in time.

Nevertheless, the landscape is highly subject to change: due to the lack of tidal effects, other processes are given a chance. Tidal channels have disappeared, but the Steenbergsche Vliet still drains water through the area. The environment becomes less saline and sediment can still be deposited at high river water levels. This way, an evolution towards a freshwater river floodplain is

taking place, in which new plant species colonize the former tidal area. The former salt marshes are now overgrown with shrubs and trees.

The location of the fossil salt marshes, tidal flats, channels and shoals is still reflected in the vegetation: differences in elevation and composition of the subsoil (sand or clay) affect, for instance, the speed at which desalination takes place and thus the occurrence of various new plant species in the landscape.

Relation with other geosites

- Smalle Beek Valley – upstream branch of the Steenbergsche Vliet.
- Markiezaat – former tidal area where tidal activity has disappeared.
- Veerse Meer – former inlet where tidal activity has disappeared.
- Salt marshes of Rumoirt and Sint-Annaland – active tidal area north of Tholen and around Sint Philipsland, part of geosite Eastern Scheldt.
- Drowned Land of Saeftinghe – extensive active tidal area in Zeeuws-Vlaanderen.

Fig. 02.2. Location map of the area.

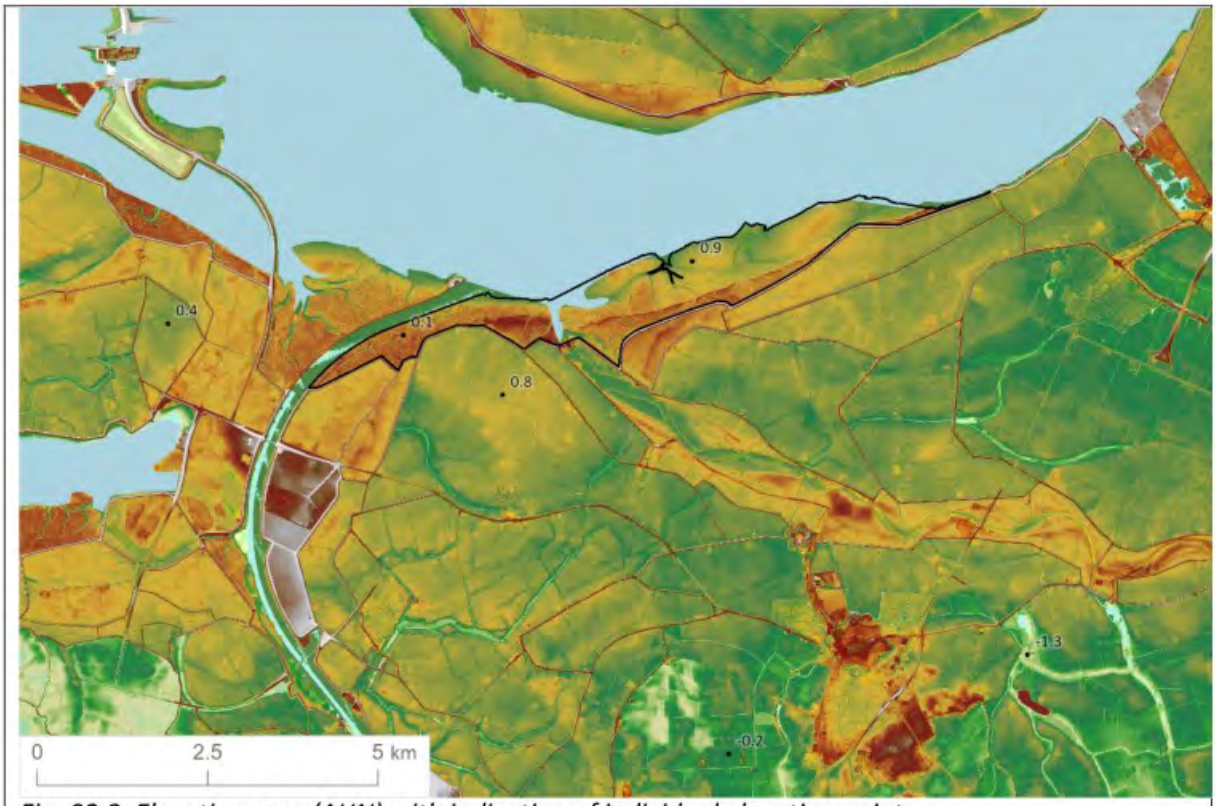

Fig. 02.3. Elevation map (AHN) with indication of individual elevation points.

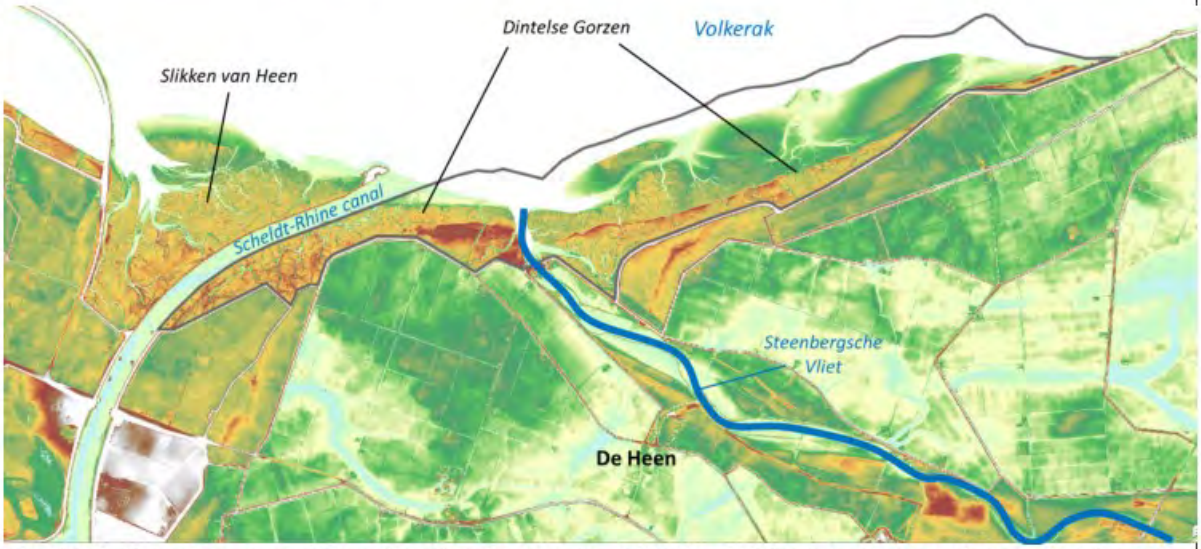

Fig. 02.4. Overview map of geosite Dintelse Gorzen with the AHN2 as background elevation image.

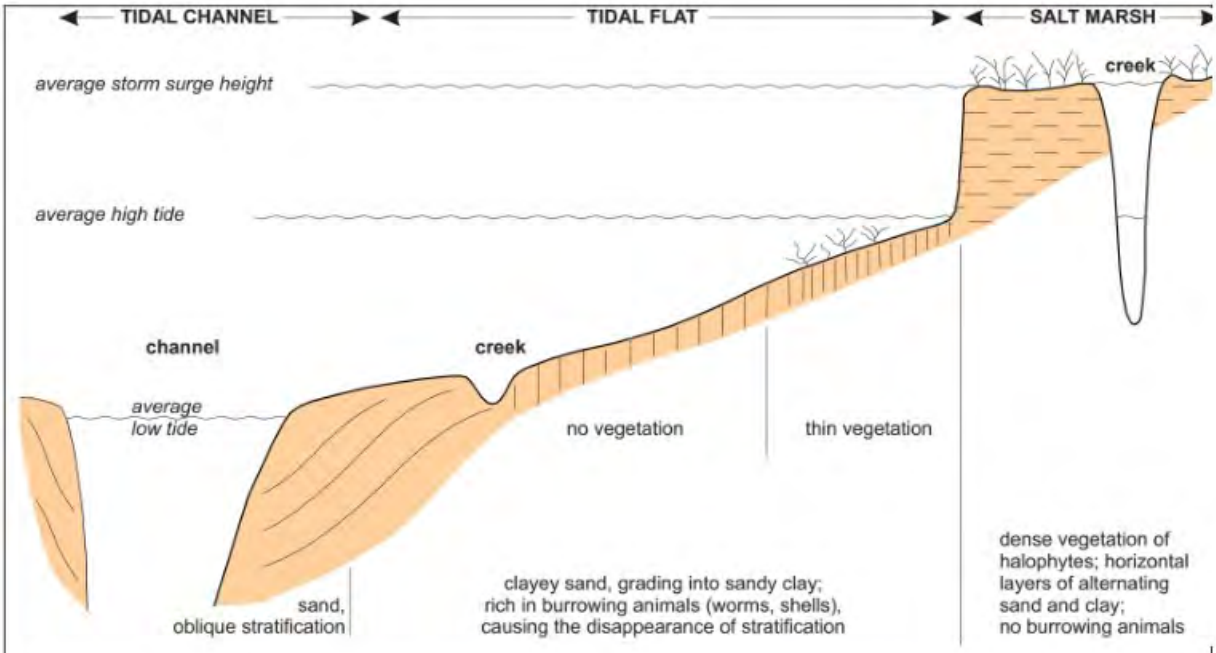

Fig. 02.5. Schematic representation of sedimentary environments in a tidal area. After Zagwijn, 1986

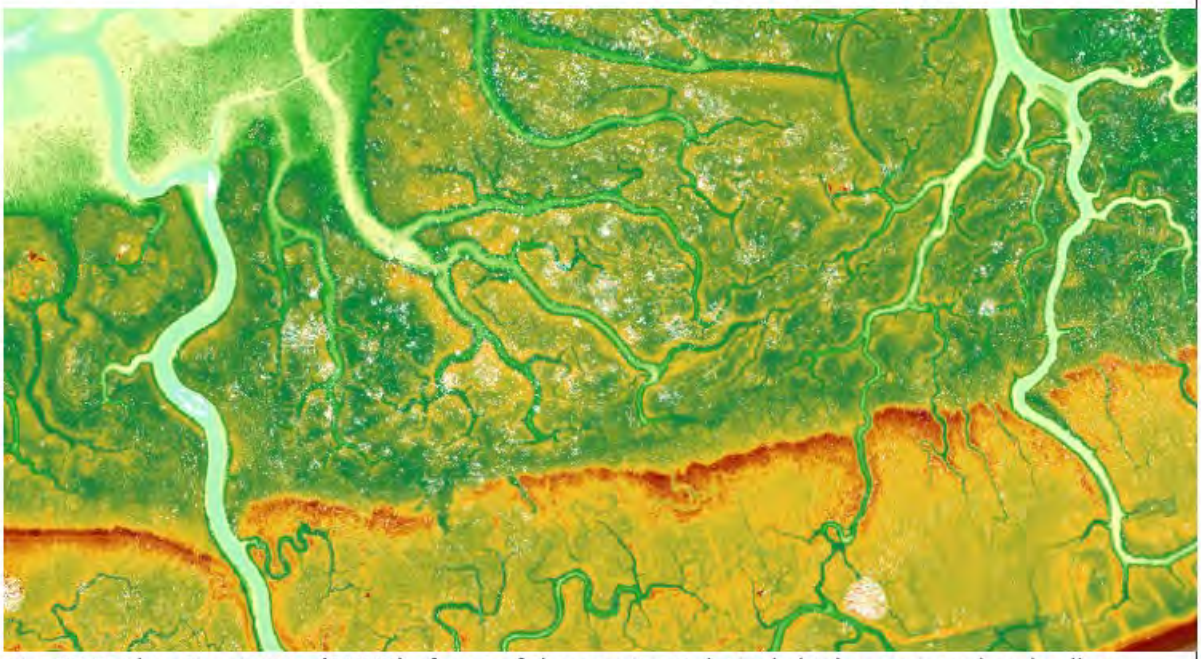

Fig. 02.6. Elevation image (AHN3) of part of the geosite. Relatively high area in red and yellow; low-lying parts in green and bright blue. In the elevation image, a salt marsh ridge (red) and channels that cut through the salt marsh (green to bright blue) can be recognized. Along the tidal channels, levees have been formed (yellow). Foot of the sea dike is visible in the south-east corner (dark red).

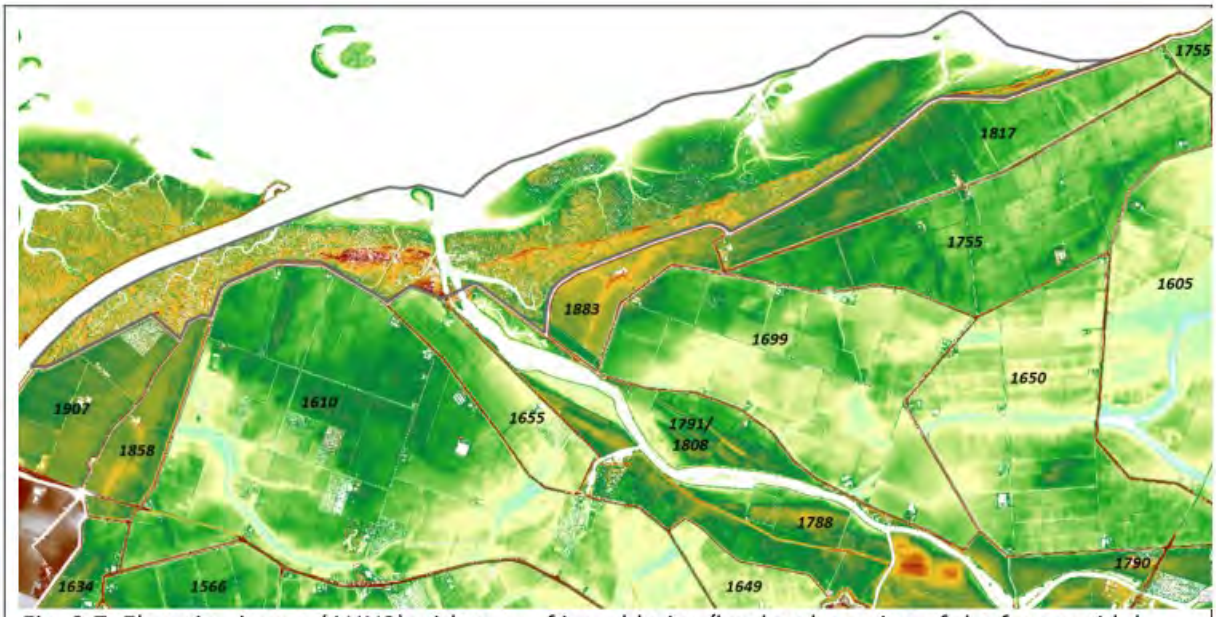

Fig. 2.7. Elevation image (AHN2) with year of impoldering/land reclamation of the former tidal area south of the Dintelse Gorzen.

Documentation and resources

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- Renes, 1984. Cultuurhistorisch landschapsonderzoek West-Brabant, deel 1 & 2. Stichting voor bodemkartering. Rapportnummer 1892.
- Zagwijn, 1986. Geologie van Nederland - Nederland in het Holoceen. Rijksgeologische Dienst Haarlem.

Geosite n°03	**Eastern Scheldt** From estuary and Scheldt mouth to tamed inlet
 Fig. 03.1: Map of Geopark Schelde Delta. Eastern Scheldt is number 3.	**Scientific importance** The Eastern Scheldt (Oosterschelde) and Western Scheldt (Westerschelde) are the only inlets in the southwest of the Netherlands that still have an open connection with the North Sea, although it is partially closed in case of the Eastern Scheldt. The Eastern Scheldt is a very dynamic area in which natural processes of erosion and sedimentation take place relatively undisturbed and in which many features of the former active estuary can still be recognized. The Eastern Scheldt has long been extensively researched and is continuously monitored for various aspects, both separately and in their mutual relationship: morphology and morphodynamics, sedimentation and erosion, hydrology, ecology, navigability, flood risk, management, etc. The Eastern Scheldt Storm surge barrier (Oosterscheldekering) is, along with the other dams and bridges of the Delta Works, a world-class hydraulic and geotechnical work of art. Geological and sedimentological research, among others in various construction sites of the Delta Works, emphasizes the importance of the former estuary as a modern analogue for the interpretation of older tidal deposits in hard rocks, for instance for sedimentology, paleoecology, oil and gas exploration and mining. Fossils, mainly of Pliocene and Pleistocene age, are retrieved from deep tidal channels in the Eastern Scheldt, such as the Hammen and the Roompot. These finds are important not only to amateur geologists and palaeontologists, but also to academic researchers. Although the finds are not in situ (but usually surface close to the original place of burial), they contribute to a refinement of, for example, the distribution area of certain species of molluscs or mammals. The Eastern Scheldt is the largest National Park in the Netherlands and is also a geologically valuable area of the Province of Zeeland of international importance.
Municipality	Noord-Beveland, Reimerswaal, Schouwen-Duiveland, Veere, Tholen, Goes and Kapelle
Province and country	Zeeland, the Netherlands

Protection status	Provincial geologically valuable area, Natuurnetwerk Nederland, Natura-2000, geological important area, In the Voordelta: some areas Voordelta Rustgebieden, PMV environmental protection area; Verdronken Stad Reimerswaal: Archeologisch Rijksmonument
Site management organizations	Oosterschelde National Park, Rijkswaterstaat, Natuurmonumenten, Staatsbosbeheer, Stichting Het Zeeuwse Landschap
Accessibility	The Oosterschelde National Park is (except for Natura2000 areas) fully accessible to the general public.
Relevance for tourism	- Entrance points - Excursions - Educational programmes - Cruises
Relevance for education	The Nationaal Park Oosterschelde offers a great variety of educational activities for the greater public.
Teaching equipment	Continuous learning line for children (1-12 years), excursions, guided tours, information panels.
Code	**Significance**
G-03	International
Geological interest(s)	
Paleontology: Hundreds of species of fossils, mainly molluscs and vertebrates of Pliocene to Pleistocene age, are retrieved from deep tidal channels or found on tidal flats and beaches near the mouth of the estuary. Although these finds are not in situ (but usually are close to the original place of burial), they are important not only for amateur geologists and palaeontologists, but also for academic research as they contribute to a refinement of e.g. the distribution area of certain species.	
Stratigraphy: The finds of Pliocene and Pleistocene mollusc and vertebrate fossils in the estuary (see above) also contain species that were previously unknown in this region and as such contribute significantly to our knowledge of biostratigraphy and paleogeography.	
Geomorphology: Although partly closed off from the sea cut off from the fluvial input of the Scheldt river, this large and dynamic former estuary still retains many estuarine features such as tidal flats, salt marshes and intertidal bars and shoals separating winding ebb and flood channels.	
Sedimentology: In the 1970-1980's the construction pits of the storm surge barrier were the site of internationally acclaimed field investigations into tidal sedimentology, providing modern analogues for the interpretation of older tidal deposits in the geological record, while sedimentological and related processes are closely studied and systematically monitored over many decades to predict and manage the future development of the estuary.	
DETAILED DESCRIPTION 1. **Location** The Eastern Scheldt is the former estuary and mouth of the river Scheldt, which has its source in France and flows through Belgium to the Netherlands. It also received part of the discharge from the Rhine and the Meuse via the Hollandsch Diep and Volkerak. However, since 1867, the Eastern	

Scheldt has been cut off from its source river, the Scheldt, and since the completion of the Delta Works, also from the Rhine and the Meuse. Since the term 'estuary' refers to the mouth of a river where fresh and salt water mix, the current Eastern Scheldt is strictly speaking no longer an estuary, but an inlet. There is virtually no supply of fresh water anymore and as a result there is no longer a fresh-salt gradient in the Eastern Scheldt, as is the case in the Western Scheldt. The current Eastern Scheldt is a saltwater tidal area, but has retained many features of the former estuary, such as the tidal flats.

The Eastern Scheldt is eight to nine km wide in the mouth part between the storm surge barrier and Zierikzee, where the estuary narrows to only four km (Fig. 03.2). In the central part, landward of Zierikzee, the inlet branches into a one to two km wide northern branch (Mastgat) and a three to six km wide south-western branch (Eastern Scheldt). In the so-called Kom, between Yerseke and the Oesterdam, the inlet widens again to nine km. The length of the Eastern Scheldt from the storm surge barrier to the back of the Kom near the Oesterdam is approximately 50 km. With an area of 35.100 ha, the Eastern Scheldt is slightly larger than the Western Scheldt.

The Eastern Scheldt is a dynamic area that consists of tidal channels of varying depth and tidal flats and salt marshes, which are dry at low tide (Fig. 03.3, 03.4 and 03.5). The shoals, tidal flats and salt marshes (also called intertidal areas) make up about 3% of the total surface of the estuary. The largest tidal flats and salt marshes are located in the more inland parts of the inlet, around St. Philipsland, Tholen and in the Kom.

The tidal range (difference in height between high and low water) in the Eastern Scheldt is approximately 2.5 m just behind the storm surge barrier at the mouth and increases deeper in the estuary, up to three m at the Philipsdam and 3.4 m at the very south-east at the Oesterdam. This geosite also includes part of the Voordelta, a shallow part of the North Sea off the coasts of Zeeland and Zuid-Holland.

2. **Landscape formation**

Origin of the landscape

In the geologically recent past, the Eastern Scheldt was not the first course of the Scheldt towards the North Sea. At the end of the last ice age, about 12,000 years ago, the North Sea was still much lower and there was no marine influence at all in Zeeland. The area was part of an extensive coversand landscape in which the Scheldt flowed northwards in a deep valley at the foot of the Brabant Escarpment (Brabantse Wal), towards the large valley of the Rhine and the Meuse (Fig. 03.6). Due to the rise in sea level, a large part of Zeeland turned into a tidal area with tidal flats, salt marshes, shoals and tidal channels. The predecessor of the current Eastern Scheldt originated between 7400 and 6300 years ago. An important tidal channel developed approximately at the location of the present Eastern Scheldt, and connected eastwards through Tholen with the northward flowing Scheldt at the foot of the Brabant Escarpment. The Scheldt started to use this shortcut to the sea in a north-westerly direction. The original northern course fell into disuse and was filled in with clay and peat.

In the course of the Holocene, the rate of sea level rise continued to decline. Around 3800 years ago, an almost uninterrupted beach ridge had formed more or less at the position of the current coastline, which protected the area behind it against sea breaches. Behind this coastal barrier was a large freshwater swamp area in which peat accumulated. At the location of the current Eastern Scheldt, an opening remained, which formed the mouth of the river Scheldt. This small estuary was much narrower than the current Eastern Scheldt. It connected to a Scheldt that meandered like a small winding river through the vast peatlands. An exceptionally well-preserved part of the Scheldt from this period near Poortvliet on Tholen is about hunderd m wide and a maximum of seven m deep, and had only weak tides or no tides at all.

Since a few centuries BC, marine influence increased again. Sea breaches entered ever deeper inland, especially since the Roman period, aided by the compaction of the peat, which was already being reclaimed at that time. The Scheldt mouth was eroded deeper and wider, but was probably less than one km wide and therefore still much narrower than the Eastern Scheldt as we know it today. The entire coastal plain again turned into a large tidal area with channels that cleared the peat.

Also at the mouth of the current Western Scheldt, south of Walcheren, breakthroughs occurred and tidal channels penetrated deeper and deeper inland. Between 700 and 800 AD, one of those tidal channels made a connection with the then Scheldt at the location of the current Western Scheldt. For a long time after the Western Scheldt connection originated, the Eastern Scheldt remained the most important connection between the Scheldt and the North Sea. With time, the Western Scheldt became more and more important compared to the Eastern Scheldt, but it was only around the end of the 15th century that it was wide and deep enough for shipping traffic to Antwerp. From the 16th century, however, the Western Scheldt became the main connection between the Scheldt and the sea. The catastrophic storm surges of 1530 and 1532 AD probably played a decisive role in this shift. A large part of eastern Zuid Beveland flooded, including many villages and the city of Reimerswaal (the polders Brede Watering Beoosten Yerseke/Land of Reimerswaal, now the Drowned Land of Zuid-Beveland). This created a much broader connection between the Eastern Scheldt and the Western Scheldt in that area. This caused major changes in the tidal currents, causing the flow velocity in the Eastern Scheldt channel near Woensdrecht to drop, so that it quickly began to silt up.

At the end of the Middle Ages, the Eastern Scheldt had become much larger due to the land loss caused by the many floods, and the tidal currents had become much more powerful. As a result, the mouth of the estuary, formed by the Hammen channel, became wider and deeper. In the course of the fourteenth and fifteenth centuries, a second drainage channel, the Roompot, developed at the mouth. The Hammen formed a large meander in a northerly direction, pushing the south coast of Schouwen about four km northward. Large parts of the polders on Schouwen were lost. In the 16th century, the Eastern Scheldt had grown from a narrow estuary in Roman times into a wide estuary with tidal channels and shoals, tidal flats and salt marshes. In the course of the following centuries, the widening and deepening of the channels continued. While the drainage of the river Scheldt via the Eastern Scheldt gradually decreased after 1570, the estuary did become more important as a drainage course for the Meuse and Rhine.

From the end of the 19th century onwards, human impact further increased. In 1867, the Kreekrak near Woensdrecht was almost completely silted up and was closed by the construction of a railway dam. The last connection between the Eastern Scheldt and the Western Scheldt was the Sloe, which was definitively closed in 1871, also by the construction of a railway bank (Fig. 03.8).

<u>Tidal flats and salt marshes, shoals and tidal channels</u>

During low tide, a number of characteristic landscape elements of the estuary can be seen from the dikes along the Eastern Scheldt. The salt marshes are closest to the dike and are largely covered with vegetation. They have silted up so high that they are only flooded for a short time at the highest high-water levels. Lower and further from the dike are the tidal flats, which are flooded at every high tide and are barren. Sometimes the salt marshes gradually merge into tidal flats, but often this transition is abrupt with a cliff edge that can be more than 1 metres high and is formed by wave or tidal erosion. On salt marshes and tidal flats, small channels can be found that supply and drain water at high tide and low tide and which are usually dry part of the time.

Just like tidal flats and salt marshes, shoals are situated between high and low water, but they are not attached to the shore and are often located in the middle of the kilometers wide inlet. Most of the shoals are barren and because of their sandy nature, they resemble a beach, in contrast to the silty and clayey mudflats. This is due to the higher flow velocities on the shoals, which allow only larger and heavier sand grains to be deposited, while on the tidal flats close to the banks the flow is slower and finer silt and clay particles can also settle. Megaripples occur especially on the lower parts of the seaward shoals, such as the Roggenplaat. These are a much larger variety of the small sand ripples that can be found on a beach. Instead of a few centimeters high and a decimeter wide, these megaripples can be more than a metres high and several metres wide. They are created by the displacement of large amounts of sand over the surface, by the strong currents that flow over the shoals during high and low tide.

Between the shoals and the banks of the Eastern Scheldt are large and deep tidal channels along which the tide flows in and out of the estuary during high and low tide. These channels can locally reach depths of over 50 m below NAP, such as in the Roompot, immediately behind the threshold of the storm surge barrier or a few kilometers southwest of Zierikzee. The deepest points are mainly in narrow passages between the islands, where the water flow is concentrated, or at protruding 'capes' such as at Zierikzee, where the water is forced around an obstacle.

Ebb and flood channels

In the wider parts of the Eastern Scheldt, two or more tidal channels are usually present next to each other. The channel that is followed by the current at low tide (ebb channel) is generally the deepest and winds in curves from one bank to the other. Like a river, the ebb channel reaches its greatest depths in the bends. Next to the ebb channel shallower channels are usually present (flood channels) that are mainly followed by the current at high tide and that are separated from the ebb channel by shallow zones and shoals.

The tidal channels in the Eastern Scheldt show a pattern of ebb and flow channels that is typical for many estuaries (Fig. 03.7). In the bends formed by the ebb channel, the flood current tends to go straight ahead rather than follow the ebb channel. As a result, a flood channel often forms that reaches a dead end in the upstream direction on the shallow zones and shoals that separate it from the ebb channel. In a similar way, but to a lesser extent, the ebb current also forms ebb channels that come to a dead end on shallow zones in the downstream direction.

The functioning of an estuary: tides as a driving force

The Eastern Scheldt is a complex system in which powerful tidal currents, natural erosion and deposition, human interventions and vegetation all interact. Tides and strong tidal currents are the driving force behind all processes that take place in the estuary. At an average high tide, 880 million cubic metres of seawater flow into the inlet through the Eastern Scheldt Storm surge barrier. This comes down to a flow rate of 41,000 m^3/s. By way of comparison: the Rhine, the largest river in Western Europe, at Lobith has an average flow rate of 2,200 m^3/s, almost twenty times lower, and an extreme peak discharge of about 12,000 m^3/s once every hunderd years.

The amount of water that flows in and out of the estuary depends on the tidal prism, the volume that is available between high and low tide and above the tidal flats, salt marshes and shoals. It is this tidal prism that actually determines the size of the tidal channels and the power of the tidal currents. Changes in tidal prism due to natural or human causes have large-scale and sometimes irreversible consequences for the development of the inlet. The tidal prism increases for instance if polder areas that were previously located outside the estuary inundate due to a dike breach. This causes more water to flow into the estuary, causing the tidal channels to become larger. By contrast, reducing the tidal prism, for instance by silting up of channels into shoals, tidal flats and

salt marshes, impoldering of tidal flats and salt marshes or damming of parts of the estuary, means that tidal currents decrease and channels can fill with sand.

Human influence and the Delta Works

Humans have particularly caused major changes in the Eastern Scheldt after the last connection with the Western Scheldt was broken in 1871 (see above). From the beginning of the 20th century, more and more dredging and canalization works were carried out in the Eastern Scheldt. This increased the tidal volume (the amount of water that flows into the estuary at each tide) by 15%. In response to this, the tidal currents changed and a new channel was created in the mouth, the channel of the Roggenplaat.

After the storm surge disaster of 1953, the Delta Works were initiated. First, a number of side branches of the Eastern Scheldt were closed off by means of dams. The Zandkreekdam was built in 1960 and the Veersedam closed off the Veerse Gat from the North Sea in 1961 (Fig. 03.8). As a result of the closure of the Grevelingen (1960-1964) and the Volkerak (1969), the tidal volume of the Eastern Scheldt increased by 8% between 1960 and 1983. Due to the total increase in the tidal volume between 1872 and 1983 and the resulting changes in tidal currents, 340 million m^3 of sand were transported from the Eastern Scheldt to the North Sea.

In 1986 the Eastern Scheldt Storm surge barrier was completed as a semi-permeable pillar dam that can be completely closed at extreme water levels. In order to maintain the largest possible tidal range after the construction of the storm surge barrier, the volume of the Eastern Scheldt basin had to be reduced. To this end, so-called compartmentalization dams have been built in the eastern part of the Eastern Scheldt. With the completion of the Oesterdam in 1986 and the Philipsdam in 1987, the Delta Works around the Eastern Scheldt were completed.

Due to the Delta Works, the Eastern Scheldt and its water management have changed significantly. The average tidal range, tidal volume, current velocities and freshwater supply have decreased. The compartmentalization dams have reduced the surface of the estuary from 45,200 ha to 35,100 ha. The area of shoals, tidal flats and salt marshes between high and low water level has decreased from 18,300 to 11,800 ha. This decrease is also partly caused by a smaller tidal range: the high tide is less high and the low tide has become less low. In Yerseke, for instance, the tidal range has decreased from 3.70 to 3.25 m. The tidal volume has decreased by approximately 30%, from 1,230 million m^3 to the current 880 million m^3. As a result, the flow velocities have also decreased by about a third.

Greedy channels: the sand hunger of the Eastern Scheldt

The major changes in the water management of the Eastern Scheldt as a result of the Delta Works disrupted the balance between the build-up and erosion of shoals, tidal flats and salt marshes (the so-called intertidal area). Since the construction of the storm surge barrier and the compartmentalization dams, less water flows in and out of the Eastern Scheldt at each tide (see above). However, the tidal channels have not yet been adapted to this new condition and are too large for the smaller amount of water. As a result, the water flows more slowly than before and has insufficient power to transport sand from the channels to the intertidal area, where the sand is supposed to build up shoals and tidal flats. However, the process of degradation of the intertidal zone has not changed since the Delta Works. Erosion is especially strong during storms. Then sand is washed off the tops of the flats into the channels and remains there. Hence, the destructive forces are still active, but the constructive ones no longer work: the balance is disturbed. This results in a net breakdown of shoals, tidal flats and salt marshes. The excess sand fills the channels until they will be adapted to the slower tidal currents and a new equilibrium situation will be achieved. Until then, the Eastern Scheldt will suffer from so-called 'sand starvation'.

The Eastern Scheldt Storm surge barrier stops almost all sand from the North Sea that could help satisfy this sand starvation. As a result, the tidal flats and shoals of the Eastern Scheldt are the only source of sand with which to fill the channels. Between 1986 and 2001 the surface of shoals and tidal flats lowered on average by 25 cm and approximately 1,100 ha of shoals and tidal flats were permanently drowned. This process of decomposition will probably only end after about a hundred years. If no measures are taken, the shoals and tidal flats in the Eastern Scheldt will be halved by 2050: from more than 11,000 ha in 1986 to about 5,000 ha in 2045. Salt marshes can then only be found in sheltered locations (Rattenkaai and Krabbenkreek). In unsheltered locations they will have completely disappeared around that time. In 2100 the intertidal area will reach a final situation of approximately 1,500 ha. In this new equilibrium situation, the Eastern Scheldt will consist of wider, shallower channels with only small shoals and few tidal flats.

The Voordelta

Seaward of the storm surge barrier, the mouth of the Eastern Scheldt widens between the Kop van Schouwen and the northwest coast of Noord-Beveland and Walcheren. Here is the so-called outer delta, a zone in the sea that consists of shallow shoals (e.g. Banjaard, Noordland, Hompels) and tidal channels such as the Westgat and the Hammen close to the coast of Schouwen and the Roompot in the south).

An outer delta forms where the relatively narrow estuary enters into the open sea. Due to the widening seaward of the mouth, the velocity of the ebb current flowing out of the inlet suddenly decreases. As a result, the ebb current deposits the transported sand and shallow shoals arise in front of the mouth. Waves erode the top of the shoal and transport the sand back into the estuary or to the adjacent coast.

The outer delta of the Eastern Scheldt is the second southernmost of the outer deltas of the estuaries of Zuid-Holland and Zeeland, which are now largely dammed, namely (from north to south) the former Brielse Maas, Haringvliet, Grevelingen, Eastern Scheldt and Western Scheldt 'Voordelta' refers to the approximately 10 km wide shallow part of the North Sea from Hoek van Holland to Zeebrugge in Belgium, and consists of the adjacent outer deltas of these five estuaries.

Relation with other geosites

- Western Scheldt.
- The river Scheldt in Belgium (several geosites).
- Geosites originated under influence of the development of the Eastern Scheldt (e.g. by breaches and/or floods from the Eastern Scheldt or predecessors), e.g. Veerse Meer, Schenge, Kolk lakes of Zuid-Beveland, Pluimpot, Markiezaat (incl. Duintjes), Kop van Schouwen.

Fig. 03.2. Location map of the geosite.

Fig. 03.3. Elevation map (AHN2) with depths in the Eastern Scheldt.

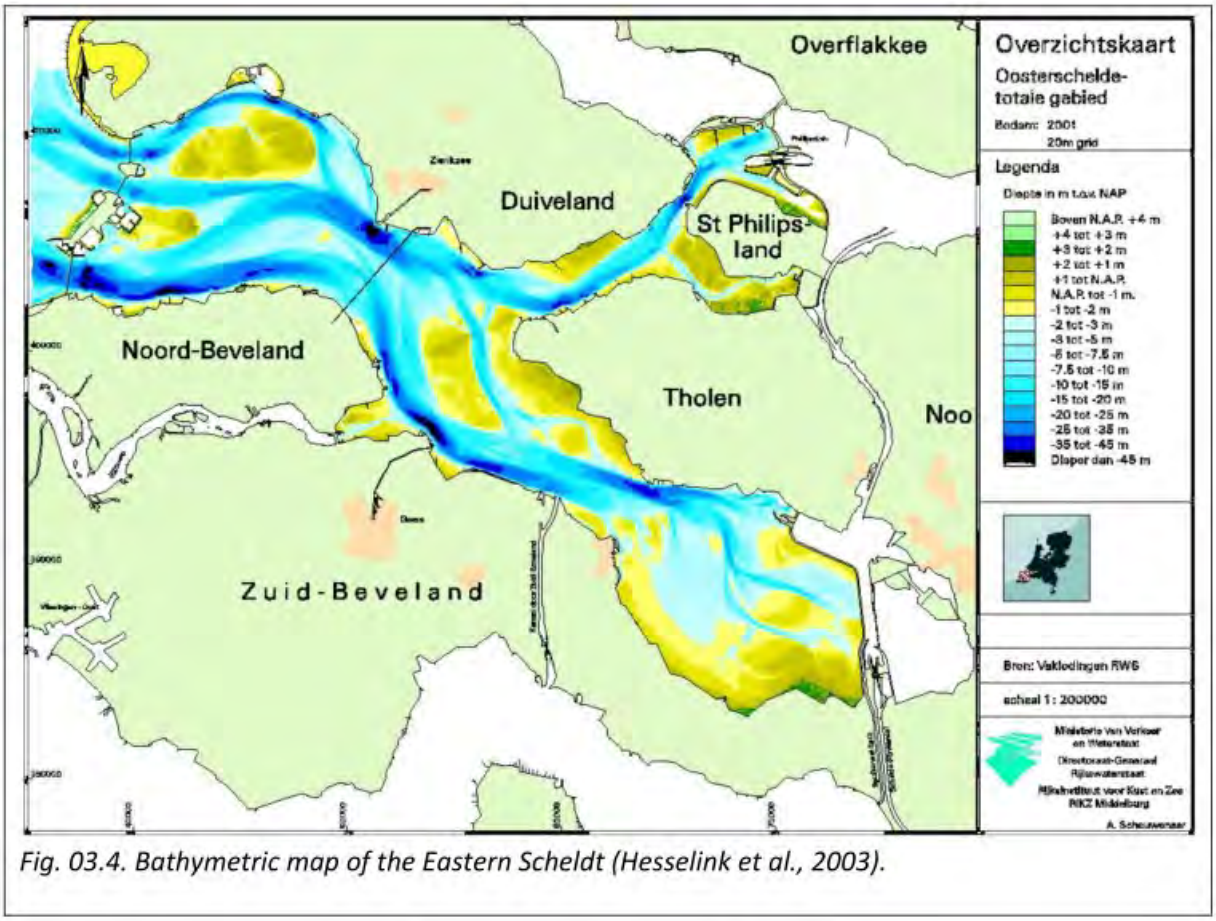

Fig. 03.4. Bathymetric map of the Eastern Scheldt (Hesselink et al., 2003).

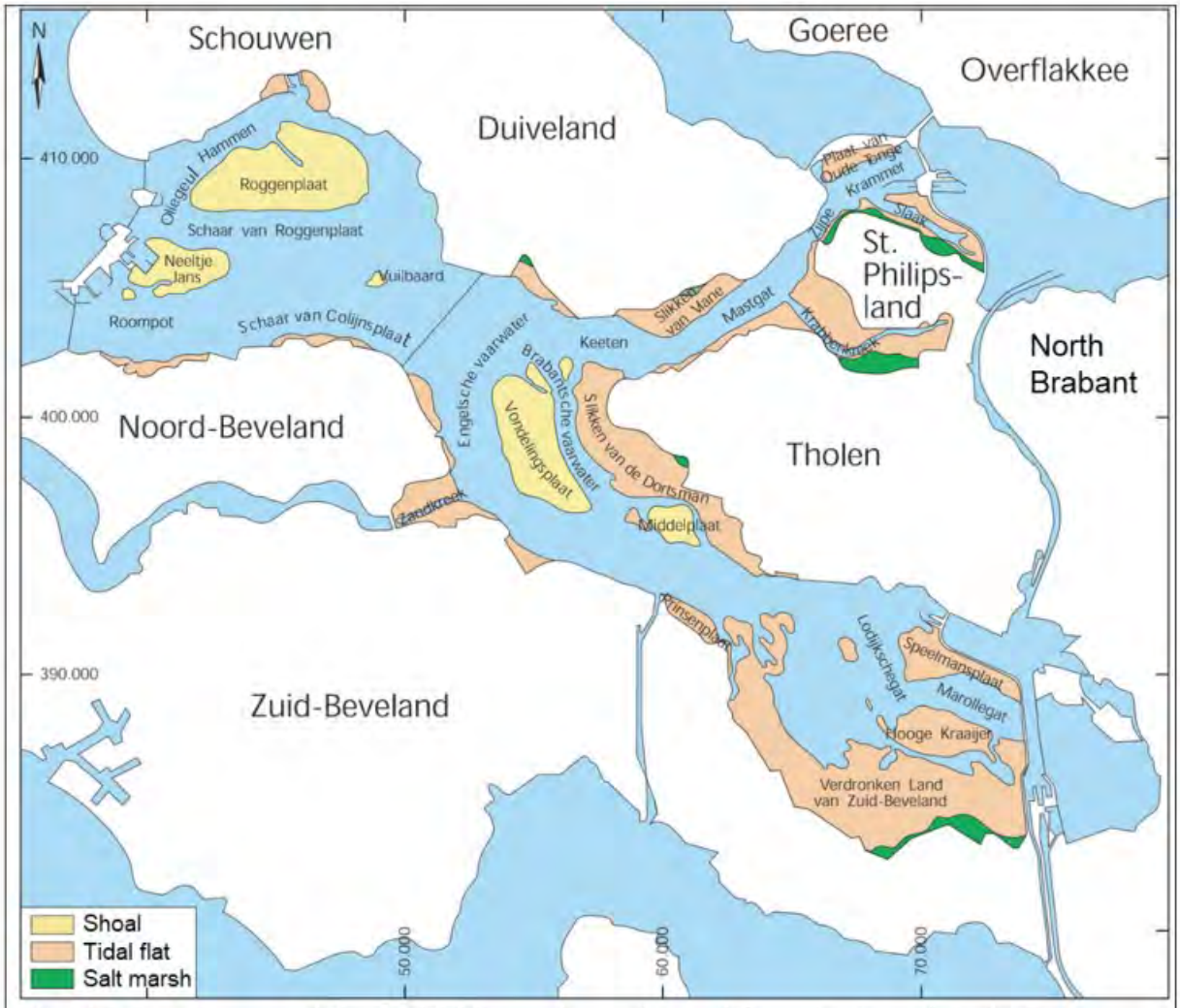

Fig. 03.5. Location map of shoals, tidal flats, salt marshes and the main channels in the Eastern Scheldt (Geurts van Kessel et al., 2003).

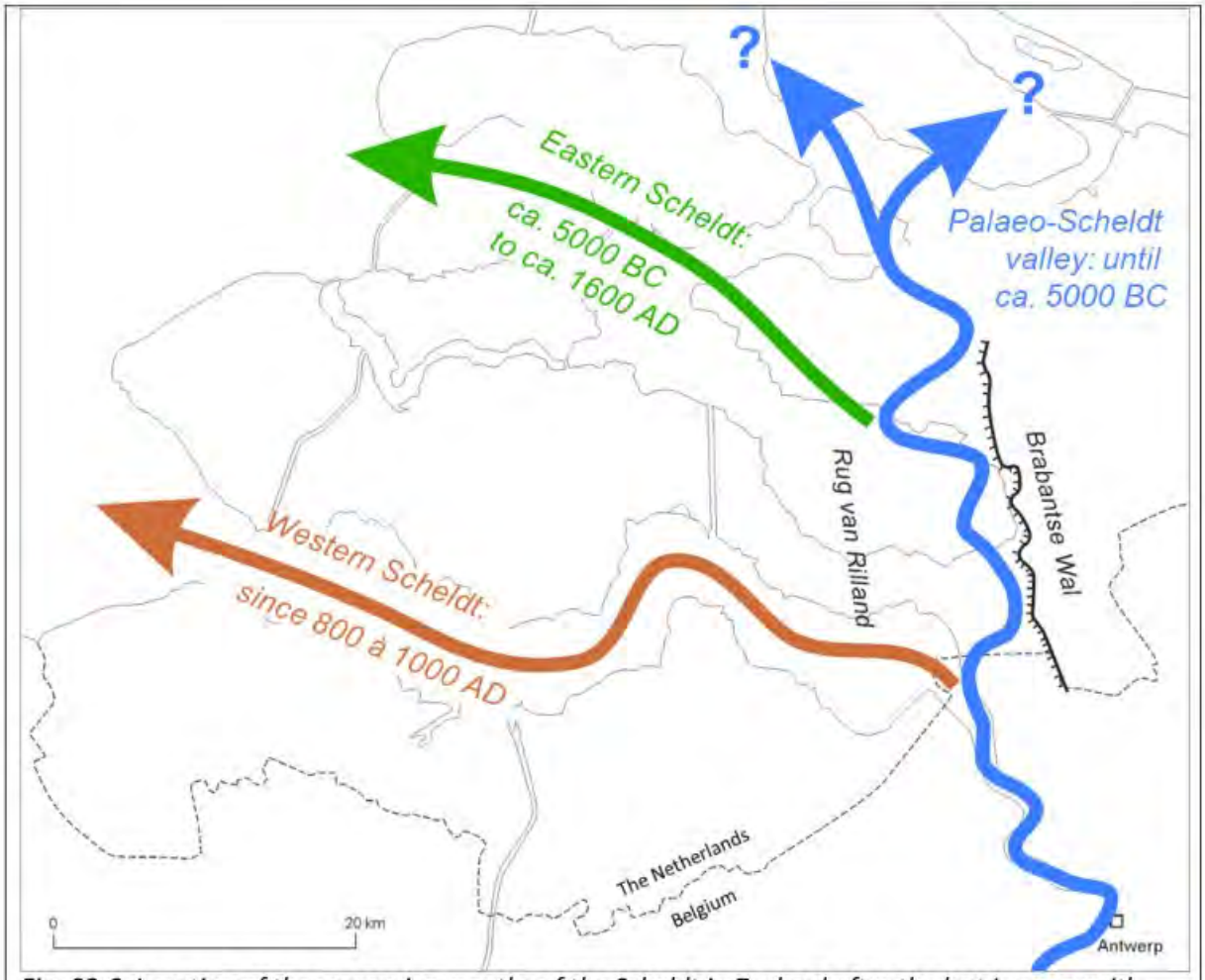

Fig. 03.6. Location of the successive mouths of the Scheldt in Zeeland after the last ice age, with their main period of activity (after Kiden, 2006).

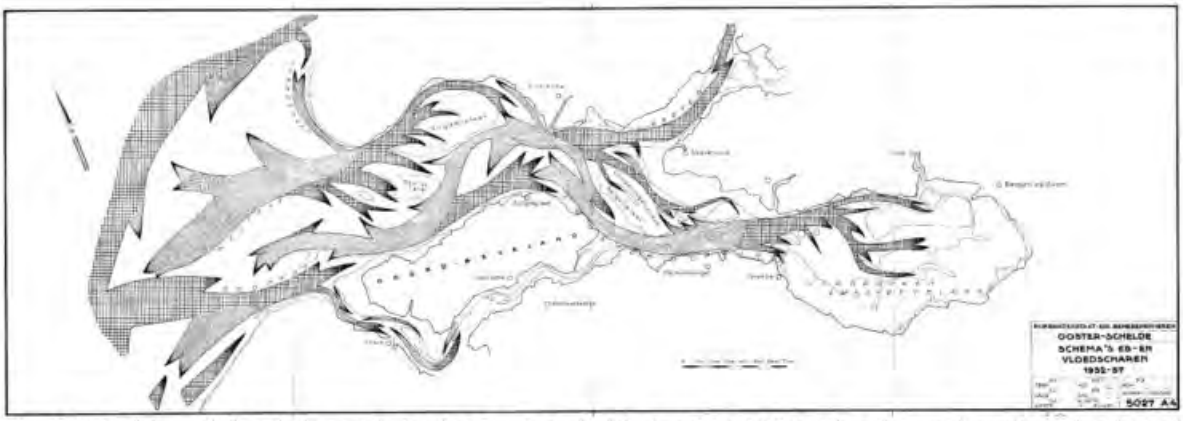

Fig. 03.7. Ebb and flood channels in the Oosterschelde in 1932-1937. The channels with a checkered pattern are flood channels, the ones with a line pattern are ebb channels (Ministry of Infrastructure and Water Management, Rijkswaterstaat, Directie Benedenrivieren, Blad no. 5027 A 4, https://puc.overheid.nl/rijkswaterstaat/doc/PUC_122195_31/1/, downloaded 23/5/2021).

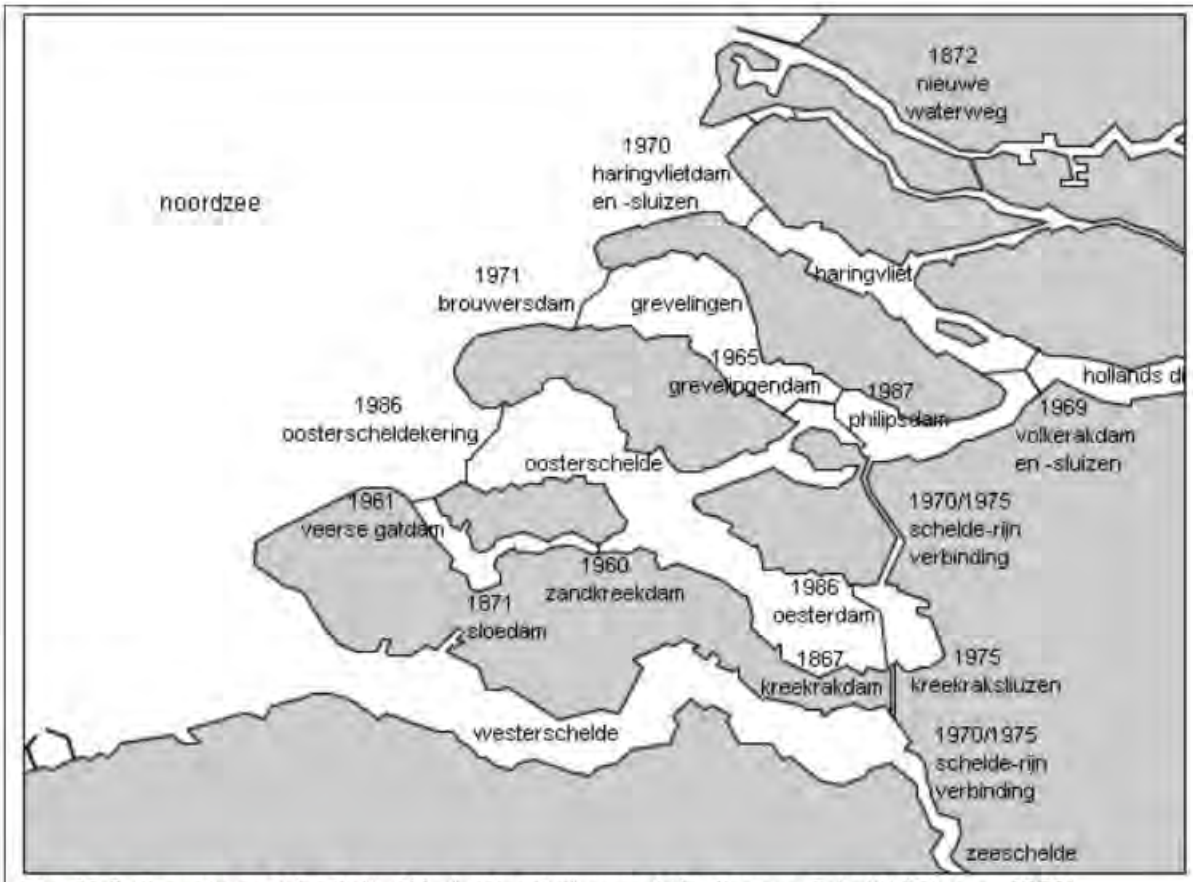

Fig. 03.8. Overview of the Delta Works that influenced the Eastern Scheldt (Pieters, 1989).

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Geosite n°04	**Pluimpot tidal channel remnant** The division of Tholen by a large tidal channel.
 Fig. 04.1: Map of Geopark Schelde Delta. Pluimpot tidal channel remnant is number 4.	**Scientific importance** The tidal channel that used to divide Tholen in two is still clearly visible in the current landscape due to the old dikes along both sides of the former channel and the higher location of the land between these dikes compared to the surrounding areas. The southernmost part of the original channel between Sint-Maartensdijk and the Eastern Scheldt (Oosterschelde) still comprises open water and forms the current nature reserve 'De Pluimpot'. The Pluimpot is a geologically valuable area of the Province of Zeeland, of national importance.
Municipality	Tholen
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area; Southern area: Natuurnetwerk Zeeland, Natura-2000, PMV environmental protection area, provincially valuable landscape
Site management organizations	Staatsbosbeheer; Municipality Tholen
Accessibility	Site is accessible to the general public.
Relevance for tourism	The natural reserve is part of the Oosterschelde National Park.
Relevance for education	Since the natural reserve is part of the Oosterschelde National Park educational material is disclosed via the infrastructure of the National Park.
Teaching equipment	Continuous learning line for children excursions, guided tours, information panels.

Code	**Significance**
G-04	National
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: The former tidal channel is recognizable as a low ridge in the landscape, up to 2 m higher than the surrounding polder area, as a result of (1) continued sedimentation in the channel for 300 years after embankment of the polders and (2) differential subsidence of the polder area due to stronger clay and peat compaction than in the channel.	

Sedimentology: not applicable.

DETAILED DESCRIPTION

1. **Location**

The geosite concerns the more than 7 kilometers long and several hundred metres wide former tidal channel the Pluimpot. This feature forms a ridge in the landscape that is in most places 1 to 2 metres higher than the surrounding polders. On the ridge are the villages of Sint-Maartensdijk and Scherpenisse. The southernmost part of the original channel still contains water.

2. **Landscape formation**

Origin of the landscape

About 3800 years ago, Zeeland was protected from the sea by an almost closed coastal barrier of beach ridges and dunes. Behind it a vast swamp area stretched out, in which peat accumulated. However, from a few centuries BC, the protective coastal barrier was locally breached. The sea entered deeper and deeper inland. At the current location of Tholen, a tidal flat and salt marsh area developed with islands that were separated from each other by tidal channels. Around 500 AD, Tholen was completely flooded and turned into a salt marsh landscape, in which the peat was partly eroded by tidal channels and partly covered by a clay layer.

The former channel, that we now call the Pluimpot, was probably formed because smaller branches of the current Krabbenkreek in the north and the Eastern Scheldt in the south came into contact with each other. The Pluimpot was thus created as a connection between tidal channels north and south of the island.

Creek ridge

The Pluimpot is now recognizable in the landscape as a higher ridge that runs through Tholen from north to south. Because the land in this channel was diked much later than the surrounding polders, the tide was able to deposit sand here for longer than in the polders. The difference in relief is emphasised because the surface outside the tidal channel becomes lower over time, due to clay dehydration and peat compaction and degradation. By contrast, in the former Pluimpot channel, the peat layer has been washed away by the tides and the sandy subsoil is much less sensitive to compaction.

Damming

About 1000 years ago, Tholen consisted of a group of five islands. The five oldest dikes were built as ring dikes to protect these islands against flooding. But there was a need for contact between the islands. Over time, 'salt dams' were built in the shallow parts of the channel to connect the islands. At low tide, these dams dried up and people could cross the channels on foot.

In the course of the 13th and 14th centuries, all areas between the islands were diked. After the damming of the tidal channel the Striene, east of the Pluimpot, in the year 1220, the Pluimpot was the channel that separated the island of Tholen into an eastern and a western part. Due to, among other things, the construction of dikes in the area, the flow in the Pluimpot slowed down, causing it to silt up. In 1494 the oldest dike was built in the tidal channel itself, followed by several more. In 1556, the northern part of the channel was dammed, creating an important connection over land between the western and eastern parts of the island after the Middle Ages. The damming of the southern part of the channel was not completed until 1957, as part of the Delta Plan after the flood disaster of 1953.

Dike breaches and crevasse splays

Several dike breaches have occurred along the Pluimpot over the centuries. The land immediately behind the dike breach is often somewhat higher than the surrounding polders. Such higher areas are called crevasse splays. Crevasses splays form because water flowing into the polder carries

sediment (sand and clay) in suspension. This sediment originates from the tidal channel on the other side of the breached dike and from the kolk lake (*weel*) that forms immediately behind the breach. Because the water depth behind the dike is much lower than in the channel, where the water comes from, the flow velocity of the water suddenly decreases as it enters the polder. As a result, the water can no longer transport its sediment load. Sand and clay are therefore deposited around the dike breach and raise the polder land surface immediately behind the breach.

The name 'Pluimpot'

On older maps and descriptions, the channel at the Pluimpot is indicated as *Haast-Ee*, which roughly translates as 'fast-flowing watercourse'. This name was later changed to Pluimpot. Possibly this derives from the French word *plumet*, which means plumb line: because of the limited depth of the channel, skippers had to constantly plumb the water depth.

Relation with other geosites

- Salt marshes of Rumoirt and Sint Annaland – salt marshes north of the Pluimpot, part of geosite Eastern Scheldt.
- Eastern Scheldt, Voordelta & Drowned Land of Zuid-Beveland – adjacent geosites.

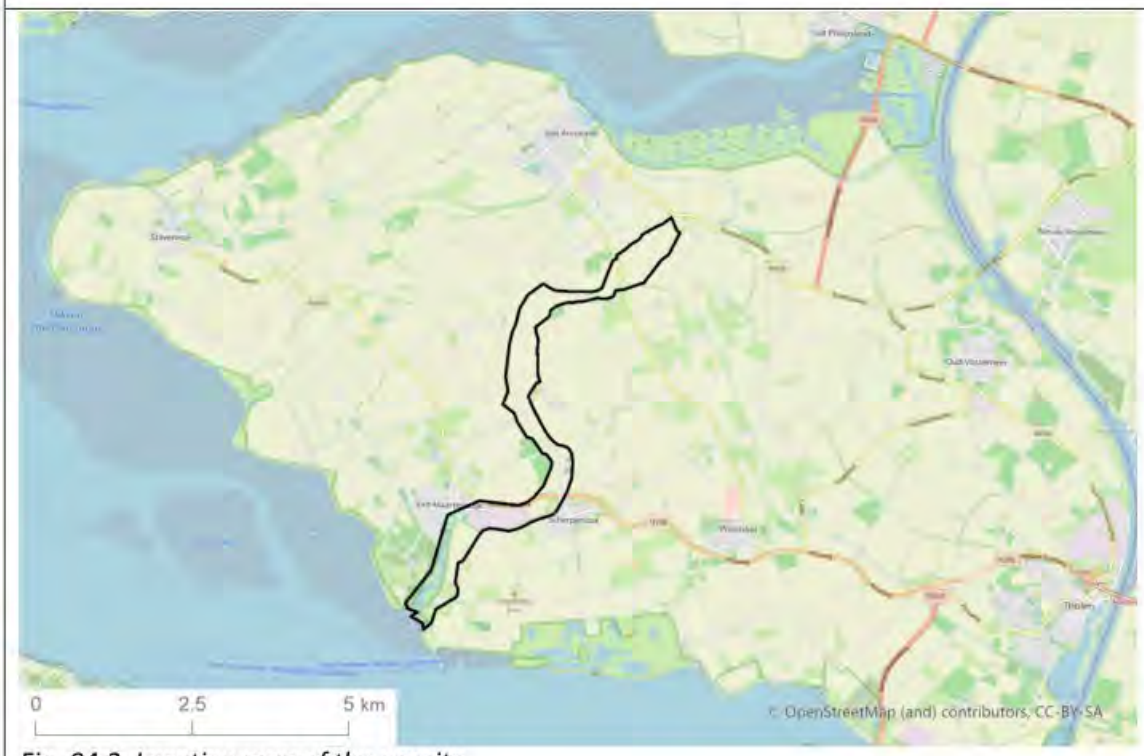

Fig. 04.2. Location map of the geosite.

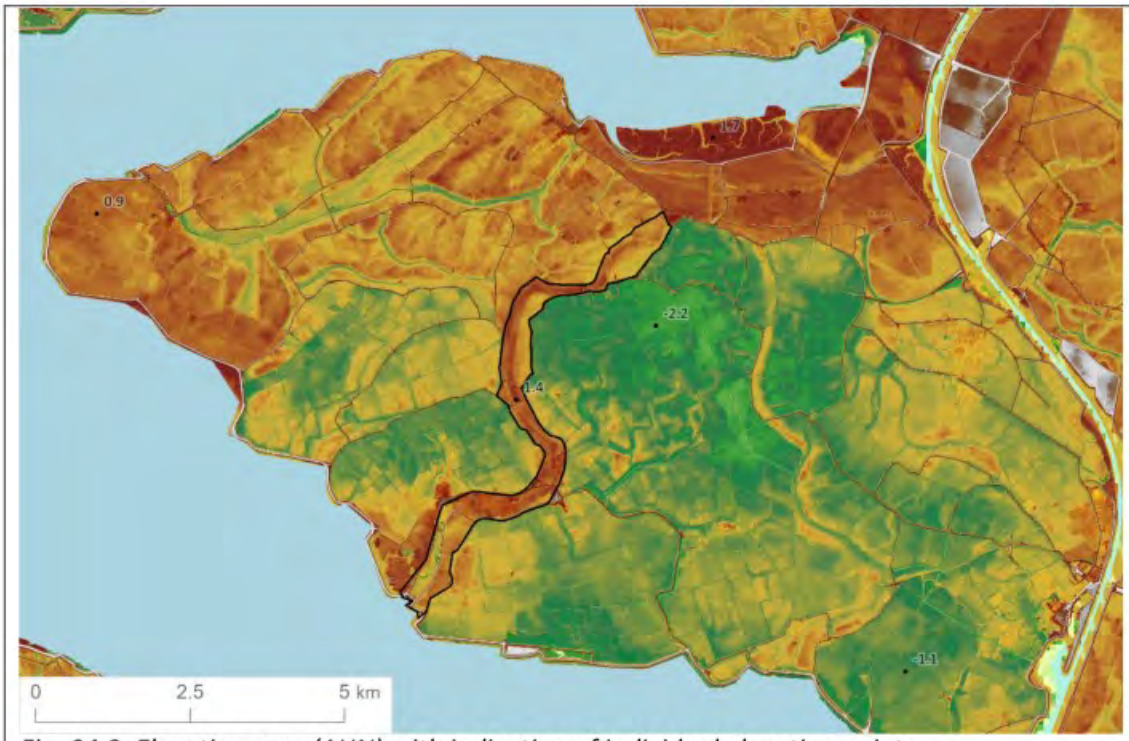

Fig. 04.3. Elevation map (AHN) with indication of individual elevation points.

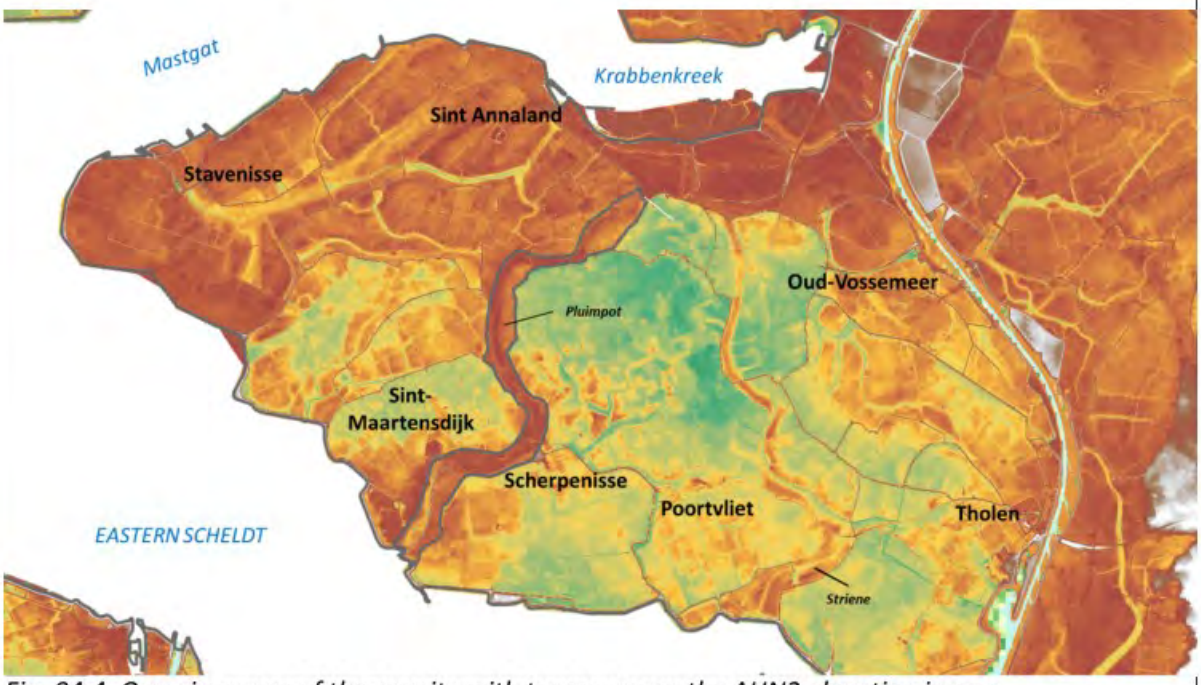

Fig. 04.4. Overview map of the geosite with toponyms on the AHN2 elevation image.

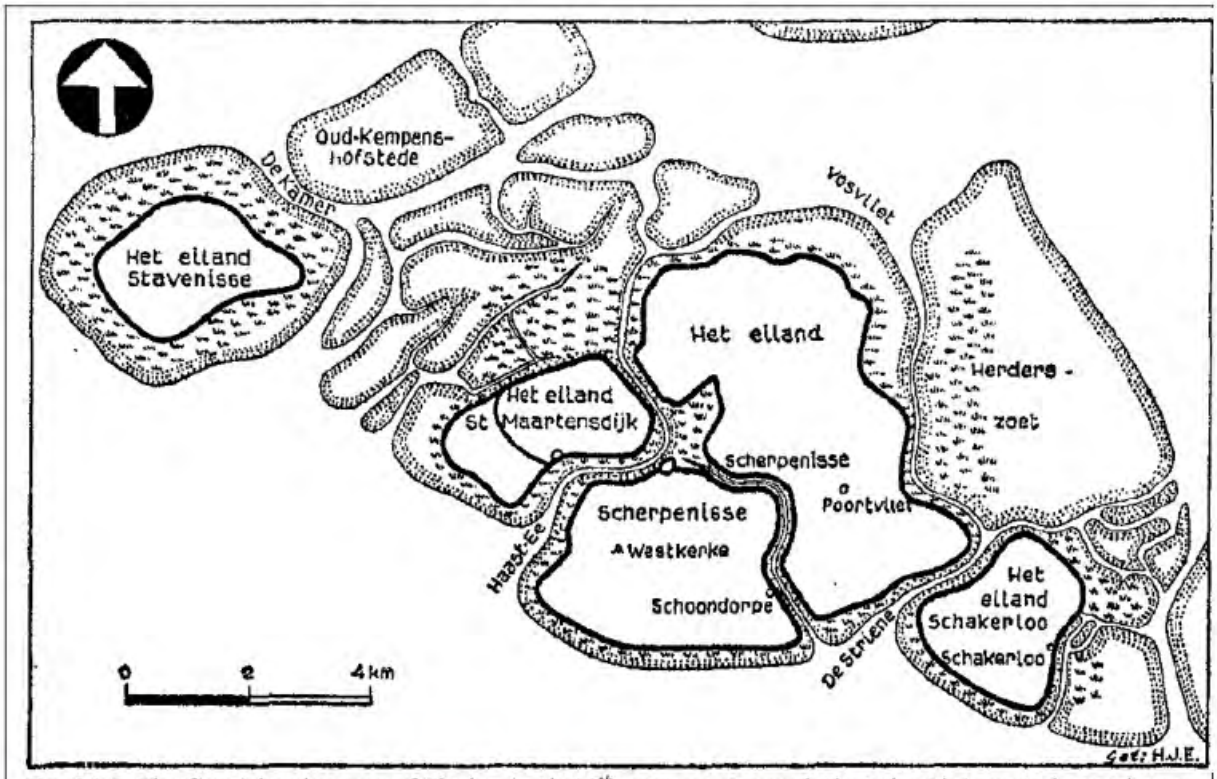

Fig. 04.5. The five-island group of Tholen in th 13th century. Remark that the Pluimpot channel was still called Haast-ee in this map. Source: Wilderom, 1968.

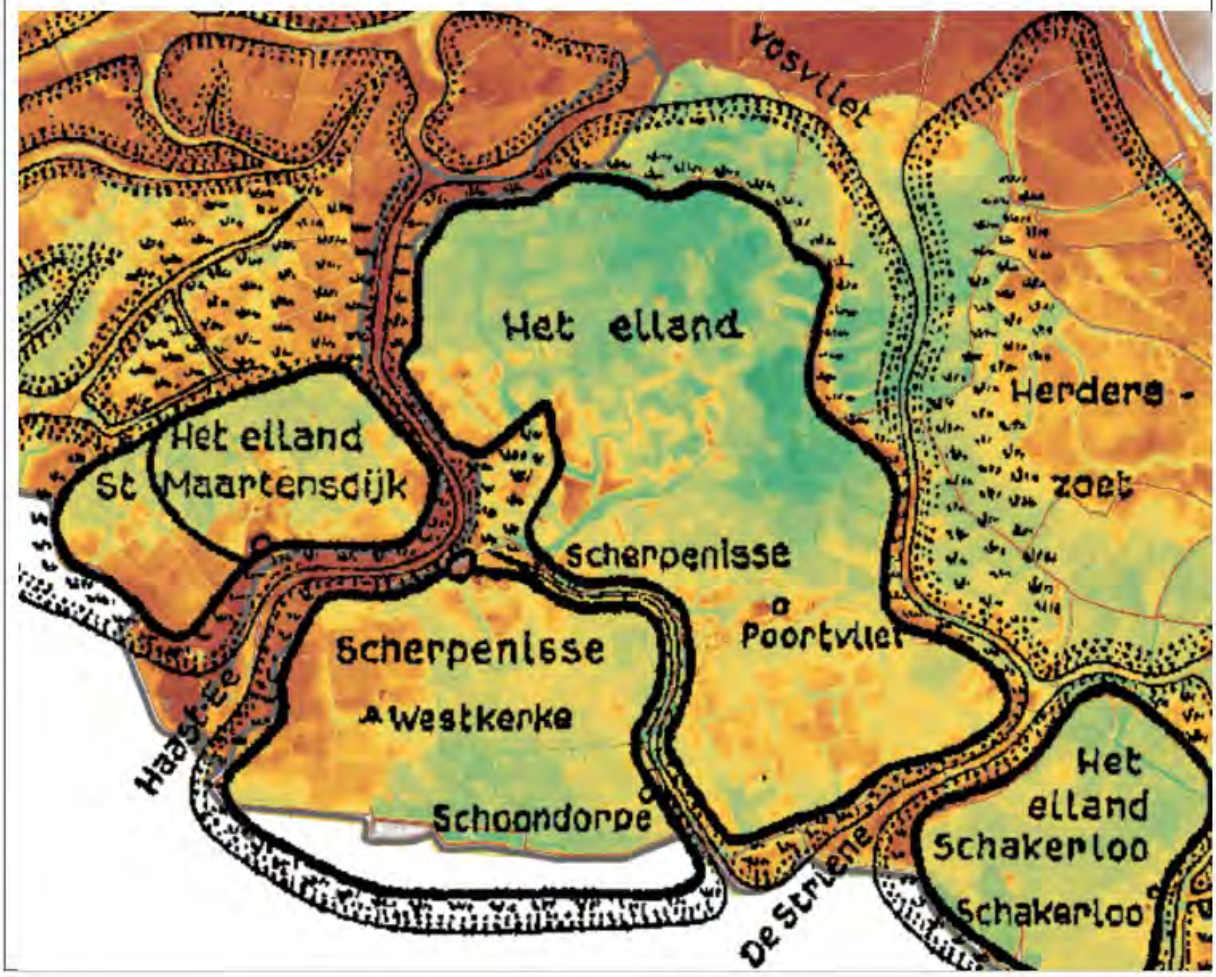

Fig. 04.6. Cut-out of the five-island group map (cf. Fig. 04.5) overlaying a part of the AHN2 elevation image. The Pluimpot channel is here indicated as the Haast-ee. The black outlined islands are relatively low-lying, except for somewhat higher grounds at the borders of the islands – possibly crevasse splays locally with incised breach channels.

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Geosite n°05	Veerse Meer and Schenge
Fig. 05.1: Map of Geopark Schelde Delta. Veerse Meer and Schenge is number 5.	**Scientific importance** The Veerse Meer area demonstrates the consequences of deliberate human intervention in a dynamic tidal environment: how does the removal of the tide affect the development of the (former) tidal area? This altered system and the adapted biodiversity make this an area of national and international interest. The former tidal channel of the Schenge is clearly visible in the current landscape due to the higher location of the land in relation to the surrounding areas. It is therefore a good example of *'Nieuwland'*, where peat has been swept away and the deposition of clay and sand has continued for a longer time than in the areas that were reclaimed earlier. Parts of the former tidal channels in the area are still under water, which contributes to the diversity of the landscape and further emphasizes its origin. The Veerse Meer and Schenge is a geologically valuable area of the Province of Zeeland and is of national importance.
Municipality	Veere, Middelburg, Noord-Beveland, Goes,
Province and country	Zeeland, the Netherlands
Protection status	Provincial geological important area; Plates in Veerse Meer en creek structure Schenge: Natuurnetwerk Zeeland; Veerse Meer: Natura-2000; Plates in Veerse Meer: PMV environmental protection area; Creek structure Schenge: provincially valuable landscape
Site management organizations	Staatsbosbeheer, Natuurmonumenten, Stichting Het Zeeuwse Landschap, Province of Zeeland, Municipality Goes
Accessibility	Site is nearly fully accessible to the general public.

Relevance for tourism	As the Veerse Meer is almost fully accessible there is a well-developed infrastructure for tourism.
Relevance for education	- Excursions/guided tours - Educational materials for schools
Teaching equipment	Guided tours as well as unguided activities. Info panels are on site.

Code	**Significance**
G-05	National

Geological interest(s)

Paleontology: not applicable.

Stratigraphy: not applicable.

Geomorphology: Although the tide has disappeared from the Veerse Meer due to the damming, parts of the original tidal landscape are still recognizable such as former tidal flats, salt marshes and shoals between the channels. The now embanked tidal channel of the Schenge is clearly visible in the current landscape due to the somewhat higher location of the land relative to the surrounding area and is a good example of 'Nieuwland', where peat has been swept away and the deposition of clay and sand has continued longer than in the areas that were reclaimed earlier.

Sedimentology: The area demonstrates the effects of human intervention in a dynamic tidal environment; tidal erosion and sedimentation processes have disappeared, and desalination and compaction of former salt marshes and tidal flats has taken over.

Geological significant sites

Geosite n° 5a	**Veerse Meer** A former inlet south of the Eastern Scheldt, now dammed from tidal activity.
 Fig. 05a.1. Location map of the geosite 5a	**Scientific importance** The area demonstrates the consequences of deliberate human intervention in a dynamic tidal environment: how does the removal of the tide affect the development of the (former) tidal area? This altered system and the adapted biodiversity make this an area of national and international interest. It is also part of the geologically valuable area of the Province of Zeeland 'Veerse Meer and Schenge', of national importance.

DETAILED DESCRIPTION

1. **Location**

The Veerse Meer geosite is a former tidal inlet that constitutes the boundary between Walcheren, Noord-Beveland and Zuid-Beveland and which used to form a connection between the North Sea in the west and the Eastern Scheldt (Oosterschelde) in the east. The Veerse Meer is approximately 20 km long and between 250 and 1600 m wide. It is bordered on its western end by the Veerse Gatdam and on its eastern end by the Zandkreekdam. Since the dams were built, the tidal activity has disappeared from the area and the lake has a fixed water level. Former tidal channels and low shoals have permanently disappeared under water and cause large differences in depth within the lake (from 0 to ca. 20 m - NAP). Former salt marshes and high shoals and tidal flats are now above water level. In addition, some artificial islands have been constructed in the lake.

2. **Landscape formation**

Origin of the landscape

As a result of the Holocene sea level rise, the barren sand landscape from the last ice age evolved into a tidal area that covered most of Zeeland around 6300 years ago. When the rate of sea level rise decreased, the beach ridges along the coast developed into an almost continuous barrier, which protected the area behind from the sea from about 3800 years ago. Behind the beach ridges, a vast swamp area developed in which a thick layer of peat accumulated. At the location of the Eastern Scheldt, however, an opening remained: at the time, this was the estuary through which the river Scheldt flowed into the North Sea. Its funnel-shaped mouth was much narrower than it is today.

Eventually, insufficient sand was supplied from the sea to maintain the coastal barrier. Therefore, the nearly closed coast was breached again locally from about 2600 years ago. The mouth of the Eastern Scheldt was widened. From Roman times, major sea breaches eroded the peat in the hinterland and turned Zeeland back into a tidal area.

Around 350 AD, the inlet of the Veere-diep had formed between present-day Walcheren and Noord-Beveland and continued southwards from there. Around 1000 AD, a deeply incised tidal channel also developed towards the east, between the present-day Noord- and Zuid-Beveland: the Zuidvliet. The western and eastern parts were later called the Veerse Gat and the Zandkreek respectively. Together they would eventually form the Veerse Meer.

Land reclamation

After the breaching of the coastal barrier, large parts of Zeeland were flooded. The peat from the former swamp only survived on a few old island cores between the large tidal channels, where it was only incised locally by small tidal channels and covered with a layer of clay. Several of these old island cores are present around the Veerse Meer: the vast Walcheren (largely embanked before the 13th century AD), a large part of Noord-Beveland (embanked from 1598 AD) and the former islands that now jointly form Zuid-Beveland (various dates of embankment).

Over the centuries, more and more land has been embanked around the island cores. Where the tides deposited sufficient sediment (sand and clay), higher tidal flats and shoals developed. If these were not eroded again by a tidal channel, they could silt up further and eventually evolve into a salt marsh – a higher area that was only flooded at very high-water during spring tides and storm surges. Over time, new salt marshes were reclaimed on the shores. That way, the Veerse Gat and the Zandkreek (precursor of the Veerse Meer) became narrower. The most recently diked polders along the geosite are those on the south side of Noord-Beveland and some polders on Zuid-Beveland along the former Schenge tidal channel, which was connected to the Veerse Gat. These date from the 19th century.

Damming

Both sides of the tidal inlet, until then known as the Veerse Gat (west side) and the Zandkreek (east side), were closed off as part of the Delta Works by the Veerse Gatdam and Zandkreekdam in 1960 and 1961 AD respectively. This was the origin of the present-day Veerse Meer. On the North Sea end, it was a closed dam, while on the Eastern Scheldt end, a dam with locks was constructed for the purpose of shipping traffic. With the damming, tidal activity disappeared from the area. As a result, more than 2000 hectares of salt marsh have become permanently dry. Natural sedimentation (deposition of sand and clay) and erosion disappeared. Lack of circulation and the associated desalination led to major changes in biodiversity. In 2004, a passage to the Eastern Scheldt was put into use, resulting in a return to higher salinity levels. The water level no longer varies with the tides: nowadays an artificial water level is maintained.

The Schotsman

Between the Veerse Dam and Noord-Beveland, there is an approximately 200 ha nature reserve 'De Schotsman', which dried up after the Veerse Gat was closed. Before damming, there were salt marshes, hundreds of metres wide, and shoals, more than 1 kilometre wide, originally stretching from Kamperland to beyond the current Veerse Dam. On the seaward side, the salt marshes merged into low dunes, formed by sand that was blown up from the seaward shoals. This dune ridge is still recognizable in the landscape. The area consisted of a beach plain or a spit.
The creeks are still clearly visible on the former salt marshes. Its current grassy vegetation reflects the clayey subsoil that is typical for salt marshes. Silt and clay layers are also present in the subsoil under the dunes: an indication that older salt marshes (creeks and flats) have been drifted over by sand. At the mouth of the Veerse Gat, shell layers tens of centimeters thick are also locally present in the subsoil.

Artificial islands

Due to the damming, the tide has disappeared from the Veerse Meer and the original tidal landscape in the area has thus been lost. However, there are still sandbanks and islands in the lake between the former channels. Some of these shoals have arisen naturally, but due to the fixed artificial water level they are no longer flooded. In addition to the natural shoals, several islands have been constructed artificially. The Soelekerkeplaat has been constructed to protect against further bank erosion along the southern shore of the Haringvreter. The Zandkreekplaat, Bastiaan de Langeplaat and Spieringplaat (near Piet) have been constructed as a separation between the waterways of commercial and recreational shipping.

Relation with other geosites

- Eastern Scheldt – inlet with which the Veerse Gat was connected.
- De Schenge – former inlet near the Veerse Gat and the Zandkreek.
- Kolk lakes of Zuid-Beveland – dike breaches along the former connection with the (current) Western Scheldt.
- Dintelse Gorzen – salt marsh area without tidal activity in Noord-Brabant.
- Dune complex Oranjezon and the Manteling– adjacent geosite on the west side of Veerse Meer (dune valleys and spits, comparable with the Schotsman).

Fig. 05a.2. Overview map of the geosite with toponyms and surrounding geosites mentioned in the text.

Fig. 05a.3. Elevation map (AHN) with indication of some individual elevation points.

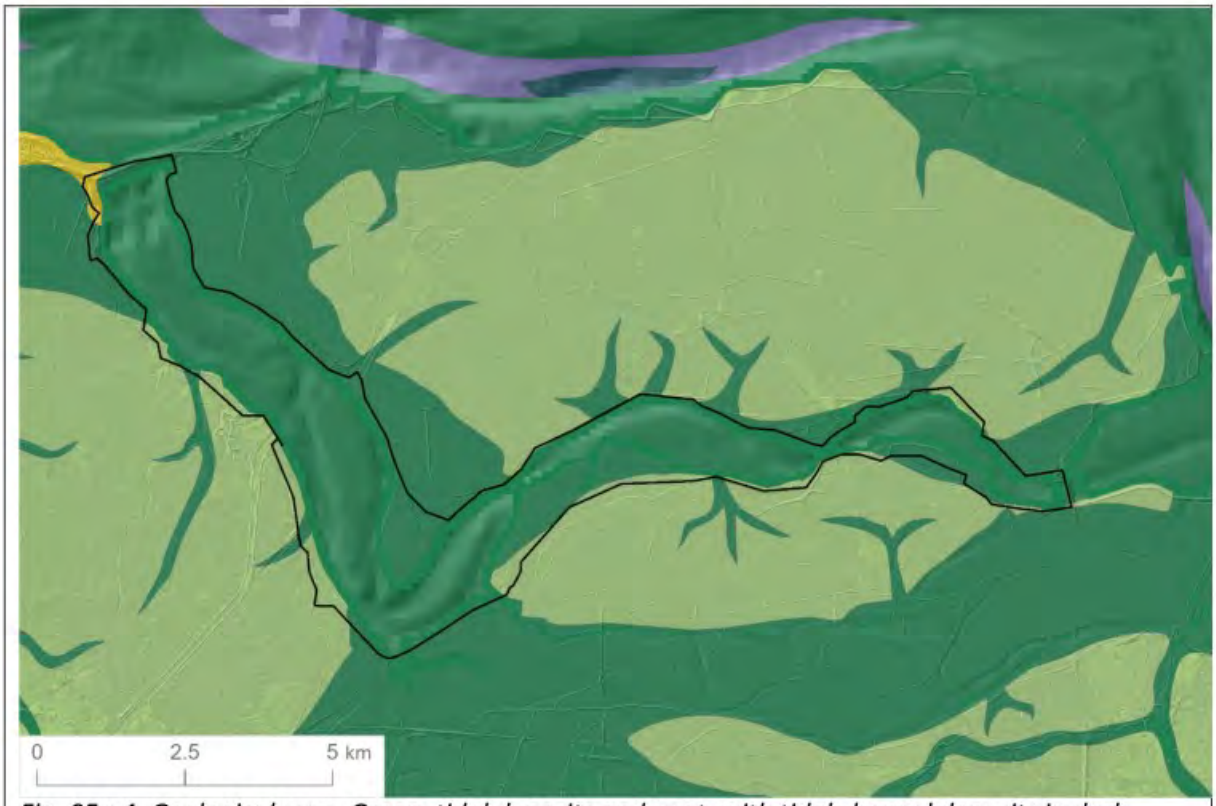

Fig. 05a.4. Geological map. Green: tidal deposits and peat, with tidal channel deposits in dark green (Holocene); yellow: coastal dunes (Holocene); purple: fluvial and estuarine deposits (Early and Middle Pleistocene), exposed at the bottom of the Eastern Scheldt through erosion by active tidal channels.

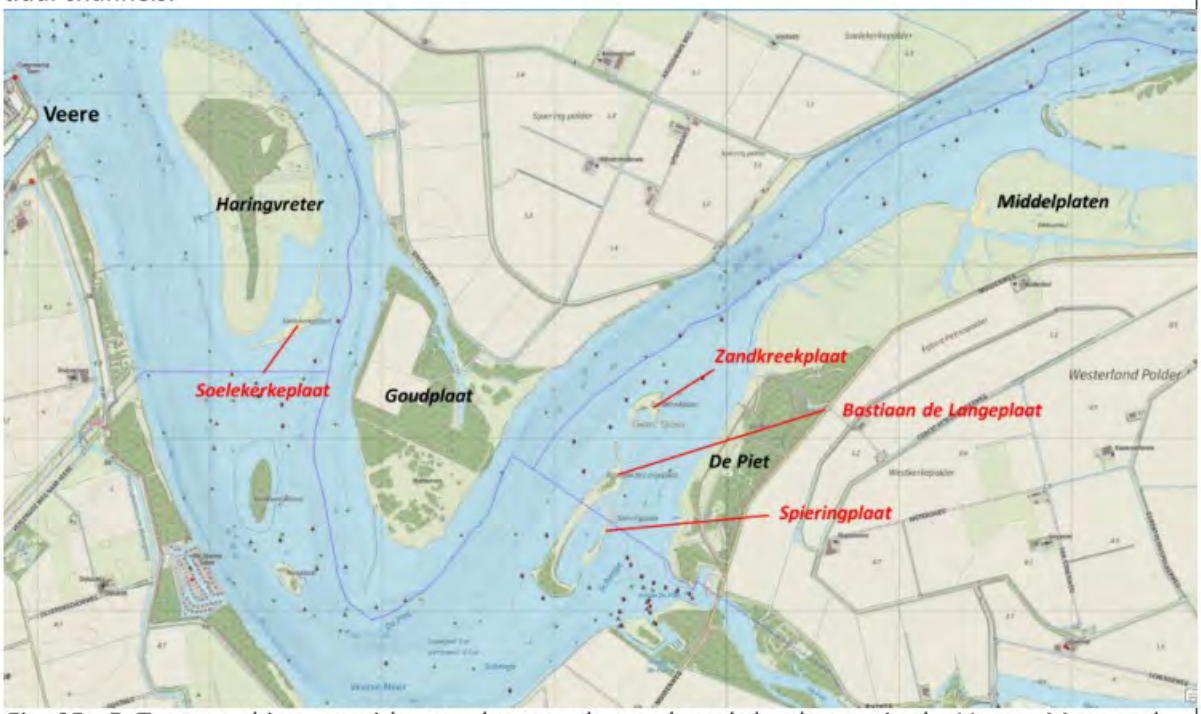

Fig. 05a.5. Topographic map with some larger salt marsh and shoal areas in the Veerse Meer and the artificial islands mentioned in the text (indicated in red).

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Geosite n°05b	**Schenge** Former tidal gully that divided Zuid-Beveland.
 Fig. 05b.1. Location map of the geosite 5b.	**Scientific importance** The former tidal channel of the Schenge is clearly visible in the current landscape due to the higher location of the land in relation to the surrounding areas. It is therefore a good example of *'Nieuwland'*, where peat has been swept away and the deposition of clay and sand has continued for a longer time than in the areas that were reclaimed earlier. Parts of the former tidal channels in the area are still under water, which contributes to the diversity of the landscape and further emphasizes its origin. The Schenge is part of the geologically valuable area of the Province of Zeeland 'Veerse Meer and Schenge', of national importance.

DETAILED DESCRIPTION

1. **Location**

The Schenge geosite is part of the embanked Schenge tidal area, which formed a branch of the Veerse Gat – the former sea inlet that is called the Veerse Meer since its damming in 1960/1961 AD. The branch ran along the southern shore of the former island of Wolfaartsdijk and extended to the Eastern Scheldt about 15 kilometers to the east. On the west and east sides, the geosite only includes the final active channels in the tidal area. The currently open water parts of the main channel are called the Westerschenge and Oosterschenge. The smaller Wolfaartsdijkse Gat in the northeast is also included in the geosite. The central part of the geosite comprises a wider zone that also includes some earlier embanked zones. Beside the higher dikes, the surface of the area is between 1.5 metres - NAP and 1.5 metres + NAP.

2. **Landscape formation**

Origin of the landscape

As a result of the sea level rise in the Holocene, the barren sandy landscape from the last ice age changed into a tidal area that covered most of Zeeland around 6300 years ago. As the rate of sea-level rise slowed, a row of beach ridges developed along the coast, forming a nearly continuous barrier from about 3800 years ago, protecting the area beyond from marine influence. An extensive swamp area developed here, in which a thick peat layer accumulated.

Eventually, insufficient sand was supplied from the sea to maintain the coastal barrier. Therefore, the nearly closed coast was breached again locally from about 2600 years ago. Between 100 and 350 AD, this process accelerated. From Roman times, sea breaches created large inlets and tidal channels, including the Veerse Gat, the Zandkreek, the Schenge and their southern branches. These channels eroded the peat. On the islands between the channels, where the peat remained, it got covered by sand and clay. The region thus changed back into a tidal area with tidal flats, salt marshes, channels and shoals.

Embankment and damming

Until the 17th century, the Schenge formed the division between the former island of Wolfaartsdijk and Zuid-Beveland. Wolfaartsdijk, north of the Schenge, consists of the salt marsh Oud-Sabbinge, which was diked before 1216 AD, and the surrounding younger polders. Over the centuries, much of the polder area has been flooded by storm surges and was later re-embanked. As a result, parts of the island have been under water several times or for a long time.

The first polder to be constructed in the Schenge is the Goesse polder northwest of Goes in 1331 AD. For centuries this served as protection against the south-east shifting of the Schenge channel. After the Heerenpolder was constructed on the south side of the island of Wolfaartsdijk in 1649 AD, the Schenge between this polder and the Goesse polder was at its narrowest (about 900 metres). Two main channels flowed in this eastern part of the Schenge area: the Puije / the Goesse Diep (nowadays called Oosterschenge) and the Wolfaartsdijkse Gat. In 1708 AD, east of Wolfaartsdijk, the island of Oost-Beveland was embanked. The construction of the Wilhelminapolder in 1809 AD connected the individual islands around the Schenge. With three more embankments to the west, the Schenge area was completely reclaimed that same century.

Nieuwland

The Schenge is part of a large tidal area in which the peat from the older swamp landscape was completely eroded after the coastal barrier was breached. Here, the shallow subsoil consists almost exclusively of tidal deposits (sand and clay). This type of land is called *Nieuwland* (new land) in the region. By contrast, land that has been much less affected by the sea after the breach of the coastal barrier is called *Oudland* (old land). Even on the surface, differences can be seen between *Nieuwland* and *Oudland*: (1) *Nieuwland* is relatively high: the sea has been able to deposit sand and clay for a longer time, and the surface has compacted less because there is no peat left in the subsoil and because less time has elapsed since the deposition of sand and clay; (2) the former tidal channels are relatively low-lying in the *Nieuwland* landscape, while those in *Oudland* are higher and (3) the allotment pattern on *Nieuwland* is different: parcels are often relatively larger and rectilinear.

NB. Characteristic Oudland *can be found on Zuid-Beveland southeast of the geosite in the* Brede Watering Bewesten Yerseke *polder. The nearby geosite 8 'clay-covered peatlands and creek ridges of Walcheren' also displays typical* Oudland*. The core of the former island of Wolfaartsdijk is also* Oudland*, but it has been inundated for such a long time that its original landscape features are not very clear anymore due to later accretion.*

Elevation differences

The former channels and the surrounding flats and salt marshes show considerable elevation differences between them in the Schenge polders. The lowest parts of former tidal channels in the area lie at 1.5 metres – NAP. This is about 3 metres lower than the surrounding area, which has silted up to 1.5 metres + NAP.

The tidal channels in the Schenge cannot be recognized as depressions over their entire length: their deepest part often stops very suddenly behind a dike or dam. After diking or damming, the

part of the channel located behind the dike remains devoid of sediment (sand and clay), which was previously brought in by the tide. As a result, a depression remains on the land side of the dike at the location of the channel, while on the sea side of the dike it is filled with sand and clay. Something similar happens with reclaimed salt marshes: after reclamation, sediment is no longer supplied. The later an area has been diked, the longer accretion took place. Older polders are therefore generally lower in the landscape than areas that were reclaimed later. Around the Schenge, this is visible in the elevation difference of a few decimeters between the polders of the former island of Wolfaartsdijk (mainly from the 16th and 17th centuries) and those in the Schenge area (from the 19th century).

Relation with other geosites

- Veerse Meer – former inlet Veerse Gat, forming the westward connection between the Schenge and the North Sea.
- Eastern Scheldt – former inlet connected with the east end of the Schenge.
- Kolk lakes of Zuid-Beveland – located in tidal area that formed part of the division of the Veerse Gat and the Schenge with the (current) Western Scheldt.
- Drowned Land of Zuid-Beveland – large-scale land loss during the 16th century storm surges, part of geosite Eastern Scheldt.
- Creek ridges and pool grounds of Walcheren – example of *Oudland* (opposite of *Nieuwland*).

Fig. 05b.2. Elevation map (AHN) with indication of individual elevation points.

Fig. 05b.3. Overview map of the geosite.

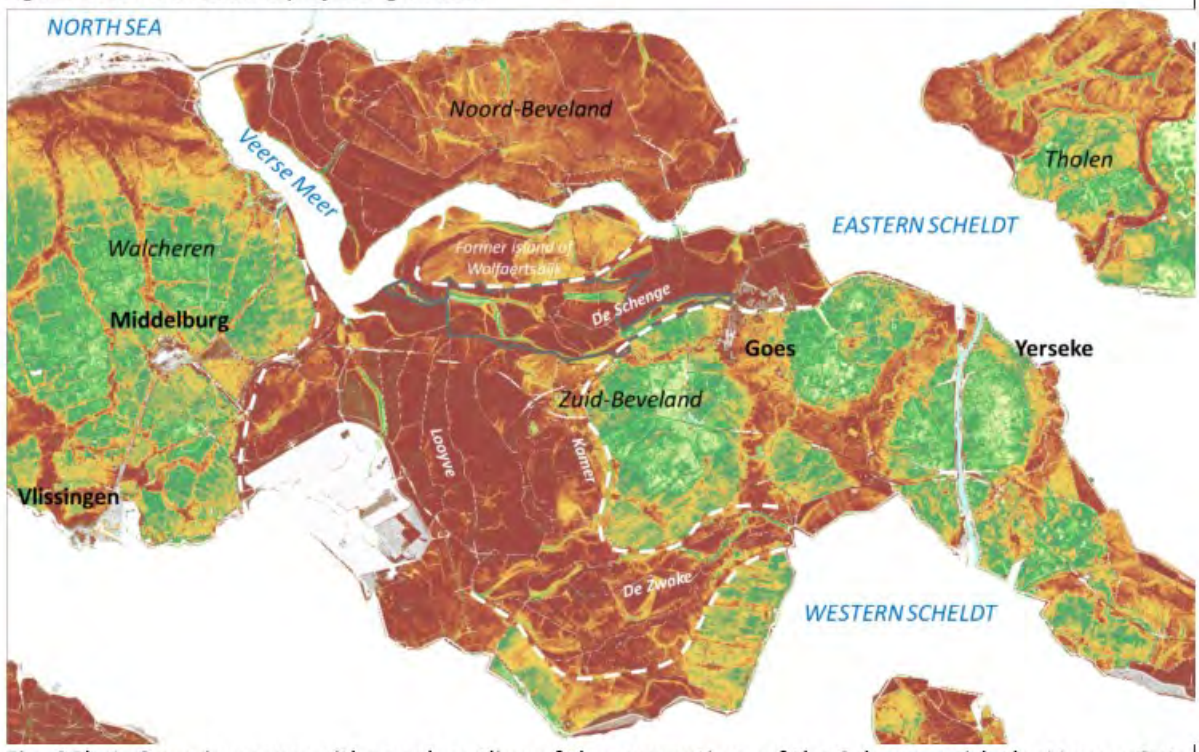


Fig. 05b.4. Overview map with rough outline of the connections of the Schenge with the Veerse Gat (now: Veerse Meer), the Eastern Scheldt (Oosterschelde) and the Western Scheldt (Westerschelde). The high, red-colored areas between the white dashed lines formed extensive tidal areas (Nieuwland). Lower areas, mainly green, are the old island cores that were preserved after breaching of the coastal barrier (Oudland).

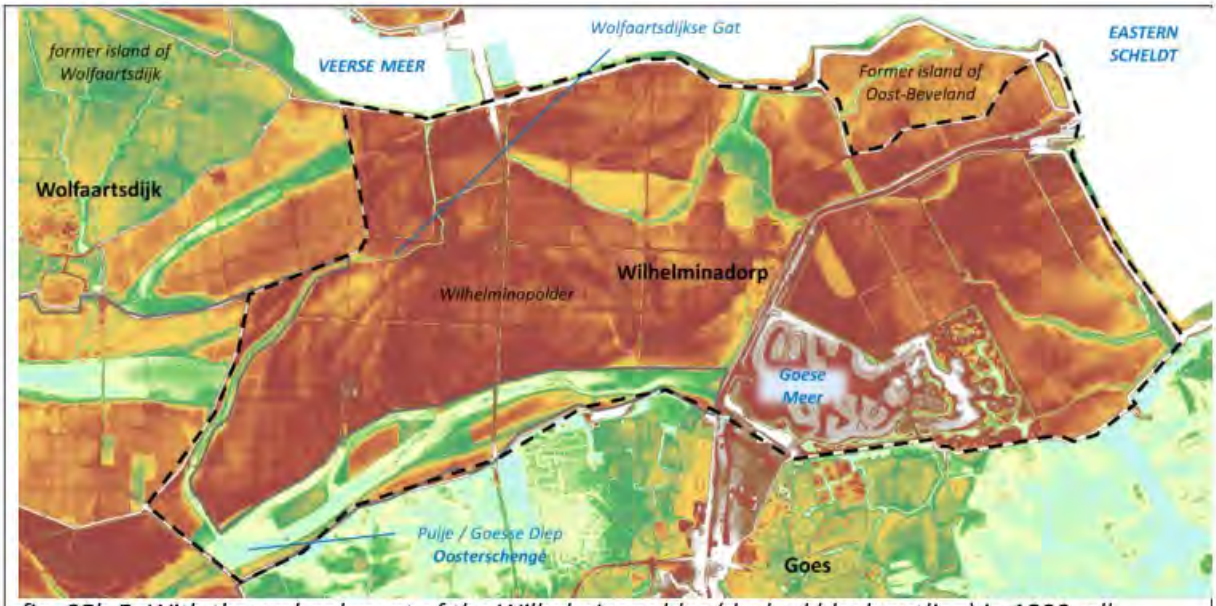
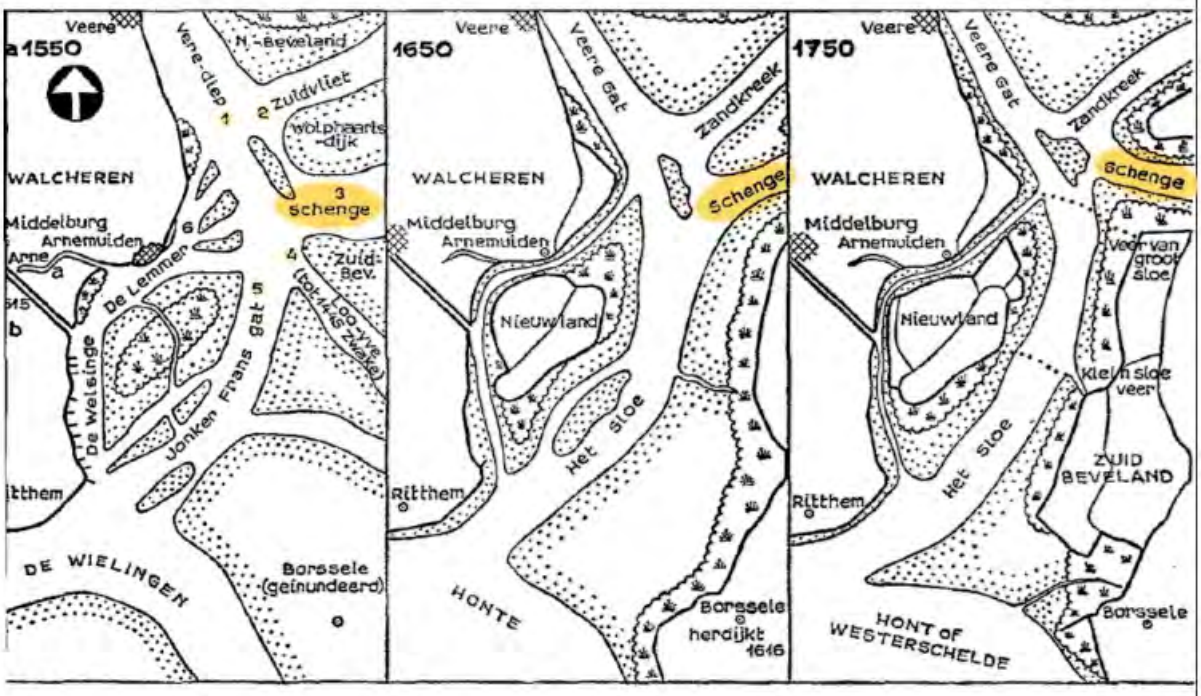


fig. 05b.5. With the embankment of the Wilhelminapolder (dashed black outline) in 1809, all islands around the Schenge were connected. In addition to the wider former tidal channel Oosterschenge, which still contains water, smaller creeks in the polder are also recognizable as low-lying (green) zones in the elevation image. The allotment pattern of this Nieuwland is very rectangular



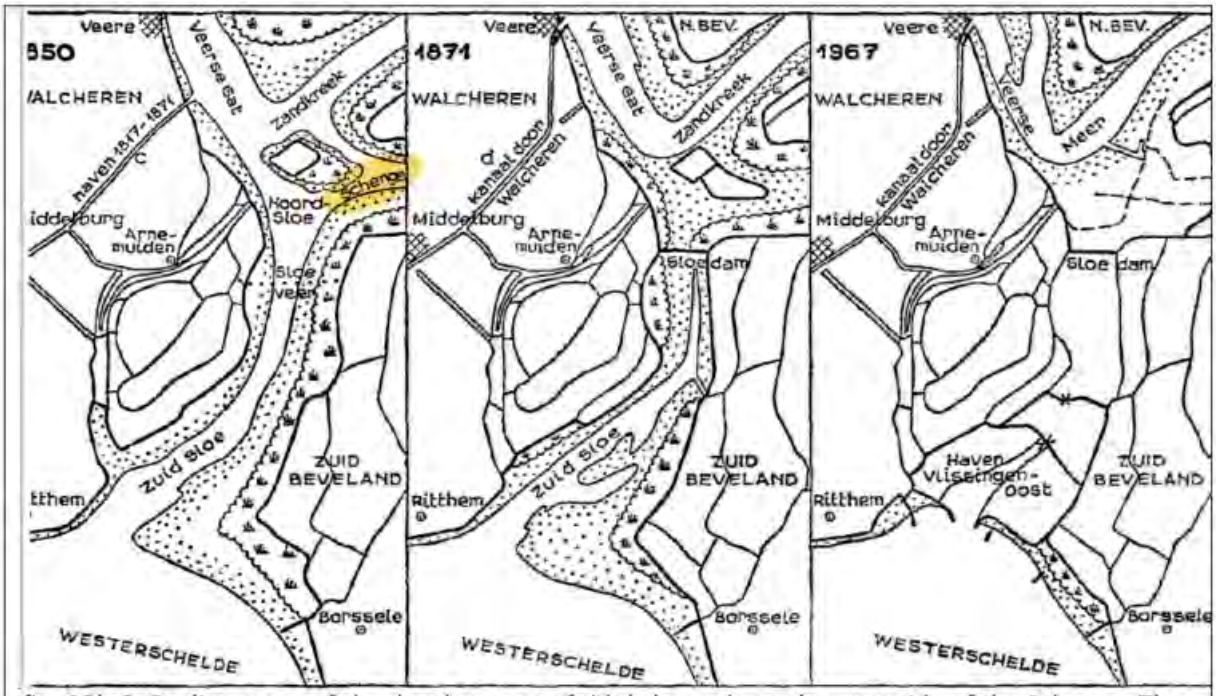


fig. 05b.6. Outline maps of the development of tidal channels on the west side of the Schenge. The image from ca. 1550 shows a six-way intersection of tidal channels between Walcheren and Noord- and Zuid-Beveland, where the Veere-diep and Zuidvliet (predecessors of the Veerse Gat and Zandkreek) and the Schenge came together. Between and around these tidal channels, salt marshes, tidal flats and shoals developed. Wilderom, 1968.

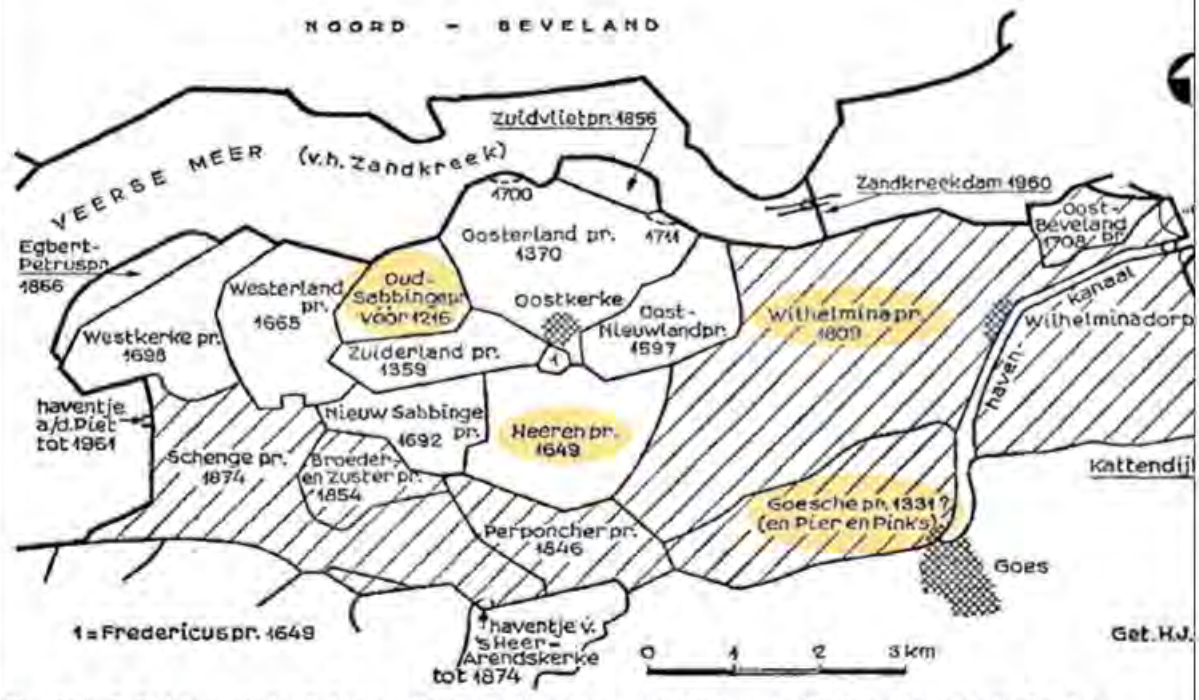


Fig. 05b.7. Polders of the Schenge (hatched) and around Wolfaartsdijk (non-hatched). Polders mentioned in the text are indicated in yellow.

Documentation and resources

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Geosite n°06	**Dune complex Oranjezon and the Manteling** Old and Young Dunes, coastal erosion and accretion.
 Fig. 06.1: Map of Geopark Schelde Delta. Dune complex Oranjezon and the Manteling is number 6.	**Scientific importance** Both Old and Young Dunes occur in this geosite. Different stages of dune development can be seen, from very young embryonic dunes to well-preserved fossil foredunes, primary dune valleys and parabolic dunes. The occurrence of oak forests in the immediate vicinity of the sea, such as in the Old Dunes of this area, is rare in Europe. Biodiversity is high in this varied landscape. Rare plant species can be found in the dune valleys of the Young Dunes. Cultural history is often closely intertwined with landscape development. Dune complex Oranjezon and the Manteling have a rich history, including settlement remains from the Late Iron Age, the Roman period and the early Middle Ages, a Roman sanctuary, a Carolingian castle that served as a refuge during Norman raids and ancient country estates with stately country houses. It is a Geologically valuable area of the Province of Zeeland, of national importance. Oranjezon is a geological monument of the Province of Zeeland.
Municipality	Veere
Province and country	Zeeland, the Netherlands
Protection status	Natuurnetwerk Zeeland, Natura-2000, provincial geologically valuable area, Nationaal Landschap Zuidwest-Nederland-deelgebied Walcheren, PMV environmental protection area; Oranjezon: groundwater protection area, provincially valuable landscape
Site management organizations	Staatsbosbeheer, Natuurmonumenten, Municipality Veere
Accessibility	Site is accessible to the general public
Relevance for tourism	- Visitor center - Excursions/guided tours
Relevance for education	- Visitor center - Educational material for schools and visitors

Teaching equipment	The visitor center of the Manteling and Oranjezon is Terra Maris. Terra Maris is also a local nature and environmental education center for education at Walcheren. Dunceomplex Oranjezon and the Manteling are part of the Wandelroutenetwerk Zeeland. In addition to independent walking, there are also guided tours. On your way you can find some information panels.

Code	Significance
G-06	National

Geological interest(s)

Paleontology: The beach to the northeast of Oostkapelle is a site for mollusc fossils of mainly Holocene and Pleistocene age while to the southwest, between Oostkapelle and Domburg, older fossils of Pliocene age, and, to a lesser extent, of Eocene, Oligocene and Miocene age can also be found.

Stratigraphy: not applicable.

Geomorphology: A diversity of coastal dune landforms in various stages of dune development can be seen: from active very young embryonic dunes, primary dune valleys and parabolic dunes of more than 20 m above sea level to lower, stabilized and well-preserved fossil dunes ('Old Dunes').

Sedimentology: The relationship between coastal and eolian processes of erosion and accretion, sediment transport and deposition, weather conditions, tides, vegetation and groundwater level in the development of different dune types, eolian bedforms and sedimentary structures can be observed and studied in semi-natural field conditions. On the erosional stretch of coast between Domburg and Oostkapelle, clay and peat banks predating the formation of the dunes are exposed at low tide.

DETAILED DESCRIPTION

1. **Location**

The geosite consists of a dune area that extends along the northwest side of Walcheren, from Domburg to the Veerse Meer. This site includes the nature reserves The Manteling and Oranjezon and has an area of more than 7 km^2 with an elevation varying from approximately 1 to more than 20 metres + NAP. The area contains both the fossil, relatively low Old Dunes and the partly still active and relatively high Young Dunes and dune valleys.

2. **Landscape formation**

Origin of the landscape

During the last ice age, a very large part of the North Sea was dry, because a lot of seawater was stored in the land ice sheets. Due to the sea level rise that started at the beginning of the Holocene, the sea penetrated the country from the northwest and formed a tidal area with salt marshes, tidal flats, shoals and tidal channels that covered most of Zeeland about 6300 years ago. Sand was imported from the North Sea, and deposited by the tide on the sea side of the salt marshes. As a result, protective beach ridges were built up here and there. The first beach ridges were far west of the current coastline. Due to the continuously rising sea level, these were cleared up again and new beach ridges formed further east (landwards).

In the course of the Holocene, the rate of sea level rise decreased. Around 3800 years ago, approximately at the location of the present coastline, an almost uninterrupted beach ridge had formed, which protected the area behind against marine intrusions. Low dunes - the Old Dunes - formed on the beach ridges as a result of onshore winds. A peat landscape arose in the area behind the beach ridges and dunes that was closed off from the sea. About 2600 years ago, the protective coastal barrier was breached again. Gradually, the sea re-entered the landscape behind.

As a result of these marine intrusions, the peat area turned back into a salt marsh landscape and was covered with a thin layer of clay. Between 1500 and 1250 years ago, the salt marshes and tidal flats of Walcheren had silted up to the point that they formed one island. From about 1000 years ago, the coastal erosion became stronger, possibly due to an increase in the number of storms. The sand that was released caused the formation of the Young Dunes.

Old Dunes and Young Dunes

The *Oude Duinen* (Old Dunes) form elongated sand ridges, usually only a few metres high, which lie parallel to the coast. Since their formation, vegetation has developed, which fixates the dune sand. Over time, centuries-old dune oak forests have been formed in De Manteling on the Old Dunes. They used to be further inland, but due to strong erosion of the coast they are now exceptionally close to the sea by European standards.

The formation of the Young Dunes is still going on. They are located on or on the seaward side of the Old Dunes and are generally higher. The oldest Young Dunes are the furthest inland. The younger ones are formed closer to the sea and are even less vegetated, with pioneer species such as marram grass. Further sand drifting is possible here. The recent dune formation takes place on the beach.

Dune structures

In the initial stage of coastal dune formation, low dunes are formed on the beach from blown beach sand. Above the spring tide mark, such embryonic or primary dunes form a low continuous dune ridge. If there is sufficient sand supply, this will grow into a row of dunes up to a few tens of metres high. In case of an expanding coast, a new dunes ridge can arise seaward of the previous dune ridge. The sand supply to the older dune ridge then decreases sharply and the younger dune ridge grows.

The wind can affect both the coastward dunes and the dunes further inland. Wind erosion takes place until the sand can no longer be picked up, for instance when a more solid layer in the subsoil or the groundwater has been reached. This is how dune slacks are created in the dune landscape. The sand that is picked up by the wind, is redeposited behind the original dune. This process often gives rise to parabolic dunes.

Coastal erosion

The coast west of Oostkapelle has been an erosional coast for many hundreds of years. Over the centuries, erosion has moved the coastline several kilometers inland. Hundreds of metres have also been eroded from the original dune area. The zone with the Young Dunes is therefore very narrow or even absent here, and the Old Dunes are relatively close to the coast.

Close to the waterline on the coast between Domburg and Oostkapelle, clay and peat banks can be seen at low tide. They were exposed by wave erosion. They are remnants of the peat and salt marsh landscape from before 1000 years ago, when the *Jonge Duinen* (Young Dunes) had not yet been formed and this zone was sheltered from the connected row of beach ridges further seaward. Coastal erosion makes these buried landscapes visible again.

Fossil foredunes at Oranjezon

The north-easterly current along the coast of Walcheren brings sand with it. As a result, an elongated beach developed on the north side of Walcheren, which was attached to land on the south-west side and ended in the sea on the north-east side: a hook-shaped spit. Behind this beach was a sea inlet. Dune formation started on the spit and spread inland over the salt marsh that had developed in the inlet. This way, the inlet was gradually closed off from the open sea. A wet, primary dune valley formed. The process of forming a spit and closing off the area behind has

been repeated several times, causing the coast to expand seaward. This created a landscape with alternating dune ridges and primary dune valleys around the Oranjezon area.

Relation with other geosites

- Beach ridge of Walcheren – nearby possible beach ridge along the former Eastern Scheldt coast.
- Veerse Meer – former inlet the 'Veerse gat', northern boundary of this geosite.
- Creek ridges and pool grounds of Walcheren – old island center, protected by coastal barrier.
- Coastal dunes of southwest Walcheren – very high dune area along the Western Scheldt.
- Kop van Schouwen – extensive dune area with various dune morphologies.

Fig. 06.2. Location map of the geosite.

Fig. 06.3. Elevation map (AHN) with indication of individual elevation points.

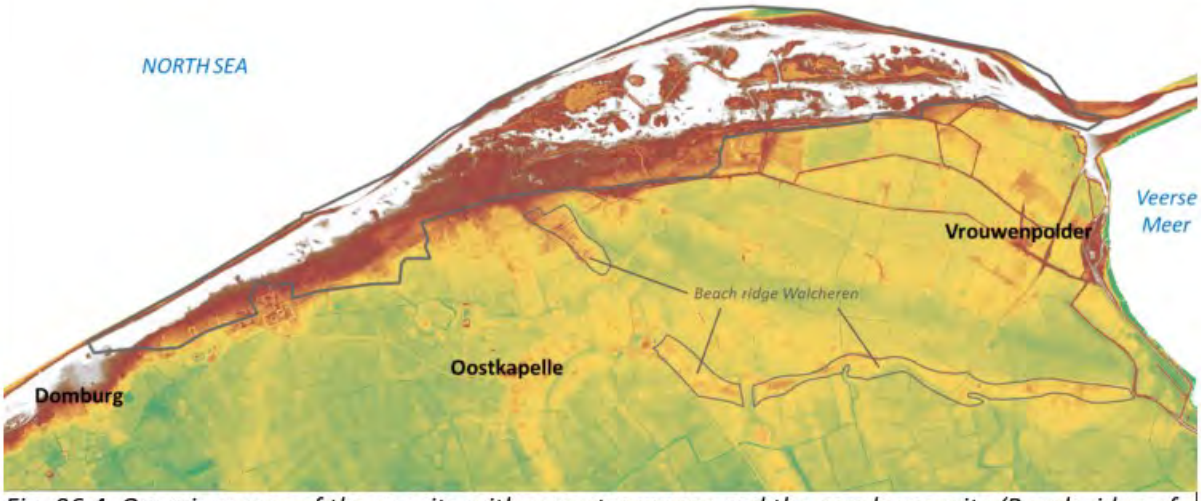

Fig. 06.4. Overview map of the geosite with some toponyms and the nearby geosite 'Beach ridge of Walcheren'.

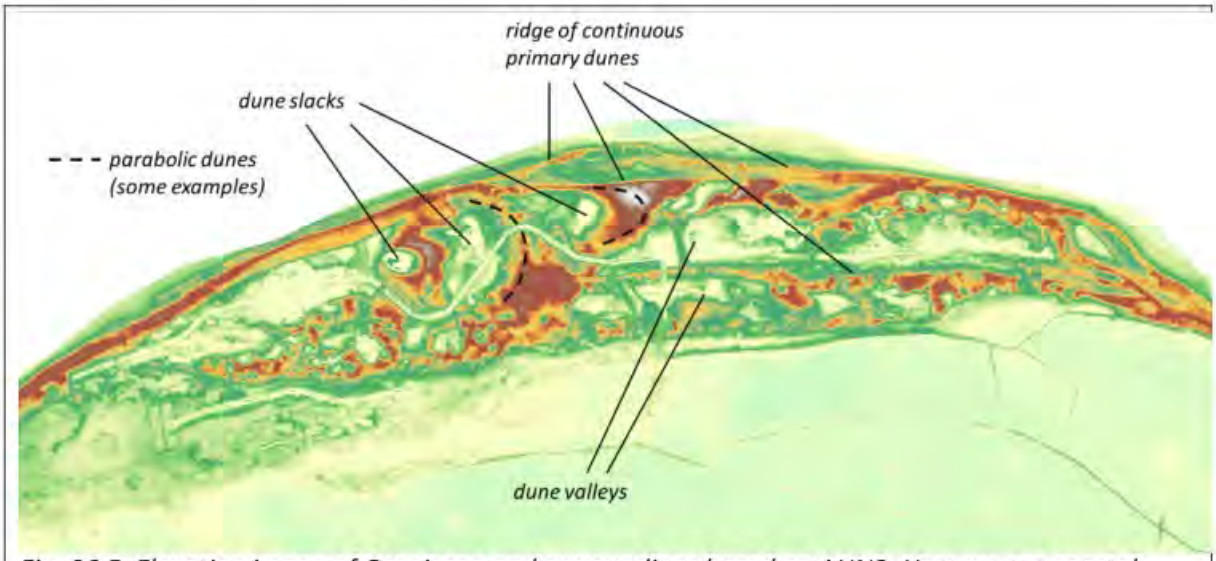

Fig. 06.5. Elevation image of Oranjezon and surroundings based on AHN2. Here we see coastal accretion. Several primary dune ridges and dune valleys are indicated, as well as some dune slacks and parabolic dunes.

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- De Mulder et al. (2003). De Ondergrond van Nederland. Wolters-Noordhoff, Groningen/Houten.
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Geosite n°07	**Beach ridge of Walcheren** Striking, yet unexplained ridge in the landscape.
 Fig. 07.1: Map of Geopark Schelde Delta. Beach ridge of Walcheren is number 7.	**Scientific importance** There is still uncertainty about the exact origin of this phenomenon: it could be a beach ridge, a coastal ridge or a salt marsh ridge. This ridge has a different orientation compared to other beach ridges in the Netherlands, which generally run north-south parallel to the coast. This ridge contains secrets about the genesis of the north side of the island of Walcheren during the Holocene. Further research by Geopark Schelde Delta will therefore take place. Geologically valuable area of the Province of Zeeland, of provincial importance.
Municipality	Veere
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Nationaal Landschap Zuidwest-Nederland-deelgebied Walcheren
Site management organizations	Municipality Veere
Accessibility	Site is accessible to the general public.
Relevance for tourism	Routes that one can travel independently.
Relevance for education	There is nothing (yet).
Teaching equipment	The Zeeland walking network runs along the beach ridge of Walcheren.
Code	**Significance**
G-07	Provincial
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: A low ridge in the landscape which stands out from the surrounding polder area and could be a former beach ridge, a coastal ridge, or a salt marsh ridge.	
Sedimentology: not applicable.	
DETAILED DESCRIPTION 1. **Location** This geosite consists of an approximately 1.5 km long, more or less west-east oriented, elongated elevation in the landscape between Oostkapelle, Vrouwenpolder and Serooskerke. The ridge has a width of 150 to 200 metres and is at ca. +1.3 metres NAP, approximately half a metres higher than	

the surrounding area. There is still uncertainty about the exact origin of this phenomenon: it could be a beach ridge, a coastal ridge or a salt marsh ridge.

The geosite is located on the north side of the Oudland of Walcheren, which is characterized by a special relief of sandy ridges at the location of former tidal channels (creek ridges) and low-lying marshy areas where the subsoil is made up of peat and clay (clay-covered peatlands).

NB. On the geological map of the Geopark, the beach ridge is not distinguished as a separate unit, but overlaps with different types of tidal units.

2. **Landscape formation**

Origin of the landscape

During the last ice age, a very large part of the North Sea was dry, because a lot of seawater was stored in the large land ice sheets. Due to the sea level rise that reached Zeeland at the beginning of the Holocene, the sea penetrated the country from the northwest and formed a tidal area with salt marshes, tidal flats, shoals and tidal channels that covered most of Zeeland about 6300 years ago. Sand was brought in from the North Sea and was deposited by the tide on the sea side of the salt marshes. As a result, protective beach ridges were built up here and there. The first beach ridges were far west of the current coastline. Due to the constantly rising sea level, these were cleared up again and new beach ridges formed further east.

As a result of the decreasing rate of sea level rise, an almost uninterrupted beach ridge had formed around 3800 years ago, protecting the area behind it against marine intrusions. A narrow opening remained at the position of the current Eastern Scheldt (Oosterschelde) mouth.

Behind the protective coastal barrier, a vast peat landscape developed. About 2600 years ago, however, the barrier was breached again. The sea gradually invaded the land behind. The mouth of the Eastern Scheldt was widened and on the north side of Walcheren, the Veere-diep tidal inlet – predecessor of part of the current Veerse Meer – was created.

Due to the marine intrusions, the peat area turned back into a salt marsh landscape and was covered with a thin layer of clay. Between 1500 and 1250 years ago, the salt marshes and tidal flats of Walcheren had silted up to the point that they formed one island. This island comprised the area southwest of the geosite, but not yet the polder area on the far north side of Walcheren (diked in the 12th and 13th centuries). At the time, the ridge was located on the bank of the newly formed tidal inlet, the Veere-diep.

Deviating location

The 'beach ridge' of Walcheren has a different orientation compared to other beach ridges in the Netherlands, which generally run north-south parallel to the coast. This ridge, however, is formed parallel to the former coastline of the Veere-diep. North of the beach ridge, all peat in the subsoil has been cleared by tidal currents in the inlet. By contrast, peat is still present in the subsoil south of the ridge.

The ridge consists of three parts. The westernmost interruption coincides with a wide creek ridge on the Oudland ('old land': the old island core, where peat has been preserved in the subsoil). At Oostkapelle, this creek ridge is perpendicular to the presumed beach ridge. The eastern break coincides with the Serooskerke Kreek. Because the creeks cut through the ridge, it is likely that they were already active during the formation of the ridge, thus preventing the formation of a continuous ridge here.

Beach ridge or not?

There is still uncertainty about the exact origin of the 'beach ridge' at Walcheren. A beach ridge is a sandbank parallel to the coast that dries up at low tide. It is built up of sand that is eroded (elsewhere) by the current and wave action, and transported into the shallow surf zone. Sand brought in by sea and wind further raises the beach ridge, until it eventually emerges above high-water level and forms a new beach. Due to drifting sand, dune formation can take place on this beach. In this way, beach ridges can develop into natural coastal barriers that protect the land behind.

On the geomorphological map of the Netherlands (1:50,000), the higher ridge on Walcheren is not marked as a beach ridge, but as a coastal ridge. A coastal ridge is described as a low and relatively narrow, elongated ridge of material that is deposited by wave action. The difference with a beach ridge is that a coastal ridge forms onshore during a period of coastal erosion, instead of in the shallow surf zone of a seaward expanding coast. Beach ridges and coastal ridges are both regarded as coastal areas that are influenced by tidal action, as well as wave action, currents and wind.

Another phenomenon is the salt marsh ridge. This is a slight elevation of the surface on a salt marsh (a high, vegetated part of the tidal area) where sand and silt are trapped by the vegetation during spring tides and storm surges. Salt marsh ridges are regarded as a marine environment and are mainly influenced by the tide. Some investigators consider the ridge of Walcheren to be a salt marsh ridge, which extended as far as Veere before it was partly eroded by the tides.

Age

Besides differences in interpretation of the formation history of the ridge in the landscape, different reports are also made about the age of the ridge. According to the geomorphological map of the Netherlands from 2019 (1:50,000), the material of the ridge would have been deposited after 900 AD. Other sources mention a formation beginning around 350 AD and reaching a maximum around 1000 AD. To the north of the 'beach ridge' there are still a few polders that were diked before the year 1200. Hence, the rampart must at least date from before that.

Relation with other geosites

- Dune complex Oranjezon and the Manteling – dunes and beach ridges.
- Creek ridges and pool grounds of Walcheren – Oudland Polder of Walcheren.
- Eastern Scheldt – inlet along which the ridge is formed.
- Veerse Meer – remnant of the inlet that formed after the breach of the coastal barrier along the beach ridge on the north side of Walcheren.

Fig. 07.2. Location map of the geosite.

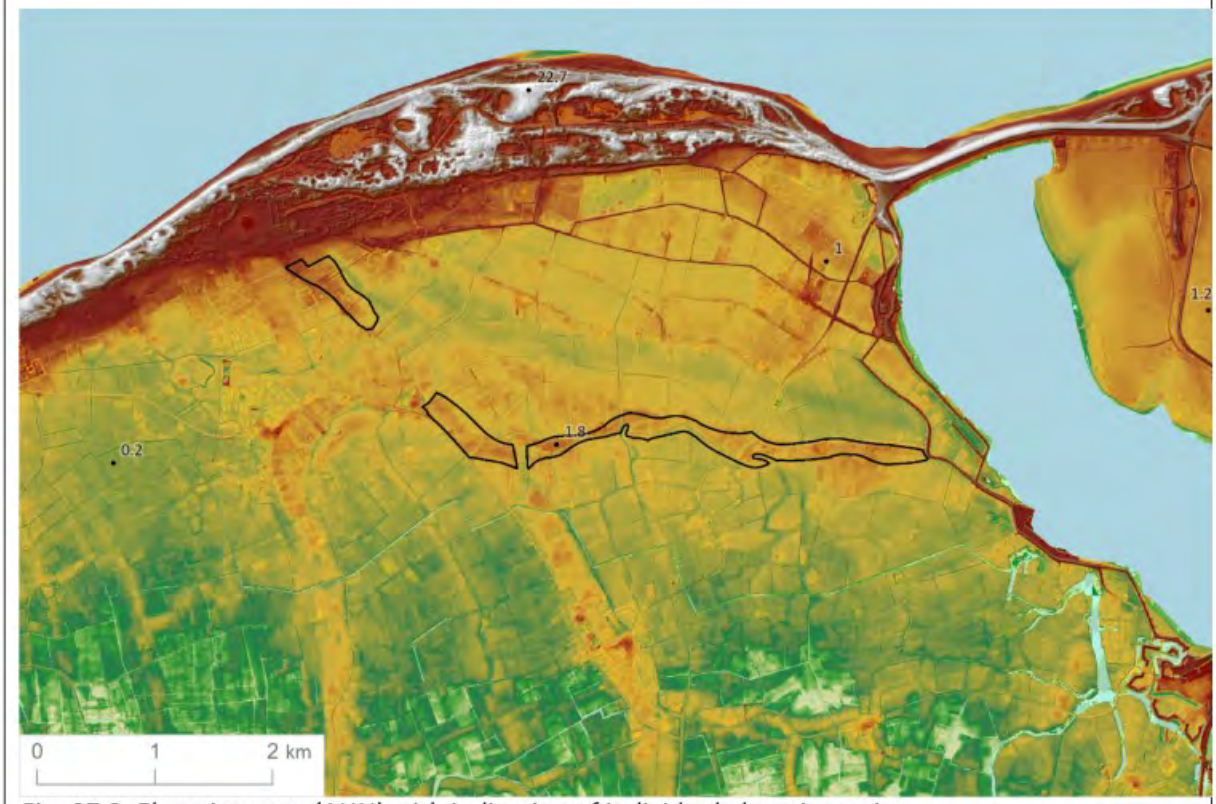

Fig. 07.3. Elevation map (AHN) with indication of individual elevation points.

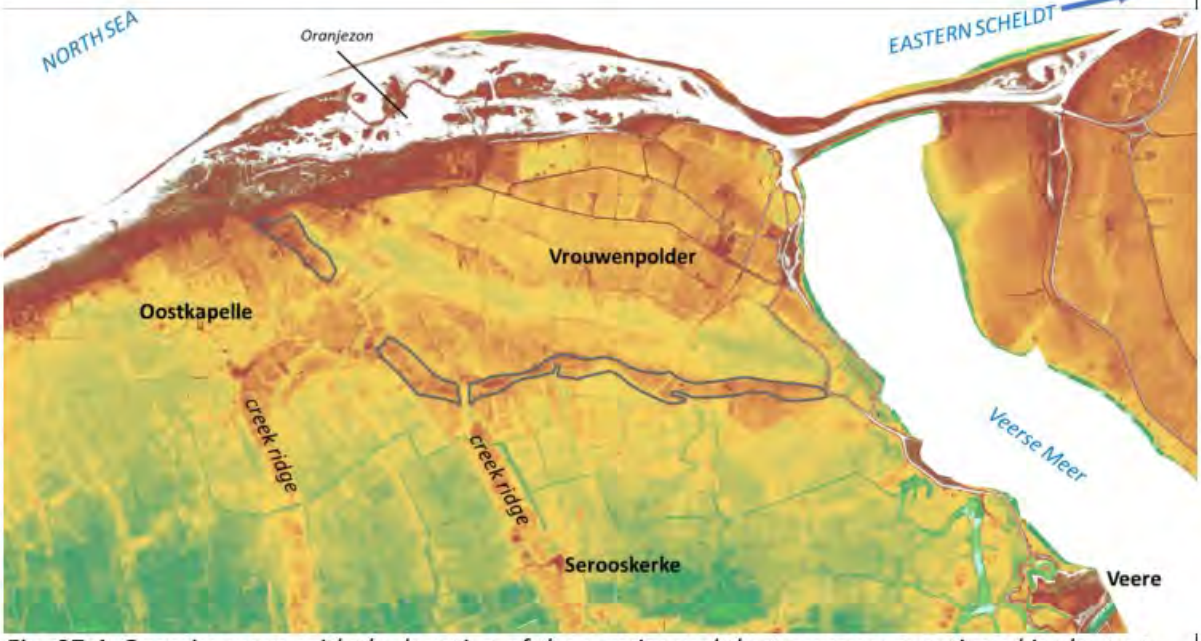

Fig. 07.4. Overview map with the location of the geosite and the toponyms mentioned in the text. The ridge in the landscape (outlined in dark grey) is divided into three parts and is intersected in the west by a wide creek ridge at Oostkapelle and centrally by the ridge belonging to the Serooskerkse creek.

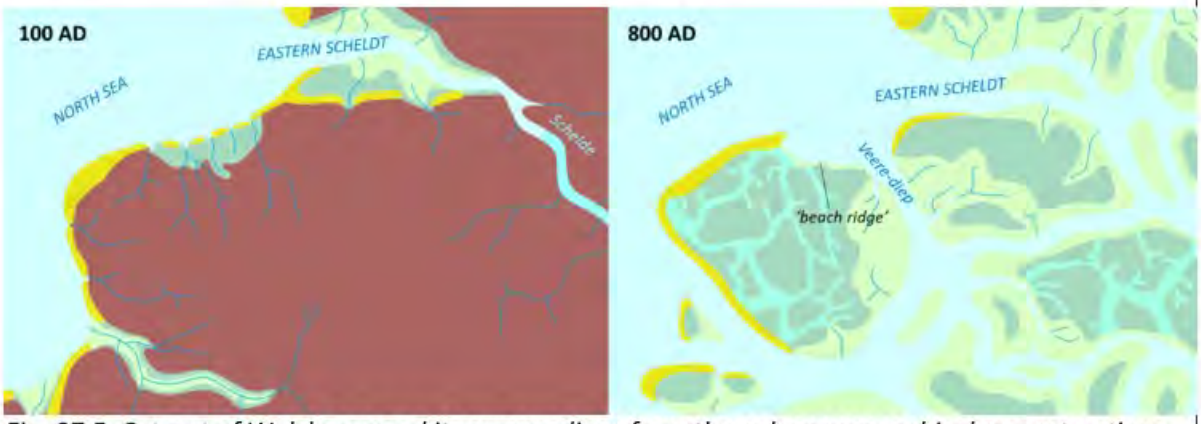

Fig. 07.5. Cut-out of Walcheren and its surroundings from the palaeogeographical reconstructions at 100 and 800 AD from the Atlas of the Netherlands in the Holocene (Vos et al., 2018) with annotations from this text. During this period, the new tidal inlet Veere-diep was created on the north side of the island and the peat area (brown) behind the coastal barrier (yellow) that had already been partially breached here turned into a tidal landscape with salt marshes (grey-green) and creeks, which silted up over time (aquamarine). Tidal flats are also shown (pale green). On the north side of the island of Walcheren, the rampart that forms the geosite (also in light green) arose.

Documentation

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- Vos & Zeiler, 2008. Overstromingsgeschiedenis van zuidwest-Nederland, interactie tussen natuurlijke en antropogene processen. Grondboor & Hamer 3/4.
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Geosite n°08	**Creek ridges and pool grounds of Walcheren** Old land with creeks of varying sizes and patterns.
 Fig. 08.1: Map of Geopark Schelde Delta. Creek ridges and pool grounds of Walcheren is number 8.	**Scientific importance** The 'creek ridges and pool grounds of Walcheren' geosite is a geologically valuable area of the Province of Zeeland. The area is a fine (and often cited) example of so-called 'relief inversion' in which the originally low-lying tidal channels and creeks now form the highest parts of the landscape. A number of smaller creek ridges also display a striking rectangular pattern, inherited from a network of man-made drainage ditches from Roman times. This testifies to the early influence of humans in the peatland and thus on coastal development.
Municipality	Veere
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area; Parts of Westkapelse Kreek: Natuurnetwerk Zeeland, Nationaal Landschap Zuidwest-Nederland-deelgebied Walcheren
Site management organizations	Staatsbosbeheer, municipality Veere
Accessibility	Site is accessible to the general public.
Relevance for tourism	Routes that one can travel independently.
Relevance for education	Area where students of earth sciences can do fieldwork as part of their education.
Teaching equipment	The Zeeland walking network runs along the area.
Code	**Significance**
G-08	Provincial
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: The area is a fine (and often cited) example of so-called 'relief inversion' in which the originally low-lying tidal channels and creeks now form the highest parts of the landscape. Some smaller creek ridges display a rectangular pattern, inherited from a network of man-made drainage ditches from Roman times and thus demonstrating the early influence of humans on coastal development.	
Sedimentology: not applicable.	
DETAILED DESCRIPTION	

1. **Location**

The geosite is located on the west side of Walcheren and covers an area of creek ridges and clay-covered peatlands with a total area of 33 km^2. The area stretches from Westkapelle in the west to Grijpskerke in the east, and from Aagtekerke in the north to Zoutelande in the south. Various types of tidal channels can be seen in the area: old, large-scale systems hundreds of metres wide, small-scale rectangular creeks following a historic ditch pattern and a young sea breach as a result of military inundation during the Second World War.

2. **Landscape formation**

Origin of the landscape

The barren, glacial landscape of the final Pleistocene got covered by tidal deposits (sand and clay) during the warmer Holocene as a result of the melting ice sheets and rising sea level. Initially the coast was open: there was no barrier protecting the inland from marine influence. Around 6,500 years ago, a landscape with salt marshes, tidal flats and tidal channels had developed on Walcheren.

During the Holocene, the rate of sea level rise decreased and about 3800 years ago an almost closed coastal barrier of beach ridges was created. Because of this somewhat higher zone on the coast, the hinterland was protected from the tide and a large freshwater swamp was created, in which peat accumulated. That way a vast peat area developed in Zeeland, with peat up to several metres thick.

From a few centuries BC, the protective coastal barrier was locally breached and the influence of the sea increased once again. Especially since Roman times, sea breaches penetrated ever deeper inland. Over the centuries, part of the peat was eroded by large tidal channels, but in some areas, such as in West Walcheren, there was no such deep erosion. Here, the peat was only incised in a few creeks. Beyond those creeks, the sea deposited a thin layer of sediment (clay and sand) on top of the peat, which was buried and got more and more compressed.

Clay-covered peatlands and creek ridges

Although large-scale erosion has not occurred in this area, creeks have incised into the peat. The creeks drained the peat area, causing the peat to partly decompose. As a result, the peat surface was lowered and during high tides clay from the creeks was deposited on top of the peat, forming a thin clay layer. The weight of the clay further compressed the peat. In this way the peat area changed back into a salt marsh landscape.

The current within the creeks of this salt marsh landscape was stronger than outside the creeks. As a result, in addition to clay particles, the creeks were also able to transport the heavier sand grains. That way, during the silting up of the salt marsh, only clay was deposited outside the channels, but the creeks themselves got filled with (clayey) sand, with only a thin clay cover on top.

Over the centuries, the peat and clay outside the creeks were compressed, thus lowering the land surface. This compression affected the sandy creek infill to a much lesser extent. That is why the former channels now form higher elevations in the landscape. We call these higher parts creek ridges. This is often where the oldest roads and settlement centers are located. Because of their higher and drier location, creek ridges were also used as arable land. The low-lying clay-covered peatlands outside the creek ridges are called *poelgronden* in the region. These soils are often under water for a long time in winter and are almost exclusively suitable for pasturage.

Creek ridges of southwest Walcheren

Southwest Walcheren is intersected by several large, hundreds of metres wide creek ridges that testify to the wide tidal channels that once cut through the area. Along the southeast side of the area is a wide creek ridge that is approximately 1.5 metres higher than the surrounding land. This former tidal channel was active from ca. 270 to 1000 AD. Several villages have been founded on it, including Grijpskerke and Meliskerke, first mentioned in writing in 700 and 1240 AD respectively. A younger, somewhat smaller tidal channel cuts through the creek ridge on its southeast side. A second wide creek ridge runs on the northwest side of the area. The village of Aagtekerke is located on this ridge. This creek ridge is in turn intersected by a younger, smaller tidal channel, the Westkapelle creek, which formed as a result of a bombing raid in the Second World War.

Bombing and the Westkapelle creek

By the end of the Second World War, the port of Antwerp was controlled by the western Allies. To secure its access via the Western Scheldt, it was important to liberate the banks of the Scheldt from German occupation. That is why the Allies decided to conduct a military inundation of Walcheren.

Residents were warned to leave the island by means of pamphlets and the English radio, after which part of the population fled. On October 2, 1944, the seawall of Westkapelle was bombed by the Allies. Besides the seawall, the western part of the village was also destroyed. Many civilians who remained, died. In contrast to other, more inland inundations, here the tides strongly affected the hinterland and eroded two large gullies inland. The gap at Westkapelle was not closed until October 12, 1945.

NB. Despite the spring tide, the bombardment near Walcheren, in which approximately 130 metres of seawall was breached, proved insufficient to inundate the island. That is why hundreds of metres of seawall at Vlissingen, Rittem and Veere were also destroyed in the same month, and the locks at Vlissingen and Veere were bombed. That way, 16,000 ha (160 km^2) of Walcheren was deliberately flooded. After a difficult period of recovery, the last gap was closed on February 22, 1946.

Historic ditch pattern

Between the large former tidal channels, smaller and lower creek ridges occur. Some of these creek ridges follow a natural, somewhat irregular pattern, as expected from tidal channels. But the small creeks that cut through the clay-covered peatlands of Walcheren often follow a rectangular, unnatural-looking pattern. When the sea re-entered the land after breaching the coastal barrier, the small tidal channels followed the path of least resistance. In this area there was an existing network of ditches dating mainly from Roman times. These ditches were dug to drain the peatland and make it habitable. They connected to the larger tidal channels. The peat itself was also dug out as a fuel and for salt production.

Relation with other geosites

- Dune complex Oranjezon and the Manteling – more about beach ridges and dunes.
- Southwest Walcheren – adjacent dune area.
- Beach ridge of Walcheren – ridge in the landscape on the north side of Walcheren.

Fig. 08.2. Location map of the geosite.

Fig. 08.3. Elevation map (AHN) with indication of the individual elevation points.

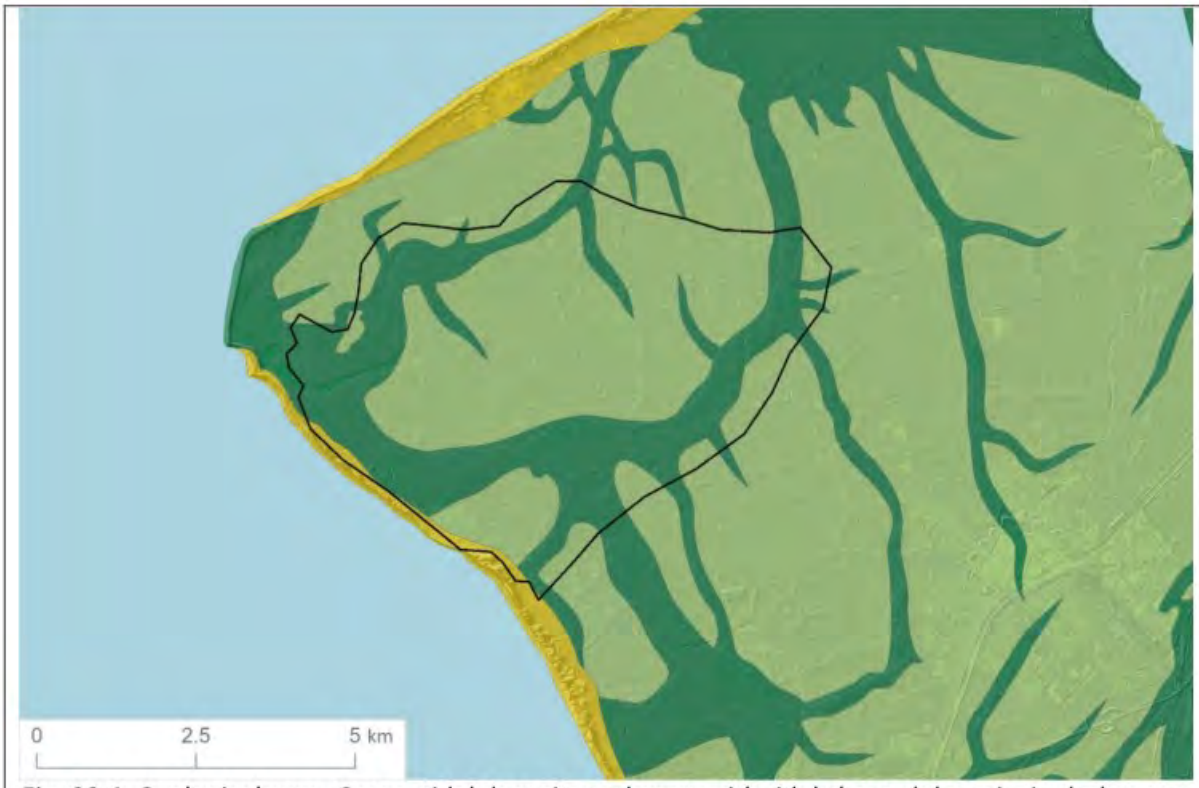

Fig. 08.4. Geological map. Green: tidal deposits and peat, with tidal channel deposits in dark green (Holocene); yellow: coastal dunes (Holocene); light blue: water.

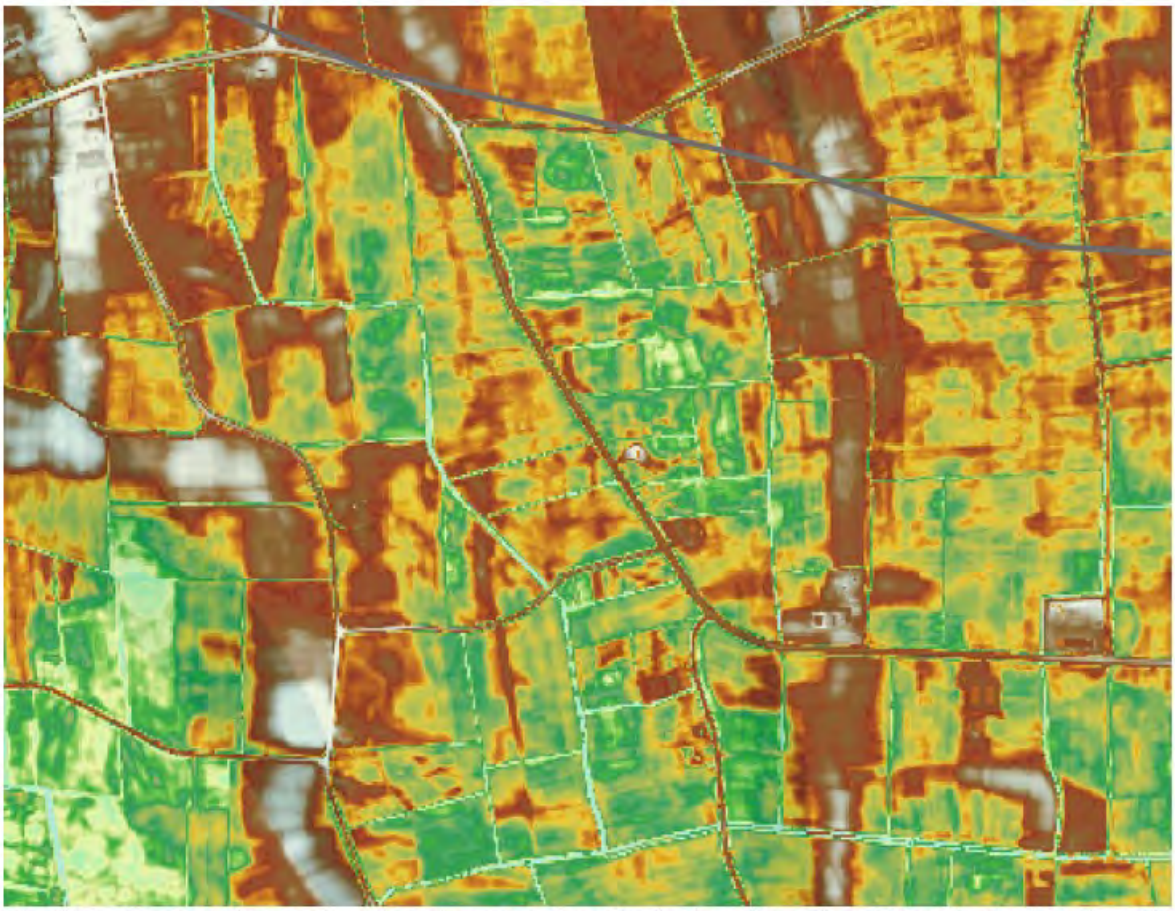

Fig. 08.5. Rectangular creek pattern between Aagtekerke (northwest) and Grijpskerke (southeast), visible on AHN2 elevation image.

Documentation and resources

- Wilderom M.H., 1968. Tussen Afsluitdammen en Deltadijken - III. Midden-Zeeland (Walcheren en Zuid-Beveland). Vlissingen, 447 pp.
- Pierik et al., 2017. Late Holocene coastal-plain evolution of the Netherlands: the role of natural preconditions in human-induced sea ingressions. Proceedings of the Geologists' Association 128 (2017) 180–197.
- Vos P.C. & Van Heeringen R.M., 1997. Holocene geology and occupation history of the Province of Zeeland (SW Netherlands). In: M.M. Fischer (ed.), Holocene evolution of Zeeland (SW Netherlands). Mededelingen Nederlands Instituut voor Toegepaste Geowetenschappen TNO 59, Haarlem, 5 - 109.
- Vos P.C. & Zeiler F.D., 2008. Overstromingsgeschiedenis van Zuidwest-Nederland, interactie tussen natuurlijke en antropogene processen. Grondboor & Hamer 62 (3/4), 86-95.

Geosite n°09	**Coastal dunes of southwest Walcheren** A narrow, steep and very high dune area parallel to the Western Scheldt (Westerschelde).
 Fig. 09.1: Map of Geopark Schelde Delta. Coastal dunes of southwest Walcheren is number 9.	**Scientific importance** Despite the very narrow foredune, the dunes are among the highest in the Netherlands. The geosite is a geologically valuable area of the Province of Zeeland, of national importance.
Municipality	Veere
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Zeeland, Nationaal Landschap Zuidwest-Nederland-deelgebied Walcheren, provincial valuable landscape
Site management organizations	Staatsbosbeheer
Accessibility	Site is accessible to the general public.
Relevance for tourism	Routes that one can travel independently.
Relevance for education	Coastal defence
Teaching equipment	The Zeeland walking network runs along the area. The information panels along this route show information about the Atlantikwall.

Code	**Significance**
G-09	National

Geological interest(s)
Paleontology: not applicable.
Stratigraphy: not applicable.
Geomorphology: The tops of this narrow and steep coastal dune ridge reach up to 50 m above sea level and are among the highest in the Netherlands; they offer a fine view seaward over the mouth of the Western Scheldt estuary and its (largely submerged) ebb-tidal delta and over the polder area of Walcheren to the landward side.
Sedimentology: The peculiar narrow and high shape of the dune ridge is the result of its location on an eroding shore of the Western Scheldt estuary and its orientation perpendicular to the

dominant south-westerly winds. Erosion is evident in the cliff between the dunes and the beach, and in the local exposure of intertidal deposits predating the formation of the dunes on the beach at low tide.

DETAILED DESCRIPTION

1. **Location**

The geosite consists of the dune area at the mouth of the Western Scheldt that extends along the southwestern side of Walcheren, from Zoutelande to Vebenabos near Dishoek. The dune tops reach up to ca. 50 m + NAP and are among the highest in the Netherlands. The dune ridge is only a few 100 metres wide. On the southwest side, an erosional cliff forms a steep transition to the beach. On the northeast side, the high dunes change quite abruptly into the polder area behind, which is partly covered by a thin layer of dune sand. This former tidal area inland from the dunes is located at approximately 0.5 m - NAP (clay-covered peatlands) to 1.0 m + NAP (creek ridges). Elsewhere along the southwest coast of Walcheren, from Westkapelle to Vlissingen, the dune area is even narrower than at the geosite. There, it consists of only one row of dunes about 100 metres wide, which runs parallel to the coast of the Western Scheldt.

2. **Landscape formation**

Origin of the landscape

During the last ice age, the North Sea was largely dry, because a lot of seawater was stored in the large land ice sheets. Due to the sea level rise after the ice age, the sea entered from the northwest into Zeeland and formed a tidal area with salt marshes, tidal flats, shoals and tidal channels that covered most of Zeeland about 6300 years ago. From the North Sea, sand was brought in and deposited by the tide on the sea side of the salt marshes. This resulted in the build-up of protective beach ridges here and there. The first beach ridges were far west of the current coastline. Due to the continuously rising sea level, these were eroded again and new beach ridges formed further east (landwards).

In the course of the Holocene, the rate of sea level rise decreased. Around 3800 years ago, an almost continuous barrier of beach ridges and dunes had formed more or less at the position of the current coastline, protecting the area behind against sea breaches. Behind it, a vast swamp area formed, in which peat accumulated.

From about 2600 years ago, the protective coastal barrier was locally breached, thus causing the return of marine influence on the hinterland. Here and there, possibly also at the present estuary of the Western Scheldt south of Walcheren, there were narrow openings in the coastal barrier, along which small channels drained the peat area. The Honte, the predecessor of the current Western Scheldt, may have been created in this way. From Roman times, as a result of marine intrusions, the peat river de Honte gradually grew eastwards into a tidal inlet, from which the inland flooded. Between 350 and 500 AD, Walcheren changed back into a tidal landscape with salt marshes, tidal flats, shoals and tidal channels covering the peat area. Along the mouth of the inlet, just south of the present-day coast of Walcheren, new beach ridges were formed.

Between 1500 and 1250 years ago, the salt marshes and tidal flats of Walcheren had silted up to such an extent that Walcheren formed one island. The expanding tidal inlet eroded the newly formed beach ridges and the dunes that had formed on them. However, new beach ridges and dunes formed further inland and maintained. They may have formed against dikes built in the Middle Ages. Around 750 AD, a new coastal barrier had been formed along the current southwest side of Walcheren on the north bank of the (predecessor of the) Western Scheldt.

Very steep and high dune ridge

The dunes along the southwest side of Walcheren have been deposited on the older tidal landscape that has partly been eroded again by marine intrusions from the Western Scheldt. Locally, along the coast, the edge of this tidal landscape, which is covered by beach and dune sand, is exposed again at low tide. Immediately south of the geosite and just off the coast is the Oostgat, a more than 10 metres deep tidal channel in the mouth of the Western Scheldt that erodes the shore. This is one of the reasons that the dune area here is so narrow, steep and high.

Due to the location of the tidal channel, the sand supply available for the formation of dunes is limited, and there is only a very narrow beach in front of the dune ridge. During storm surges, the dunes can be eroded. Moreover, due to the orientation of the dune ridge with respect to the predominant south-westerly wind direction, the sand that is deposited on the beach is blown up almost immediately and deposited on top of the dune. This raises the dune considerably.

Due to the dangerous situation with the deep Oostgat near the coast, this dune area is meticulously maintained by humans. Sand that drifts inland is captured by vegetation as quickly as possible. Partly because of this, the dunes along the southwest coast of Walcheren are very narrow. However, at the location of the geosite, the wind has gained a better grip on the dune, and the sand has been blown hundreds of metres inland. There, a thin layer of windblown beach and dune sand is present on the older tidal deposits behind the highest dunes.

<u>Dike breach and the subsoil below the dunes</u>

Although dune formation on the southwest coast of Walcheren started centuries earlier and historical sources from the 14th and 15th centuries already mention dunes, there was no continuous dune ridge near Dishoek about 600 years ago. A medieval dike was built to protect the polder land behind from flooding. In January 1396, however, this dike was breached. That is why secondary dikes were built – these dikes were located further inland than the usual seawalls, and were intended to prevent the seawater from penetrating even deeper into the polder. These secondary dikes were also threatened by the sea in the subsequent period. This illustrates the late formation of the continuous dune ridge in the area.

The subsoil in the hinterland and under the dunes consists of predominantly clayey and peaty deposits, formed in the former swamp and tidal area, intersected by wide, sandy creek ridges. At Dishoek, such a creek ridge runs under the dune area towards the sea. This is recognizable in the elevation image: in the polder landscape, the creek ridge is slightly higher than the surrounding area. The local composition of the subsoil may have played an important role in the collapse of the dike at this location: the relatively loose sandy subsoil of a creek ridge is more susceptible to erosion than the solid clay and peat layers of the surrounding area.

<u>Relation with other geosites</u>

- Kop of Schouwen – extensive and diverse dune area along which both coastal erosion and coastal accretion take place.
- Dune complex Oranjezon and the Manteling (northwest Walcheren).
- Creek ridges and pool grounds of Walcheren – old island core, protected by coastal barrier, immediately north of this geosite.
- Western Scheldt – description and development of the estuary south of the geosite.

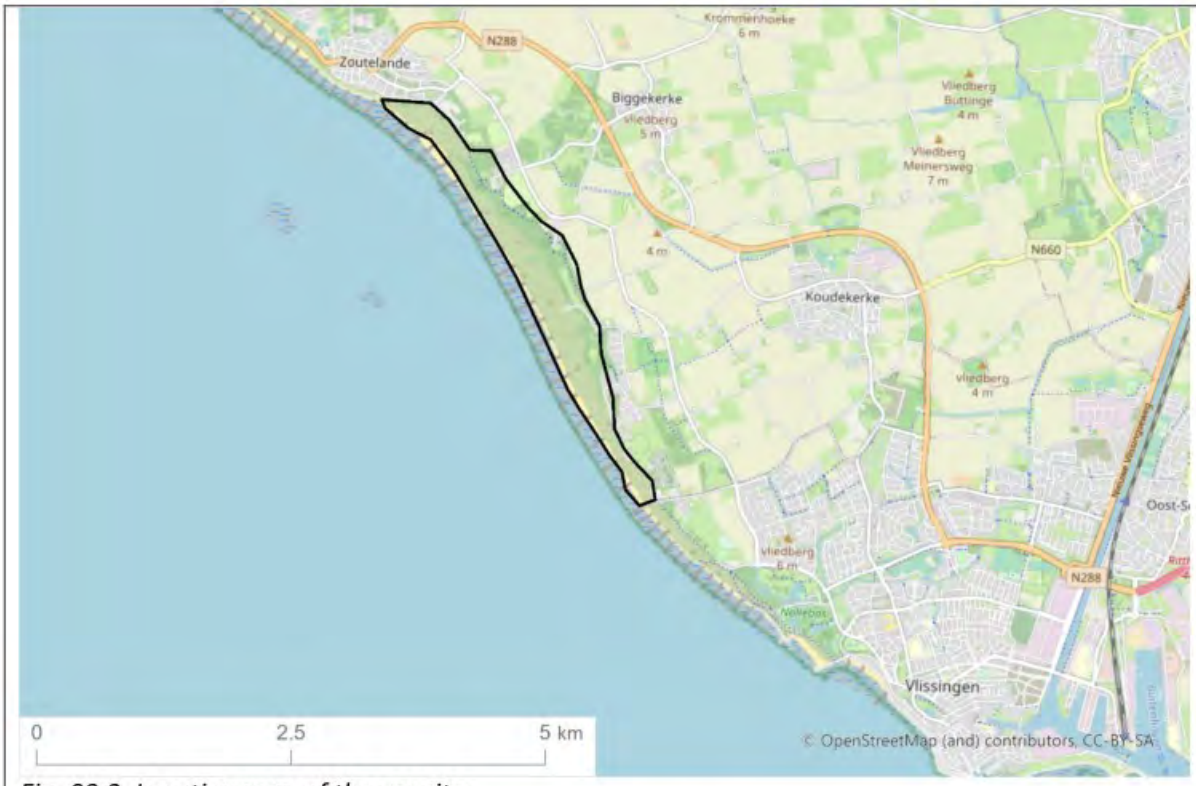

Fig. 09.2. Location map of the geosite.

Fig. 09.3. Elevation map (AHN) with indication of individual elevation points.

Fig. 09.4. Geological map. Green: tidal deposits and peat, with tidal channel deposits in dark green (Holocene); yellow: coastal dunes (Holocene); light blue: water.

Fig. 09.5. Overview map of the geosite with elevation image based on AHN2. The dune area within the geosite is clearly wider and higher than to the north and south of the geosite. In the hinterland of the dune area, the low-lying, predominantly clayey and peaty former tidal area (light green) is intersected by slightly higher, broad, sandy creek ridges (light yellow). At Dishoek, such a creek ridge runs under the dune area towards the sea. The sandy composition of the subsoil may be one of the causes of the breakthrough at this location.

Documentation and resources

- Van Haperen A. & Stooker G., 1999. Aan de monding van Maas en Schelde - Natuurgebieden in Zuidwest-Nederland. Staatsbosbeheer, Middelburg, 320 pp.
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Geosite n°10	**Oudland area De Poel** An authentic piece of the old island core
 Fig. 10.1: Map of Geopark Schelde Delta. Oudland area De Poel is number 10.	**Scientific importance and valuation of the geosite** In many old island cores, the original small-scale elevation differences as a result of peat reclamation and salt production have been lost through levelling and rearrangement of land parcels. However, at this geosite, the original character has been better preserved. The geosite is a geologically valuable area of the Province of Zeeland, of national importance. In the south-eastern part of the geosite is a geological monument, Hoeve van der Meulen. The clay-covered peatlands in the north-western part of the area are part of the geese reserve of De Poel.
Municipality	Borsele
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Zeeland; PMV environmental protection area, provincially valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied Zak van Zuid-Beveland
Site management organizations	Natuurmonumenten, Stichting Het Zeeuwse Landschap
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Routes that one can travel independently
Teaching equipment	Information center Zwaakse Weel gives practical information about the area. From this information center, visitors can follow both walking and cycling routes through the old land area De Poel. Along the routes, information panels provide information about the area. Guided walks are also offered, such as an eating nature walk and activities for children.

Code	**Significance**
G-10	National
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	

Geomorphology: A rare example of an area that is part of an old island core ('Oudland') and where the original small-scale irregular relief resulting from medieval peat extraction and salt production is still visible.

Sedimentology: not applicable.

DETAILED DESCRIPTION

1. **Location**

This geosite consists of two areas in the old island core *'Brede Watering Bewesten Yerseke'* with a combined area of approximately 2 km^2. The largest area is located west of Sinoutskerke and the smaller area south of 's-Heer Abtskerke. The original character of the old island core has been preserved because for centuries the former island was not or hardly under marine influence, and little or no levelling and rearrangement of land parcels has taken place at the geosite.
NB. Near Nisse, in the extreme southwest of this polder, there is another place that is called De Poel, but that is located outside the geosite. Here too, the original character of the landscape has been better preserved than in other parts of the former island.

2. **Landscape formation**

Origin of the landscape

The barren ice age landscape at the end of the Pleistocene became covered by tidal deposits (sand and clay) during the warmer Holocene, as a result of the melting ice sheets and rising sea levels. Initially the coast was open: there was no barrier protecting the inland from marine influence.

During the Holocene, the rate of sea level rise decreased and about 3800 years ago an almost closed coastal barrier of beach ridges and dunes was created. Because of this higher zone on the coast, the hinterland was protected from the tide and a large freshwater swamp was created, in which peat accumulated. That way a vast peat area developed in Zeeland, with peat up to several metres thick.

From a few centuries BC, the protective coastal barrier was locally breached and the influence of the sea increased once again. Especially since Roman times, sea breaches penetrated ever deeper inland. Over the centuries, part of the peat was eroded by tidal channels, but in some areas, such as De Poel, there was no such deep erosion. Here, the sea only deposited a thin layer of sediment (clay and sand) on top of the peat, which was buried and got more and more compressed.

NB. Old island cores such as this area, which experienced little erosion after breaching of the coastal barrier, are also called Oudland *(old land). Other areas were largely eroded by the marine intrusions, but later silted up again. These areas, which were often only dammed after 1200 AD, are called* Nieuwland *(new land).* Nieuwland *is relatively high in the landscape, because the sea has been able to deposit sediments there for a long time. West and south of the island core of this geosite are the major sea breaches described in geosites of the kolk lakes of Zuid-Beveland and De Zwake.*

Creek ridges and pool grounds

Large-scale erosion has not occurred around the geosite after the breach of the coastal barrier, but the old island core has been incised in several places by large and small tidal creeks. Due to the stronger current in the creeks than outside, part of the peat has been washed away and sand has been deposited in the creeks. Outside the creeks, the flow rate of the water was lower and mainly clay was transported and deposited on top of the peat. Over the centuries, the peat and clay outside the creeks compacted, thus decreasing the land surface there. Compaction affected the sandy channel fills much less. That is why the former channels are now higher in the landscape and form so-called creek ridges. This is often where the oldest roads and settlement centers are located. Because of their higher and drier position, creek ridges were also used as arable land. The

low-lying clay-covered peatlands outside the creek ridges are called *poelgronden* in the region. This land is often submerged in water for a long time in winter and is almost exclusively suitable for pasturage.

Creek ridges vary in size. The *Brede Watering Bewesten Yerseke* contains several creek ridges of more than a kilometre wide, which are approximately 2 metres higher than the surrounding landscape. The geosite is located in between some of these large creek ridges. In the north-western part of the geosite itself, no small creek ridges are recognizable. These clay-covered peatlands now form a valuable bird area and are part of the geese reserve of De Poel. The elevation differences here are very irregular and probably caused by peat excavation. The south-eastern part of the geosite is crossed by two parallel south-west-northeast oriented creek ridges about 150 metres wide, which are 1 metres higher than the surrounding clay-covered peatlands. The seventeenth-century farm *Hoeve van der Meulen* is located on the northern creek ridge: a geological monument.

Peat excavation and salt production

When the peat in the region was flooded by seawater after breaching of the coastal barrier, salt was left behind in the peat. The peat was therefore not only suitable as fuel, but also for salt production. The excavation of peat for salt production is called *moernering*, *selnering* or *darinkdelven* in the region.

Initially, the excavation of the peat under the clay layer was not yet regulated. This is called 'wild' *moernering*. After digging away the peat, a bumpy terrain was left behind that was hardly usable anymore. Locally, this is also referred to as a *hollebollig* (concave-convex) landscape.
During later, and better regulated, peat excavations, rectangular blocks or long and narrow strips were dug out. The layer of young marine clay was first dug out. Between the pits, a strip of peat remained, on which the excavated clay was placed. That strip also served as a water barrier for the adjacent pit. The peat under the clay layer was extracted. The unevenness in the landscape due to this type of peat extraction follows more regular patterns.

Land reclamation and disappeared inner dikes

De Poel is part of the *Brede Watering Bewesten Yerseke* polder, which dates from before the 13th century. This is the largest polder in Zuid-Beveland, stretching from Nisse in the west-southwest to Yerseke in the east-northeast. This polder was not constructed in one phase, but built up from several smaller former polders, to which new pieces of silted up salt marsh were gradually added by diking them. The dikes that ended up within the new seawall as a result of the embanking of the salt marshes were often removed in the past, because they were no longer useful. That way the *Brede Watering Bewesten Yerseke* has grown into a polder of exceptional size, without inner dikes. However, the consequence of the destruction of the inner dykes was that in case of dike breaches, there is no second (or later) protective flood defence in the hinterland. As a result, large pieces of land were at risk of being engulfed by the sea in the event of dike breaches – a fate from which this large polder was however spared. The breaking down of dikes was forbidden in 1452 AD. The inner dikes have therefore been preserved in land that was reclaimed later.

Relation with other geosites

- The development of geosite 'Oudland area De Putting' is comparable with De Poel.
- Yerseke and Kapelse Moer – peat excavation in the east of the *Breede Watering Bewesten Yerseke* polder.
- Kolk lakes of Zuid-Beveland – dike breaches along the former inlet west of De Poel.

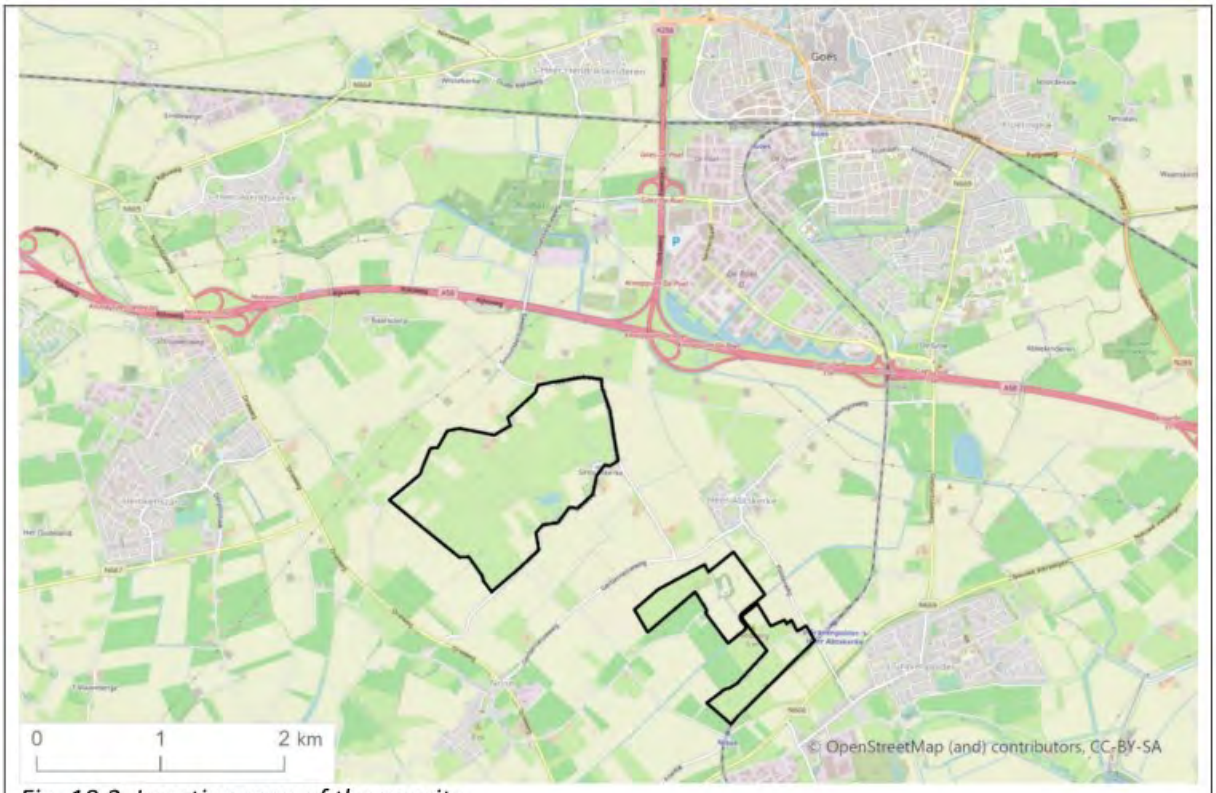

Fig. 10.2. Location map of the geosite.

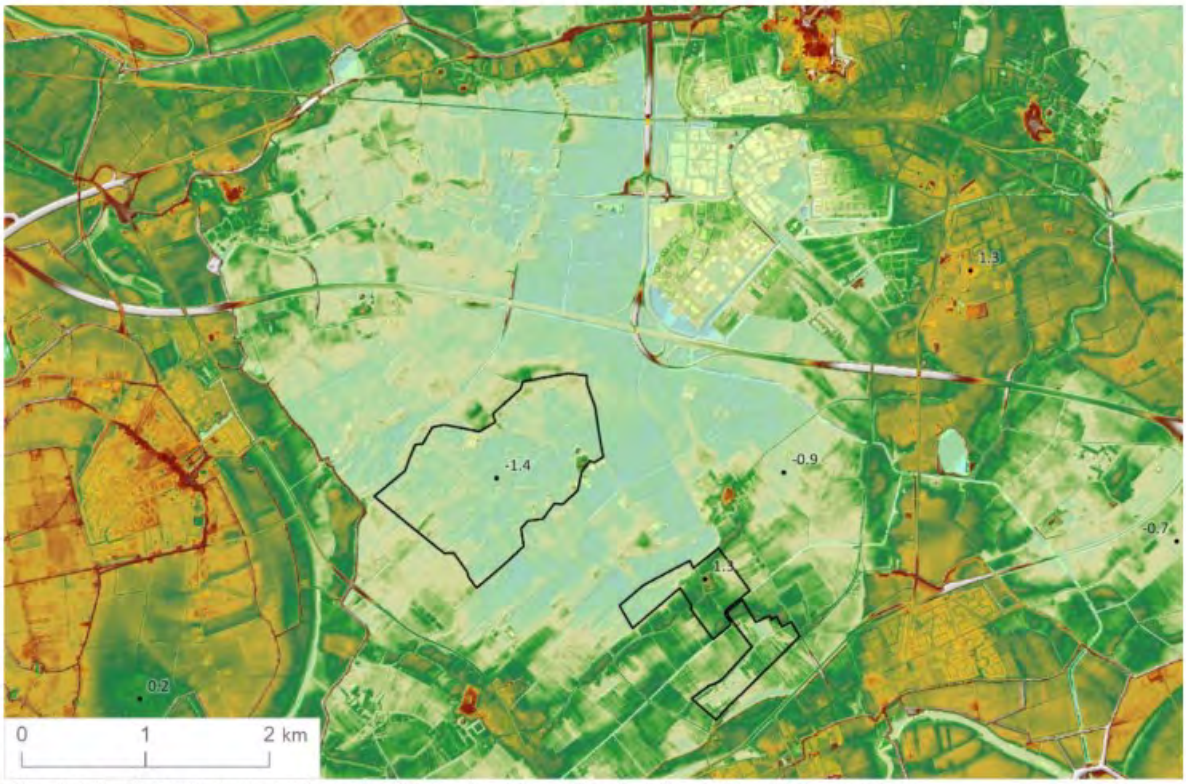

Fig. 10.3. Elevation map (AHN) with indication of individual elevation points.

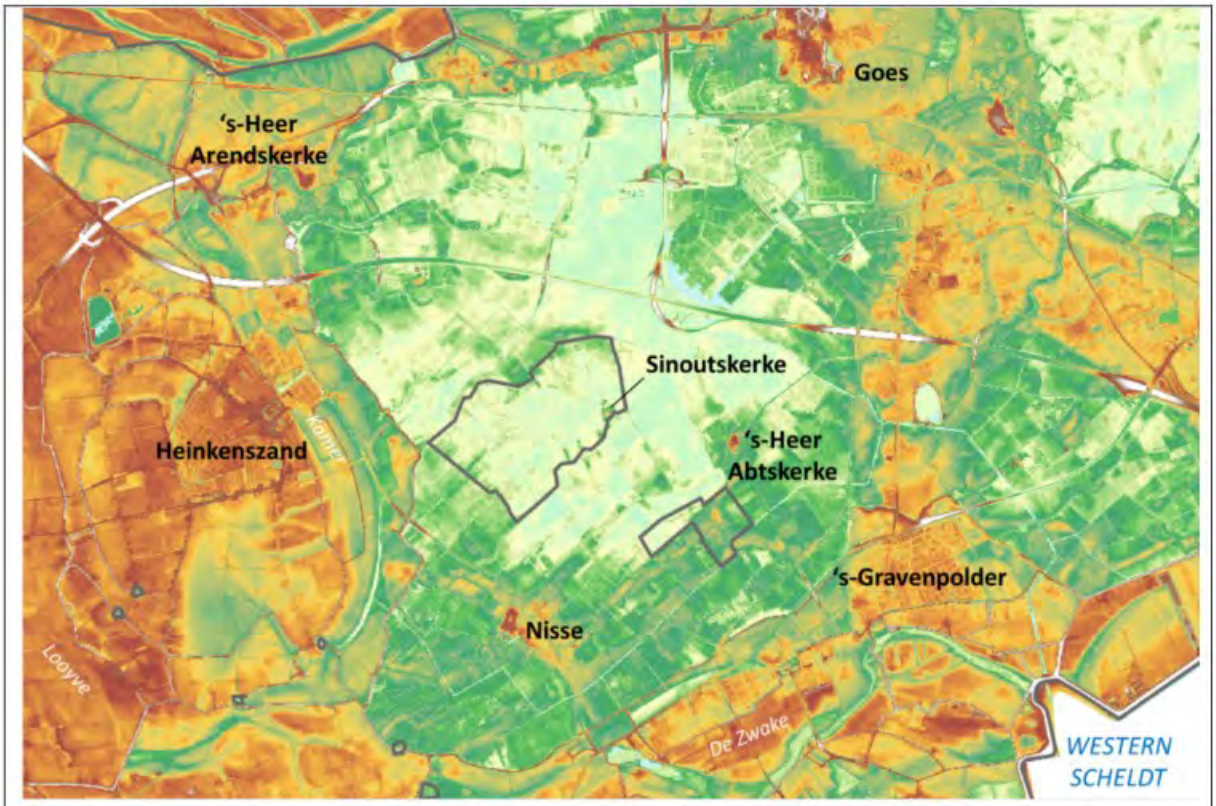

Fig. 10.4. Overview map to clarify the location in relation to toponyms that are mentioned in adjacent geosites (geosites 'Kolk lakes of Zuid-Beveland' and 'De Zwake'). Note that several larger villages (Nisse, 's-Gravenpolder, Goes) are located on a creek ridge. The high elevation parts in the west and south of the map do not belong to the old island core.

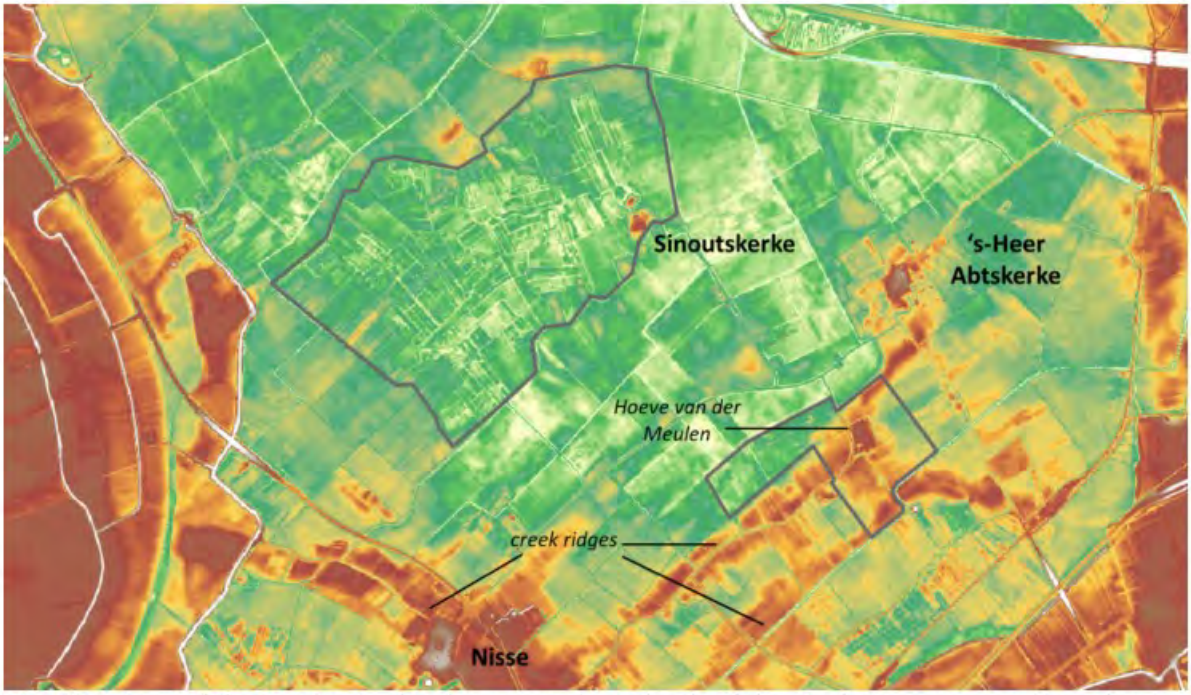

Fig. 10.5. Map of the geosite. In the clay-covered peatlands of the north-western area, irregular elevation differences are visible. The south-eastern area is intersected by two creek ridges, with the seventeenth-century farm Hoeve van der Meulen on the northernmost creek ridge.

Documentation and resources

- Wilderom M.H., 1968. Tussen Afsluitdammen en Deltadijken - III. Midden-Zeeland (Walcheren en Zuid-Beveland). Vlissingen, 447 pp.
- Rijkswaterstaat, 1971. Beschrijving van de provincie Zeeland behorende bij de waterstaatskaart. Directie Algemene Dienst van de Rijkswaterstaat, Staatsuitgeverij 's Gravenhage, 139 pp.
- Laban C., 2009. Darinkdelven. Grondboor en Hamer 2009 nr. 3/4, 98-102.
- Encyclopedie van Zeeland. Brede Watering Bewesten Yerseke. Published online: 24-11-2020. https://www.ensie.nl/encyclopedie-van-zeeland/brede-watering-bewesten-yerseke

Geosite n°11	**Kolk lakes of Zuid-Beveland** Deep kolk lakes and winding dikes as silent witnesses of past dike breaches.
 Fig. 11.1: Map of Geopark Scheldt Delta. Kolk lakes of Zuid-Beveland is number 11.	**Scientific importance and valuation of the geosite** The kolk lakes and winding dikes are witnesses of the many dike breaches that have ravaged the area. However, the deep kolk lakes have another geoscientific importance. After the restoration of the dike, kolks fill up very gradually with sediment (sand and clay) and organic material. This infill can be regarded as a lake deposit and forms a natural archive from which one can reconstruct the history of flooding, climate and vegetation since the formation of the kolks. The kolk lakes of Zuid-Beveland are a geologically valuable area of the Province of Zeeland, of provincial importance.
Municipality	Borsele
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Zeeland, provincial landscape points of interest; Nationaal Landschap Zuidwest-Nederland-deelgebied Zak van Zuid-Beveland
Site management organizations	Natuurmonumenten, Municipality Borsele
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Educational programme for children - Routes that one can travel independently
Teaching equipment	The kolk lakes of Zuid-Beveland are also part of het Oudland area de Poel. Information center Zwaakse Weel gives practical information about the area. From this information center, visitors can follow both walking and cycling routes through the old land area De Poel. Along the routes, information panels provide information about the area. Guided walks are also offered, such as an eating nature walk and activities for children.

Code	Significance
G-11	Provincial

Geological interest(s)

Paleontology: The infill of the kolk lakes forms a natural sedimentary archive from which one can reconstruct the history of a.o. flooding, climate and vegetation since the formation of the kolks, but this line of research has not yet been explored here.

Stratigraphy: not applicable.

Geomorphology: The kolk lakes ('welen' or 'wielen') and winding dikes are witnesses of the many dike breaches that ravaged the area at a time when large tidal channels still penetrated far inland, and of the attempts of the inhabitants to repair the damage.

Sedimentology: The kolk lakes testify of the erosional force of (tidal) waters spilling over a dike, and their form, size and depth depends on a.o. duration of flow and the height of the water level above the polder being inundated. After the repair of the dike, the kolks fill up gradually with lake deposits consisting of (fine) clastic and organic material.

DETAILED DESCRIPTION

1. **Location**

This geosite consists of a cluster of a number of scattered lakes in the landscape of Zuid-Beveland, between the villages of Heinkenszand and Ovezande. The lakes were originally kolk holes, which were formed as a result of a dike breach. They are located right in front of or behind the dike, are more or less round and about 100 metres in diameter. Such kolk lakes are called *welen* or *wielen* in the region.

The kolk lakes are formed in an originally extensive tidal area with an elevation of approximately 1 m + NAP. Adjacent to the northeast boundary of the former tidal area, the village of Nisse is located in a relatively low-lying part of the polder at ca. 0 m + NAP. This is part of one of the oldest former islands of Zeeland, which was called the '*Brede Watering Bewesten Yerseke*'.

2. **Landscape formation**

Origin of the landscape

As a result of the sea level rise after the end of the last ice age, large parts of Zeeland changed into a tidal area with salt marshes, tidal flats, shoals and tidal channels between 9,000 and 6,300 years ago. When the rate of sea level rise decreased in the course of the Holocene, an almost closed coastal barrier of beach ridges developed. Due to this somewhat higher zone on the coast, the hinterland was protected from the tide and a large freshwater swamp was created, in which peat grew up to several metres thick. That way, a vast peatland developed in Zeeland.

From about 2600 years ago, the protective coastal barrier was locally breached and the influence of the sea increased once again. Especially since Roman times, sea breaches penetrated ever deeper inland. Over the centuries, part of the peat was eroded by tidal channels: in the 13th century, central Zeeland consisted of a series of islands, with between Walcheren and Zuid-Beveland a vast tidal area, approximately 10 km wide, consisting of salt marshes, tidal flats, shoals and tidal gullies. At the geosite, two tidal channels ran from north to south: the Looyve on the west side and the Kamer on the east side. In between were large sandflats and a few salt marshes: Heinkenszand and Ovezande, approximately at the location of the current villages with the same name. Where the tidal channels converged in the south and bent to the east, they merged into one large channel that formed the connection with the Western Scheldt: De Zwake.

Land reclamation

De reclamation of the region began in the 13th century: in the year 1289 a ring dike was constructed on one of the salt marshes between the two main tidal channels. This surrounded the first polder in the tidal area: the *Ouwelandpolder* (old land polder). In the following century, the

Kamer silted up and the area was gradually reclaimed. Around 1400 only a 300-metre-wide channel was left of the Kamer, which was then dammed on both sides. The *Ouwelandpolder* was thus connected to the eastern island: the *Brede Watering Bewesten Yerseke*.

In the year 1441, between the Schenge in the north and De Zwake in the south, approximately 1,530 hectares of salt marsh were diked in a complex of 21 small polders. The Looyve, the tidal channel on the west side of the Ouwelandpolder, was also completely dammed in 1445. In the middle of the 15th century, the connection between De Zwake and the Western Scheldt was also closed. Reclamation of the tidal area west of the Looyve only occurred in the following centuries. The former channel de Kamer between the dams is still recognizable as a low-lying zone in the landscape. Today only the *Schouwerweelsche watergang* remains as a remnant of the originally several kilometers wide channel.

Formation of kolk lakes

By the reclamation of the tidal area during and after the Late Middle Ages, man formed new land. But that reclamation was not without a struggle. The dikes surrounding newly reclaimed land were always exposed to open water. Under the influence of weather and tides, these sea dikes sometimes breached. As a result, the water plunged forcefully into the area behind the dike. Where the dike collapsed, the vortex created a kolk hole (called *weel* in the region).

When the dike breach could be repaired quickly, the dimensions of the kolk hole remained limited. In the small kolk lakes of this geosite, that was probably the case. When tides have access to the area behind the dike for a longer period of time, they erode the inland and the salt marsh or tidal flat on the sea side of the dike and form a channel. If not prevented by humans, the polder behind it will drown and the channel can develop into a new tidal inlet.

NB. The Zwaakse Weel, a recreation area and geosite to the southeast of this area, has a misleading name. This geosite is not a dike breach, but a remnant of a tidal channel.

Recognizing dike breaches

Most dikes are constructed in relatively straight lines. However, after a dike breach, people usually chose the easiest way to repair the dike: with a bend around the deep kolk lake. The new dyke was constructed landward or seaward of the hole. Former dike breaches can therefore be recognized by the round lakes just behind or in front of the dike, as well as by irregular bends in the dike itself.

A clear example is the Brilletjesdijk, northwest of Ovezande. No fewer than four kolk lakes are present here along a less than one-kilometre-long stretch of winding dike. Two of the breaches occurred so close to each other that the kolk pools now form a figure-eight shaped lake. Such overlapping kolks are sometimes referred to as '*brilletjes*' (glasses), hence the name Brilletjesdijk.

The Oudland of Nisse

The elevation map shows that the village of Nisse is located much lower than the surrounding tidal area, which was reclaimed later. This is because Nisse is located on the southwest side of the former island of the 'Brede Watering Bewesten Yerseke'.

The *Brede Watering Bewesten Yerseke* is one of the oldest and largest polders in Zeeland. The area has hardly been influenced by the sea for many centuries. This type of land is therefore called *Oudland* (old land). Because the land has been diked for so long, hardly any new sediment (sand and clay) has been deposited here by the sea for centuries. In the surrounding area that was diked only later (the *Nieuwland* or new land), sediment accumulation lasted much longer. As a result, the polders of the Looyve, the Kamer and the Zwake (Nieuwland) are at a higher elevation than the Oudland.

Nisse itself is located a bit higher than its immediate surroundings. This is due to its location on a wide creek ridge that runs through the Oudland. Sand was deposited in a former tidal channel, while clay was deposited on a peat layer outside the channel. The sand has kept its volume, but in the centuries since the area was diked, the surface of the surrounding clay-covered peatland has lowered due to compaction of the underlying peat. As a result, the former channel with its banks is now higher than the surrounding landscape.

Relation with other geosites

- De Poel – peat extraction in the *Oudland* of the *Brede Watering Bewesten Yerseke.*
- Yerseke and Kapelse Moer – peat extraction in the *Brede Watering Bewesten Yerseke.*
- Veerse Meer – connected this former tidal area with the North Sea.
- Schenge – connected this former tidal area with the Eastern Scheldt.

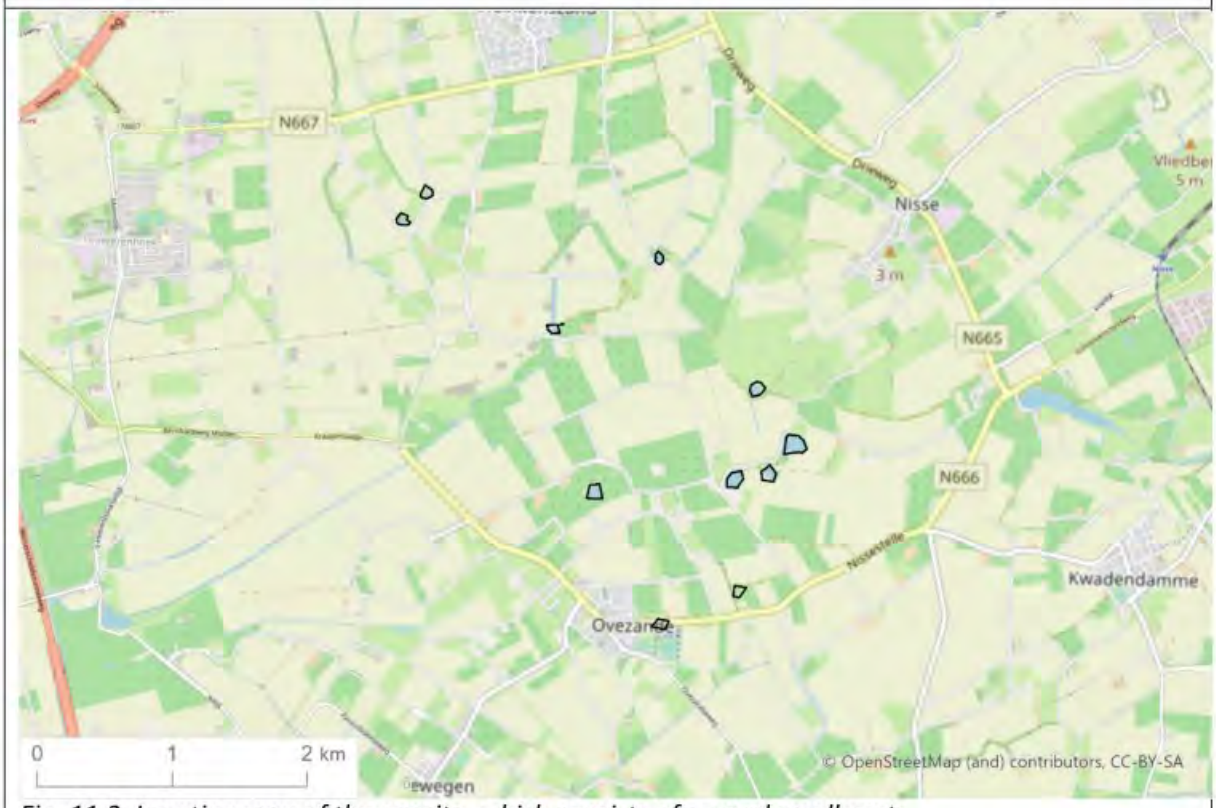

Fig. 11.2. Location map of the geosite, which consists of several small parts.

Fig. 11.3. Elevation map (AHN) with indication of individual elevation points.

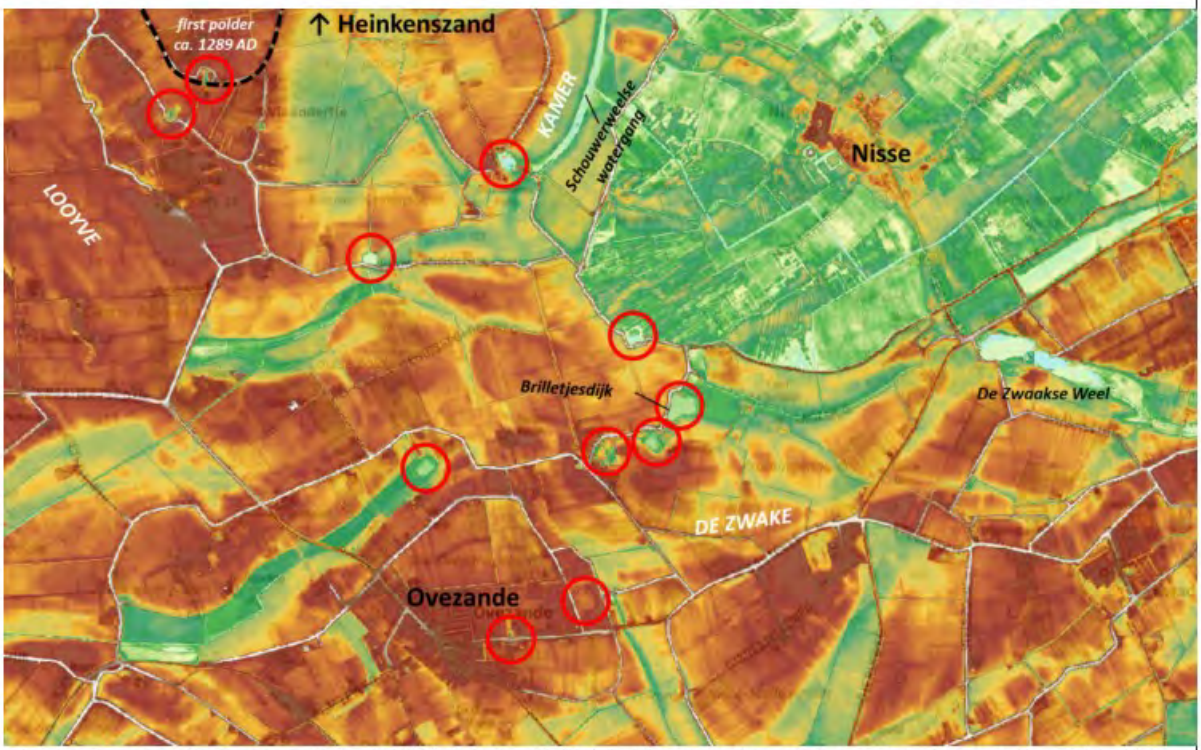

Fig. 11.4. Overview map of the kolk lakes included in the geosite, with toponyms mentioned in the text, former tidal channels and the first polder ('eerste polder').

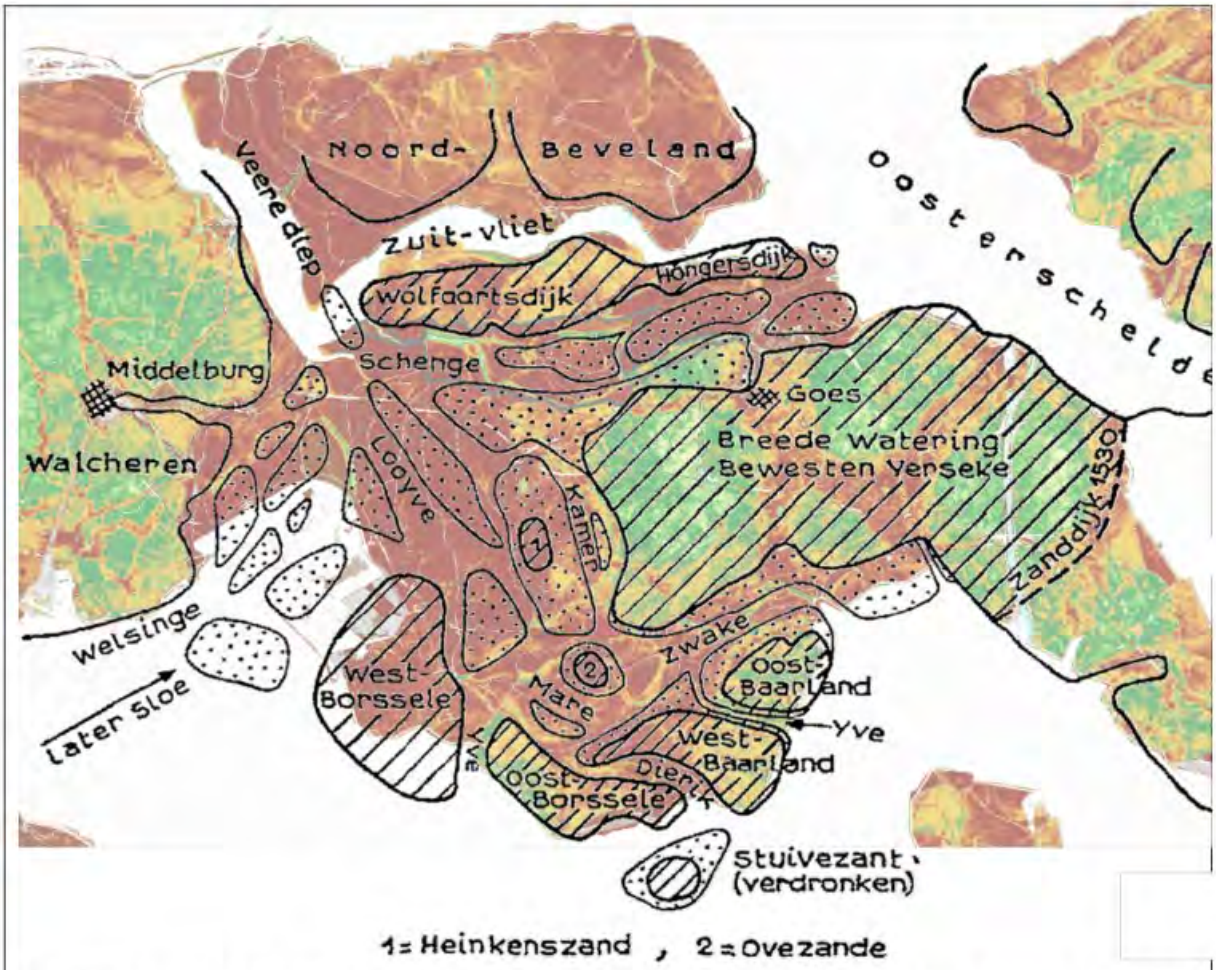

Fig. 11.5. Overview map of the tidal area and the former islands surrounding the geosite. Outline of Zuid-Beveland in the Middle Ages from Wilderom (1968), projected on the AHN2 elevation image. Note that the old island cores are lower (green colours) than the intermediate tidal area that was subject to more accretion (reddish colours).

Fig. 11.6. Kolk lakes along the Brilletjesdijk.

Documentation

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Zeeland (SW Netherlands). Mededelingen Nederlands Instituut voor Toegepaste Geowetenschappen TNO 59, Haarlem, 5 - 109.
- Vos P.C. & Zeiler F.D., 2008. Overstromingsgeschiedenis van Zuidwest-Nederland, interactie tussen natuurlijke en antropogene processen. Grondboor & Hamer 62 (3/4), 86-95.
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Geosite n°12	**Yerseke and Kapelse Moer** Old land and authentic Zeeland polder landscape from the 12th century.
 Fig. 12.1: Map of Geopark Schelde Delta. Yerseke and Kapelse Moer is number 12.	**Scientific importance and the valuation of the geosite** In the past century, many peat extraction areas have been levelled and reparcelled. The Yerseke and Kapelse Moer are special because the authentic twelfth-century polder landscape has been better preserved and is still visible. The geosite is a geologically valuable area of the Province of Zeeland, national importance. Next to this, it has a status of geologic monument.
Municipality	Kapelle, Reimerswaal
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Zeeland, Natura-2000, provincially valuable landscape
Site management organizations	Staatsbosbeheer; Stichting Het Zeeuwse Landschap
Accessibility	The area is only accessible from July 15 until October 15.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Educational programme for children - Routes that one can travel independently
Teaching equipment	Walking (guided and unguided) walking routes with information panels.

Code	**Significance**
G-12	National
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: Embanked in 12th century AD and part of one of the oldest polders in the Geopark, this is a rare example of an area of 'old land' ('Oudland') where the original small-scale irregular relief resulting from medieval peat extraction and salt production is preserved and still visible.	
Sedimentology: not applicable.	

DETAILED DESCRIPTION

1. **Location**

The Yerseke and Kapelse Moer is situated between the Western Scheldt (Westerschelde) and the Eastern Scheldt (Oosterschelde) on both sides of the Zuid-Beveland Canal at an elevation of approximately -1.5 to +0.5 m NAP. They have a combined area of 5 km^2 and originally formed one connected area on the old island core in the *Brede Watering Bewesten Yerseke* polder. In the Middle Ages, the area was intensively used by man for salt production. The authentic twelfth-century polder landscape has been very well preserved here, in contrast to the surrounding area.

2. **Landscape formation**

Origin of the landscape

The barren glacial landscape at the end of the Pleistocene got covered by tidal deposits (sand and clay) in the warmer Holocene as a result of the melting ice sheet and rising sea levels. Initially the coast was open: there was no barrier protecting the inland from marine influence.

In the course of the Holocene, the rate of sea level rise decreased and about 3800 years ago an almost closed coastal barrier of beach ridges and dunes formed. Because of this higher zone along the coast, the hinterland was protected from the tide and a large brackish water swamp developed that later became fresh and in which peat accumulated. This way, a vast peat area developed in Zeeland, forming an up to several metres thick peat layer that could protrude far above the high-water level at the time.

From about 2600 years ago, the protective coastal barrier was locally breached and the marine influence increased once again. Especially since Roman times, sea breaches penetrated ever deeper inland. Over the centuries, part of the peat was eroded by tidal channels. There was no such deep erosion on the island core on which the Yerseke and Kapelse Moer are located. Here the sea only deposited a thin layer of sediment (clay and sand) on the peat, which got buried and increasingly compacted.

Oudland

The *Oudland* (old land) of Zuid-Beveland is formed as an old tidal landscape from before common era, in which marine influence has been relatively limited since its formation. Areas such as this, which experienced little erosion after breaching of the coastal barrier are considered *Oudland*. The Oudland of Yerseke and the Kapelse Moer was diked in the 12th century. It is part of the former island of '*Brede Watering Bewesten Yerseke*' - one of the oldest polders in Zeeland.

No large-scale erosion did occur on the *Oudland* after the breaching of the coastal barrier, but the island core has been incised in several places by tidal creeks. Due to the stronger current in the creeks than outside, part of the peat has been washed away and sand has been deposited in the creeks. Outside the creeks, the flow rate of the water was lower and mainly clay was transported and deposited on top of the peat. Over the centuries, the peat and clay outside the creeks compacted, thus decreasing the land surface there. Compaction affected the sandy channel fills much less. That is why the former channels are now higher in the landscape and form so-called creek ridges. The low-lying clay-covered peatlands outside the creek ridges are called *poelgronden* in the region. The geosite is situated in such clay-covered peatland, which is surrounded by some larger creek ridges.

NB. The areas that developed after 1000 AD and were often embanked after 1200 AD are called Nieuwland *(new land).* Nieuwland *is relatively high in the landscape, because the sea has been able to deposit sediments there for a long time.*

Peat extraction and salt production

When the peat in the region was flooded by seawater after breaching of the coastal barrier, salt was left behind in the peat. The peat was therefore not only suitable as fuel, but also for salt production. The extraction of peat for salt production is called *moernering*, *selnering* or *darinkdelven* in the region.

Initially, the extraction of the peat under the clay layer was not yet regulated. This is called 'wild' *moernering*. After digging away the peat, a bumpy terrain was left behind that was hardly usable anymore as agricultural land. Locally, this is also referred to as a *hollebollig* (concave-convex) landscape.

During later, and better regulated, peat excavations, rectangular blocks or long and narrow strips were dug out. The layer of young marine clay was first dug out. Between the pits, a strip of peat remained, on which the excavated clay was placed. That strip also served as a water barrier for the adjacent pit. The peat under the clay layer was extracted. The unevenness in the landscape due to this type of peat extraction follows more regular patterns.

Effects of peat extraction

Peat excavation locally has a major effect on the landscape. The land surface becomes more irregular and the average surface elevation is lowered. The intensive excavation leads to drainage problems, local differences in humidity, vegetation and later land use.

Outer dike peat extraction could lead to destruction of the foreland of the dike, increasing the risk of dike damage during storm surges. By extracting peat within the dikes, the sea could penetrate deeper into the country in the event of breaches. It is thought that the disastrous dike breaches of the St. Elizabeth's Flood in 1421 may have been partly the result of peat extraction. Peat extraction is also said to have contributed to the drowning of the Land of Reimerswaal (het Drowned Land of Zuid-Beveland, now in the Eastern Scheldt) east of Yerseke.

Due to the extensive damage to the landscape, peat extraction was bound by rules and even banned at the end of the Middle Ages. Many affected areas have been levelled and reparcelled on a large scale in the past century. The Yerseke and Kapelse Moer are therefore special: the authentic twelfth-century polder landscape can still be seen here.

Relation with other geosites

- Eastern Scheldt – The area Drowned Land of Zuid-Beveland (the former polder *De Brede Watering Beoosten Yerseke)*, lost to the tides in the 16th century.
- *Oudland* area De Putting – peat extraction landscape on Zuid-Beveland.
- *Oudland* area De Poel – peat extraction landscape in Zeeuws-Vlaanderen (Zeelandic Flanders).

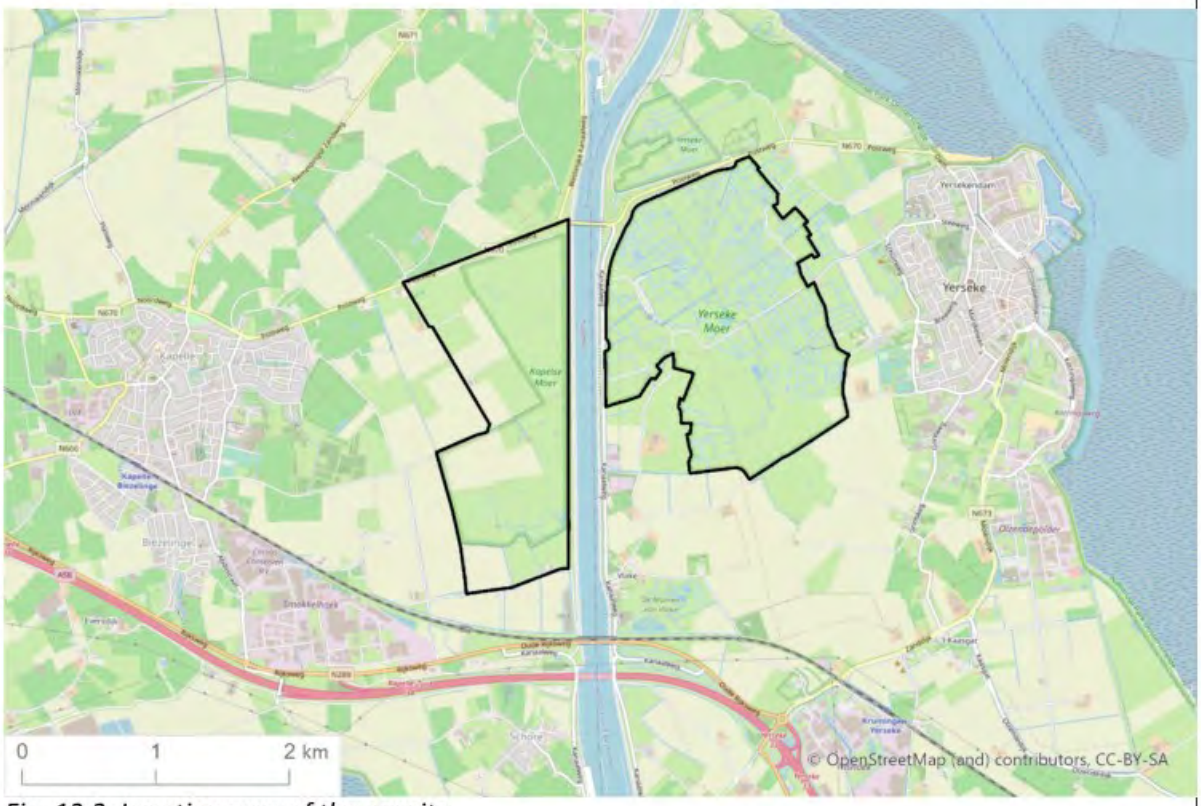

Fig. 12.2. Location map of the geosite.

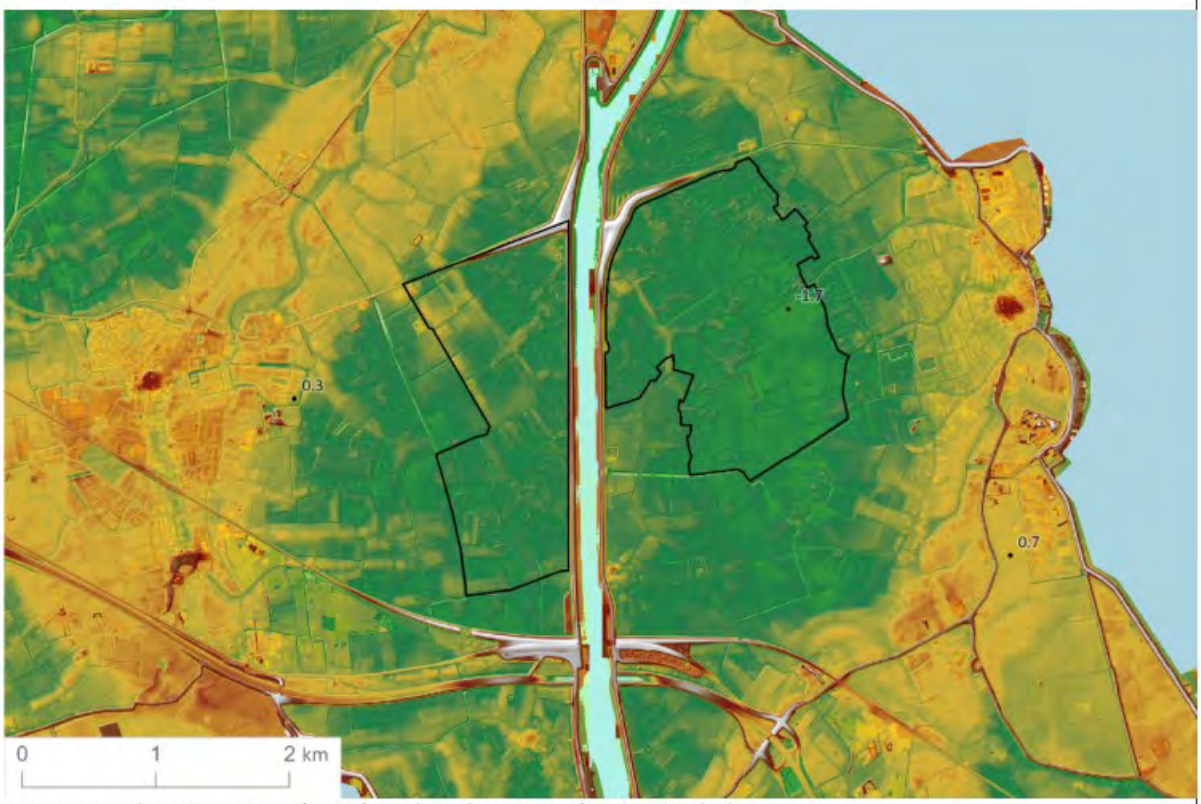

Fig. 12.3. Elevation map (AHN) with indication of individual elevation points.

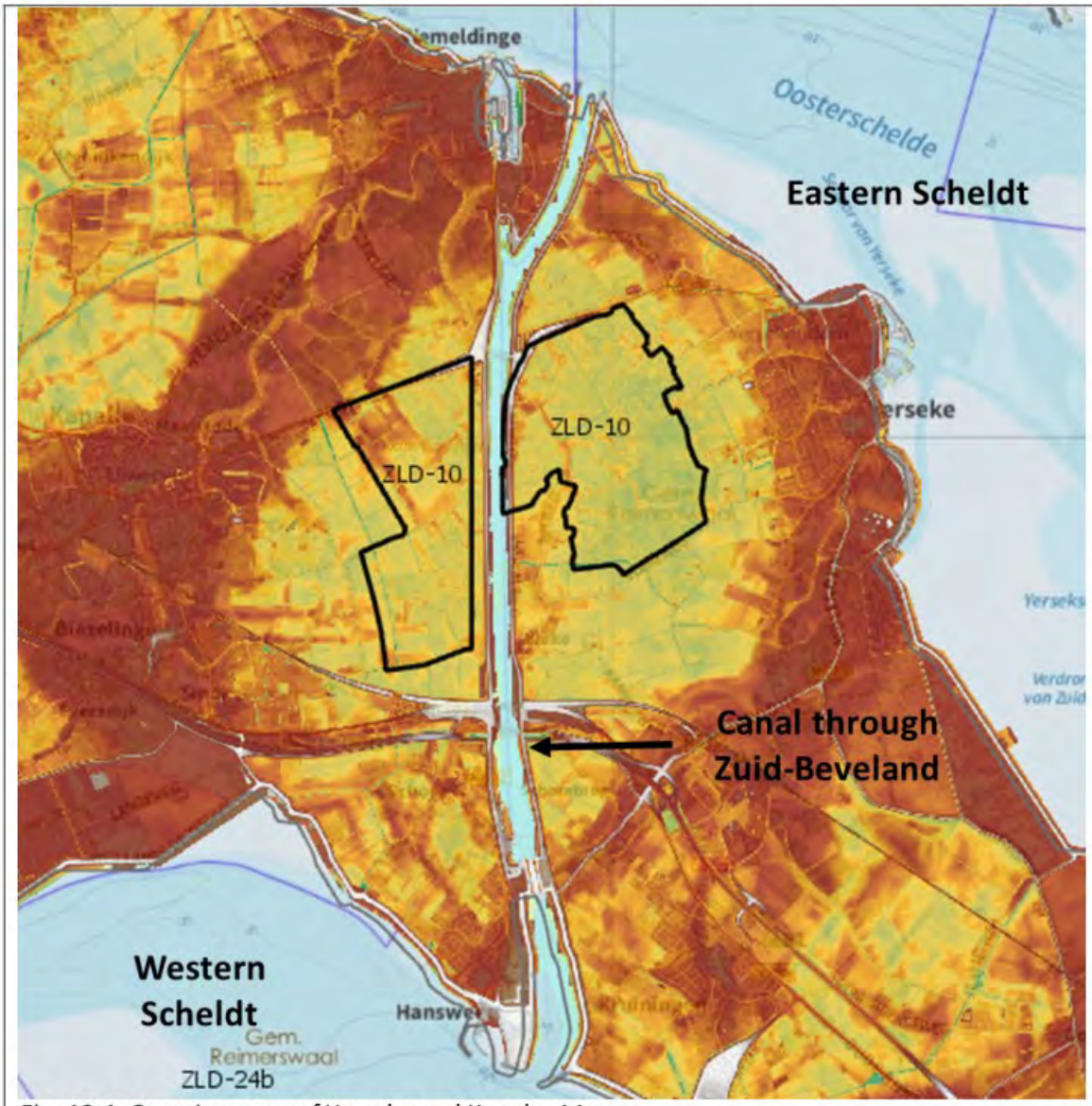

Fig. 12.4. Overview map of Yerseke and Kapelse Moer.

Fig. 12.5. Hollebollig (concave-convex) landscape of the Kapelse Moer (photo: Ben Biondina, beeldbank.zeeland.nl)

Documentation and resources

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- Vos P.C. & Zeiler F.D., 2008. Overstromingsgeschiedenis van Zuidwest-Nederland, interactie tussen natuurlijke en antropogene processen. Grondboor & Hamer 62 (3/4), 86-95.
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Geosite n°13	**13. Markiezaat** From drowned land to wetland.
 Fig. 13.1. Map of Geopark Schelde Delta. Markiezaat is number 13.	**Scientific importance** Markiezaat is a geologically valuable area of the Province of Noord-Brabant. It is an example of a former tidal area that has been fossilized due to the disappearance of tidal activity and is has now become dry land, where the former landforms no longer correspond to current processes. The area can serve as a 'field laboratory' to demonstrate and study the effects of the disappearance of tidal activity on the development of a former tidal area, not only on a geologically but also ecologically and pedologically. The patterns of the former tidal channels and creeks are still recognizable in the area. The current processes of hydroseral succession, soil maturation and desalination are also clearly visible. De Duintjes are peculiar as young coastal dunes that have formed far inland in an estuary.
Municipality	Reimerswaal, Bergen op Zoom, Woensdrecht
Province and country	Noord-Brabant, the Netherlands
Protection status	Natuurnetwerk Brabant, Natura-2000, provincial geologically valuable area, cultural-historical valuable area
Site management organizations	Het Brabants Landschap
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center - Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Visitor center - Excursions/guided tours - Routes that one can travel independently - Educational programme for children
Teaching equipment	Walking (guided and unguided) tours. Markiezaat Duintjes is part of Natuurpodium Brabantse Wal and Bezoekerscentrum de Kraaijenberg.

Code	**Significance**
G-13	National
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	

Geomorphology: Although tidal influence has stopped due to human intervention, the former tidal landscape retains many features of its active state and the patterns of the tidal channels dissecting the former salt marshes are still recognizable. De Duintjes are peculiar as young coastal dunes that have formed far inland in an estuary but are also no longer active.

Sedimentology: The area can serve as a 'field laboratory' to demonstrate and study the effects of the disappearance of tidal activity on the development of a former tidal area, where new dynamic processes such as soil maturation and compaction, desalination and hydroseral succession are clearly visible.

DETAILED DESCRIPTION

1. Location

The geosite Markiezaat is located in the west of the Province of Noord-Brabant, immediately southwest of Bergen op Zoom, on the territory of the municipalities of Bergen op Zoom, Reimerswaal, Woensdrecht and Tholen. The western part of the geosite belongs to the Province of Zeeland. In the east it borders the geosite Brabant Escarpment (Brabantse Wal) – Kalmthoutse Heide (no. 15).

Markiezaat is a former tidal area with salt marshes, tidal flats, shoals and tidal channels and creeks, and a small area with young drifting dunes in the east, against the Brabant Escarpment (Duintjes). Half of the area consists of open water, the Markiezaatsmeer, which is weakly brackish. It concerns a former part of the saltwater tidal area of the Eastern Scheldt, which was closed off from tidal activity and became more fresh after the construction of the Scheldt-Rhine connection. The geosite is about 6.5 km long in a north-south direction and 4.5 km from west to east and is about 2000 ha, of which 1000 ha is open water. The elevation increases from 0.5 m + NAP on the banks of the Markiezaatsmeer to approx. 3 m + NAP at the foot of the Brabant Escarpment in the east. The dried-up salt marsh area in the south is located at a maximum of approximately 2 m + NAP. The highest point is in the Duintjes at about 7 m + NAP. The water level of the Markiezaatsmeer fluctuates between approximately 0.0 m and 0.5 m + NAP. The lake is a maximum of about 3 metres deep and an average of 2.1 metres.

2. Landscape formation

Origin of the landscape

The end of the last ice age: the Scheldt at the foot of the Brabant Escarpment

At the end of the last ice age, the sea level was much lower than it is now and a large part of the North Sea was dry. The area of Markiezaat was part of a vast polar desert. The wind had free rein and deposited a layer of coversand over the entire landscape, with a thickness of 1 to 2 m. The Scheldt flowed at the foot of the Brabant Escarpment from Antwerp to the north, towards the valley of the Rhine and the Meuse. A wide bend of this former Scheldt valley lies at a depth of 10 to 15 m below the tidal flats and salt marshes of Markiezaat.

Rising sea level after the last ice age: tidal deposits, the Eastern Scheldt (Eastern Scheldt) and peat formation.

After the last ice age, the sea level rose rapidly due to the melting of the large land ice sheets. In the coversand landscape of that time, this was first noticeable by a deterioration of the drainage, which resulted in the formation of a peat layer that covered the lowest parts of the landscape (the so-called Basal peat). Around 8,000 years ago, the sea entered the low-lying Scheldt valley at the foot of the Brabant Escarpment near the Markiezaat, which first changed into an estuary with weak freshwater tides and then into a brackish water tidal area with salt marshes, tidal flats and deep tidal channels.

The predecessor of the current Eastern Scheldt developed between 7,400 and 6,300 years ago. An important tidal channel developed from the coast in an easterly direction, approximately at the location of the present Eastern Scheldt. Through Tholen it connected with the northward flowing Scheldt near the Brabant Escarpment, just northwest of the Markiezaat. The Scheldt started to use this shortcut to the sea in a north-westerly direction. The original northern course fell into disuse and was filled in with clay and peat.

Due to the slowdown in sea level rise, around 3,800 years ago an almost uninterrupted beach ridge had formed more or less at the position of the current coastline, and protected the area behind against further intrusions from the sea. Behind this coastal barrier was a large freshwater swamp in which a thick layer of peat accumulated. At the location of the current Eastern Scheldt, a small opening remained, which formed the mouth of the river Scheldt. The Scheldt flowed through the vast peat area like a small meandering river. At the Markiezaat it was no more than 100 m wide and was subject to weak tides or no tides at all.

The sea has returned
From a few centuries before common era, marine influence increased once more. Especially from Roman times, sea breaches entered ever deeper inland. The Scheldt mouth was eroded deeper and wider, but was still much narrower than the Eastern Scheldt as we know it today. The entire coastal plain again became a large tidal area with tidal gullies eroding the peat. Around 300 AD the area of the Markiezaat had once again turned into a tidal flat and salt marsh landscape. Close to the Scheldt and other tidal channels, a relatively thin layer of clay and sand was deposited on top of the peat. Further from the Scheldt, at the foot of the Brabant Escarpment, the peat was still at the surface.

Reclamation and flooding
The embankments along the Scheldt in the area of the Markiezaat already started in the 12th century. The first dikes protected only limited areas. Possibly in response to new floods (e.g. in 1134 AD), these small polders were subsequently connected to form larger entities by building dikes around salt marshes and creeks that were located between the polders. The dike along the village of Hildernisse, already mentioned in 1095, may have had such an age.

The low-lying early polders west of the Brabant Escarpment were used as agricultural land, which led to subsidence due to drainage. Moreover, peat was extracted on a large scale for use as fuel, but also for the economically more interesting production of salt, which had washed into the peat over the centuries. The peat extraction had a major effect on the land, which became wet and attained an irregular surface. Moreover, the extraction of peat, in combination with the drainage of the polders, led to a lowering of the land surface, making the area very vulnerable to flooding.

During storm surges in the 13th, 14th and 15th centuries AD, dike breaches repeatedly occurred in the polders along the Scheldt, but the damage could be repaired relatively quickly. However, the storm surges of 1530 AD (Saint Felix Flood) and 1532 AD had disastrous consequences throughout the region. Large parts of Zuid-Beveland (the current Drowned Land of Zuid-Beveland) and all polders along the Scheldt up to present-day Belgium were lost as a result of these floods. Although parts of the land were temporarily re-embanked, many polders were permanently lost during subsequent floods in 1552 and 1570 AD. In the Markiezaat area, the old village of Ossendrecht, the prosperous Hildernisse, the hamlets of Vijfhuizen and Roversberg and the Emmaus monastery drowned along with the polders. Much of the lost land has never been reclaimed again. The old polder land was incised by channels and creeks which, under tidal influence, deposited sand and subsequently clay on top of the old polders, in tidal flat and salt marsh environments. This salt marsh and creek landscape can still be recognized in the current Markiezaat. Until the 19th century, the tidal flats and salt marshes southwest of Bergen op Zoom were known as the

'Drowned Land of de Markiezaat van Bergen op Zoom'. In the west it connected to the extensive tidal flats and salt marshes of the Drowned Land of Zuid-Beveland, from which it was only separated by the relatively narrow channel that connected the Eastern Scheldt en the Western Scheldt.

Since the development of the Western Scheldt (Westerschelde) in the 9th century AD, the Scheldt had two courses to the sea: via the Eastern Scheldt and via the Western Scheldt. The Western Scheldt became increasingly important compared to the Eastern Scheldt and from the 16th century onwards, it became the main connection of the Scheldt with the sea. Subsequently, the connecting channel between the Eastern Scheldt and the Western Scheldt to the west of the Brabant Escarpment started to silt up quickly. In 1867 AD this channel, the Kreekrak, was closed by a railway dam near Woensdrecht, just south of the Markiezaat, which separated the two Scheldt branches from each other. The Markiezaat area remained part of the Eastern Scheldt as a dynamic tidal area. At low tide, large areas of tidal flats emerged, but at high tide the water reached the foot of the Kraaijenberg, one of the protruding 'capes' of the Brabant Escarpment east of the Markiezaat. During the storm surge disaster of 1953, erosion even took place at the foot of the Kraaijenberg.

The Markiezaat after the damming of the Eastern Scheldt
With the construction of the Markiezaatskade in 1983 and the Oesterdam in 1986, the tidal flat and salt marsh area of the Drowned Land of de Markiezaat van Bergen op Zoom was closed off from the Eastern Scheldt and the natural tidal activity disappeared from the area. Subsequently, the area was further compartmentalized by the construction of the Bergse Plaat residential area (1984) and the Binnenschelde lake (1988). The remaining Markiezaatsmeer gradually became more fresh within a couple of years. The lake level can fluctuate naturally for about 40 cm. On the south shore, extensive, permanently dry former salt marshes are present. Within the shallow lake there is one island, the Spuitkop.

Due to differences in elevation, the former salt marshes, tidal flats and channels are still visible in the current landscape. But the tidal erosion and sedimentation has ceased and the development of tidal landforms has come to a halt. Yet, the landscape is diverse and highly subject to change. Due to differences in elevation and soil composition (sand or clay), the rate of soil desalination varies from place to place. This partly determines the occurrence of new plant species in the landscape. The high salt marshes in particular have become completely fresh, but many low salt marsh and creek soils still have a somewhat saline character, resulting in barren or sparsely vegetated land. Freshwater seepage at the foot of the Brabant Escarpment locally causes faster desalination.

The Markiezaat is now evolving from saltwater tidal area to 'wetland', and from tidal flats and salt marshes to grassland, reed marsh and/or (carr) forest. The vegetation in the former tidal flat area is increasing rapidly, causing the pattern of tidal creeks and channels to become less visible. In the border zone, the contrast between the former tidal area and the sandy dunes will fade as the brackish and low tidal flat and salt marsh vegetation is replaced by freshwater plant communities.

<u>Tidal flats and salt marshes, tidal channels and levees</u>
In a tidal zone, the flood brings in sediment (sand and clay) from the tidal inlets twice a day. Part of the sediment is left behind on the coastal plain. Because sand is heavier and is only transported by fast-flowing water, it is mainly deposited in and along the tidal channels. Between the channels are tidal flats that are flooded at high tide, leaving a thin layer of sand behind. The finer and lighter clay particles can also be transported at low flow rates and mainly precipitate during the reversal from high to low tide. The tidal flats therefore consist of an alternation of thin layers of sand and clay.

The highest parts of the tidal landscape are the salt marshes, which are only flooded at very high water (spring tide and storm surge). Here the water is supplied and discharged via a branched system of small stream channels. On the salt marshes, mainly clay is deposited. These are often vegetated with halophytic (salt-tolerant) plants. A salt marsh is called schor in the region, but is also known as kwelder or gors elsewhere in the Dutch coastal area.

There are also elevation differences within the salt marsh. For instance, so-called levees can form on the banks of the channels that overflow during high tide. This happens because the flow velocity of the water that overflows the banks suddenly decreases. As a result, the water no longer has enough energy to transport sand that was in suspension in the channel, and the sand gets deposited on the bank. This process forms a slightly higher zone directly along the channel. Further away from the channel, lighter and finer material is deposited. As a result, depressions filled with clay are formed at a distance from the channel.

Especially in the southern part of the Markiezaat, levees and depressions can still be recognized in the former salt marsh surface, with an elevation difference of 0.5 to 1 m.

<u>De Duintjes</u>
De Duintjes are located at the foot of the Brabant Escarpment, between the former tidal flat and salt marsh area of the Markiezaat in the west and the Brabant Escarpment in the east. It is a small coastal dune area that reaches up to ca. 7 m + NAP, while the surrounding surface level is at ca. 2 m + NAP.

De Duintjes probably developed as coastal dunes on the former shore of the Eastern Scheldt, after the loss of the polder land to the west of the Brabant Escarpment due to the 16th century storm surges. The sandy tidal flats of the Drowned Land of de Markiezaat van Bergen op Zoom then reached up to the foot of the Brabant Escarpment. The predominant south-westerly to westerly winds picked up sand from the tidal flats at low tide and blew it up to the foot of the Brabant Escarpment into a small dune massif. This process was stopped by the damming of the Markiezaat in 1983. The former tidal flats and salt marshes desalinized and the vegetation has been expanding ever since, resulting in less impact by the wind on the sand. The dunes are no longer actively built up by the supply of new sand. Like the Markiezaat itself, they are a 'fossil' relief phenomenon, in this case formed by the processes of erosion, drifting and deposition of sand by the wind that are no longer active in this area.

<u>Relation with other geosites</u>
- The geosite Markiezaat previously belonged to the Eastern Scheldt, on which it borders to the west.
- The development of the area shows clear parallels with the Drowned Land of Zuid-Beveland, (also part of the Eastern Scheldt geosite).
- In the east, the area borders on the geosite Brabant Escarpment – Kalmthoutse Heide. It is located at the foot of the Brabant Escarpment.
- The Dintelse Gorzen geosite is a comparable former tidal area from which tidal activity has disappeared.

Fig. 13.2. Location map of the geosite.

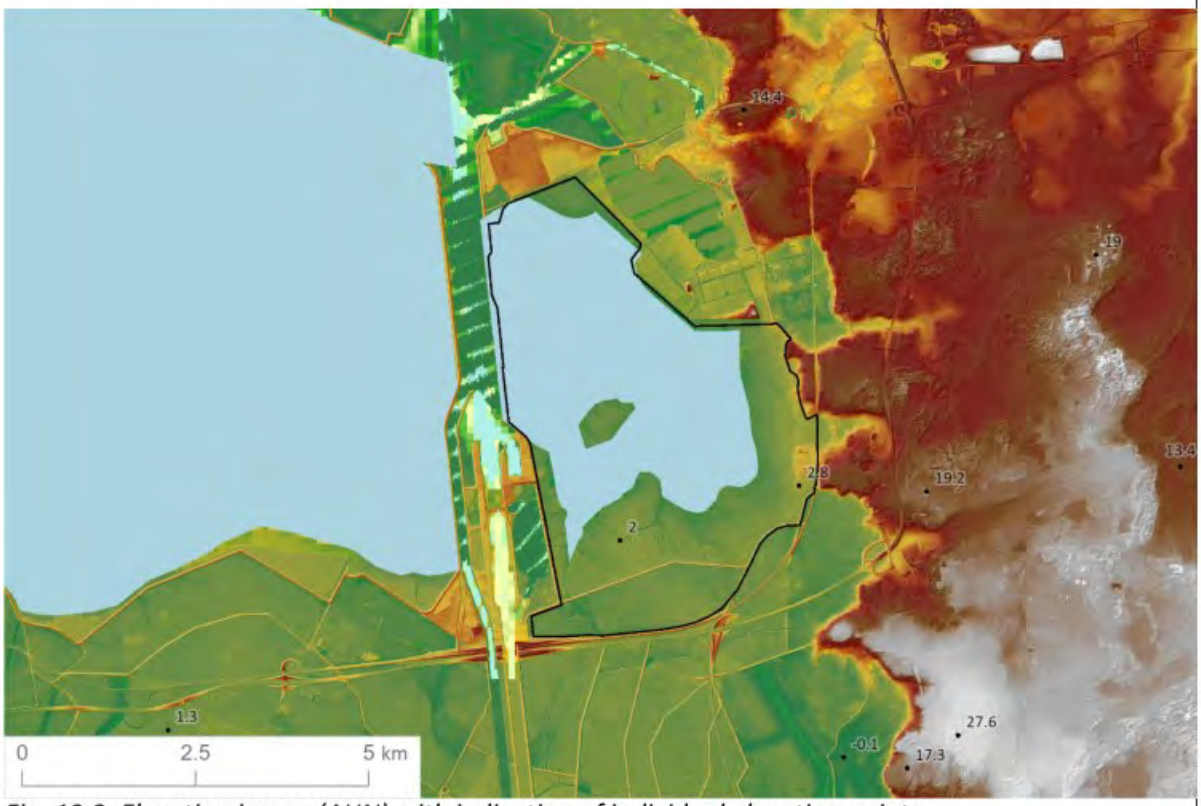

Fig. 13.3. Elevation image (AHN) with indication of individual elevation points.

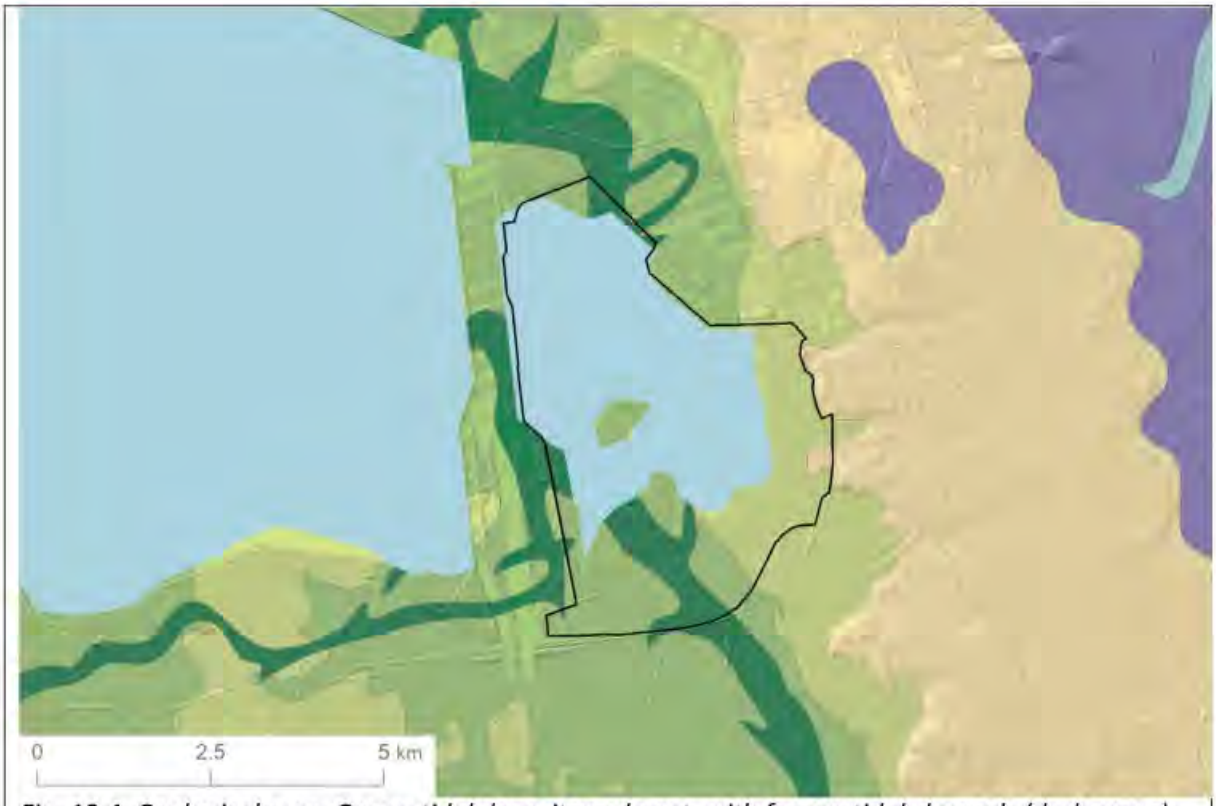

Fig. 13.4. Geological map. Green: tidal deposits and peat, with former tidal channels (dark green) (Holocene); yellow: driftsand deposits (Holocene) and river dune deposits (Late Pleistocene); purple: fluvial and estuarine deposits (Early and Middle Pleistocene, mostly Waalre Formation); light grey blue (upper right): brook deposits (Holocene); light blue: water.

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- Bureau Lantschap, 2009. Ontgonnen verleden - Regiobeschrijvingen provincie Noord-Brabant. Ministerie van Landbouw, Natuur en Voedselkwaliteit Directie Kennis, Ede, Rapport DK nr. 2009/dk116-K, 177 pp.
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Geosite n°14	**Smalle Beek Valley** Remarkably deeply incised stream valley in a glacial coversand landscape
 Fig. 14.1. Map of Geopark Schelde Delta. Smalle Beek Valley is number 14.	**Scientific importance and valuation of the geosite** The stream valleys of the Smalle Beek and Het Loopje are clearly visible in the open, slightly undulating coversand landscape near Wouw. The stream valley incisions are deeper and the stream valley slopes steeper than those of stream valleys in other parts of North Brabant, due to the presence of resistant clay of the Waalre Formation close to the surface and the general slope of the landscape to the north. Smalle Beek Valley is a geologically valuable area of the Province of Noord-Brabant.
Municipality	Steenbergen, Roosendaal
Province and country	Noord-Brabant, the Netherlands
Protection status	AHS Landschap, NLRE landschap, provincial geologically valuable area, Natuurnetwerk Brabant, ecological connection zone, Groenblauwe Mantel
Site management organizations	Waterschap Brabantse Delta, Municipality Roosendaal
Accessibility	Site is accessible to the general public.
Relevance for tourism	Routes that one can travel independently.
Relevance for education	Information panels.
Teaching equipment	Unguided walking tours along information panels.

Code	**Significance**
G-14	National
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: The stream valleys of this geosite are clearly visible in the open, slightly undulating coversand landscape, as they are incised deeper and their slopes are steeper than those of streams in other parts of the coversand region in the southern Netherlands and north Belgium, due to the presence of resistant early Pleistocene clay close to the surface.	
Sedimentology: not applicable.	

DETAILED DESCRIPTION

1. **Location**

The geosite Smalle Beek Valley is located in West Brabant, on the territory of Roosendaal, 4 to 6 km west of the city center (Fig. 14.2). The relatively small area, about 6 km long in a north-south

direction and between 2.5 km and 500 m wide, includes the brook valleys of the Smalle Beek (west of Wouw) and its tributary Het Loopje (north of Wouw) and parts of the adjacent coversand landscape.

The brook valleys of the Smalle Beek and Het Loopje drain to the north, following the general slope of the landscape. Approximately 1 km north of the geosite boundary, the Smalle Beek flows into the marine clay polders of Northwest Brabant, a few kilometers south of the Polder Cruijsland In the southern end of the geosite, the elevation of the base of the Smalle Beek valley is at approximately 6 m + NAP. It descends down to 2.5 m + NAP west of Wouw and to 0.5 m + NAP in the northern end of the area. The stream valley of Het Loopje descends from about 3 m to 1 m + NAP at its mouth in the Smalle Beek. The watersheds between the stream valleys, usually located just outside the geosite boundaries, are at 10 to 11 m + NAP in the south and at 4 to 5 m + NAP in the north (Fig. 14.3).

2. **Landscape formation**

Origin of the landscape

An estuary of the Rhine, Meuse and Scheldt

In the Smalle Beek area, very old clay and sand layers are present close to the surface. About 2 million years ago, at the beginning of the Pleistocene, the area was part of the large estuary of the Rhine and Meuse, into which the rivers of the Scheldt Basin also flowed from the south. The tidal area at that time probably resembled the Eastern Scheldt before the Delta Works. Between 2 and 1.6 million years ago, an alternation of sandy and clayey layers was deposited in this estuary. These are now buried several metres below the surface (Waalre Formation) (Fig. 14.4). The Brabant Escarpment (geosite 15) is made up of the same deposits.

Erosion during the Pleistocene glaciations

After the deposition of the Waalre Formation, the course of the Rhine and the Meuse moved to the northeast and disappeared from the area. Meanwhile, rivers of the Scheldt basin in West Brabant continued to deposit tens of metres thick layers of fine sand, loam and clay. From about 1 million years ago, the surface of West Brabant gradually rose and most of these deposits were eroded again by small streams and by the wind during successive ice ages. In the area of the Smalle Beek there are still several metres thick remnants of these old Scheldt deposits.
From the long 1.5-million-year period between these Early Pleistocene deposits and the coversands from the last glacial, usually only a thin layer of gravel remains at the interface between both. The gravel mainly consists of quartz and flint and its particle size is up to a few centimeters. This gravel layer is the last remnant of the thick layers that were deposited on top of the Waalre Formation more than a million years ago by the rivers from the Scheldt Basin. The gravel, also called 'Scheldt gravel', was left behind after the finer components of these deposits were washed away by streams or blown away by the wind.

The end of the last ice age: coversand and changing streams

At the end of the last ice age, West Brabant was part of a vast polar desert. In the dry and cold climate, the wind deposited a 1 to 2 m thick layer of coversand over the entire landscape. The streams flowed through wide valleys and had a so-called ‘braided’ pattern, with many channels that carried a lot of water in a short time but were nearly dry for much of the year (Fig. 14.5). In the cold glacial conditions, a lot of water was released in the summer due to the melting of snow and ice. Because the subsoil was frozen, all this water was quickly drained over the surface, taking large amounts of sand and loam with it. During this time of the year, the river valley was largely under water and the channel positions moved quickly. Sand ridges were repeatedly eroded and rebuilt elsewhere.

During the lateglacial, from about 14,500 to 12,000 years ago, the climate started to warm – albeit with intermittent cold peaks. Vegetation increased and the frozen subsoil thawed. Groundwater flows became more important for water drainage, which became much more gradual. The streams therefore changed from braided to meandering systems with a single channel and clear bends (Fig. 14.6). During wet periods, the streams still had much greater peak discharges than they do now, causing them to cut deep into the subsoil. Therefore, beneath the current valley floor in the stream valleys of Brabant, we can find remains of a deep and narrow channel, which can be 6 metres deep even in small brook valleys such as the Smalle Beek, but only a few tens of metres wide.

The Holocene: formation of the current stream valleys
With the rapid climate improvement at the beginning of the Holocene, about 12,000 years ago, the water discharge decreased sharply. As a result, the stream valleys gradually filled with fine deposits such as sand, loam and peat. These flattened the relief, so that in the current landscape there's nothing left to see of the deep lateglacial incision.

In the Holocene, a thick layer of peat covered large parts of the West Brabant coversand landscape. However, this did not happen in the valleys of the Smalle Beek and Het Loopje. The largest peat bogs were in areas with poor drainage such as flat watersheds. However, the relatively high and steep valley slopes of the Smalle Beek ensured good drainage, despite the presence in the subsoil of the poorly permeable clay layers of the Waalre Formation. Peat only accumulated in the low and wet valley itself.

The naturally meandering course of many brooks in Brabant has been straightened by man. This also happened to the Smalle Beek and Het Loopje in the 1930s.

<u>Deep stream valleys</u>
The stream valleys of the Smalle Beek and Het Loopje are, by Dutch standards, remarkably deeply incised into the surrounding coversand landscape. The elevation difference is about 2 to 4 m. The slopes of the stream valleys are clearly visible and the landscape shows a striking undulating relief. This is especially the case where the valley of the Smalle Beek is narrow, such as immediately west and southwest of Wouw. North of Wouw, between the Smalle Beek and Het Loopje, we find 'De Donken', an arable complex on coversand with a clear convex relief. Its highest point (5.5 m + NAP) protrudes 4 m above the lowest parts of the surrounding stream valleys. Elevation differences of 4 to 5 m between the stream valley and the higher watersheds (which are mostly located just outside the boundaries of the geosite) can also be found along the Smalle Beek in the southern part of the geosite.

The valleys of the brooks in the West Brabant coversand area generally have steeper slopes and are somewhat deeper than those elsewhere in North Brabant. There are several reasons for these differences. The valley incisions are not the result of the small present-day streams, but were created during the ice ages (see above), by braided meltwater flows that transported a lot of sand and loam. In a large part of West Brabant, old, resistant clay layers of the Waalre Formation are present under the thin coversand layer. Clay less easily eroded than sand, so the slopes were less flattened. As a result, the streams have incised deeper and moved less laterally (which would have resulted in wider valleys). Moreover, the area has a relatively high elevation and a fairly steep slope to the north, so the streams have a greater slope in that direction. As a result, the water flows faster and the stream incises deeper.

<u>Relation with other geosites</u>

- Brabant Escarpment (Brabantse Wal): the Pleistocene deposits that are present close to the surface in the area of the Smalle Beek are visible in former quarries in the area of the Brabant Escarpment.

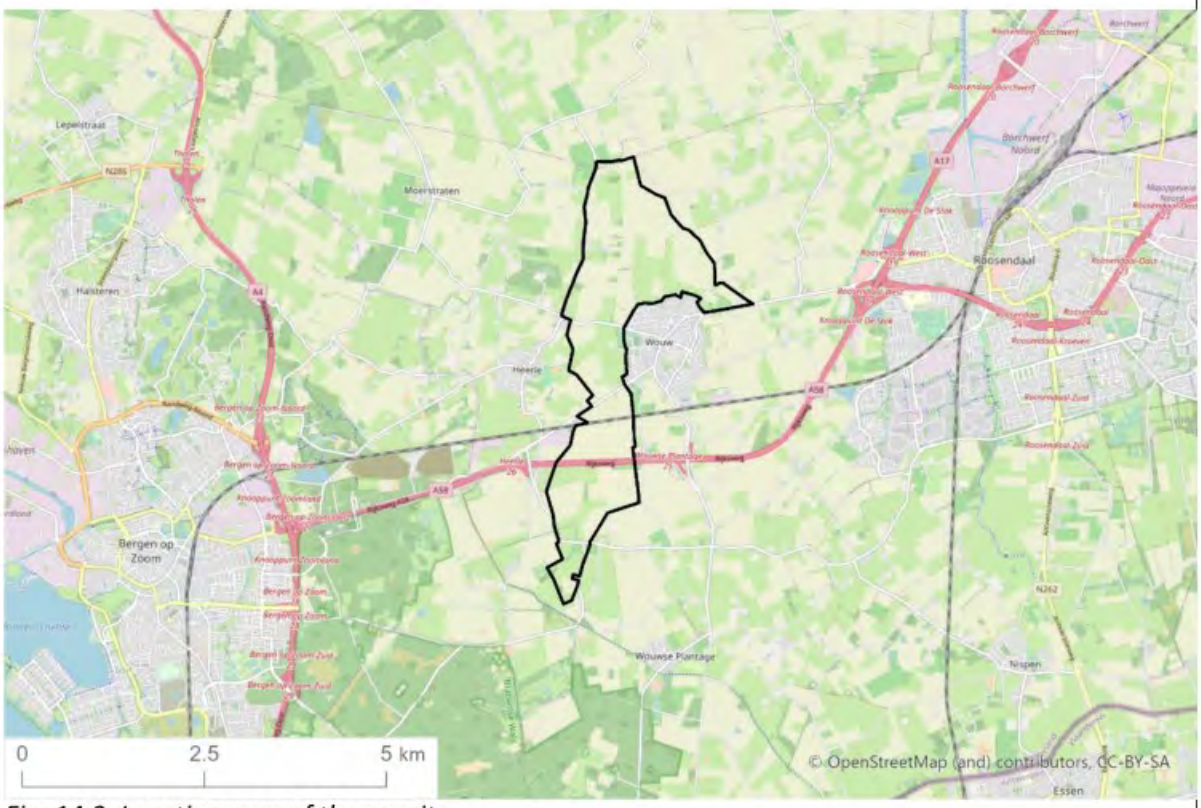

Fig. 14.2. Location map of the geosite.

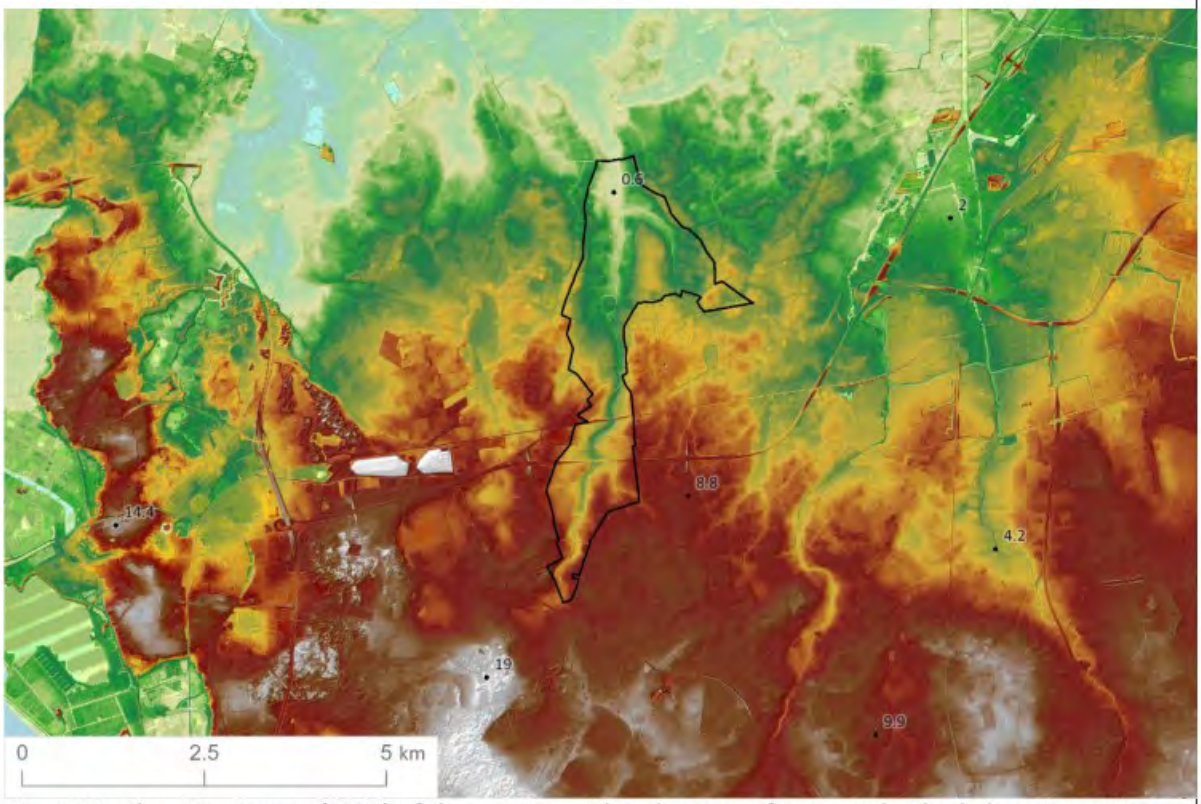

Fig. 14.3. Elevation image (AHN) of the geosite with indication of some individual elevation points.

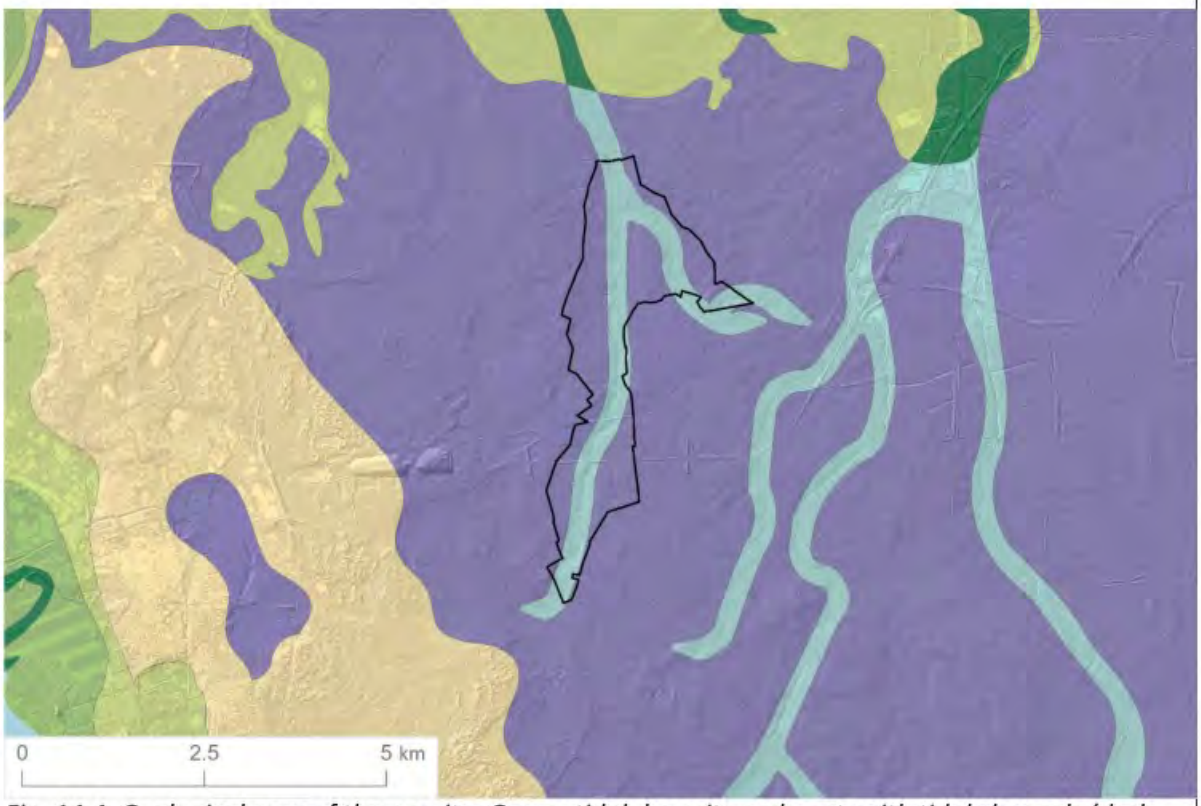

Fig. 14.4. Geological map of the geosite. Green: tidal deposits and peat, with tidal channels (dark green) (Holocene); yellow: drifting sand deposits (Holocene) and river dune deposits (Late Pleistocene); purple: fluvial and estuarine deposits (Early and Middle Pleistocene, mainly Waalre Formation); light grey-blue: brook deposits (Holocene).

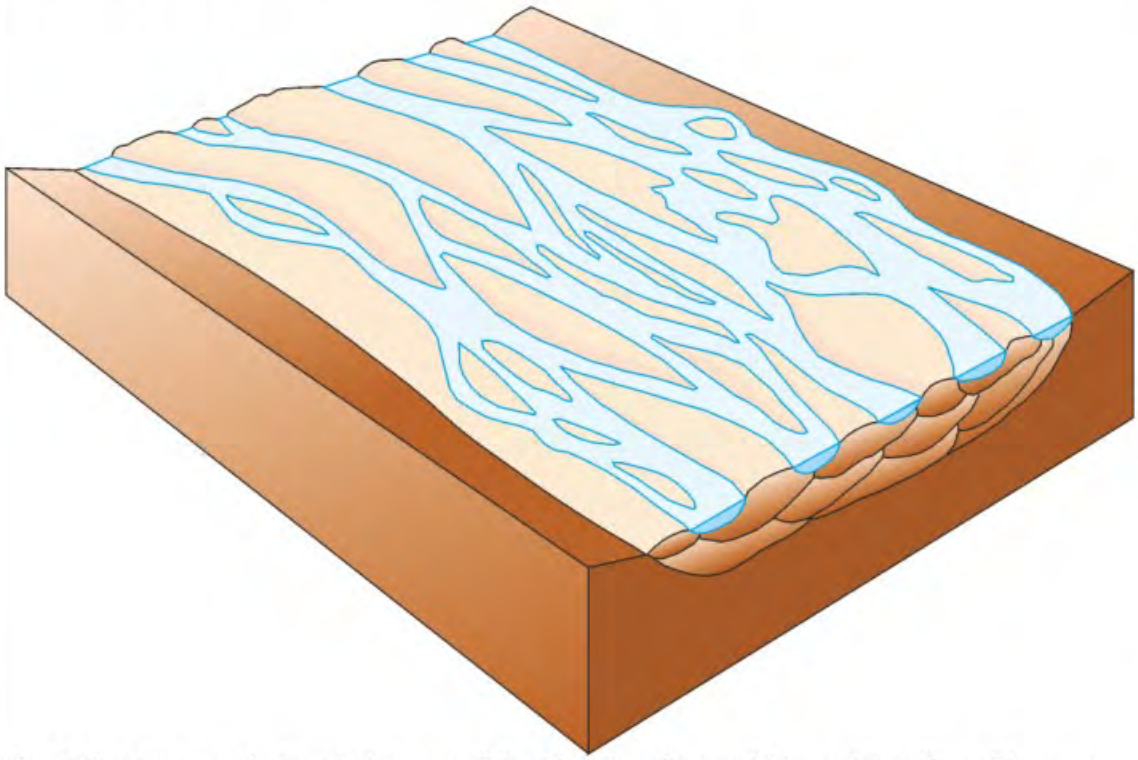

Fig. 14.5. Diagram of a braided stream. A braided river flows within a wide valley with many channels that are mostly dry during much of the year. During wet periods (see diagram), the fast-

flowing stream discharges large amounts of water and sediment over a short time. The river valley is then largely under water and the channels shift rapidly. Sand and gravel banks are repeatedly eroded and rebuilt elsewhere (after Koomen et al., 2007).

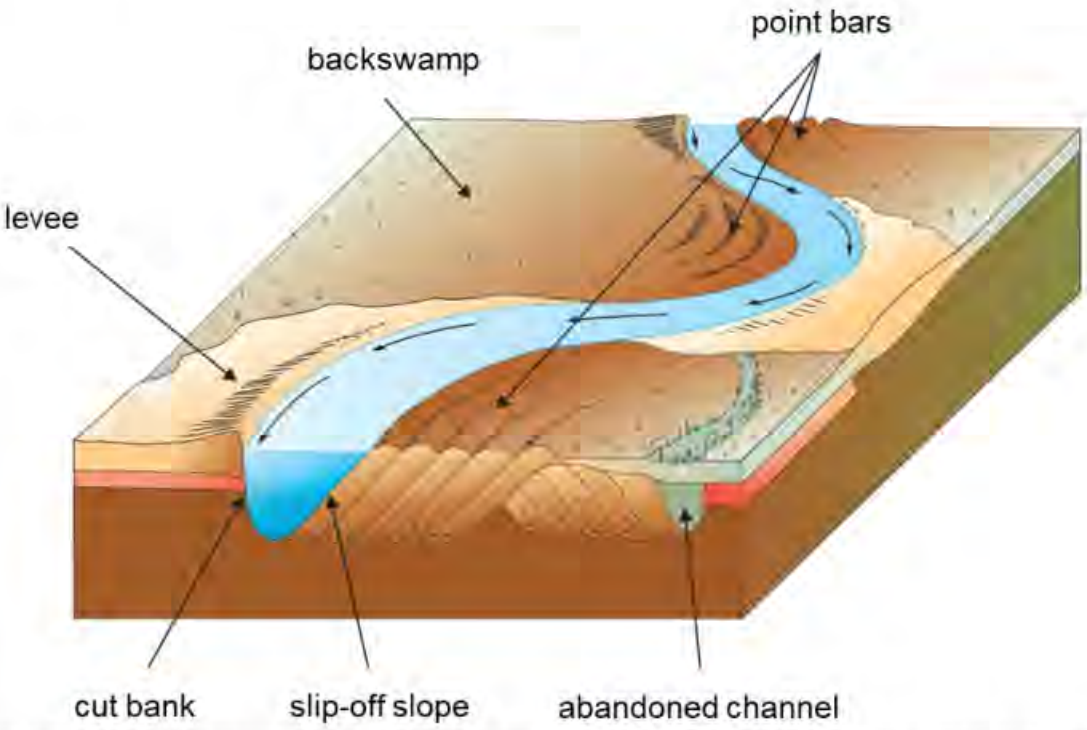

Fig. 14.6. Diagram of a meandering stream. When the river overflows its banks, sand is deposited on the levees. Clay settles in the lower backswamp basins behind the levee. The loops of a meandering stream tend to become larger because the cut bank is eroded in the outer bend, while sediment is deposited on the opposite slip-off slope. This happens especially at high water levels, creating a pattern of crescent-shaped point bars. These are most visible in larger streams systems. By widening the loops, the stream eventually cuts off part of its own course. Over time, the abandoned channel or residual channel will be completely filled in and will at most remain visible in the landscape as a somewhat lower, wet zone (after Koomen et al., 2007).

Documentation and resources

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Geosite n°15	**Brabant Escarpment - Kalmthoutse Heide** More than a remarkable escarpment between low and young, and high and old.
 Fig. 15.1. Map of Geopark Schelde Delta. Brabant Escarpment – Kalmthoutse Heide is number 15.	**Scientific importance and valuation of the geosite** The escarpment testifies to the strong erosion of the land surface during the Pleistocene by rivers of the then Scheldt Basin. This erosion lowered the surface west of the Wal by at least a few tens of metres and accentuated the Wal itself as a steep escarpment. The connection with the Scheldt is clear due to the location of the Late Pleistocene Scheldt at the foot of the Wal, resulting in further erosion of the escarpment, but also deposition of significant river dune complexes on top of the Wal. The Brabant Escarpment (Brabantse Wal) is the western boundary of the relatively high plateau of West Brabant, which remained outside the influence of the Rhine and Meuse (and later also of the Scheldt) for a large part of the Pleistocene and on which an erosional surface or peneplain developed. Old, Early Pleistocene deposits are therefore present directly below the surface. This phenomenon is relatively rare for the Netherlands, which is largely a subsidence area where older deposits are buried relatively quickly under younger ones. In some former quarries on the slope and on top of the Wal, tidal deposits from the Waalre Formation crop out, which, with an age of approximately 1.8 million years, are among the oldest Pleistocene deposits in the Netherlands. The tidal character of these deposits can be clearly observed and demonstrated in these outcrops, which are also suitable for educational purposes. There are plans to develop at least one of these quarries (the Boudewijn quarry) into a geological monument. River dune and drifting dune complexes comparable to those on the Brabant Escarpment occur in the Netherlands (e.g. along the Meuse) and in large parts of northwester Europe at similar locations along lateglacial river valleys. The Dutch part of the geosite is a geologically valuable area and geological monument of the Province of Noord-Brabant. The Belgian part is included in the Heritage Inventory of Flanders (Vlaanderen) as a landscape entity and as a protected cultural-historical landscape. The part east of Hoogerheide and Ossendrecht largely coincides with the cross-border nature reserve 'Grenspark Kalmthoutse Heide'.

Municipality	Bergen op Zoom, Woensdrecht, Reimerswaal & Essen, Kalmthout
Province and country	Noord-Brabant and Zeeland, the Netherlands, and Antwerp, Belgium.
Protection status	Natuurnetwerk Brabant, Natura-2000, provincial geologically valuable area, cultural-historical valuable area, quiet zone, PMV water storage reservering, water catchment area, groundwater protection management
Site management organizations	Grenspark Kalmthoutse Heide, Natuurmonumenten, Het Brabants Landschap, Natuurpunt Beheer, Deparmtement Omgeving, Agentschap Natuur en Bos, Vlaams Gewest, Manucipality Kalmthout, Province of Antwerp
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center - Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Visitor center - Excursions/guided tours - Routes that one can travel independently - Educational programme for children
Teaching equipment	Guided and unguided activities and routes. You can set off on your own route (with children) using a Natuur Ontdek Box. The Kalmthoutse Heide visitor center regularly organizes educational activities for a wide audience.

Code	**Significance**
G-15	International

Geological interest(s)
Paleontology: Although macroscopic body fossils and trace fossils such as burrows are rare in the early Pleistocene tidal deposits, pollen and related microfossils are present and have been studied in detail together with plant macro remains to reconstruct paleoenvironmental and paleoclimatic conditions at the time of deposition.
Stratigraphy: Both the early Pleistocene estuarine deposits and the overlying Late Weichselian and Holocene eolian deposits were the subject of detailed litho-, bio- and chronostratigraphic multi-proxy studies (sedimentology, paleobotany, paleomagnetism, OSL- and radiocarbon dating) which enabled correlation with other early Pleistocene sites in the Netherlands, Belgium and Germany, and with other records of Late Weichselian and Holocene paleoenvironmental and paleoclimatic events and eolian activity in the NW-European coversand region.
Geomorphology: This conspicuous escarpment testifies of the Middle to Late Pleistocene deep erosion of the land surface by rivers of the Scheldt basin and forms the marked boundary between the Campine Plateau to the east and the coastal plain to the west. The altitude of the escarpment

is accentuated by large Weichselian Lateglacial river dunes on top of it, sourced from the Scheldt floodplain which was at the foot of the escarpment at that time.

Sedimentology: The estuarine Early Pleistocene deposits making up the escarpment as well as the Late Weichselian to Holocene eolian sediments at the top have been studied extensively in boreholes and exposures and can be clearly observed in former quarries on the slope and the top of the escarpment, which are also suitable for educational purposes.

DETAILED DESCRIPTION

1. Location

The geosite Brabant Escarpment – Kalmthoutse Heide is a large and diverse area with a complex boundary, which extends in a southeast-northwest direction for approximately 15 km from Kalmthout in Belgium to the southern edge of Bergen Op Zoom in the Netherlands. In an east-west direction, the area is rather wide in the south (10 km between Ossendrecht and Kalmthout) but much narrower in the north (1 km). In the north, it borders the geosite Markiezaat (no. 13), a former tidal flat and salt marsh area that used to be part of the Eastern Scheldt (Oosterschelde).

A wide variety of landscape elements and geological phenomena occur within the geosite. The distinctive characteristic of the area is the striking escarpment of the Wal itself, which forms the transition from the low-lying polders of the Zeeland coastal plain in the west to the higher elevated coversand landscape of the West Brabant Plateau (or Campine Plateau) in the east. The escarpment reveals Early Pleistocene deposits from the Rhine and Meuse that are also present close to the surface on the West Brabant Plateau. It is maximum about 25 m high, south of Ossendrecht, and gradually decreases in a northerly direction. At Lepelstraat, outside the geosite north of Bergen Op Zoom, the escarpment continues under the polder surface and disappears from the landscape as a relief element. The geosite comprises the highest and most striking part of the Brabant Escarpment, including part of the polders at its foot. On a large scale, the escarpment is remarkably straight, but on a more detailed level, it has a strongly lobed character, with projecting 'capes', and 'bays' where clearly incised stream valleys enter the polders.

The remarkable elevation difference of the escarpment is further emphasized by the presence of river dunes and drifting dunes on top of the Wal, with a maximum height of more than 35 m + NAP. Small and large fens are located in blowout depressions between the dunes. At the eastern border of the geosite, the steep and high eastern flank of the large parabolic dunes forms a remarkably sharp boundary with the open and relatively flat coversand landscape of the Campine Plateau to the east of it. The highest dune tops here sometimes protrude more than 15 m above the coversand landscape (e.g. northeast of Huijbergen, the Boterbergen to the north of Kalmthout).

The large dune complexes are mostly covered by forest, but there is also heathland, especially on the Kalmthoutse Heide in Belgium. Locally, management is aimed at developing and maintaining open, active sand drifts, such as in the Kriekelareduinen and the Kalmthoutse Heide.

2. Landscape formation

Origin of the landscape

An estuary of the Rhine, Meuse and Scheldt

About 2 million years ago, at the beginning of the Pleistocene, the area of the Brabant Escarpment was part of the large estuary of the Rhine and Meuse, into which the rivers of the Scheldt Basin also flowed from the south. The tidal area at that time probably resembled the Eastern Scheldt before the Delta Works. Between 2 and 1.6 million years ago, an alternation of sandy and clayey layers was deposited in this estuary. These layers now form the subsoil of the Brabant Escarpment (Waalre Formation, formerly called Tegelen Formation). These tidal deposits crop out in the slope

of the Wal, for instance in the former quarry De Bunt. They were also clearly visible in the Boudewijn quarry before it was partly filled in.

Pleistocene erosion and the formation of the Brabant Escarpment
After the deposition of the Waalre Formation, the course of the Rhine and the Meuse moved to the northeast and disappeared from the area. Meanwhile, rivers of the Scheldt basin in West Brabant continued to deposit tens of metres thick layers of sand and clay. From about 1 million years ago, the surface of West Brabant gradually rose and most of these deposits were eroded again by small streams and by the wind during successive ice ages. Near the Scheldt, the erosion was more intensive and the lowering of the landscape more pronounced. The firm clay layer at the top of the Waalre Formation offered more resistance to these erosive processes and created the escarpment of the Brabant Escarpment.

Barely any traces are left of the long period of 1.5 million years between the deposition of the Waalre Formation and the last ice age. Only a thin layer of gravel on the clay separates the Early Pleistocene Waalre Formation from the Late Pleistocene coversand. The gravel contains particles up to a few centimeters in size, which consist mainly of quartz and flint. This gravel bed is the last remnant of the layers that were deposited on top of the Waalre Formation more than a million years ago by the rivers of the Scheldt basin. The gravel, also called 'Scheldt gravel', was left behind after the finer components of these deposits were washed away by streams or blown away by the wind.

The end of the last ice age: sand blown up from the Scheldt valley forms river dunes
At the end of the last ice age, the sea level was much lower than it is now and a large part of the North Sea was dry. The area of the Brabant Escarpment was part of a vast polar desert. In the dry and cold climate, the wind deposited a 1 to 2 m thick layer of coversand over the entire landscape. In the same period, the Scheldt flowed northward from Antwerp, along the foot of the Brabant Escarpment, towards the valley of the Rhine and the Meuse. The Scheldt valley of that time is located a few kilometers west of the escarpment, at a depth of 10 to 15 m below the current polder surface. During the Younger Dryas, a last cold interval of the last ice age between about 13,000 and 12,000 years ago, large amounts of sand from this Scheldt valley were blown up onto the slope and on top of the Brabant Escarpment. The sand was deposited on top of the Wal in a 4 to 10 km wide belt of so-called river dunes, which often have a parabolic or sickle shape, with the open side facing west-southwest, the prevailing wind direction at the time.

After the Ice Age: drifting dunes due to human activity
Due to the improvement of the climate after the last ice age, the landscape quickly got overgrown with forest from about 12,000 years ago. This vegetation stopped the sand drifts and stabilized the river dunes. About 5,500 years ago, drifting resumed on a limited scale, possibly as a result of clearing small openings in the forest for early agriculture.

Especially from the Late Middle Ages onwards, the lateglacial river dunes started to drift again due to the strong increase of human impact on the landscape. Clearing forests, overgrazing and cutting heath sods allowed the wind to regain grip on the exposed sand and large drifting dune complexes were created. Climate changes may also have played a role, namely due to an increase in the number and strength of extreme storms.

The river dune and drifting dune areas on the Brabant Escarpment now form a very varied landscape with for instance parabolic dunes and compound parabolic dunes with multiple windward arms of various sizes, and partly or completely peat-filled blowout depressions and fens. The most beautiful examples are in the area of the Groote and Kleine Meer (Meersche Duinen), the Kriekelareduinen and in various locations on the Kalmthoutse Heide. In the last two areas

there are still some zones with open and actively drifting sand. As a result, the podzol soils that developed in the dune sands after the last ice age also reappear locally. Fens are mainly located in depressions between the dunes where water stagnates on impermeable clay layers of the Waalre Formation that occur close to the surface in this area.

On the eastern edge of the dune areas, there are some striking steep and high crest dunes or drifting sand ridges that form a clear boundary with the much flatter coversand landscape to the east. These originated when man halted the historic sand drifts by planting the slopes with coppiced oak wood.

Rising sea level after the last ice age: the polders at the foot of the Wal
Nowhere in the Netherlands is the transition from the coversand landscape to the marine clay polders as abrupt as at the Brabant Escarpment. About 1 km west of the Wal, a more than 10 m thick layer of fluvial and tidal deposits and peat is present in the subsoil. These deposits represent a large part of the current warm period after the last ice age (the Holocene, the last 12,000 years). At the beginning of that period, 8,000 years ago, the sea level rose rapidly. The deep Scheldt valley at the foot of the Brabant Escarpment drowned. The landscape west of the steep edge changed into a tidal area with tidal channels, tidal flats and salt marshes. These tidal deposits also filled up the old Scheldt valley.

From about 4,000 years ago, the area was covered by a thick layer of peat. In the Middle Ages, the peat was extracted and the land was cultivated. These early peat polders were lost due to a series of floods in the 16th century, which were also responsible for the Drowned Land of Zuid-Beveland. Villages such as Ossendrecht and Woensdrecht were temporarily located by the sea. The former peat area turned back into a tidal flat and salt marsh landscape and the peat was covered with sand and clay.

From the 17th to the 20th century, the silted up tidal area was gradually embanked, starting from the Brabant Escarpment. The oldest polders from 1685, such as the Noordpolder of Ossendrecht, are located directly at the foot of the escarpment. The younger polders are further west. The young polders are clearly higher than the old ones: the polders from 1685 are about 0.5 m + NAP, but the most recent polders have silted up more than a metres higher.

This is the result of the gradual rise of high-water levels in the Western Scheldt in recent centuries. The surface level of the salt marshes follows the rise in the high-water level, so the youngest salt marshes are silted up higher. Moreover, the oldest polders have lowered – subsided – because the subsoil consists of a thin layer of marine clay on peat. Due to the lower elevation, the oldest polders are wetter than the younger ones. This effect is further enhanced by groundwater seepage from the high sandy soils on the Brabant Escarpment. This seepage surfaces at the foot of the Wal, where the oldest polders are located. Right at the foot of the escarpment is a strip of peatland.

<u>More human interventions: extraction of peat, clay and sand</u>
In addition to causing drifting sands and drifting dunes (see above), humans have also intervened in other ways in the formation of the current landscape.

In historical times, peat was mined on a large scale, especially in the flat coversand landscape east of the Brabant Escarpment – Kalmthoutse Heide geosite, but more local peat extraction also took place within the area. For instance, many fens were dug out. Ditches and canals (*vaarten*) were dug here to control the water level and to drain the peat.

On top of the Brabant Escarpment, some fens have dried up considerably due to groundwater extraction (e.g. Kleine and Groote Meer, de Nol). Fens that are located above impermeable clay

layers of the Waalre Formation retain their water level better. Extracting large amounts of groundwater also reduces seepage in the polders at the foot of the Wal.

A number of fens are not of natural origin, but were created by sand extraction, such as the Langven in the Kalmthoutse Heide in Belgium. Sand extraction on the Kalmthoutse Heide mainly took place in the second half of the 19th century. Entire dune massifs were also excavated here, such as at the Boterbergen and Vossenbergen.

Small and larger quarries and excavations in the escarpment of the Brabant Escarpment (e.g. the Bunt quarry) and on its top (e.g. the Boudewijn quarry) testify to the mudbrick and calcium-silicate brick industry that used to be important in the area. For this purpose, the clay and sand layers of the Waalre Formation and the overlying coversands and drifting sands were mined.

Relation with other geosites

- In the west, the geosite partly borders on the Markiezaat (geosite no. 13).
- From a geomorphological point of view, the escarpment of the Brabant Escarpment is somewhat comparable to the cuesta fronts of the Land van Boom (geosite no. 32), Land van Waas (no. 35) and Oedelem-Zomergem (no. 40) further south and southwest. These escarpments were also formed by deep Pleistocene river erosion by rivers from the Scheldt Basin in relatively old and more erosion-resistant clay layers in the subsoil. Strictly speaking, however, the Brabant Escarpment is not a cuesta (but it is a continuation of the cuesta of the Campine Clay in Belgium, east of the Geopark). Moreover, the cuestas to the south are formed in considerably older deposits (Paleogene vs. Early to Middle Pleistocene).
- River dune and sand dune areas such as those on top of the Brabant Escarpment can also be found at a number of other locations along the Scheldt and its tributaries (e.g. geosites 'freshwater tidal area and polders of the Scheldt' (no. 30), 'Palaeomeanders Kalkense Meersen and Berlare' (no. 36) and 'Rupel Valley' (no. 33)), but these are considerably smaller.

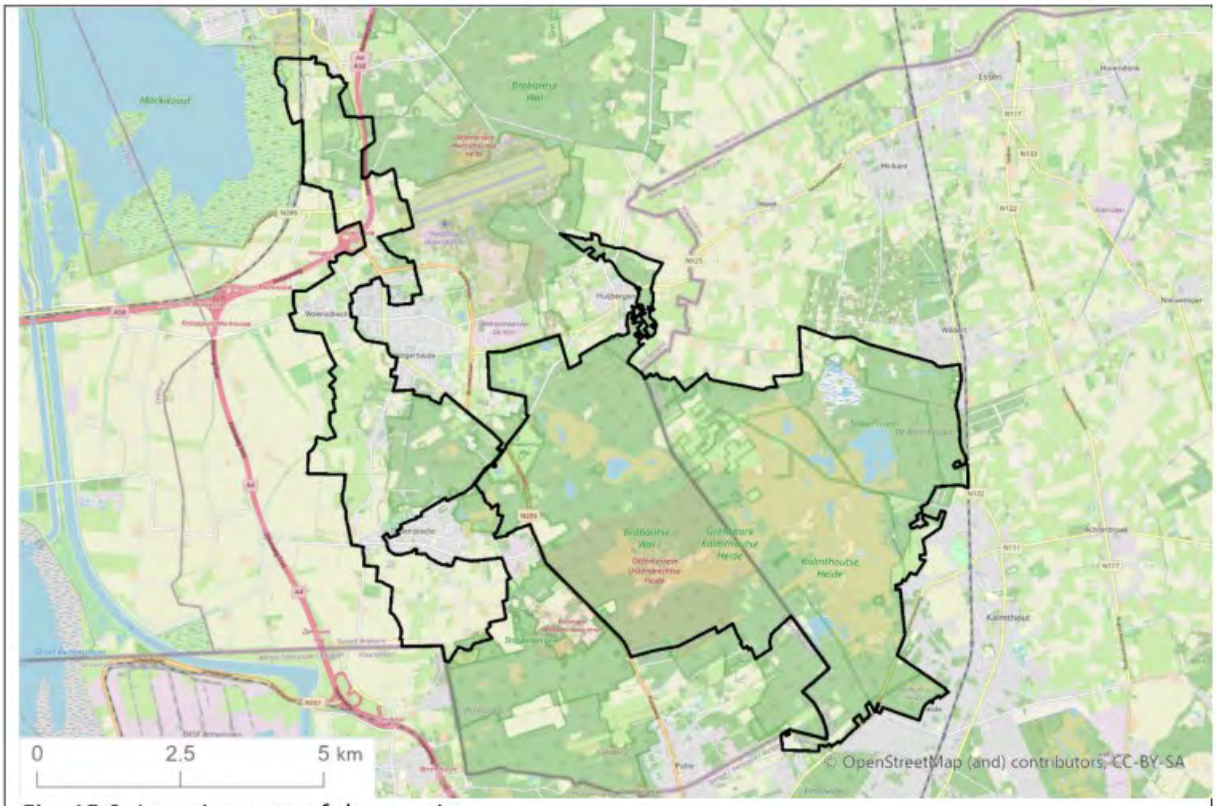

Fig. 15.2. Location map of the geosite.

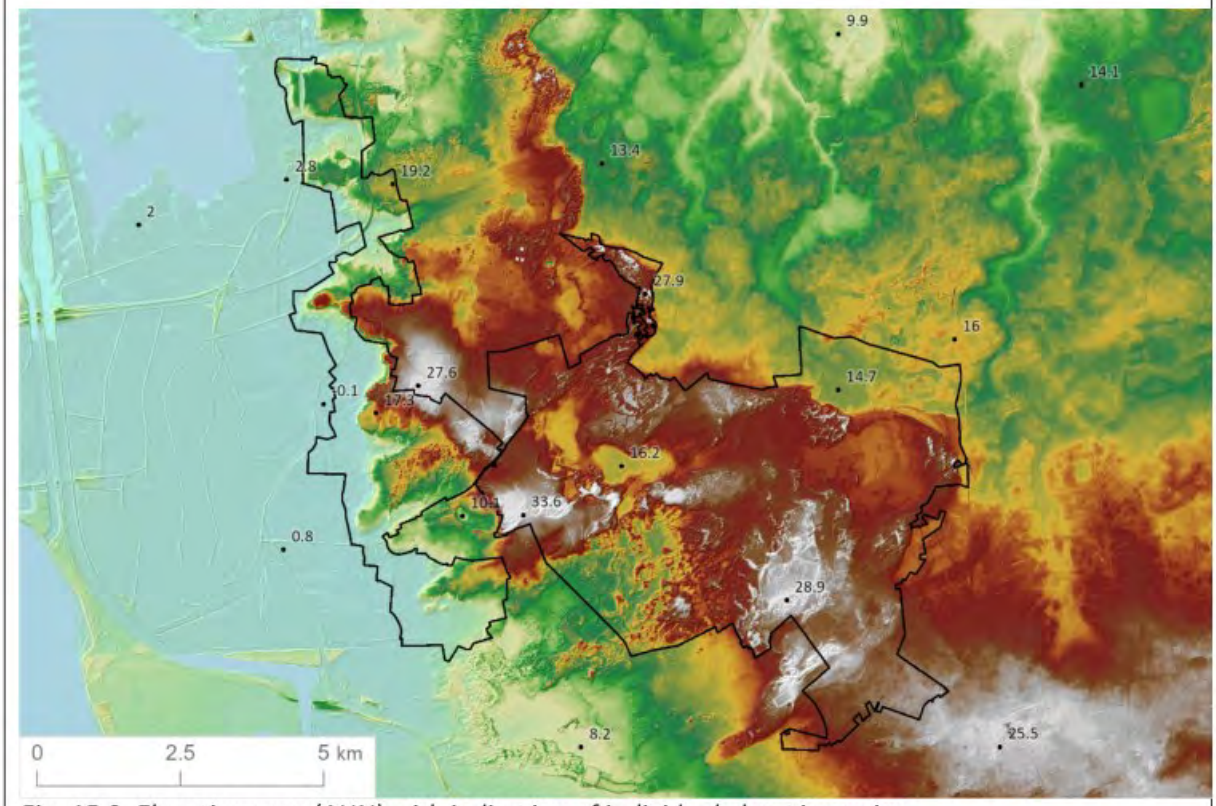

Fig. 15.3. Elevation map (AHN) with indication of individual elevation points.

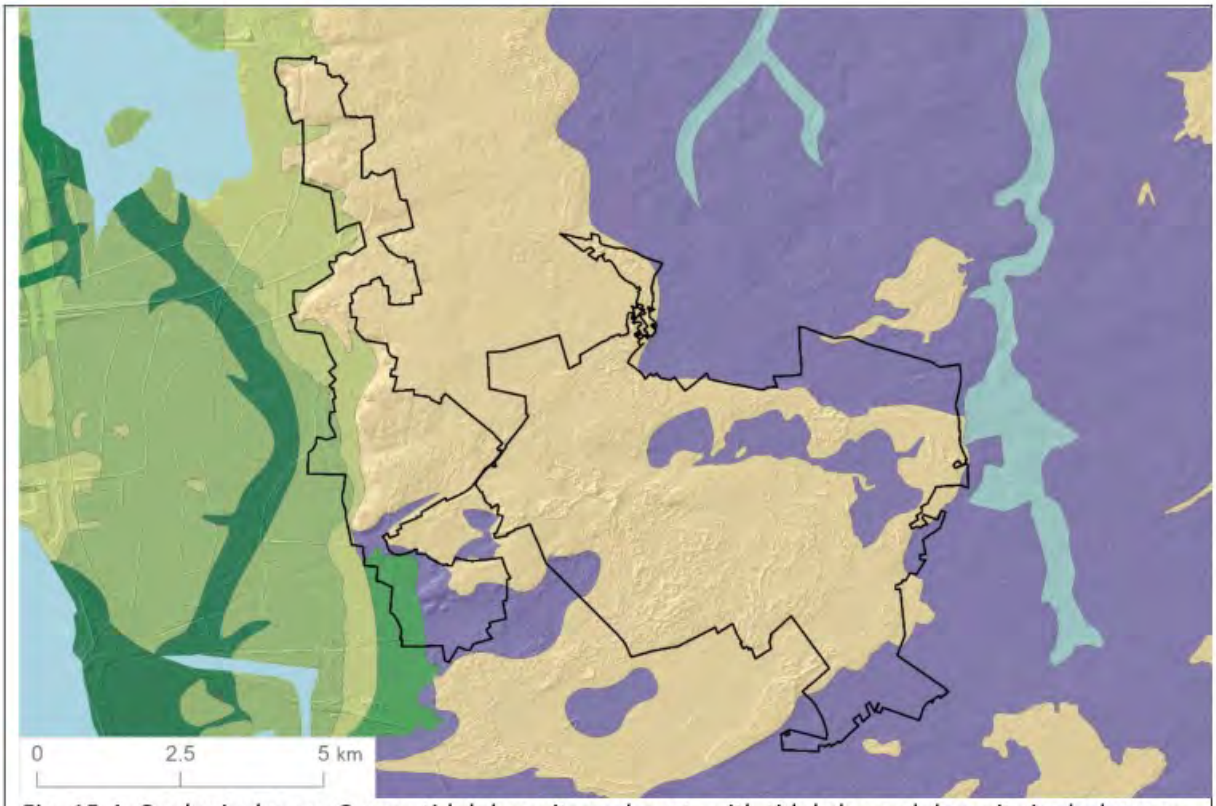

Fig. 15.4. Geological map. Green: tidal deposits and peat, with tidal channel deposits in dark green (Holocene); yellow: drifting sand deposits (Holocene) and river dune deposits (Late Pleistocene); purple: fluvial and estuarine deposits (Early and Middle Pleistocene, mainly Waalre Formation, possibly with a cover of less than 2 m of coversand, drift sand or river dune deposits); light grey-blue: brook deposits (Holocene); light blue: water.

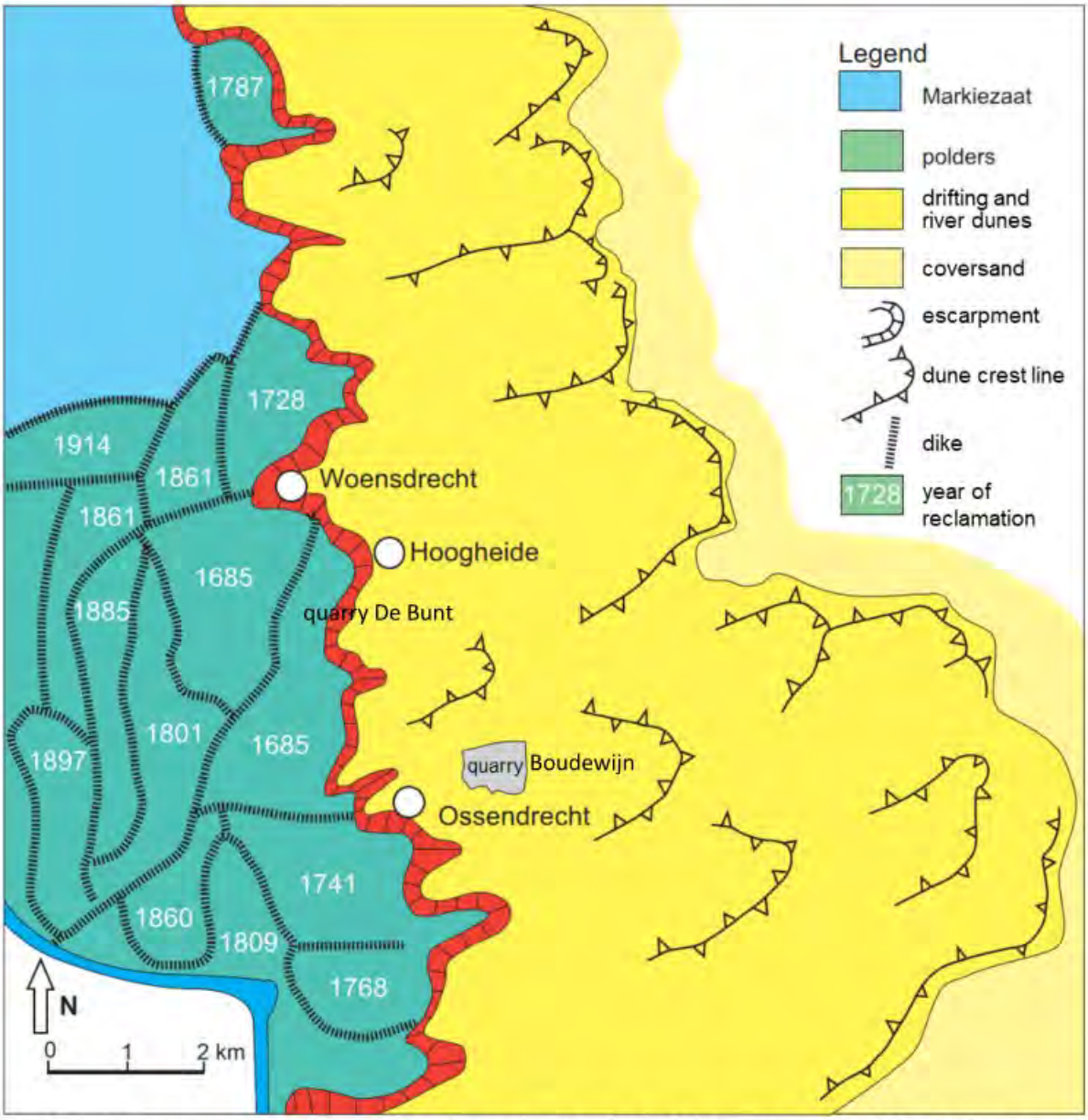

Fig. 15.5. Location and age of the polders (green) at the foot of the escarpment of the Brabant Escarpment (orange strip); distribution of river dunes and drifting dunes (yellow) and coversand (light yellow-beige) on top of the Wal (from Koomen et al. (eds.), 2007).

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Geosite n°16	**Drowned Land of Saeftinghe** Drowned polders and lost villages.
 Fig. 16.1. Map of Geopark Schelde Delta. Drowned Land of Saeftinghe is number 16.	**Scientific importance and valuation of the geosite** With its 3500 ha, the Drowned Land of Saeftinghe is the largest salt marsh area in the Netherlands and one of the largest brackish salt marshes in Europe. It is a unique nature reserve, where natural tidal processes take place undisturbed. The area itself, and the remains of drowned villages buried there, are a reflection of man's historic struggle against water. The Drowned Land of Saeftinghe is a geologically valuable area of the Province of Zeeland, of international importance.
Municipality	Hulst
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Nederland, Natura-2000; PMV environmental protection area
Site management organizations	Stichting Het Zeeuwse Landschap
Accessibility	The site is accessible with a recognized guide of the Drowned Land of Saeftinghe. There is a freely accessible walking route near the visitor center.
Relevance for tourism	- Visitor center - Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Visitor center - Excursions/guided tours - Routes that one can travel independently - Educational programme for children
Teaching equipment	The Drowned Land of Saeftinghe is only accessible with a recognized guide. A small part of the site can be visited independently. General information about the site is provided in the visitor center. There is also an infrastructure in place to accommodate school classes and/or visitors coming for the purpose of (scientific) research. Information panels are located at several places along the borders of the site.

Code	Significance
G-16	International

Geological interest(s)

Paleontology: not applicable.

Stratigraphy: not applicable.

Geomorphology: One of the largest brackish salt marshes in Europe, the area displays a wide range of active landforms of a dynamic intertidal environment, such as salt marsh and tidal flat areas dissected by intricate networks of channels of different sizes within well-developed levees.

Sedimentology: The area serves as a 'field laboratory' in which active processes of tidal erosion and sedimentation and the sedimentology of tidal deposits are studied and are also demonstrated by means of excursions for both geoscientists and the general public alike.

DETAILED DESCRIPTION

1. **Location**

With more than 3,500 hectares, the Drowned Land of Saeftinghe is the largest salt marsh area in the Netherlands and one of the largest brackish salt marsh areas in Europe. It is located in a large inner bend of the Western Scheldt (Westerschelde), near the border between the Netherlands and Belgium. Due to the large tidal range in the area, the salt marshes outside the dikes have silted up to approximately 3 m + NAP in recent centuries. The Drowned Land Saeftinghe is a unique nature reserve, where natural tidal processes take place undisturbed. The area includes the remains of several villages that were lost when the former polders drowned.

2. **Landscape formation**

Origin of the landscape

During the last ice age, Zeeuws-Vlaanderen (Zeelandic Flanders) was a coversand landscape that was part of a vast polar desert. The sea level was more than a 100 metres lower and the coastline was hundreds of kilometers further away than today. The climate got warmer after the end of the last ice age. The sea level rose and the groundwater level in the coastal area rose along. Due to its poor drainage, the coversand landscape gradually changed into a peat swamp. In Zeeuws-Vlaanderen, this happened from about 6000 years ago. The peat continued to grow for thousands of years and around 750 BC the whole of Zeeuws-Vlaanderen was covered with peat.

Because early farmers in Zeeland started draining the fertile peatlands in the Late Iron Age, the land slowly subsided and the sea gained more and more control over the area. This resulted in the flooding of Zeeland for centuries and the deposition of sand and clay on the peat. Therefore, the remaining peat areas became smaller. From the Early Middle Ages, Zeeland eventually changed almost completely into a tidal area with salt marshes, tidal flats and channels. The flooding of the peat area in the Drowned Land of Saeftinghe took place from the 7th century AD. Only the peat area along the southern border of Zeeuws-Vlaanderen was spared for several centuries, until this area was also flooded from about 1000 years ago. The landscape remained a tidal area until the first dikes were built.

The first low dikes in the Drowned Land of Saeftinghe were built in the 11th and 12th centuries. In the following centuries, floods and dike breaches alternated with phases of reclamation and rebuilding with increasingly stronger dikes. Part of the area eventually survived until the early 18th century.

In historical times, the Drowned Land of Saeftinghe consisted of two sub-areas: the former seigniory of Saeftinghe and the Polder of Namen. In the Polder of Namen, there was a village of the same name, some farms and a mill. In the seigniory of Saeftinghe, there was the small ferry village of Saeftinghe itself, which was provided with a castle at the beginning of the 16th century,

the village of Sint Lauwereyns, and in the polders around it only a single farm and a number of mills. Although the villages in the area were modest in size, varying from a few to a few dozen houses, they all had a church building.

The area has been lost in two phases, with more than 130 years in between. The first phase was in 1584 and involved a military inundation to drive out the Spanish occupation and liberate the cities of Ghent and Antwerp. The locks at the village of Saeftinghe were probably breached, after which a whole network of tidal channels could form within a few months and the land was almost completely lost. After the Spaniards conquered Antwerp after all, there was no immediate reason to save the drowned country. The Polder of Namen was not lost until 1715, after a disastrous flood partly destroyed the dikes and subsequent floods gradually turned the land into a salt marsh area. The tower of the church of Namen is said to have stuck out above the salt marshes for decades.

Salt marshes, tidal flats, tidal channels and shoals

Since the loss of the embanked area, nature has regained control over it. It is now an outer-dike area with silted and vegetated salt marshes, barren tidal flats and shoals, tidal channels and creeks. The area is formed by sediment (sand and clay) that is supplied from the Western Scheldt twice a day at high tide. Because sand is heavier and is only transported by fast-flowing water, it is mainly deposited in and along the channels. Between the channels are tidal flats that are flooded at high tide. At high tide, a thin layer of sand can be deposited here. However, the finer and lighter clay particles can also be transported at low flow velocities and mainly settle during the reversal from high tide to low tide. The tidal flats therefore consist of an alternation of thin layers of sand and clay. The highest parts are the salt marshes, which only flood at very high water (spring tide and storm surge). The water is supplied here via a branched system of creeks. The creeks and tidal channels within a salt marsh area constantly change course, thus creating a wide zone of creeks and channels. During high water, mainly clay is deposited on the salt marshes. The salt marshes are also often overgrown with halophytic (salt-tolerant) plants.

Elevation differences

There are also elevation differences within the salt marsh. For instance, so-called levees can form parallel to creeks and channels. This happens because the flow velocity of the water that floods the banks suddenly decreases. As a result, the water no longer has enough energy to transport sand, and the sand gets deposited on the bank. This process forms a slightly higher zone along the channel: a levee. Further away from the channel, lighter and finer material is deposited. As a result, depressions filled with clay are formed at a distance from the channel.

A similar process takes place on the edge of a salt marsh. Here again, the water depth at high tide is lower than above the adjacent tidal flat, and the sand brought in by the tide settles as soon as the water floods the salt marsh. The edge that develops along the salt marsh as a result is called a salt marsh ridge.

With a tidal range of 4.80 m, the Drowned Land of Saeftinghe has the largest tidal range in the Netherlands. This causes the development of relatively high and striking levees and wide channels. This large tidal range is the result of the landward narrowing of the Western Scheldt. As a result, the tidal wave entering the estuary is pushed up high and the high-water levels and the tidal range increase sharply in landward direction. The Drowned Land of Saeftinghe has been located outside the dikes for several centuries and the salt marshes have silted up to above the average high-water level in the Western Scheldt. In the same period, the polders within the dikes were flooded much less frequently and barely silted up. The active salt marshes in the Drowned Land of Saeftinghe are therefore 1 to 2 metres higher than the embanked polders.

Relation with other geosites

- Salt marshes of Rumoirt and Sint-Annaland – active salt marsh area around Sint-Philipsland, part of Geosite Eastern Scheldt.
- Dintelse Gorzen – salt marsh area from which the tidal activity has disappeared.
- Drowned Land of Zuid-Beveland – drowned polders that are still under water.
- Western Scheldt – Adjacent connection to the sea and one of the largest estuaries in Europe.

Fig. 16.2. Location map of the Drowned Land of Saeftinghe.

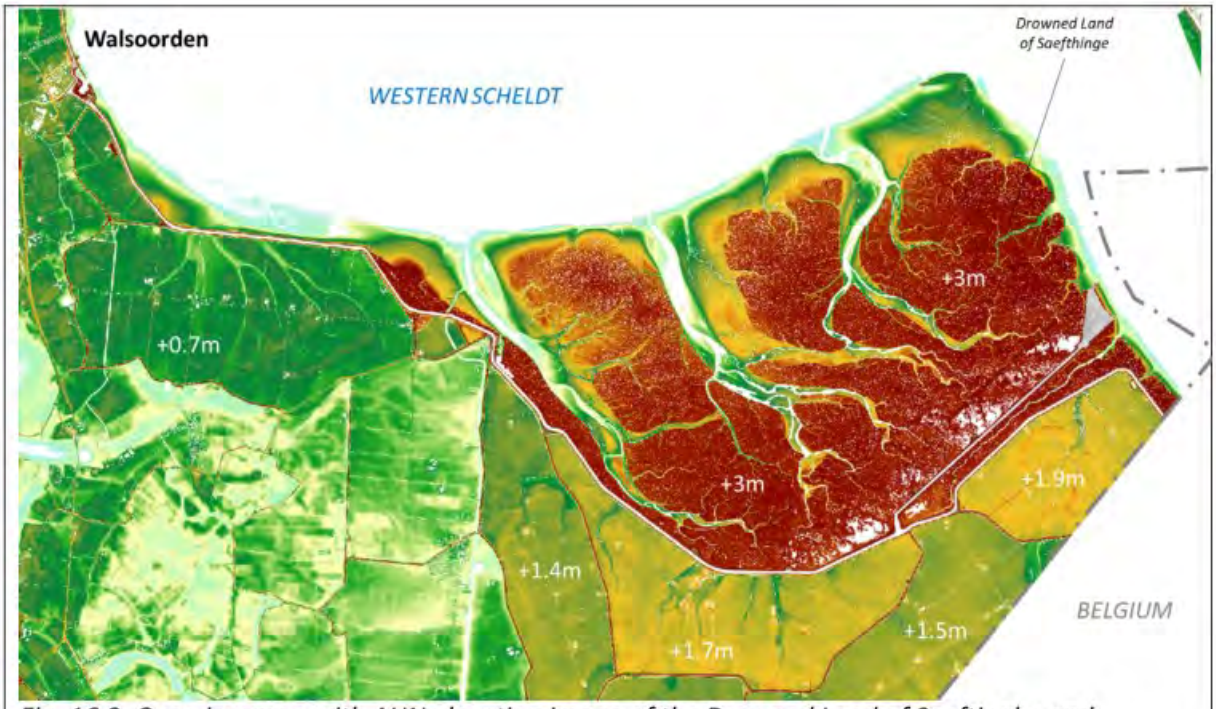

Fig. 16.3. Overview map with AHN elevation image of the Drowned Land of Saeftinghe and surrounding polders. Relatively high areas are displayed in red and yellow, low-lying areas in green and light blue. The outer-dike area of the Drowned Land of Saeftinghe has silted up more than a metres higher than the surrounding inner-dike polders.

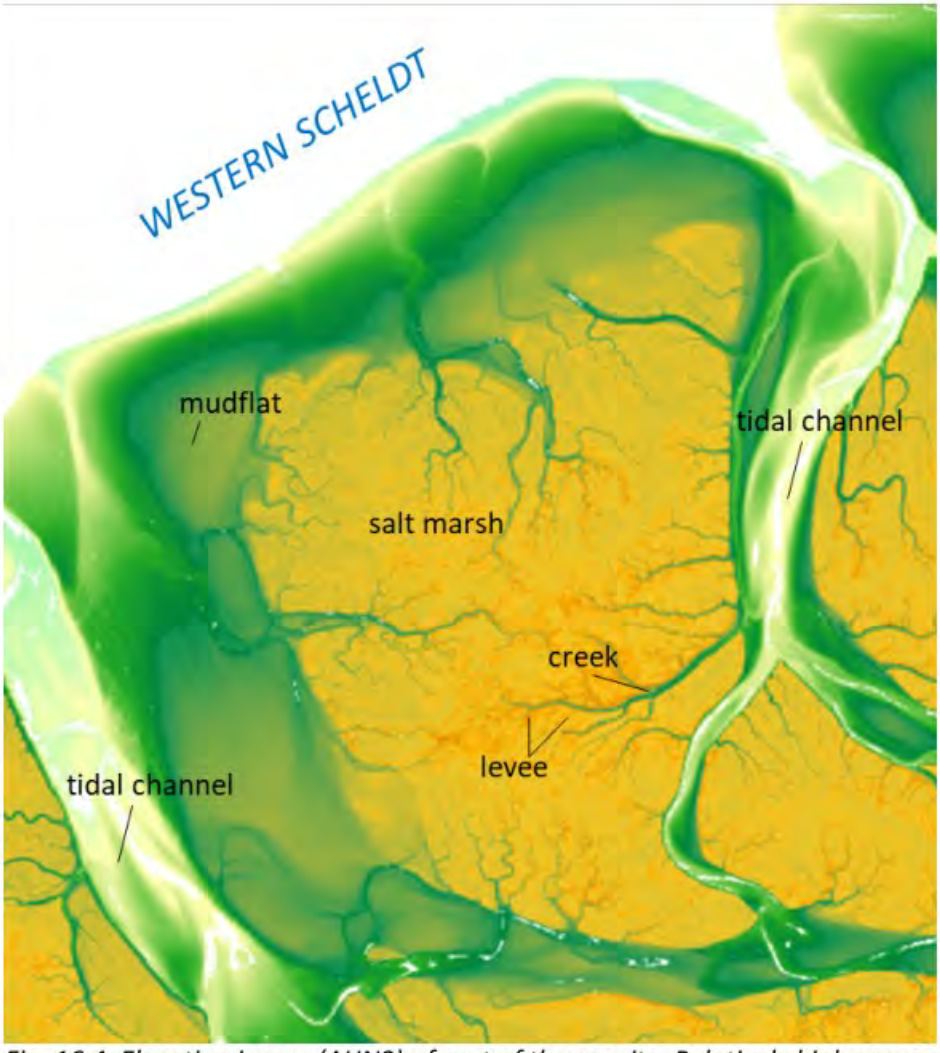

Fig. 16.4. Elevation image (AHN3) of part of the geosite. Relatively high areas are shown in orange and yellow, low-lying areas in green and light blue. Several landforms mentioned in text are shown here.

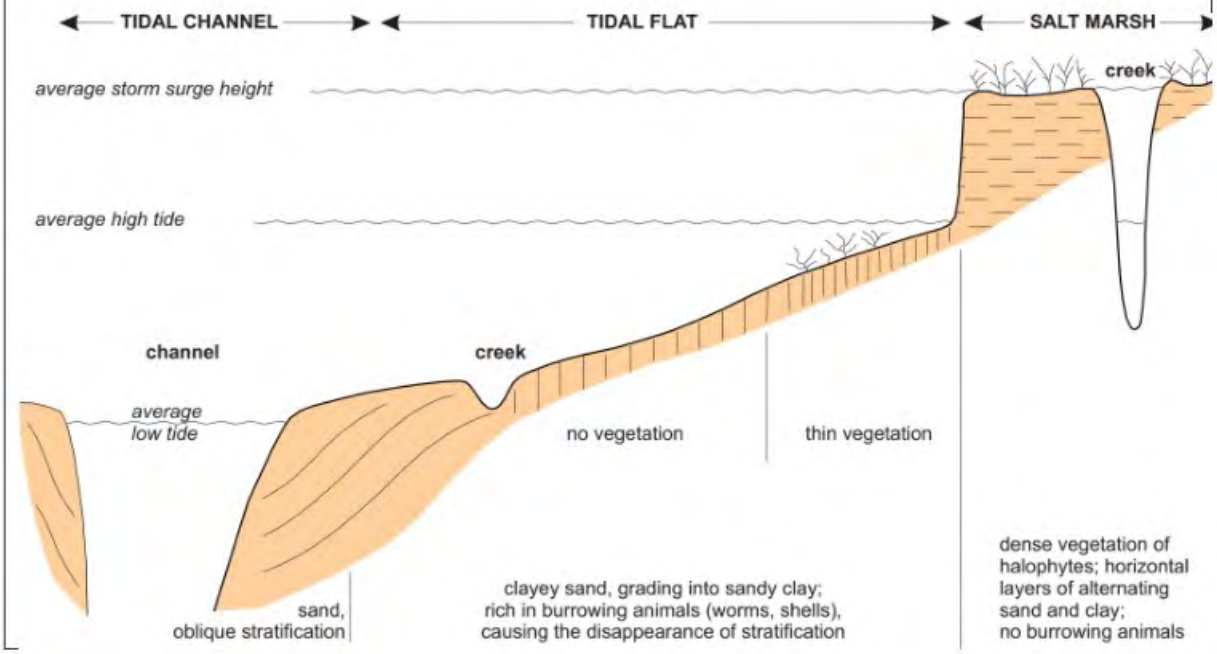

Fig. 16.5. Schematic image of various depositional environments on a tidal zone. From: Zagwijn, 1986.

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Geosite n°17	**Western Scheldt** One of the largest estuaries in Europe as a laboratory for 'geology in action'.
 Fig. 17.1. Map of Geopark Schelde Delta. Western Scheldt is number 17.	**Scientific importance and valuation of the geosite** The Western Scheldt (Westerschelde) is the most seaward part of the Scheldt estuary, which is one of the largest and longest estuaries in Europe, together with, among others, the Humber, Gironde and Elbe. The Scheldt estuary shows a complete gradient from marine environments at the mouth over brackish at the Dutch-Belgian border to freshwater upstream of Antwerp, including large areas of rare and valuable brackish and freshwater tidal areas. The Western Scheldt is the only estuary in the southwest of the Netherlands that still has an open connection with the North Sea and is a very dynamic area in which natural processes of erosion and sedimentation take place relatively undisturbed. The tidal range inland is greater than anywhere else in the Netherlands or Belgium. Geological and sedimentological research emphasizes the importance of the estuary as a modern analogue for the interpretation of older tidal deposits in hard rocks, for e.g. sedimentology, palaeoecology, oil and gas exploration and mining. Fossil 'beach finds' of shells and mammal remains from Paleogene, Neogene and Pleistocene at various locations along the Western Scheldt (e.g. more than 600 species on De Kaloot) are important not only for amateur geologists and palaeontologists, but also for academic researchers. Although the finds are not in situ (but usually surface close to the place of origin), they contribute to a refinement of, for example, the distribution area of certain species of molluscs or mammals. The Western Scheldt is a geologically valuable area of the Province of Zeeland and is of international importance.
Municipality	Veere, Vlissingen, Borsele, Kapelle, Reimerswaal, Sluis, Terneuzen, Hulst
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Nederland, Natura-2000; Plates in the Western Scheldt and Voordelta: PMV environmental protection area;

	Drowned Land of Valkenisse: Archeologisch Rijksmonument
Site management organizations	Rijkswaterstaat, Staatsbosbeheer, Stichting Het Zeeuwse Landschap
Accessibility	Site is accessible to the general public.
Relevance for tourism	Yes and no. The Western Scheldt as a whole knows different places that have a touristic interest, for example the Geosite Drowned Land of Saeftinghe is located in the Western Scheldt.
Relevance for education	See answer above.
Teaching equipment	There is no coherent educational and/or touristic infrastructure for the Western Scheldt as a whole.

Code	**Significance**
G-17	International

Geological interest(s)

Paleontology: Strong tidal currents erode deep channels and wash ashore hundreds of species of fossils from Eocene to Holocene age on tidal flats and beaches, which are true treasure coves for professional and amateur paleontologists alike.

Stratigraphy: The finds of hundreds of species of fossils of a.o. molluscs and vertebrates from Eocene to Holocene age on tidal flats along the estuary also contain species that were previously unknown in this region and as such contribute significantly to our knowledge of biostratigraphy and paleogeography.

Geomorphology: The Western Scheldt is one of the largest estuaries in Europe and shows the typical features of a highly dynamic meso- to macrotidal estuary, such as tidal flats, salt marshes and semi-submerged tidal bars and shoals separating winding ebb and flood channels.

Sedimentology: Largely due to its economic importance, all aspects of the estuary, and especially the sedimentology, morphodynamics and related subjects have been closely studied and systematically monitored over many decades, a.o. to predict and manage the future evolution of the estuary.

DETAILED DESCRIPTION

1. Location

The Western Scheldt is the Dutch part of the estuary of the river Scheldt, which springs in northern France and flows to the Netherlands via Belgium. The entire Scheldt estuary (the part of the river that is under tidal influence) stretches from the mouth at Vlissingen up to Ghent, where weirs and locks stop the tidal flow. The part of the Scheldt estuary on Belgian territory is also known as the Scheldt.

With an area of approximately 35,000 ha, of which about 7,000 ha is in Belgium, the Scheldt estuary is one of the largest in Europe, together with for instance the Humber, Gironde and Elbe. With its 160 km length from Vlissingen to Ghent, it is also one of the longest estuaries in Europe. The Western Scheldt has a typical funnel shape that gradually narrows inland from about 25 km width at the mouth at Westkapelle to 6 km at Vlissingen and 3 km at Bath near the Dutch-Belgian border. Due to the funnel shape, the tidal range (the difference in height between high and low water) increases inland: from an average of 3.8 m at Vlissingen to 4.9 m at Bath. It even increases further upstream to a maximum of 5.5 m between Antwerp and the Rupel mouth.

The mixing of saline seawater with fresh river water results in a complete gradient in the Scheldt estuary from saline over brackish (at the Belgian-Dutch border) to completely fresh (e.g. near Ghent). The brackish and freshwater tidal areas in the more upstream part are rare and have a high natural value.

The estuary is a very dynamic area consisting of tidal channels of varying depth and shoals, tidal flats and salt marshes that are above water at low tide. The shoals, tidal flats and salt marshes (also called intertidal areas) make up about 35% of the surface of the Western Scheldt. Very locally, active dunes also occur in the outer-dike areas, namely at Rammekenshoek, the Kaloot and on the Hooge Platen.

Among the salt marshes along the Western Scheldt, the Drowned Land of Saeftinghe, with its 3000 ha, is the largest salt marsh area in the Netherlands and one of the largest brackish water salt marshes in Europe. This area is discussed elsewhere as a separate geosite (number 16).

This geosite also includes part of the outer delta, a shallow part of the North Sea off the Flemish, Zeeland and South Holland coasts.

2. **Landscape formation**

Origin of the landscape

Geologically speaking, the Western Scheldt has only recently formed the mouth of the Scheldt. Before that, the Scheldt flowed to the North Sea via other routes. At the end of the last ice age, about 12,000 years ago, the North Sea was still low and there was no marine influence at all in Zeeland. Zeeland was part of an extensive coversand landscape in which the Scheldt flowed northwards in a deep valley at the foot of the Brabant Escarpment (Brabantse Wal), towards the large valley of the Rhine and the Meuse. Due to the rising sea level, Zeeland turned into a large tidal area with tidal flats, salt marshes and tidal channels. About 7,000 years ago, a tidal channel made contact eastwards with the northward flowing Scheldt, approximately at the location of the present Eastern Scheldt (Oosterschelde), thus becoming the new course of the Scheldt to the sea.

In the course of the Holocene, the rate of sea level rise decreased. Around 3800 years ago, an almost uninterrupted beach ridge had formed approximately at the location of the current coastline. It protected the area behind against marine intrusions. Behind this coastal barrier was a large freshwater swamp area in which peat accumulated. A narrow opening at the current Eastern Scheldt formed the mouth of the Scheldt, which meandered through the vast peat area as a small winding river.

It is not known exactly when the Western Scheldt originated, because historical sources and maps from that period are scarce, and because deposits from the initial phase of the development of the Western Scheldt have all been eroded as a result of the later widening and deepening of the estuary. The only thing that can be deduced with certainty from historical sources is that the Western Scheldt already existed in 1183 AD, and that the eastern part of the Western Scheldt was then a considerable inlet with tidal activity. However, the first connection between the Scheldt (which at that time still flowed to the sea via the Eastern Scheldt) and the North Sea at the location of the current Western Scheldt probably developed before 843 AD, via tidal channels that penetrated further and further inland from the coast and tapped the upper reaches of the peat river Honte, which drained in an easterly direction to the Scheldt.

For a long time after the Western Scheldt connection developed, the Eastern Scheldt remained the most important connection between the Scheldt and the sea. The Western Scheldt became more and more important compared to the Eastern Scheldt, but it was only around the end of the 15th

century that it was wide and deep enough for shipping traffic to Antwerp at the time. From the 16th century, the Western Scheldt took over from the Eastern Scheldt as the main connection between the Scheldt and the sea. The catastrophic storm surges of 1530 AD and 1532 AD probably played a decisive role in this. A large part of eastern Zuid-Beveland flooded (De Brede Watering Beoosten Yerseke / Land van Reimerswaal, now the Verdronken Land van Zuid-Beveland), creating a much broader connection between the Eastern Scheldt and the Western Scheldt. Instead of its former 500 m width, the Scheldt now had an opening of 13 km. As a result, the flow velocity decreased in the then Eastern Scheldt channel near Woensdrecht, which quickly started to silt up. The shallow connection between the Eastern Scheldt en Western Scheldt was definitively broken in 1867 by the construction of a railway dam.

Tidal flats and salt marshes, shoals and tidal channels

In many places along the Western Scheldt, characteristic landscape elements of the estuary can be seen from the dikes at low tide. The so-called salt marshes are closest to the dike and are largely covered with vegetation. They have silted up so high that they are only flooded for a short time at the highest high-water levels. Lower, and further from the dike, are the tidal flats, which are flooded at every tide and are barren. The salt marshes sometimes gradually merge into tidal flats, but often this is an abrupt transition with a cliff edge that can be more than 1 metres high and which is formed by erosion by waves or currents. On salt marshes and tidal flats, small gullies can be found that supply and drain water at high tide and low tide and are usually dry part of the time.

Just like tidal flats and salt marshes, shoals lie between high and low water, but they are not attached to the banks and are often located in the middle of the kilometre-wide estuary. Most of the shoals are barren and because of their sandy soil, they rather resemble a beach, in contrast to the silty and 'muddy' tidal flats. This is due to the higher flow velocities on the shoals in the middle of the estuary, as a result of which only larger and heavier sand grains are deposited, while on the tidal flats close to the banks the flow is slower and finer silt and clay particles can also settle. Fields with megaripples occur mainly on the lower parts of the shoals, just above the low water line. These are much larger equivalents of the small sand ripples that can be found on the beach: instead of a few centimeters high and a decimeter wide, these megaripples are up to a metres high and several metres wide. They are created by the displacement of large amounts of sand over the surface, by the strong currents that flow over the shoals during ebb and flood.

Exceptionally, some parts of shoals have become so high that they are no longer flooded on a daily basis, causing them to become vegetated, thus creating salt marshes. This is the case with the Hooge Platen, west of Breskens, the Ossenisse shoals and the Plaat van Walsoorden in the middle of the Western Scheldt, east of the Walsoorden harbor.

Between the shoals and the banks of the Western Scheldt are large and deep tidal channels along which the powerful tidal currents flow in and out of the estuary at high tide and low tide and which are used as a navigation channel for sea-going vessels calling at the inland ports of Antwerp, Terneuzen and Ghent. These channels are 15 to 20 metres deep on average but can reach depths of more than 40 metres. The deepest point of the Western Scheldt is located about 2 kilometers west of Borssele, just in front of the nuclear power plant. With more than 65 m below NAP, this 'Put van Borssele' reaches a greater depth than the deepest places in the Dutch part of the North Sea, making it the deepest point of all Dutch waters. Locally, such deep channels cut into old deposits of Paleogene, Neogene and Pleistocene ages, from which they take up fossils that are deposited on the banks of the Western Scheldt, such as on the famous 'fossils beach' of the Kaloot near Borssele, or on the Hooge Platen, east of Breskens.

Ebb and flood channels

In the Western Scheldt, two or more tidal channels are usually present next to each other. The channel followed by the ebb current (ebb channel) is the deepest and meanders from one bank to the other. Due to its depth, the ebb channel is also the main navigation route along which the large seagoing vessels reach the ports in the estuary. Like a river, the ebb channel reaches its greatest depths in the bends. In the straighter sections between the bends, the ebb channel is usually less deep. Continuous maintenance dredging is necessary to keep these shallower reaches at the required depth for shipping. Next to the ebb channel are usually straighter and shallower channels that are mainly used by the flood current and that are separated from the ebb channel by shallows and shoals.

The tidal channels in the Western Scheldt show a pattern of ebb and flood channels that is typical for many estuaries. In the bends formed by the ebb channel, the flood current tends to go straight ahead rather than follow the ebb channel. As a result, a flood channel often forms: a channel that reaches a dead end in the upstream direction on the shallow zones and shoals that separate it from the ebb channel. In a similar way, but to a lesser extent, the ebb current also forms ebb channels that come to a dead end on shallow zones in the downstream direction.

<u>The functioning of an estuary: tides as a driving force</u>
The Western Scheldt is a complex system in which powerful tidal currents, erosion and deposition, vegetation and human interventions all interact. The tides and strong tidal currents are the driving force behind all processes that take place in the estuary. At an average high tide, approximately 1 billion cubic metres of seawater flows into the estuary at Vlissingen. This corresponds to a flow rate of ca. 50,000 m^3/s. The Scheldt itself has an average flow rate of ca. 100 m^3/s and therefore has no appreciable effect on the strength of the currents in the estuary. By way of comparison: the Rhine, the largest river in Western Europe, has an average flow rate at Lobith of 2,200 m^3/s, which is 20 times lower than in the Western Scheldt, and an extreme peak discharge of ca. 12,000 m^3/s once every 100 years.

The amount of water that flows in and out of the estuary depends on the tidal prism: the volume that is available between high and low water and above the tidal flats, salt marshes and shoals. It is this tidal prism that actually determines the size of the tidal channels and the strength of the tidal currents. Changes in tidal prism due to natural or human causes have large-scale and sometimes irreversible consequences for the development of the estuary. The tidal prism increases if, for example, dike breaches inundate polder areas that were previously located outside the estuary. This causes more water to flow into the estuary, causing the tidal channels to become larger. In the long run, this could have irreversible consequences for the estuary, as happened, for example, after the storm surges of 1530-1532 AD, when the Western Scheldt grew into the most important branch of the Scheldt at the expense of the Eastern Scheldt (see above). Conversely, reducing the size of the tidal prism, for instance through silting or embankment of tidal flats and salt marshes, means that tidal currents decrease and channels can silt up.

<u>Human influence</u>
In addition to the natural factors mentioned above, the embankments and reclamations have also played a role in the development of the Western Scheldt estuary since the 12th century. It has become narrower and deeper, causing the tide to rise and the tidal range and high-water levels to increase sharply. The tides also penetrated further and further into the estuary, also on Belgian territory. Since the beginning of the 20th century, the navigation channel between Vlissingen and Antwerp has been dredged ever deeper, causing the tide to penetrate even further into the estuary. As a result, the high-water levels become even higher, especially upstream of the Belgian-Dutch border, and the risk of flooding increases. In order to increase flood safety during storm surges, areas are being depoldered and flood control areas are being constructed.

The outer delta

Seaward from Vlissingen, the Western Scheldt estuary widens considerably between Westkapelle and Cadzand. This is where the so-called outer delta of the Scheldt estuary, a roughly triangular area consisting of shallow shoals or sand banks (e.g. Vlakte van de Raan, Nolleplaat) and tidal channels such as the Oostgat, close to the coast of Walcheren, and the Wielingen in the south, which forms the main navigation route for large seagoing vessels.

An outer delta forms where the relatively narrow estuary opens into the open sea. Due to the seaward widening of the estuary, the velocity of the ebb current flowing out of the inlet suddenly decreases. This causes the sand carried by the ebb current to be deposited and creates shallow shoals in front of the estuary. Waves again knock the sand off the top of the shoals and move it back into the estuary or to the adjacent coast.

The outer delta of the Western Scheldt is the southernmost of the outer deltas of the now largely dammed up estuaries of South Holland and Zeeland, namely (from north to south) the former Brielse Maas, Haringvliet, Grevelingen and Eastern Scheldt. The name 'Voordelta' (outer delta) refers to the ca. 10 km wide shallow part of the North Sea from Hoek van Holland to Zeebrugge, which consists of the adjacent outer deltas of these five estuaries.

Relation with other geosites

- Drowned Land of Saeftinghe.
- Scheldt in Belgium (several geosites).
- Eastern Scheldt.
- Drowned Land of Zuid-Beveland (part of Geosite Eastern Scheldt (Oosterschelde)).
- Areas created by breaches from the Western Scheldt or predecessors, e.g. Braakman region and Otheense Creek.

Fig. 17.2. Location and boundaries of the geosite

Fig. 17.3. Elevation map based on AHN2 with indication of depths in the Western Scheldt in m NAP.

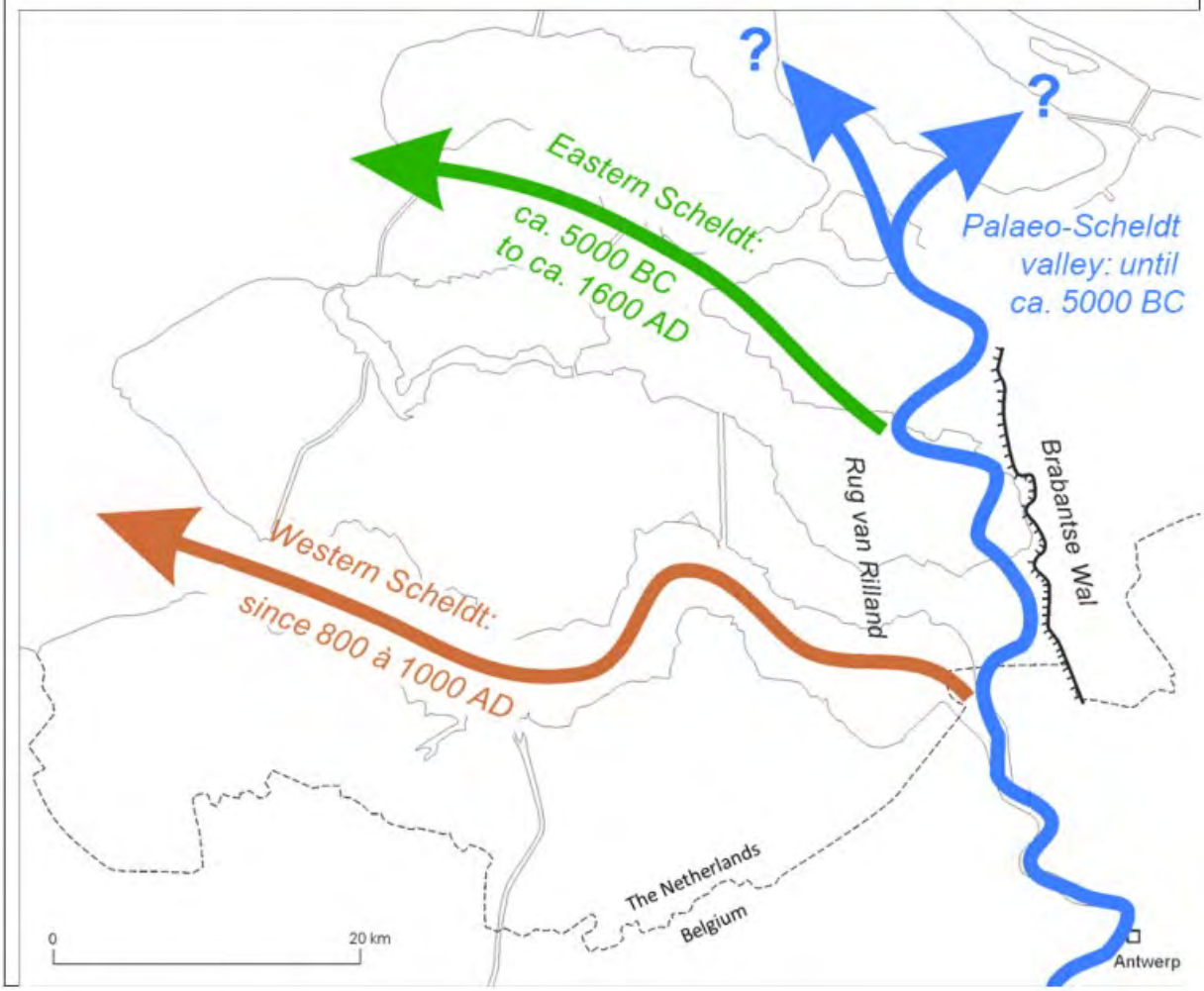

Fig. 17.4. The location of the successive mouths of the Scheldt in Zeeland after the last ice age, with their period of greatest activity (after Kiden, 2006). For the Eastern Scheldt in particular, the location is only indicated in outline, because the location of most of the former Eastern Scheldt courses in this area is not known in detail.

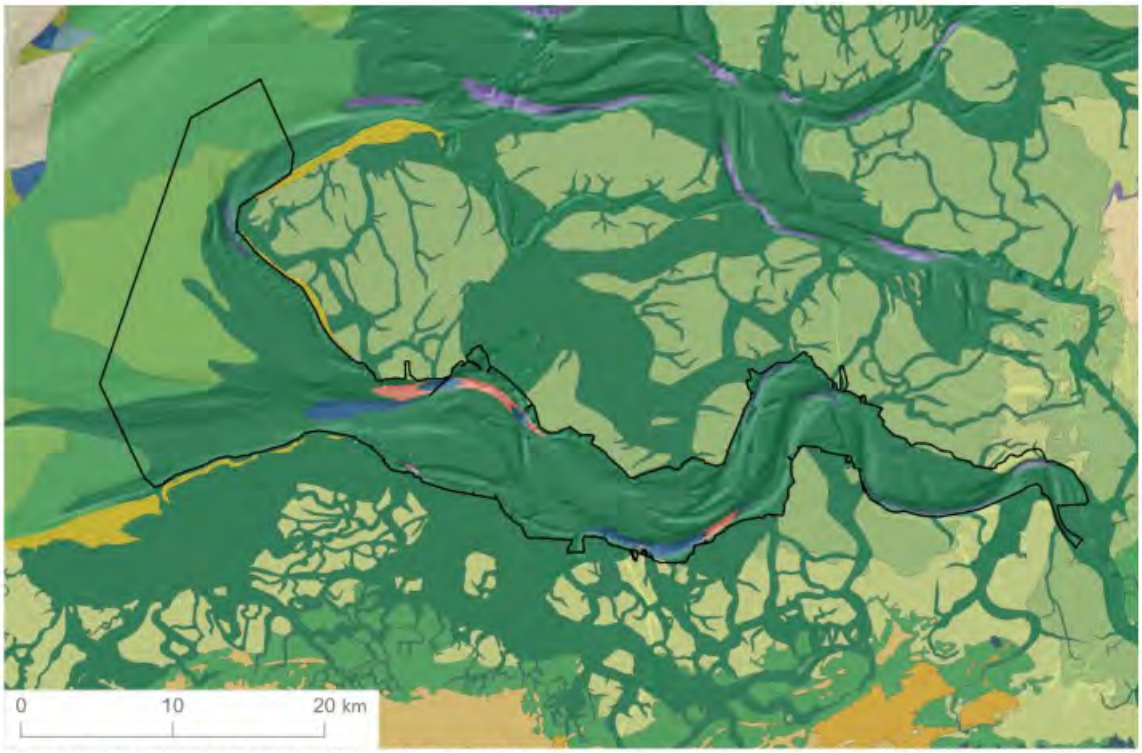

Fig. 17.5. Geological map of the Western Scheldt and its surroundings, showing various old Paleogene and Neogene geological layers in the Western Scheldt in blue and pink shades, which are incised by the deep tidal channels of the Western Scheldt, and from which fossils are taken up and redeposited on nearby beaches and flats (e.g. the Kaloot and the Hooge Platen).

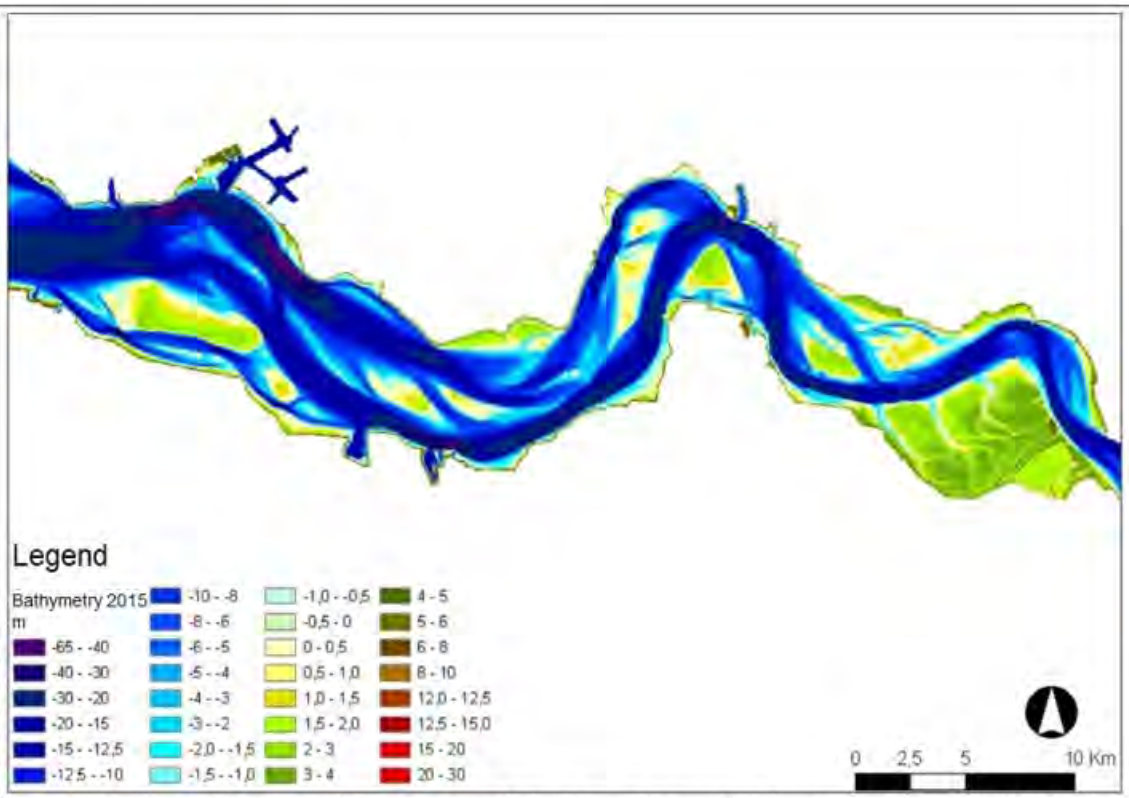

Fig. 17.6. Bathymetric map of the Western Scheldt, with parallel deep tidal channels (dark blue to purple) and intermediate shallower shoals (yellow), some of which have silted up to salt marsh level (green) (Barneveld et al., 2018).

Fig. 17.7. Ebb and flood channels in the Western Scheldt in 1938, by van Veen (1950). The ebb channels are indicated with a checkered pattern, the flood channels with a dotted pattern.

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Geosite n°18	**Drowned Zwarte Polder** A drowned polder that has risen to great heights.
 Fig. 18.1. Map of Geopark Schelde Delta. Drowned Zwarte Polder is number 18.	**Scientific importance and valuation of the geosite** Geologically valuable area of the Province of Zeeland, of national importance. One of the few small open sea inlets in an otherwise closed coast, with currently observable erosion and deposition processes on the border between sea and land (tidal flats, salt marshes, tidal channels, dunes). Fossil's site due to imported sand for beach nourishment.
Municipality	Sluis
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Nederland; Natura-2000; PMV environmental protection area, provincial valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied West Zeeuws-Vlaanderen
Site management organizations	Stichting Het Zeeuwse Landschap
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes one can travel independently
Relevance for education	- Excursions/guided tours - Routes one can travel independently
Teaching equipment	It is possible to visit the Drowned Zwarte Polder guided and unguided. Informational panels are located at several places along the walking routes.

Code	**Significance**
G-18	National
Geological interest(s)	
Paleontology: The beach is a site for shark teeth and fossil shells from the Pleistocene, Pliocene and Eocene and for trace fossils in phosphorite of Oligocene age, brought in with sand for beach nourishments from the ebb-tidal delta of the Western Scheldt estuary about 8 km north of the site.	
Stratigraphy: not applicable.	

Geomorphology: One of the few small open tidal inlets on the eastern North Sea coast south of the Wadden Sea, displaying a diversity of coastal landforms such as active tidal channels, tidal flats, salt marshes and dunes reaching 10 m above sea level.

Sedimentology: The range of landforms and deposits at this site (see above) results from currently active sedimentological processes associated with coastal, tidal and eolian erosion and deposition, which can be observed and demonstrated here in semi-natural field conditions.

DETAILED DESCRIPTION

1. **Location**

This geosite is located in the west of Zeeuws-Vlaanderen (Zeelandic Flanders) and consists of an area of ca. 600 m by 1800 m, which is located directly north of Nieuwvliet-Bad and has an open connection with the North Sea. The area has strong elevation differences over short distances, with tidal channels below sea level, tidal flats and tidal marshes that reach up to 3 m + NAP, and over 10 m high dunes that against the dike.

The Drowned Zwarte Polder had a turbulent history of land reclamation and inundation, which cannot be seen separately from developments that took place in the nearby Zwin inlet, the former important trade route to Bruges.

2. **Landscape formation**

Origin of the landscape

During the last ice age, the main part of the North Sea was dry, because a lot of seawater was stored in the large land ice sheets. After the climate warmed and the ice sheets melted, sea levels rose and seas entered the country from the northwest. Around 6300 years ago, Zeeland had turned into a tidal area with salt marshes, tidal flats and tidal channels, which was bordered on the edges by a swamp area. Sand was imported from the North Sea, and was deposited by the tide on the sea side of the salt marshes. This way protective beach ridges were built up here and there. The first beach ridges were far west of the current coastline. Due to the constantly rising sea level, these were eroded again and new beach ridges formed further east.

As a result of the decrease in the rate of sea level rise, a nearly uninterrupted beach ridge had formed around 3800 years ago, protecting the area behind against marine intrusions. A narrow opening remained at the former Scheldt mouth (at the location of the present-day Eastern Scheldt (Oosterschelde)).

Behind the protective coastal barrier, a vast swamp developed in which peat accumulated. About 2600 years ago, however, the barrier was breached again. Gradually the sea invaded the land behind. At the mouth of the Western Scheldt (Westerschelde) a sea inlet developed. With time, this inlet extended further inland and eventually tapped into the Scheldt. Due to sea breaches through various inlets such as the Western Scheldt, the peat area changed into a salt marsh landscape and became covered with a layer of clay. This salt marsh landscape was intersected by tidal channels, which resulted in the formation of several islands over time.

In the 14th century AD, a sea inlet called the Zwarte Gat developed between the former islands of Cadzand and Groede. Its existence caused quite some administrative commotion. During the following centuries, various attempts were made to artificially close the hole, to reclaim it, but also to give it up again, and then partly reclaim it. This 'giving up' happened for instance under the decree of Charles the Bold, who regarded the sacrifice of the previously reclaimed area as a matter of national interest in order to keep the Zwin inlet navigable. The Zwin was in fact a southwestern tidal inlet that connected the important trading and harbor city of Bruges with the North Sea. Many of the interventions to reclaim the Zwarte Gat were to no avail, but in the middle of the 16th

century the inlet lost its strength after all. In 1623 the salt marshes in the mouth of the Zwarte Gat were closed off from the water and the Zwarte Polder was eventually constructed.

Dike breach

However, the existence of the Zwarte Polder did not last long. During a storm surge in 1802 the dike collapsed and approximately 120 hectares of fertile polder land disappeared under water. Only a small part of the south side of the Zwarte Polder could be diked again in 1803 to protect the area behind it. At the location of the Drowned Zwarte Polder, a tidal area formed with tidal flats, salt marshes and tidal channels. The sandflats are dry at low tide, which means that the sand can be blow up and form dunes against the dikes. The main channel on the west side of the drowned polder is always under water and shifts its course over time under the influence of tidal energy. The salt marshes are located between the tidal flats and the dunes. These are only flooded at spring tide. This variation in landforms creates an area with a diverse and specific flora and fauna.

Sedimentary processes

Within the mail channel, the seawater has a high flow velocity. The current is strong enough there to erode and transport sand, but also shells and rocks at the base and sides of the channel. The current creates various types of ripples in the sand that is deposited in and around the channel. On the tidal flats, the water flows more slowly. Clay and sand are alternately deposited there, with high and low tides. By contrast, the salt marshes are rarely under water; mainly clay is deposited here and the surface is covered with halophytic (salt-tolerant) plants.

Fossil site

In the 1990s, the beach in the vicinity of the Zwarte Polder was repeatedly nourished with sand from elsewhere (the Sluissche Hompels) for coastal protection. This imported sand contained shark teeth and fossil shells from the Pleistocene (the period during which ice ages occurred), the Pliocene (the warm period before that) and the even older Eocene. Moreover, prints of marine animals can be found in pieces of black rock from the Oligocene and Miocene.

Relation with other geosites

- Dune complex Oranjezon and the Manteling – dunes and beach ridges.
- Drowned Land of Zuid-Beveland – drowned polders that are still under water.
- Western Scheldt – adjacent connection with the North Sea and one of the largest estuaries in Europe.
- Zwin: comparable open inlet in the closed coast.

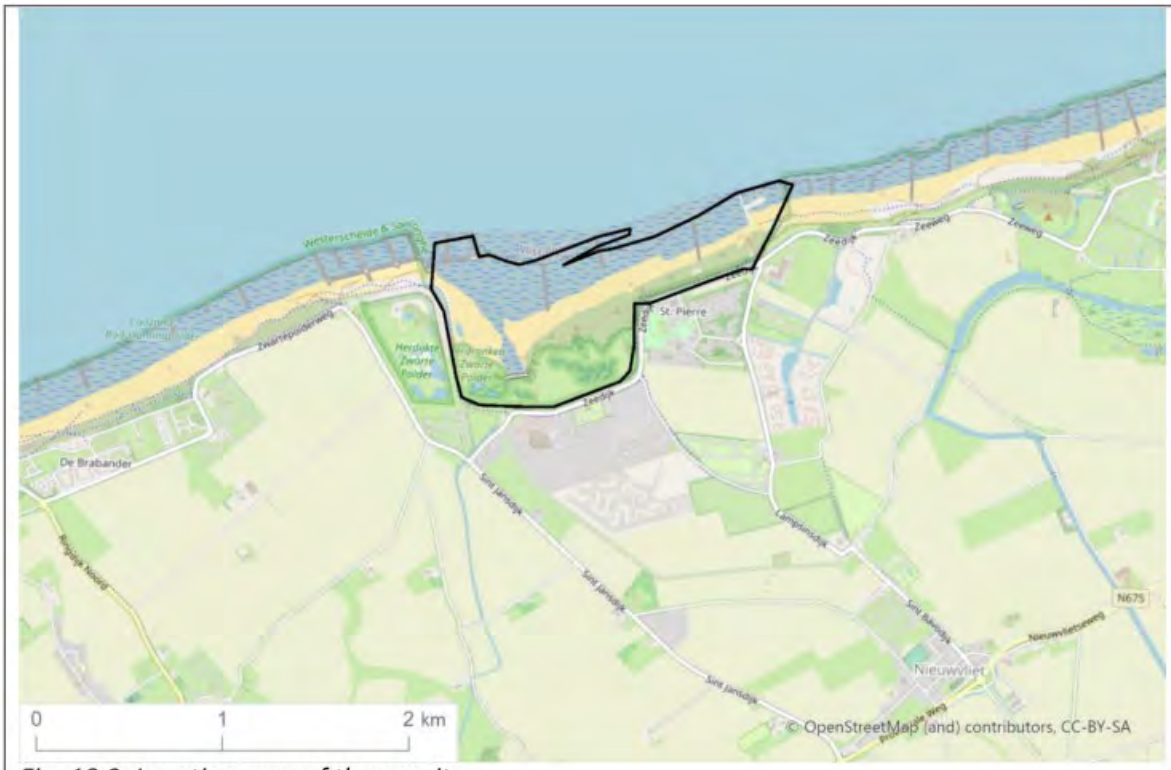

Fig. 18.2. Location map of the geosite.

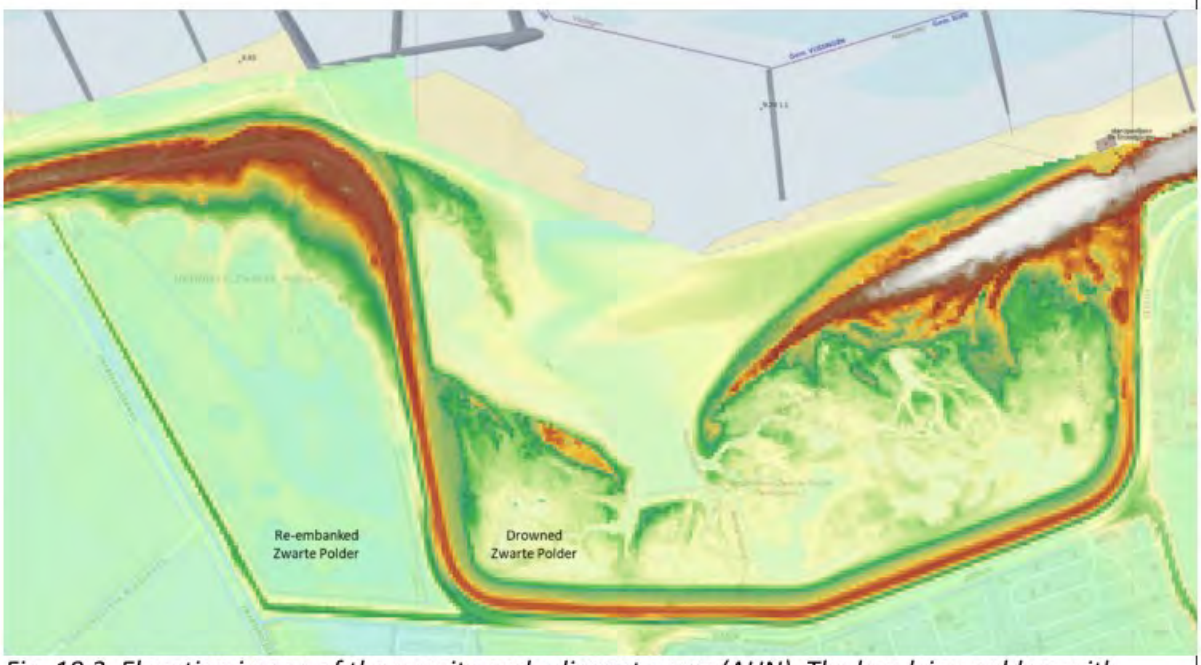

Fig. 18.3. Elevation image of the geosite and adjacent areas (AHN). The low-lying polders with creeks are displayed in light blue and green, and the higher elevated dunes and dikes in yellow and red.

Fig. 18.4. Satellite image of the geosite. The open water tidal channel, the barren sandflats, and the higher vegetated salt marshes and dunes are clearly visible. Several creeks run across the salt marsh.

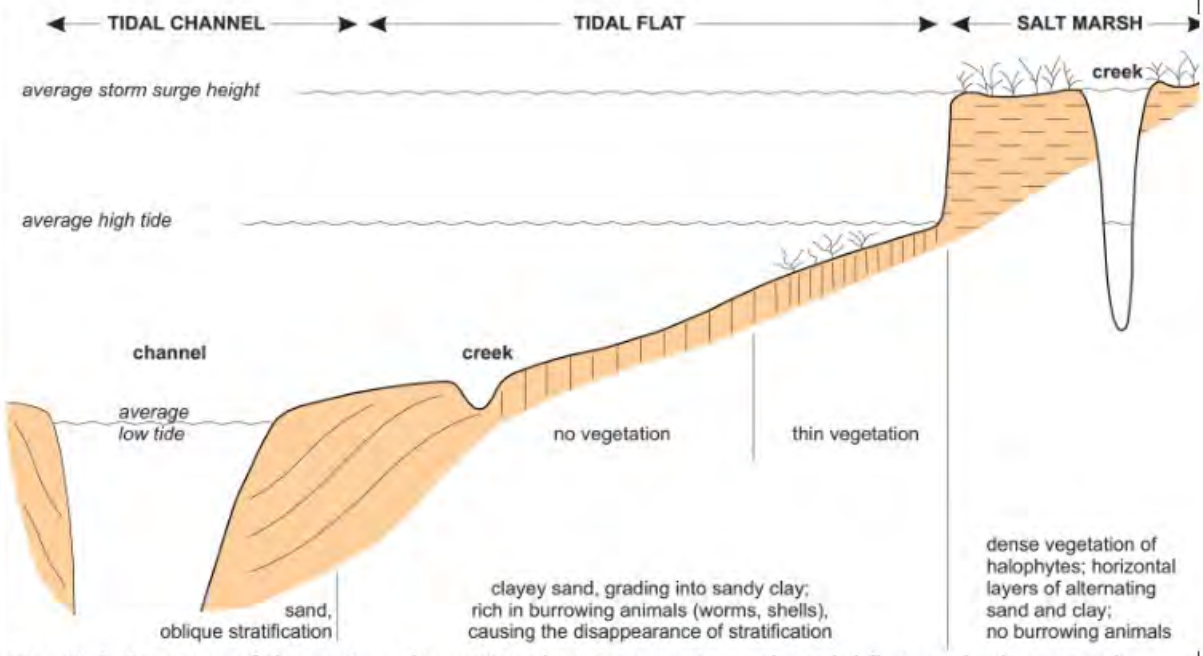

Fig. 18.5. Diagram of the various depositional environments on the tidal flats and adjacent salt marsh. From: Zagwijn, 1986.

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Geosite n°19	**Zwin** An active sea inlet with tidal landscape along the North Sea coast. The remnant of a historic tidal channel with international allure.
 Fig. 19.1. Map of Geopark Schelde Delta. Zwin is number 19.	**Scientific importance** The nature reserve Het Zwin is a very rare representative of an active tidal inlet and creek system, as well as a Natura 2000 top nature reserve. As the oldest Flemish nature reserve (1952), it is also a source of international inspiration. It is therefore of great international ecological and geological value. In addition, the international conflict landscape in and around the Zwin channel also has a national heritage value thanks to the good preservation of the archaeological and landscape remains.
Municipality	Sluis & Knokke-Heist
Province and country	Zeeland, the Netherlands and West-Vlaanderen, Belgium
Protection status	Natura 2000 Zwin: protected cultural-historical landscape; Part in Zeeland: provincial geologically valuable area, Natuurnetwerk Zeeland, PMV environmental protection area, provincially valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied West Zeeuws-Vlaanderen
Site management organizations	Stichting Het Zeeuwse Landschap, Vlaamse Landmaatschappij, Agenschap Natuur en Bos, Municipality Knokke-Heist
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center - Excursions/guided tours - Routes one can travel independently
Relevance for education	- Visitor center - Excursions/guided tours - Routes that one can travel independently - Educational programme for children
Teaching equipment	It is possible to visit the Zwin Natuurgebied with a guide. A part of the site can be visited independently. The visitor center has facilities to accommodate school

	classes and/or people wishing to visit the area for (scientific) research purposes. Information panels along the way provide more information about the site and its geological history.

Code	Significance
G-19	International

Geological interest(s)

Paleontology: The beach between the Zwin tidal channel and the village of Cadzand-Bad to the northeast is well known for its diverse fossil mollusc and shark teeth faunas of Eocene, Pliocene and Pleistocene age, eroded and reworked from the deep Wielingen tidal channel a few km offshore, from the Zwin tidal channel itself, and partly brought in with sand for beach nourishments.

Stratigraphy: not applicable.

Geomorphology: One of the few small open tidal inlets on the eastern North Sea coast south of the Wadden Sea, displaying a diversity of coastal landforms such as active tidal channels, tidal flats, salt marshes and dunes reaching more than 15 m above sea level. The site was also the subject of a limited number of international geomorphological and morphodynamic studies.

Sedimentology: The range of landforms and deposits at this site (see above) results from currently active sedimentological processes associated with coastal, tidal and eolian erosion and deposition, which can be observed and demonstrated here in semi-natural field conditions. The site was also the subject of a limited number of international sedimentological studies.

DETAILED DESCRIPTION

1. Location

The geosite 'Zwin' is located on the eastern border of the Belgian coastal plain. The border between Belgium and the Netherlands is located in the active tidal inlet, so this is a transboundary geosite. The delimited geosite comprises an area of approximately 5 km² between Knokke (B), Sint Anna ter Muiden (NL) and Retranchement (NL). The contemporary nature reserve Het Zwin extends from the beach and coastal dunes (Het Zoute and Koningsbos; 5-14 m TAW) over an active tidal landscape with tidal flats and salt marshes (below 4.5 m TAW) to the Nieuwe Zwindijk. In addition, several historic polders are located within the geosite. Part of the Willem-Leopoldpolder (4.5-5 m TAW) was recently partly depoldered and is now located within the nature reserve. Finally, the site also contains traces of historical border conflicts (Fort Isabella and Cantelmoline).

The delimited geosite is only part of the wider, historic Zwin region: the landscape that has been influenced by the Zwin channel(s) and its predecessors over time.

2. Landscape formation

The extent of the Zwin area is variable in time and space. Today it is a small active tidal inlet, dune area and tidal area. However, between the 12th and 19th centuries, the Zwin was a large and dynamic tidal channel. This channel reached as far as Damme in the south and as far as Biervliet in the east. The origin of the Zwin can even be traced back to the Sincfal, a tidal channel in Roman times and early Middle Ages, and possibly even to a Middle Holocene channel near the current Scheur, the navigation channel off the coast of Zeebrugge. The exact age of the Zwin can no longer be determined because the oldest sediments have been eroded by storms and tides. The formation history of the current Zwin can therefore only be understood in the context of the regional landscape evolution of the Zwin region.

<u>Sea level rise, development of a tidal area and a peat swamp (ca. 10,000 - 2800 years ago)</u>

The morphology of the landscape at the end of the last ice age strongly influenced the Holocene evolution of the Zwin region. During the Pleistocene, the Zwin region was partly located on the

right flank of the Flemish Valley. This higher area extended to about 20 km off the present coast. When the Scheldt stopped flowing through the Flemish valley at the end of the Weichsel glacial and the filled valley was covered with sand by the wind, a natural headland developed off the present coast. This headland protected the Zwin region from the sea during the first half of the Holocene, but it eroded during the Middle and Late Holocene. It thus formed an important sediment source for filling the tidal basins.

Thanks to this headland, the rising sea level only affected the Zwin region since 7,000 to 6,000 years ago. The coastal barrier was then 10-15 km off the present coast, but stabilized and even shifted slightly seaward until 5500 years ago due to the deceleration of the sea level rise and the supply of eroded sediment. At the position of the Scheur and the later mouth of the Zwin and/or Blankenberge channel, an erosive tidal channel may have already broken through this coastal barrier. Behind the coastal barrier, a tidal flat formed approximately up to the present coastline. This tidal flat later silted up into a salt marsh. Along the upper edges a peat swamp formed over the Pleistocene sandy landscape, due to the upwelling of fresh groundwater. Until 2800 years ago, the coastline remained stable and the peat swamp could expand further inland in pace with the slower sea level rise. It covered the coversand area and (locally) also the silted salt marshes. Remains of the peat are still preserved in the subsoil between the younger incisions of tidal channels and creeks. Dry sand ridges in this tidal flat and swamp formed temporary habitats for prehistoric hunter-gatherers.

<u>An open coastal landscape with channels (ca. 2800 - 1250 years ago)</u>
From 2800 years ago, climate change and possibly also inland deforestation caused increased drainage in the peatland. As a result, old channels (Zwin and Blankenberge channels) started to incise again and there was more space for the tides behind the coastal barrier, which eroded and shifted inland. New channels were also created (Oostkerke channel). The resistance of the peat against erosion also caused these channels to erode deeply in a vertical direction. This incision created an open tidal channel landscape with 'islands' of older, higher salt marsh (and peat) areas, on which Wulpen, Koezand, Zuidzande and Cadzand were later built.

The human use of this tidal landscape enhanced this process. The combination of channels, tidal flats, salt marshes and peat was indeed attractive to humans. They adapted their way of life and made use of the opportunities that this landscape offered. Despite its location, during Roman times this peripheral area was an active part of the Roman economy, for example through sheep farming on numerous salt marsh meadows, (large-scale) salt production or trade in shellfish as food. Small rural settlements developed on higher (and later raised) locations (mounds) in and on the edge of the salt marsh. During the Roman period, the dune barrier and coversand ridges along the edges of the tidal area also formed part of a coastal defence line with fortresses in Oudenburg and Aardenburg. Starting from the residential areas, the landscape was locally drained for small-scale agriculture and/or peat extraction and raised roads (early dikes) were built to protect against flooding.

In the early Middle Ages settlements arose in a similar way on mounds located on the salt marsh and along the channels. Small ring dikes were built around these settlements to protect the surrounding area and to exploit it more intensively. During the High Middle Ages, this reclamation evolved into a true landscape transformation, in which local dikes on the salt marsh were connected to longer systems. This created the first polders. From the late Middle Ages onwards, parts of the landscape below high-water level (tidal flats and channels) were also effectively embanked and dikes served not only to protect against storm surges, but also to reclaim land from the sea.

The Roman and (early) medieval interferences enhanced the natural peat compaction and subsidence of the surface. Since the sandy infill of the tidal channels is less compactable than the surrounding peat layers, these channel ridges became higher than their surroundings. The subsidence further increased the tidal influence in the hinterland. (Storm) floods widened the tidal inlets and condensed the network of tidal channels. It therefore took until the early Middle Ages (between 550-750 AD) before the sediment supply, tidal damping and sea level rise were back in balance and the tidal area had once again silted up above high-water level. The coastal barrier no longer eroded and stabilized about 10 km off the present coast. A broad dune ridge formed here. In this period the Blankenberge channel, the Oostkerke channel, the Sincfal and the Honte determined the landscape of the Zwin region. These channels were formed and filled at different times during the late Iron Age, the Roman period and the early Middle Ages. The first two channels silted up almost completely between Roman times and the 9th - 10th century AD, while the Honte became the new mouth of the Scheldt estuary after the Western Scheldt (Westerschelde) breached.

Sincfal: the prelude of the Zwin (… - 1134 AD)

Due to the silting up of the Blankenberge channel and (later) the Oostkerke channel, at least one canal was constructed (partly in a creek) between the Sincfal and (early) medieval Bruges: the Oud Zwin. From the 11th century, the need for agricultural land and fuel (peat) increased sharply due to population growth. By connecting elevated roads and/or low dikes to form a defensive seawall, larger parts of the salt marsh could serve as meadows. The inner-dike area was drained with canals and the former dikes between polders lost their function. As a result, the tide could no longer spread over the salt marsh and the creeks during storm surges. However, this unintentionally enhanced the silting up of the outer-dike area, including the canalized connection between Bruges and the Sincfal. In combination with peat extraction, peat compaction due to drainage of the inner-dike area and poor dike maintenance, the region became more susceptible to damage by storm surges.

Zwin (1134 AD to present)

In October 1134 AD a strong storm surge eroded an old inlet of the Sincfal, up to an old creek ridge on which (Honts-) Damme (Dam on the Honte) was later founded. Initially, this tidal channel, the Zwin, was more navigable for seagoing vessels – at least up to the transshipment harbor of Damme – than the Oude Zwin Canal, which was silting up. Thanks in part to the Zwin, Bruges grew from the middle of the 12th century to the 15th century AD into an international harbor city.

However, the natural accretion of the salt marshes along the Zwin and their subsequent embankment reduced the tidal area, as did the construction of a dam on the channel at Damme. This accelerated the natural silting from the inland towards the mouth. The decreased navigability of the Zwin channel strengthened the development of outer ports, such as Sint Anna Ter Muiden, Monnikerede, Hoeke and especially Sluis. As a result, activities of outer ports of Bruges moved gradually towards the mouth. At the same time, Bruges' economic power diminished and 16th century attempts to revive the Zwin by increasing the flow rate and digging new canals, such as the Verse Vaart, also failed.

In addition, the coastal barrier was also eroded as a sediment source for silting. Moreover, the economic depression no longer allowed dikes in the subsiding polders to be reinforced around the Zwin mouth. This again made this area sensitive to the impact of storm surges. Between the late 14th and early 16th century AD, the last islands (Wulpen) off the current coast therefore disappeared. A new coastal barrier with dunes formed over the already silted part of the Zwin mouth between Knokke and the current Zwin reserve. This coastal barrier with high dunes (up to 18.5 m TAW) was initially even more inland than the current coastline and was later secured by vegetation and the construction of the Koningsbos. The final coastline and the youngest, lower

and active dunes in front of the Zwin only formed after the Zwin channel was almost completely closed off.

Due to its economic importance, the Zwin was also the scene of international conflicts fought during naval battles (in 1213, 1340 and 1603 AD) in the tidal channel. During the Eighty Years' War (1568-1648 AD) and the War of the Spanish Succession (1702-1713 AD), the Zwin mouth formed part of the front line and defensive lines were formed on both banks, with fortresses, such as the Isabellafort, and earthen ramparts, such as the Cantelmoline which was constructed near the later national border. Flooding was also a war tactic and the dikes around the former Zwin were breached at Sluis. As a result, new tidal channels developed from the Lapscheuregat and Coxydegat and part of the polders flooded again.

In the 17th and 18th centuries, the flooded area was reclaimed again into large, rectangular plots, suitable for more intensive agriculture. In 1872-1873 AD, the Internationale Dijk also closed off this part of the Zwin from the tide and the Willem-Leopoldpolder was created. With the exception of a small residual channel near the Belgian-Dutch border, the coastline was closed again. Thanks to coastal tourism, the fishing villages by the sea flourished again from the 19th century AD. During WWI and WWII, the Zwin regained a military function in the Hollandstellung and Atlantikwall respectively.

At present, in addition to a recreational function, the Zwin has an important ecological function thanks to the gradient between wet and dry, salt and fresh water, and clay and sand. Thanks to dredging, the tidal inlet has not silted up any further over the past decades. The tidal area has recently even expanded again due to the depoldering of the Willem-Leopoldpolder, in order to slow down natural silting and accretion. This expansion is on the one hand a compensation for natural values lost elsewhere and on the other hand a buffer against the current sea level rise.

<u>Relation with other geosites</u>

- The Zwin creek remnants and Passageule (geosite 20) were part of the Zwin area in the past. These creeks reached as far as the Braakman region (geosite 23) and the creek and coversand area of Sint-Margriete – Aardenburg (geosite 22).
- The Zwin polders near Damme (geosite 21) are part of the historically reclaimed Zwin region.

Fig. 19.2. Topographic map of Zwin. Source: OpenStreetMap & contributors. CC-BY-SA

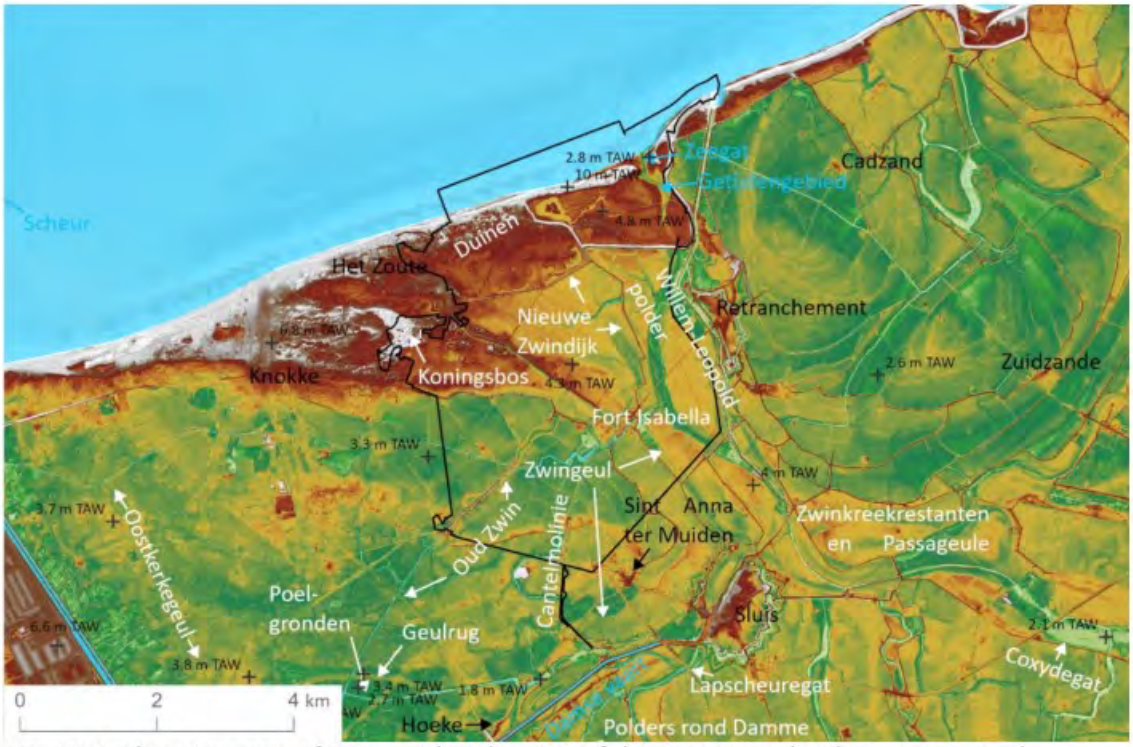

Fig. 19.3. Elevation map of Zwin, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Agentschap Informatie Vlaanderen; AHN3 Rijkswaterstaat.

Fig. 19.4. Geological map of Zwin. Source: Geological map of Geopark Schelde Delta, TNO

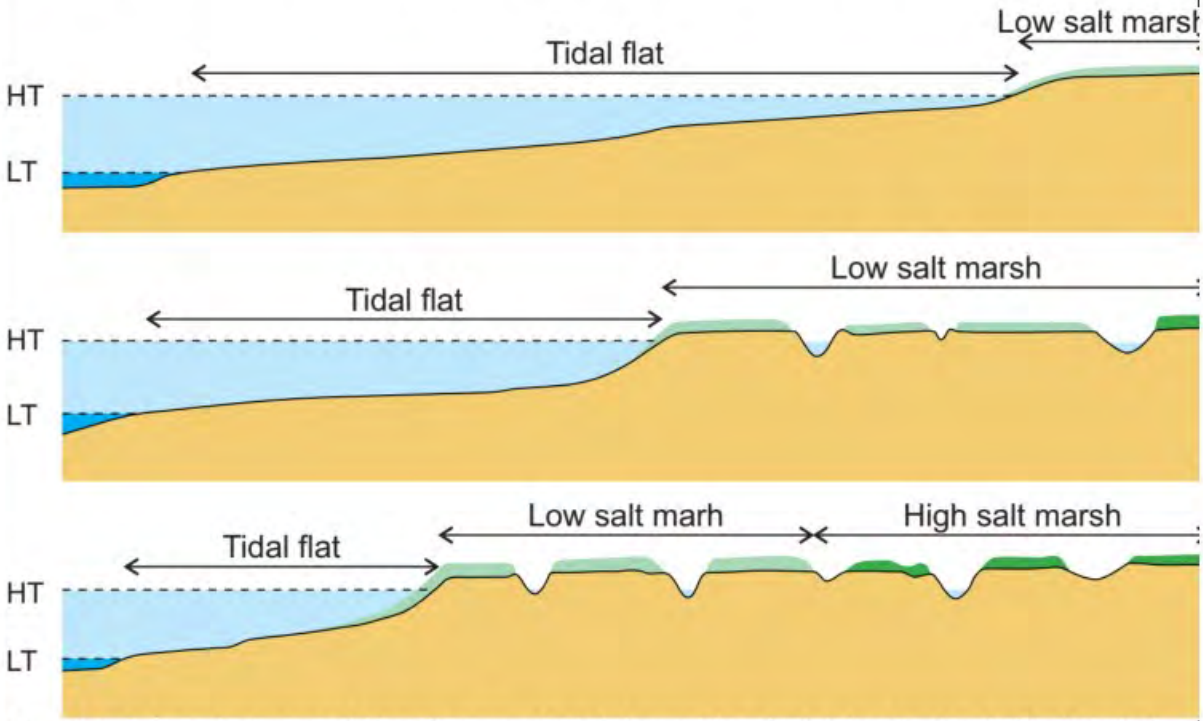

Fig. 19.5. Schematic image of the silting up of a tidal area (HT = high tide, LT = low tide). Adapted after Verhulst (1995).

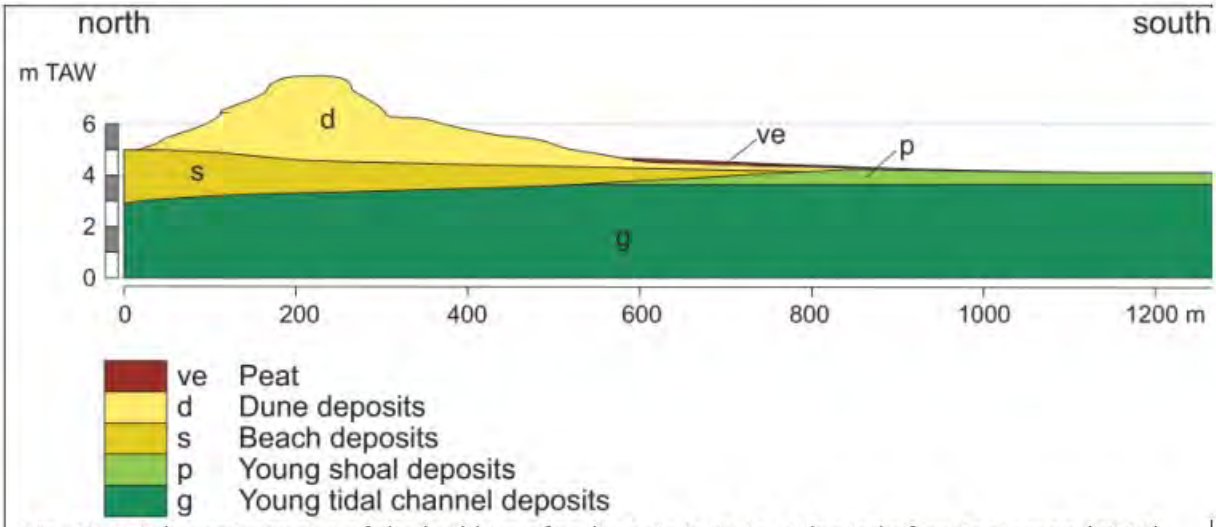

Fig. 19.6: Schematic image of the build-up of sediments in Zwin. Adapted after Baeteman (2018).

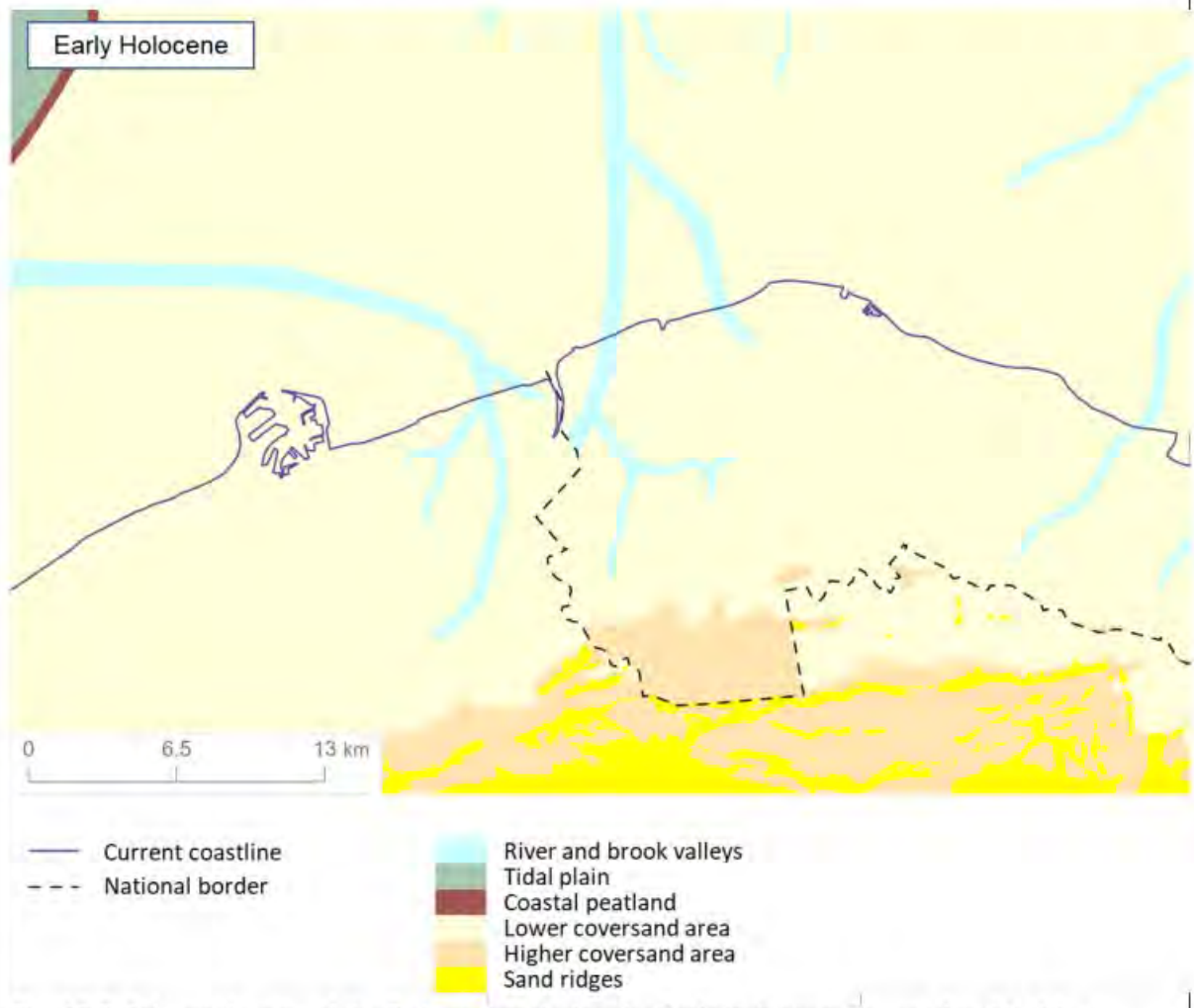

Fig. 19.7. Schematic map of the Zwin region during the Early Holocene. The sea level is rising rapidly and is gaining influence in the mapped area. As a result, basal peat forms on the edge of a distant tidal area. Rivers and brooks cross the coversand area. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

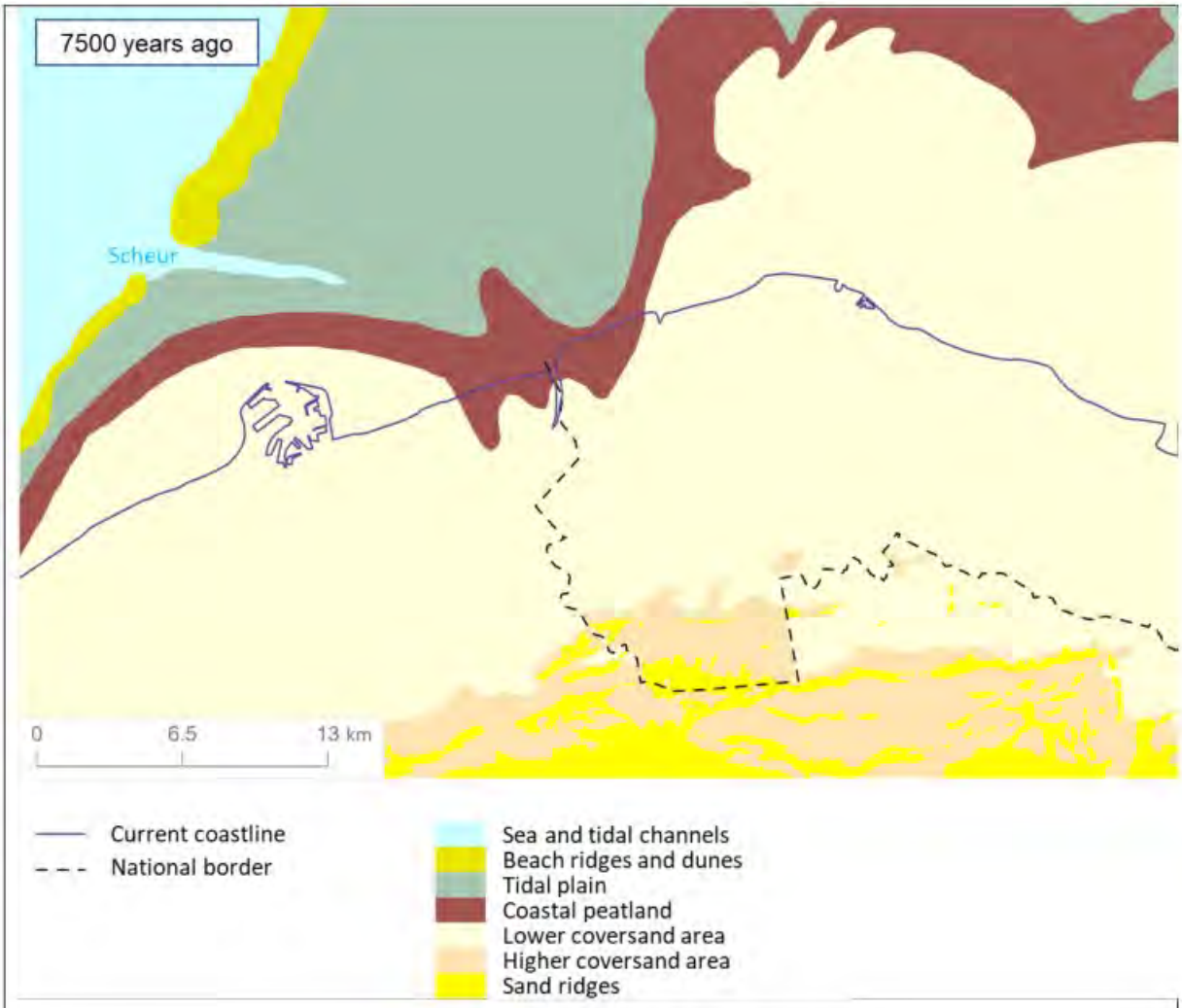

Fig. 19.8. Schematic map of the Zwin region about 7500 years ago. Due to the slowdown in sea level rise, the tidal area is starting to silt up. This stabilizes the coastal barrier (beach ridges and dunes) and the coastal marshes gradually evolve from saltwater to freshwater marshes, with peat formation. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

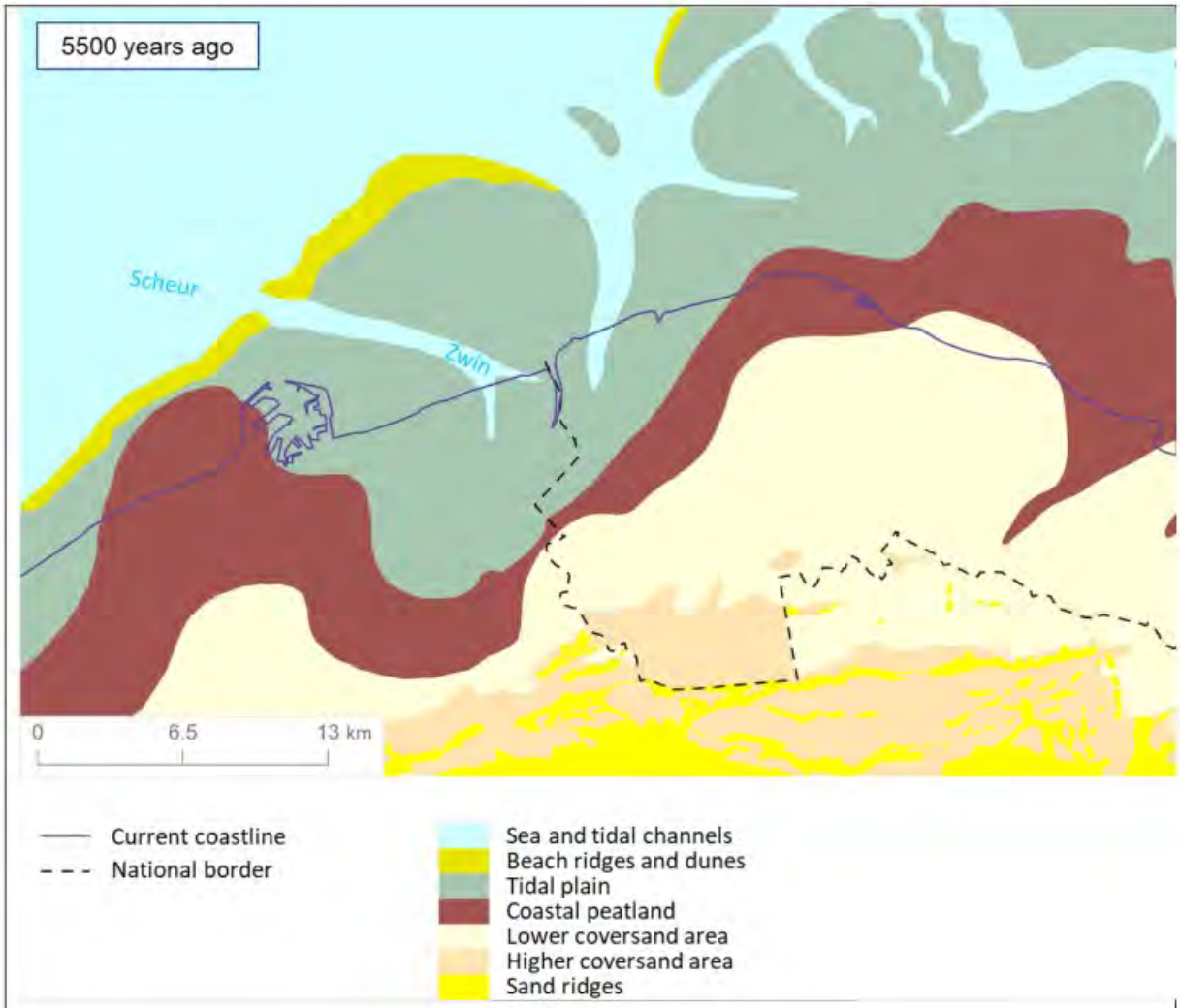

Fig. 19.9. Schematic map of the Zwin region about 5500 years ago. The coastal peat swamp is expanding due to the further slowing of sea level rise and the tidal area is further silting up, while the tidal channels are narrowing. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

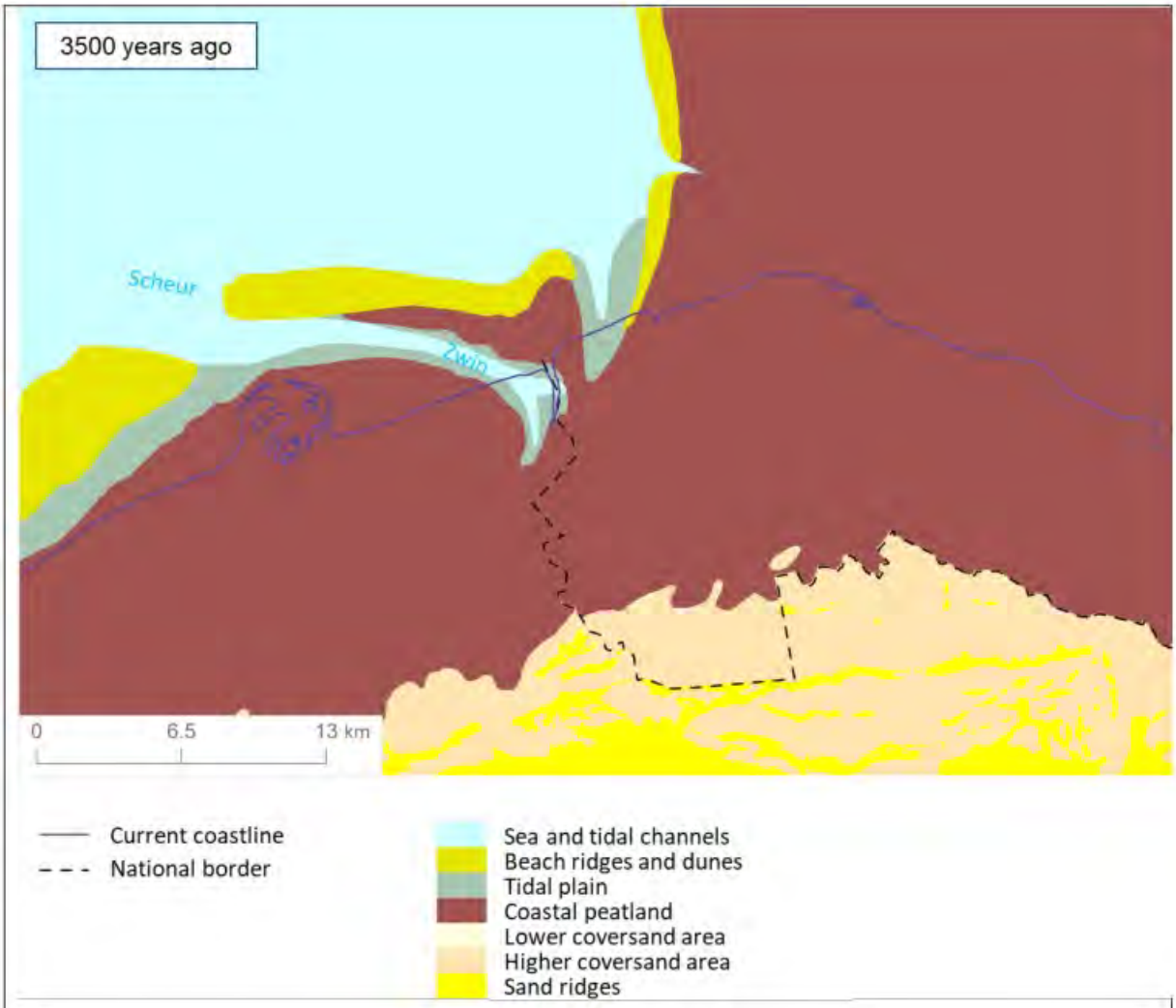

Fig. 19.10. Schematic map of the Zwin region about 3500 years ago. Almost the entire coastal area is covered by a coastal peat swamp. The tidal area has been reduced to the margins of some large tidal channels. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

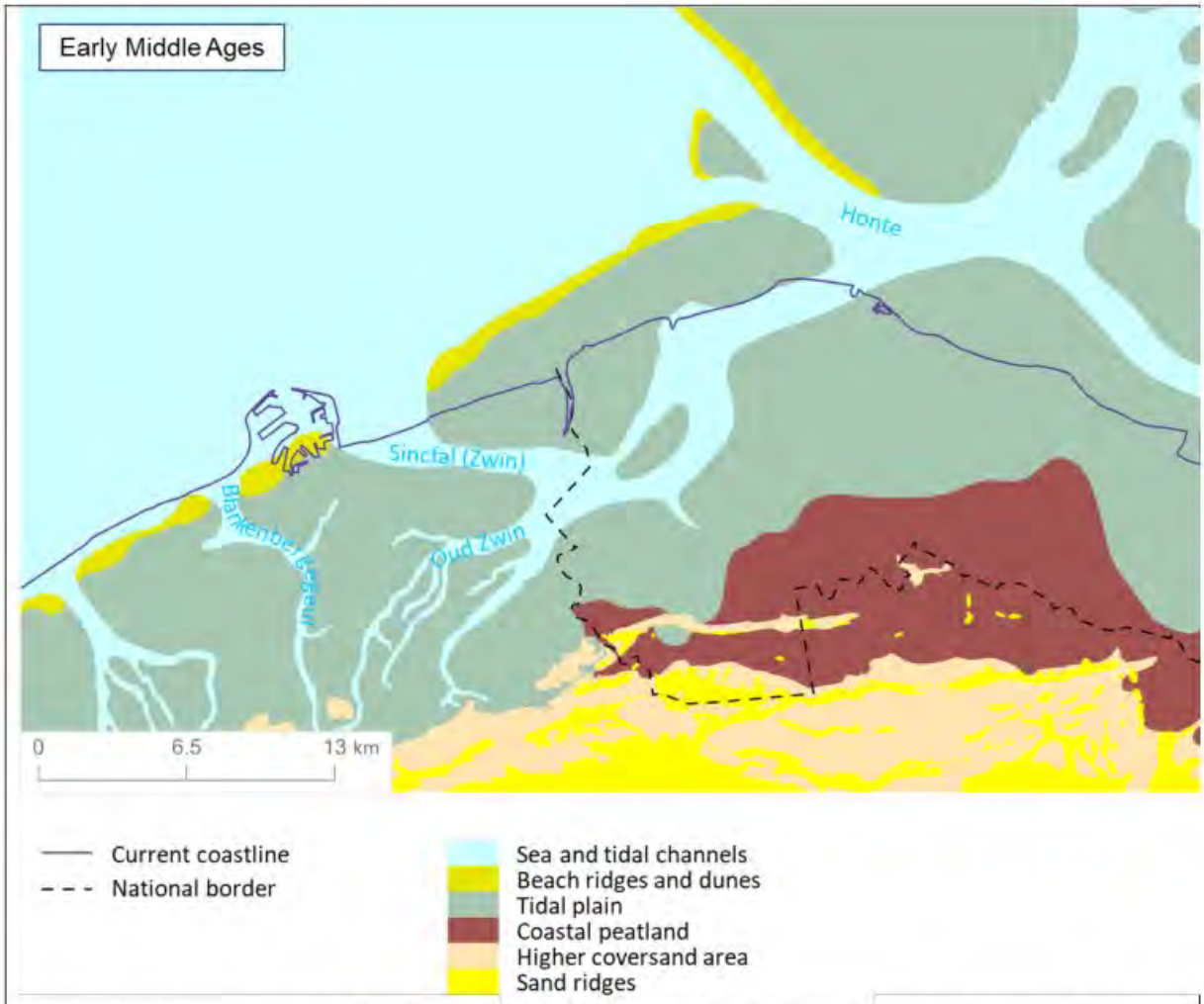

Fig. 19.11. Schematic map of the Zwin region in the early Middle Ages. From the late Iron Age to the early Middle Ages, several tidal channels are once again forming in the coastal area due to climate change, inland deforestation and human interventions in the coastal landscape. The tidal area is expanding and the coastal belt is shifting inland as a result. The Oud Zwin channel forms the connection with Bruges. The Honte inlet expands in the direction of the Scheldt. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

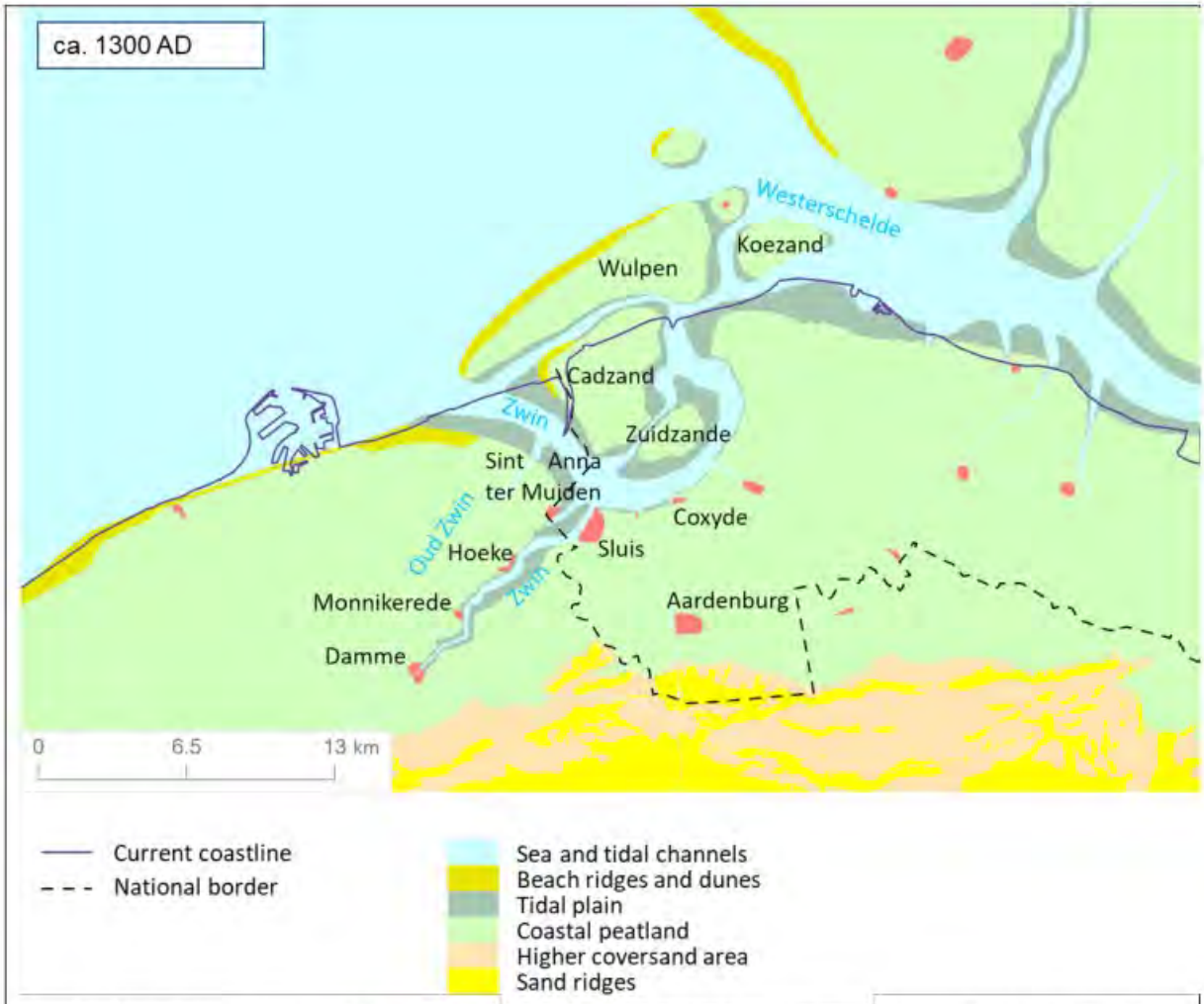

Fig. 19.12. Schematic map of the Zwin region around 1300 AD. The coastal area has been diked and impoldered. The Zwin inlet has incised up to Damme and various transhipment harbors are established along the tidal channel. Several islands (Wulpen, Koezand) are still present in front of the current coastline, but the coastal barrier is weakening. The Honte has connected with the (Western) Scheldt. Adapted from the Ruijsscher, D. (2019) (© Ghent University Department of Archaeology).

Fig. 19.13. Schematic map of the Zwin region around 1500 AD. The Zwin inlet continues to silt up and is being reclaimed. The islands (Wulpen, Koezand) off the current coast are flooded. Cadzand and Zuidzande are connected to the mainland by land reclamation. Adapted from the Ruijsscher, D. (2019) (© Ghent University Department of Archaeology).

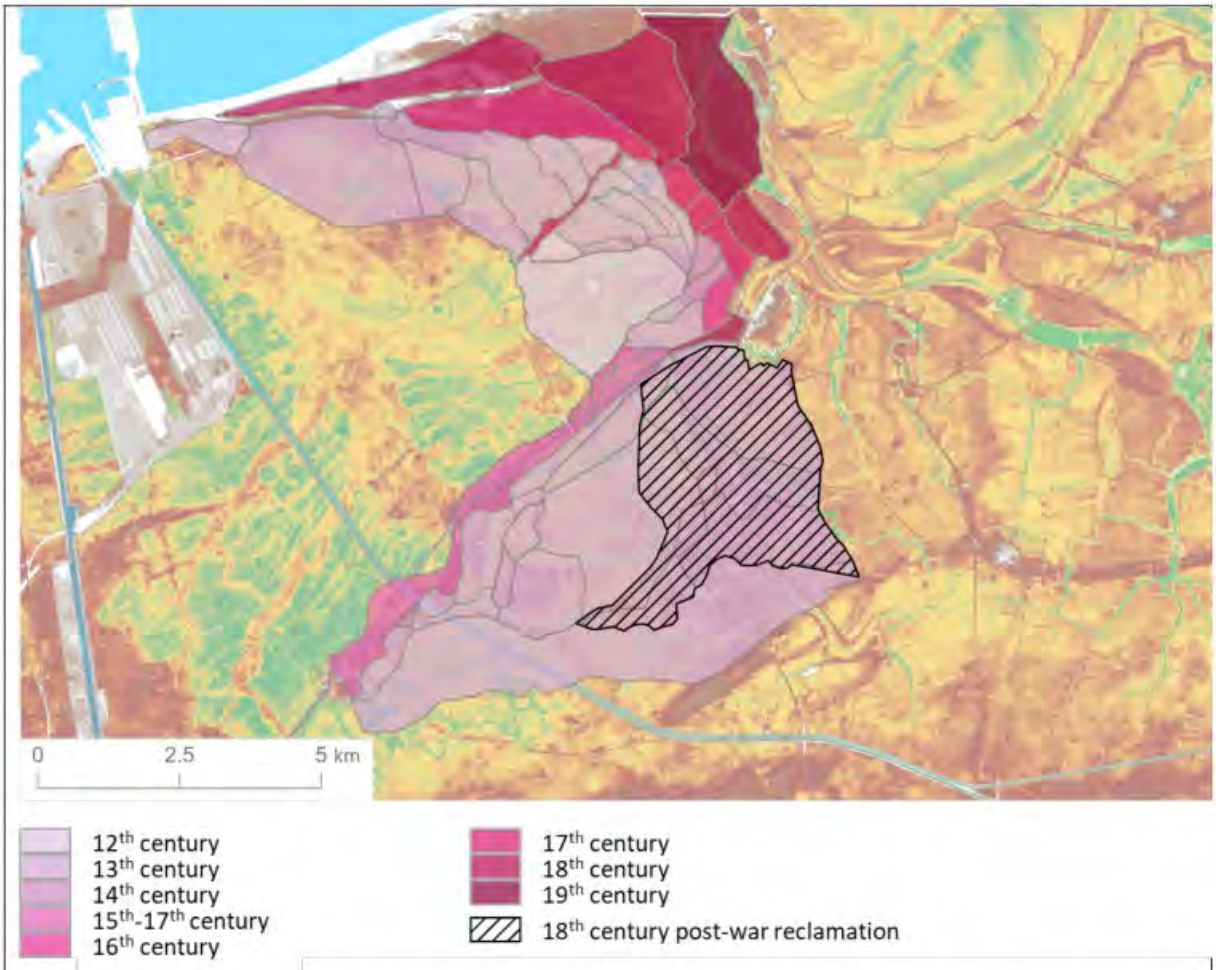

Fig. 19.14. The chronological overview map of the reclamation of the Zwin region shows the continuously advancing embankments from the Zwin channel towards its mouth. The reclamation was interrupted by the religious wars, after which re-embankments were necessary. Adapted to Trachet (2016), Econnection, Province of West-Vlaanderen and DHMVII Agentschap Informatie Vlaanderen; AHN3 Rijkswaterstaat.

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Geosite n°20	Zwin creek remnants and Passageule
 Fig. 20.1. Map of Geopark Schelde Delta. Zwin creek remnants and Passageule is number 20.	**Scientific importance** The pattern of the Zwin creek remnants (former channel systems) can still be clearly seen in the current landscape. Elevation differences between different polders or between channels and polders testify to differences in the period of reclamation. Elevation differences between different parts of channels testify to the different times when those channel sections were dammed and closed off from the sediment supply. The Passageule connected two important tidal inlets in Zeeuws-Vlaanderen (Zeelandic Flanders) for several centuries. The former channel systems are still clearly visible in the current landscape; elevation differences between channels and polders testify to differences in the timing of reclamation or damming of channels. The area was of great importance in the cultural-historical development of the border region, especially the development of Bruges and the construction of the fortifications of the Staats-Spaanse Linies (Spanish State Lines). It is a geologically valuable area of national importance of the Province of Zeeland.
Municipality	Sluis
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area; Passageule: Natuurnetwerk Zeeland, provincial valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied West-Zeeuws Vlaanderen; Zwin creek remnants: Natuurnetwerk Zeeland
Site management organizations	Stichting Het Zeeuwse Landschap, Staatsbosbeheer, Municipality Sluis
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes one can travel independently - Information panels
Relevance for education	- Excursions/guided tours - Routes one can travel independently
Teaching equipment	This is an extensive area where one can cycle and/or walk independently. Along the creek remnants,

	information panels can be found that provide more information about the area.

Code	**Significance**
G-20	National

Geological interest(s)

Paleontology: not applicable.

Stratigraphy: not applicable.

Geomorphology: Fine example of a series of embanked former channel systems which are still visible in the present landscape; elevation differences within former channels or between channels and polders testify to differences in the timing of reclamation or damming of channels, ending sediment supply to the system.

Sedimentology: not applicable.

Geological significant sites

Geosite n°20a	**Zwin creek remnants** A story of silting up and drowning.
 Fig. 20a.1. Topographic map of the surroundings of the geosite. In the northwest, the boundaries follow the national border between the Netherlands and Belgium.	**Scientific importance** The pattern of the former channel systems can still be clearly seen in the current landscape. Elevation differences between different polders or between channels and polders testify to differences in the period of reclamation. Elevation differences between different parts of channels testify to the different times when those channel sections were dammed and closed off from the sediment supply. The area was of great importance in the cultural-historical development of the border region, especially the development of Bruges and the construction of the fortifications of the Staats-Spaanse Linies. The area is part of a geologically valuable area of national importance of the Province of Zeeland.

DETAILED DESCRIPTION

1. **Location**

The geosite concerns a polder landscape containing the remains of dammed former creek courses and tidal channels, which once originated from the tidal inlet of the Zwin. The geosite is located in the west of Zeeuws-Vlaanderen, between the partly fortified towns of Retranchement, Sluis, Aardenburg, Sint-Kruis and Oostburg. Eastwards the area narrows and the boundary follows the location of a former tidal channel and its branches. The area is bordered in the east by the Bakkersdam south of Oostburg and about 8 km east of geosite Zwin.

This area is the western part of geosite 20 'Zwin creek remnants and Passageule'.

2. **Landscape formation**

Origin of the landscape

In the last ice age, the sea level was much lower and the coastline was far more seaward compared to today. The landscape was a sandy polar desert, where the wind had free rein. After the climate warmed and the land ice sheets melted, the sea level gradually rose and the sea entered the land. Around 6300 years ago, Zeeland and parts of the Flemish coastal region had turned into a tidal area with salt marshes, tidal flats and channels, surrounded on the edges by a

peat area. Sand was brought in from the North Sea and was deposited by the tide on the sea side of the salt marshes, thus building up protective beach ridges here and there. The first beach ridges were far west of the current coastline. Due to the continuously rising sea level, these were eroded again and new beach ridges formed further east.

As a result of the slowdown in the rate of sea level rise, an almost uninterrupted beach ridge had formed around 3800 years ago, protecting the area behind against marine intrusions. Only at the location of the current Eastern Scheldt (Oosterschelde), a narrow opening remained. Behind the protective coastal barrier, a vast peat landscape developed.

About 2600 years ago, the coastal barrier was breached at some locations. Because humans locally drained the peat for salt production and agriculture, the surface of the peat area lowered and the sea was able to enter the hinterland. Sea breaches from several tidal inlets transformed large parts of Zeeland and parts of the coastal region of Flanders (Vlaanderen) into a tidal landscape, consisting of tidal flats and salt marshes, intersected by tidal channels and creeks. The scouring effect of the tidal channels resulted in the creation of several islands in the area, often with settlement centers, farms and churches, which often only existed for a few centuries due to the dynamics of the tide. For instance, the islands of Cadzand and Wulpen were situated around the mouth of the Zwin for some time. Today nothing remains of the island of Wulpen, because it was swallowed by the sea, while Cadzand was spared and eventually became part of the mainland.

Medieval dikes played a major role in the development of the creeks and channels in the geosite. Before the embankments, the tidal action naturally caused the land surface to rise above high tide level due to the silting up of salt marshes. The land was therefore high enough to live on and was often used for sheep farming. People from several settlement centers constructed earthen banks and low dikes on the salt marshes to stop extreme high water. However, this had a negative effect: the dikes prevented the sea from spreading over the salt marshes during very high water, thus causing the water to push up against the dikes and at even higher water levels even causing dike breaches.

Another effect of the dikes that were built directly along tidal channels was the increase of the flow velocity of the seawater during high tide and the decrease during low tide. In this way, the sand that was brought in at high tide could no longer leave the tidal channels during low tide, with the result that many diked channels filled in with sand. Because some channels silted up, other channels received more water during storm surges and were therefore incised deeper and widened. As a result, some tidal channels gradually lost their function as navigation routes, while the sanding of other channels created new routes. The silting up of the tidal channel De Reie is a well-known example of this. This channel connected the sea with the important commercial center of Bruges, but was at risk of slowly silting up due to the dikes and becoming unnavigable. In the middle of the 12th century, the people of Bruges moved their harbor to the nearby Zwin inlet, which had become wider and deeper during storm surges. From this period, the salt marshes on the banks of the Zwin were reclaimed and used as agricultural area, causing creek and tidal channel remnants to be often preserved in the landscape. In the end, the Zwin faced the same fate as the Reie, and here too the dikes ensured that more sand was brought in at high tide than could be exported with the ebb current. Both the Zwin inlet and the Zwin mouth silted up and became virtually unnavigable for merchant ships in the early 16th century.

During the Eighty Years' War (1568-1648), the Zwin region was in the front line between the Northern (States) Netherlands and the Southern (Spanish) Netherlands. The Zwin dikes southwest and east of Sluis were breached in 1583. The sea entered the polders and eroded several new channel systems, such as the Lapscheuregat (west of Sluis) and the Coxysche Gat (or Coxydegat, between Sluis and Oostburg). Their mostly rectilinear course indicates that the inflowing water

largely followed the existing excavated waterways. In 1611 part of the flooded area was again reclaimed.

However, after the Twelve Years' Truce (1609 - 1621), the dikes were breached again. The Lapscheuregat and especially the Coxysche Gat penetrated deeper into the polder land. The branches of the Coxysche Gat reached almost up to Sint-Laureins (south of Sint-Kruis). A large area became swampy and uninhabitable. Villages were abandoned and fell into disrepair. These inundations have erased the medieval pattern in the flooded polder areas.
In this turbulent period, both sides of the Zwin mouth were provided with military reinforcements by both Spanish and Dutch troops and important fortifications were constructed such as Sluis (Spanish) and Retranchement (States-General).

Between 1648 and 1652, large-scale repoldering of the inundated areas in Zeeuws-Vlaanderen was undertaken. The still open tidal channels were confined between newly constructed dikes. Smaller creeks were also dammed. Around 1700 almost all of the inundated area had been reclaimed and only the Zwin estuary with connecting tidal channels remained open. In the meantime, the Zwin channel had moved eastwards, eroding the western side of the Land of Cadzand.
Large parts of the former main course of the Zwin were reclaimed in the 19th century and the navigability in the area was increased by the construction of new canals. This put an end to the large tidal channel of the Zwin. Only the creek remnants remained visible in the landscape as dammed, water-filled beds.

Salt marshes, tidal flats, tidal channels and creeks

In a tidal zone, high water brings sediment (sand and clay) from the tidal inlets twice a day, which is partly left behind in the coastal plain. Because sand is somewhat heavier and is only transported by fast-flowing water, it is mainly deposited in and along the channels. Between these channels are tidal flats that flood at high tide, thus being raised a little with a thin layer of sand during each flood. The finer and lighter clay particles can also be transported at low flow rates and mainly precipitate during the reversal from high tide to low tide, when the flow velocity is at its lowest. The tidal flats therefore consist of an alternation of thin layers of sand and clay. Tidal flats can occur within a tidal channel (shoals) or be attached to the mainland or to islands. The highest parts are the salt marshes that are only flooded at very high water (spring tide and storm surge) due to their elevation. They are overgrown with halophytic (salt-tolerant) plants and are intersected by creeks that supply and drain the water. Slightly higher levees can often be found directly next to the creeks.

A fossil creek system

When a tidal channel is closed off from the sea, it silts up. The narrow water that remains at the location of the old tidal channel is also called a creek (but is therefore different from the creeks described above on active salt marshes). The pattern of the wider, fossil tidal channels is still clearly visible in elevation maps. The lowest parts (up to approx. 0.8 m + NAP) are the former channels. Outside the channels, the land is at a maximum elevation of about 2 m + NAP.

Relation with other geosites

- This area is the western part of geosite 20 'Zwin creek remnants and Passageule'.
- Zwin (geosite 19) – western connection of this area with the North Sea and the Flemish coastal area.
- Passageule (20b) – Former tidal channel in Zeeuws-Vlaanderen connecting this area in an easterly direction with the Braakman inlet.
- De Braakman (geosite 23) – large tidal system that split Zeeuws-Vlaanderen in two for centuries and with which this area was connected via the Passageule in the east.

- Creek and coversand area Sint-Margriete – Aardenburg (22) – Branches of channels from the creek remnant system Zwin reached as far as this geosite.
- The Polders around Damme (geosite 21) are located southwest of this area and share the broad outline of developments in the coastal area

Fig. 20a.2. Elevation map (AHN) of the geosite, with indication of adjacent geosites Zwin in the west and Passageule in the east. The yellow-red areas are high and the green is low. The low-lying areas within the geosite are creek and channel remnants.

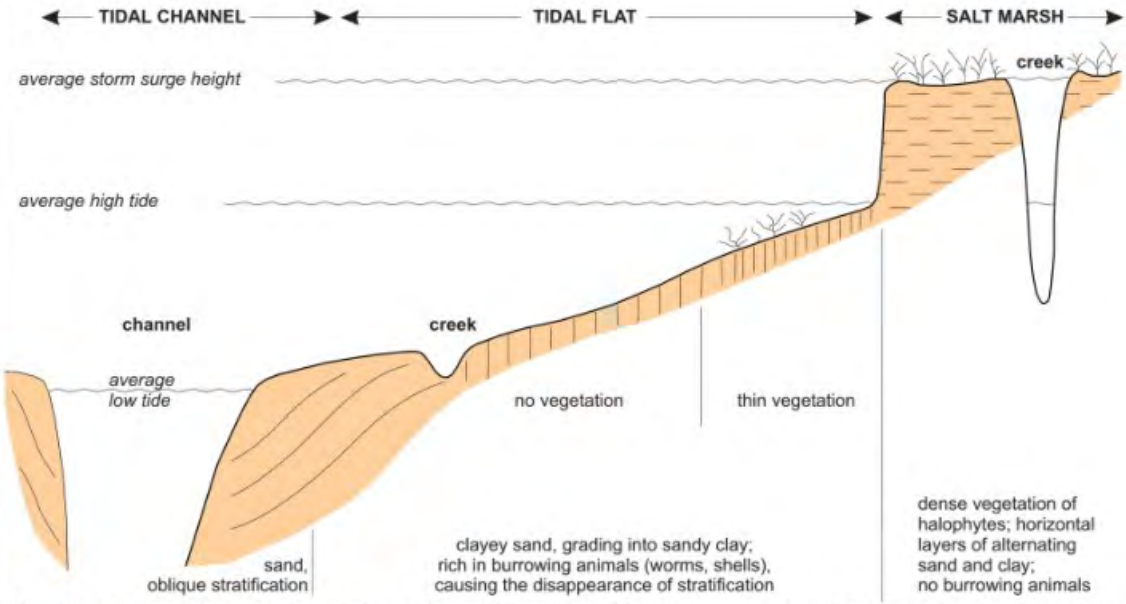

Fig. 20a.3. Diagram of the various depositional environments on the tidal flats and adjacent salt marsh. From: Zagwijn, 1986.

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Geosite n°20b

Passageule
A connection between two large tidal inlets

Fig. 20b.1. Topographic map of the surroundings of the geosite

Scientific importance
The Passageule connected two important tidal inlets in Zeeuws-Vlaanderen for several centuries. The former channel systems are still clearly visible in the current landscape; elevation differences between channels and polders testify to differences in the timing of reclamation or damming of channels.

The area is part of a geologically valuable area of national importance of the Province of Zeeland.

DETAILED DESCRIPTION

1. **Location**

The Passageule geosite is more than 12.5 km long and is a former tidal system in western Zeeuws-Vlaanderen. The Passageule once formed an important connection between the tidal inlets the Zwin and Braakman, but is now dammed and partly canalized. As a result, it no longer has its past dimensions, but the former courses can still be seen in the landscape and are easily recognized on elevation maps. The most low-lying parts (up to approx. 0.8 m - NAP) are the former channel courses, while the flanking reclaimed salt marshes have a maximum height of ca. 2 m + NAP.

This area is the eastern part of geosite 20 'Zwin creek remnants and Passageule'.

2. **Landscape formation**

Origin of the landscape

In the last ice age, the sea level was much lower and the coastline was far more seaward compared to today. The landscape was a sandy polar desert, where the wind had free rein. After the climate warmed and the land ice sheets melted, the sea level gradually rose and the sea entered the land. Around 6300 years ago, Zeeland and parts of the Flemish coastal region had turned into a tidal area with salt marshes, tidal flats and channels, surrounded on the edges by a peat area. Sand was brought in from the North Sea and was deposited by the tide on the sea side of the salt marshes, thus building up protective beach ridges here and there. The first beach ridges were far west of the current coastline. Due to the continuously rising sea level, these were eroded again and new beach ridges formed further east.

As a result of the slowdown in the rate of sea level rise, an almost uninterrupted beach ridge had formed around 3800 years ago, protecting the area behind against marine intrusions. Only at the location of the current Eastern Scheldt, a narrow opening remained. Behind the protective coastal barrier, a vast peat landscape developed.

About 2600 years ago, the coastal barrier was breached at some locations. Because humans locally drained the peat for salt production and agriculture, the surface of the peat area lowered and the sea was able to enter the hinterland. Sea breaches from several tidal inlets transformed large parts of Zeeland and parts of the coastal region of Flanders (Vlaanderen) into a tidal landscape, consisting of tidal flats and salt marshes, intersected by tidal channels and creeks. The Passageule was one of these channels and formed a connection between the inlets of the Zwin and Braakman for a long time.

In the Late Middle Ages, the Zwin inlet was incised during a number of storm surges. In the middle of the 12th century this inlet was eroded deep and wide enough to be used as an important waterway to Bruges. In the following centuries, however, the Zwin silted up and fell into disuse for shipping in the 16th century. During the Eighty Years' War (1568-1648), the Zwin was still an important front line, along which fortifications were constructed by both Spanish and Dutch troops, such as Sluis (Spanish) and Retranchement (States-General).

De Braakman inlet developed in several phases. During a storm surge in the winter of 1375-1376, an enormous breach was made in the dike of a low-lying, wet area east of Biervliet. Attempts were made to regain the area by re-embanking, but eventually a tidal inlet formed and grew larger and larger. In the course of time, channels and creeks incised from the Braakman far into the hinterland, including the Passageule.

The Passageule was first described in 1470. In the beginning it was only a branch of the Braakman, but at the beginning of the Eighty Years' War, after the dikes at Sluis were broken, a larger tidal channel formed: the Coxysche Gat (or Coxydegat). This channel connected the Passageule with the Zwin inlet, thus creating a new waterway between the Braakman and the North Sea. The Passageule formed one of the most important drainage channels in the area and, like the Zwin, was provided with a series of fortifications.

In the 17th century, after the channel had silted up, just like the Zwin, the area was reclaimed and the Passageule quickly lost terrain. In 1735 the construction of a canal started to maintain the connection between the Braakman and the North Sea. Ultimately, the Passageule remained as a connection until the end of the 18th century, after which it was definitively closed by the construction of the Kapitale Dam on the east side and the Bakkersdam on the west side. As a result, the channel silted up and only a narrow, dammed watercourse remained. However, its former dimensions are still clearly visible in the landscape.

<u>Salt marshes, tidal flats and tidal channels</u>

In a tidal zone, high water brings sediment (sand and clay) from the tidal inlets twice a day, which is partly left behind in the coastal plain. Because sand is somewhat heavier and is only transported by fast-flowing water, it is mainly deposited in and along the channels. Between these channels are tidal flats that flood at high tide, thus being raised a little with a thin layer of sand during each flood. The finer and lighter clay particles can also be transported at low flow rates and mainly precipitate during the reversal from high tide to low tide, when the flow velocity is at its lowest. The tidal flats therefore consist of an alternation of thin layers of sand and clay. Tidal flats can occur within a tidal channel (shoals) or be attached to the mainland or to islands. The highest parts are the salt marshes that are only flooded at very high water (spring tide and storm surge) due to their elevation. On the salt marshes, mostly clay is deposited. They are overgrown with halophytic

(salt-tolerant) plants and are intersected by creeks that supply and drain the water. Slightly higher levees can often be found directly next to the creeks.

Elevated tidal channel

The immediate vicinity of the Passageule is somewhat higher than the surrounding polders. This is because tidal activity lasted longer along the Passageule than in the surrounding polders. Because the polders behind the dikes were protected against the water, sand and clay were no longer supplied and deposited there during high tide. This did happen right along the channel. As a result, the area between the dikes was further raised compared to the polders. The contrast is most striking on the north side of the channel, where the elevation difference is 0.5 to 1 metres.

Relation with other geosites

- This area is the eastern part of geosite 20 'Zwin creek remnants and Passageule'.
- The Zwin Creek remnant system (20a) forms the western connection of the Passageule with the Zwin inlet.
- De Braakman (geosite 23) – large tidal system that split Zeeuws-Vlaanderen in two for centuries and with which the Passageule was connected in the east.
- Creek and coversand area Sint-Margriete – Aardenburg (geosite 22) – Branches of the Passageule system reached up to this geosite.
- Zwin (geosite 19) – western connection of the Passageule with the North Sea and the Flemish coastal area.
- The Polders around Damme (geosite 21) are located southwest of this area and share the broad outline of developments in the coastal area.

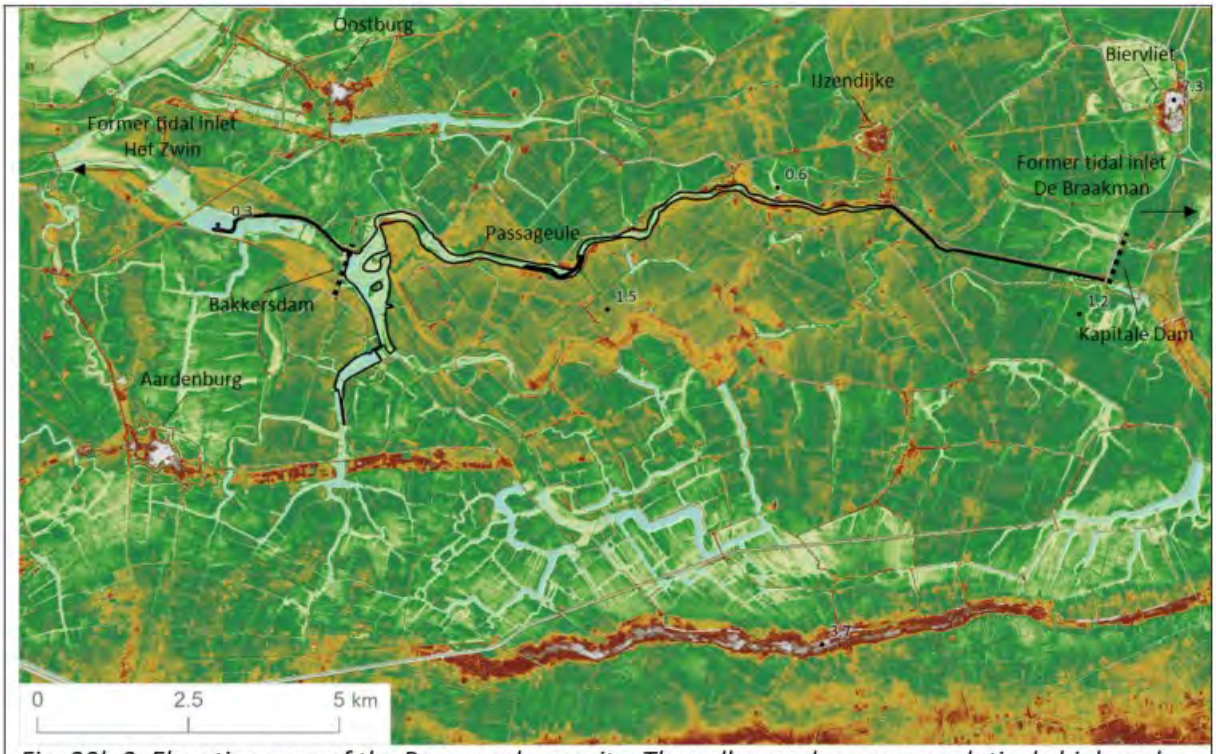

Fig. 20b.2. Elevation map of the Passageule geosite. The yellow-red areas are relatively high and the green areas are low. The former tidal inlets of the Zwin and Braakman are located west and east of the Passageule respectively. The geosite is stretched out between the Bakkersdam and the Kapitale Dam. The immediate vicinity of the Passageule is higher than the surrounding polders. This is because the Passageule silted up higher.

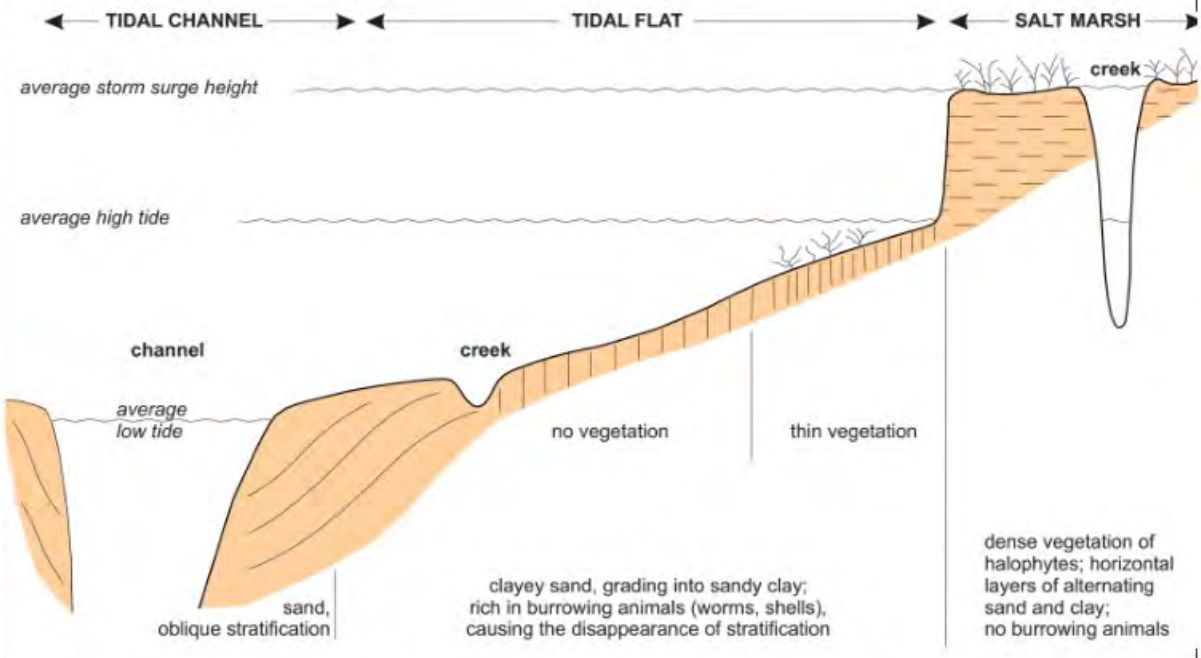

Fig. 20b.3. Diagram of the various depositional environments on the tidal flats and adjacent salt marsh. From: Zagwijn, 1986.

Documentation and resources

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Geosite n°21	**Zwinpolders around Damme** Historic polders hide the medieval harbor landscape of Bruges.
 Fig. 21.1. Map of Geopark Schelde Delta. Zwinpolders around Damme is number 21.	**Scientific importance and valuation of the geosite** The medieval harbor landscape and the international conflict landscape around the Zwin have an (inter)national value thanks to the good preservation and extensive historical, geographical and archaeological research of the remaining landscape.
Municipality	Damme
Province and country	West-Vlaanderen, Belgium
Protection status	Natura 2000; Creek area Lapscheure: protected cultural-historical landscape; Blauwe Sluis: protected cultural-historical landscape, protected monument; Damme: protected town or village scape, established archaeological zone
Site management organizations	De Vlaamse Waterweg, Agentschap Natuur en Bos, Province of West-Vlaanderen and Damme.
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes one can travel independently
Relevance for education	- Excursions/guided tours - Routes one can travel independently - Educational programme for children
Teaching equipment	This is an extensive area where one can cycle and/or walk independently. One can cycle the route 'Verdwenen Zwinhavens' from July 2021 untill November 2023. During this route the cyclist learns more about the golden history of the Zwin region. It is also possible to follow parts of this route with a guide.

Code	Significance
G-21	National
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: As a part of the wider historical Zwin inlet region, the geosite has been the subject of extensive research and is characterized by the presence of two large silted and reclaimed tidal channels, numerous creek ridges (resulting from relief inversion) and reclaimed salt marshes (clay-covered peatlands) as well as several dikes and canals.	
Sedimentology: not applicable.	

DETAILED DESCRIPTION

1. Location

The polders around Damme are located on the edge of the eastern part of the Belgian coastal plain and border on sandy Flanders (Vlaanderen) in the south. Damme, Oostkerke, Hoeke and Lapschil are the main settlement centers in a fairly flat polder landscape, which is intersected by the Leopold Canal and the Damse Vaart. Elevation differences are limited and mainly caused by the residential areas, military earthen walls, dikes, open or silted creeks and tidal channels. The historic Zwin channel crosses this polder complex, as does the silted up Oostkerke channel. Part of the delimited geosite therefore belongs to the wider, historic Zwin region, the landscape that has been influenced over time by the Zwin channel(s) and its predecessors.

2. Landscape formation

At present, the polders around Damme are characterized by the presence of two large silted and reclaimed tidal channels (the Zwin and Oostkerke channels), numerous creek ridges and reclaimed salt marshes (clay-covered peatlands). The exact age of the channels cannot always be determined, because the oldest sediments were later eroded by storms and tides. The formation history of this polder area can therefore only be explained in the context of the regional landscape evolution of the entire Zwin region.

<u>Sea level rise, development of a tidal area and a peat swamp (ca. 10,000 - 2800 years ago)</u>

The morphology of the landscape at the end of the last ice age strongly influenced the Holocene evolution of the Zwin region. During the Pleistocene, the geosite was located within the Flemish Valley, which flowed to Ostend. A higher area on the right bank extended to about 20 km off the present coast. When the Scheldt stopped flowing through the Flemish valley at the end of the Weichsel glacial and the filled valley was covered with sand by the wind, a natural headland developed off the present coast. This headland protected the Zwin region from the sea during the first half of the Holocene, but it eroded during the Middle and Late Holocene. It thus formed an important sediment source for the later filling of the tidal basins.

Thanks to this headland, the rising sea level only affected the geosite since 7,000 to 6,000 years ago. The coastal barrier was then 10-15 km off the present coast, but stabilized and even shifted slightly seaward until 5500 years ago due to the deceleration of the sea level rise and the supply of eroded sediment. At the position of the Scheur, the later mouth of the Zwin and/or Blankenberg channel, an erosive tidal channel may have already broken through this coastal barrier. Behind the coastal barrier, a tidal flat formed approximately up to the present coastline. This tidal flat later silted up into a salt marsh. Along the upper edges a peat swamp formed over the Pleistocene sandy landscape, due to the upwelling of fresh groundwater. Until 2800 years ago, the coastline remained stable and the peat swamp could expand further inland in pace with the slower sea level rise. It covered the coversand area and (locally) also the silted salt marshes. West of the Damse Vaart, remains of the peat are still preserved in the subsoil between the younger incisions of tidal

channels and creeks. Dry sand ridges in this tidal flat and swamp formed temporary habitats for prehistoric hunter-gatherers.

An open coastal landscape with channels (ca. 2800 - 1250 years ago)

From 2800 years ago, climate change and possibly also inland deforestation caused increased drainage in the peatland. As a result, old channels, at the location of the Zwin and Blankenberge channels, started to incise again and there was more space for the tides behind the coastal barrier, which eroded and shifted inland. New channels were also created, such as probably the Oostkerke channel. The resistance of the peat against erosion also caused these channels to erode deeply in a vertical direction. This incision created an open tidal channel landscape with 'islands' of older, higher salt marsh (and peat) areas, separated by a network of channels and creeks.

The human use of this tidal landscape enhanced this process. The combination of channels, tidal flats, salt marshes and peat was indeed attractive to humans. They adapted their way of life and made use of the opportunities that this landscape offered. Despite its location, during Roman times this peripheral area was an active part of the Roman economy, for example through sheep farming on numerous salt marsh meadows, (large-scale) salt production or trade in shellfish as food. Small rural settlements developed on higher (and later raised) locations (mounds) in and on the edge of the salt marsh. During the Roman period, the dune barrier and coversand ridges along the edges of the tidal area also formed part of a coastal defence line with fortresses in Oudenburg and Aardenburg. Starting from the residential areas, the landscape was locally drained for small-scale agriculture and/or peat extraction and raised roads (early dikes) were built to protect against flooding.

In the early Middle Ages settlements arose in a similar way on mounds located on the salt marsh and along the channels. Small ring dikes were built around these settlements to protect the surrounding area and to exploit it more intensively. During the High Middle Ages, this reclamation evolved into a true landscape transformation, in which local dikes on the salt marsh were connected to longer systems. This created the first polders. The castle of Oostkerke and the motte of Ten Doele are possible centers of power from this period. From the late Middle Ages onwards, parts of the landscape below high-water level (tidal flats and channels) were also effectively embanked and dikes served not only to protect against storm surges, but also to reclaim land from the sea.

The Roman and (early) medieval interferences enhanced the natural peat compaction and subsidence of the surface. Since the sandy infill of the tidal channels is less compactable than the surrounding peat layers, these channel ridges became higher than their surroundings. The subsidence further increased the tidal influence in the hinterland. (Storm) floods widened the tidal inlets and condensed the network of tidal channels. It therefore took until the early Middle Ages (ca. 550-750 AD) before the sediment supply, tidal damping and sea level rise were back in balance and the tidal area had once again silted up above high-water level. The coastal barrier no longer eroded and stabilized about 10 km off the present coast. A broad dune ridge formed here.
In this period the Blankenberge channel, the Oostkerke channel, the Sincfal and the Honte determined the landscape of the Zwin region. These channels were formed and filled at different times during the late Iron Age, the Roman period and the early Middle Ages. The first two channels silted up almost completely between Roman times and the 9th - 10th century AD, while the Honte became the new mouth of the Scheldt estuary after the Western Scheldt (Westerschelde) breached.

Sincfal: the prelude of the Zwin (... - 1134 AD)

Due to the silting up of the Blankenberge channel and (later) the Oostkerke channel, at least one canal was constructed (partly in a creek) between the Sincfal and (early) medieval Bruges: the Oud

Zwin. From the 11th century, the need for agricultural land and fuel (peat) increased sharply due to population growth. By connecting elevated roads and/or low dikes to form a defensive seawall, larger parts of the salt marsh could serve as meadows. The inner-dike area was drained with canals and the former dikes between polders lost their function. As a result, the tide could no longer spread over the salt marsh and the creeks during storm surges. However, this unintentionally enhanced the silting up of the outer-dike area, including the canalized connection between Bruges and the Sincfal. In combination with peat extraction, peat compaction due to drainage of the inner-dike area and poor dike maintenance, the region became more susceptible to damage by storm surges.

Zwin (1134 AD to present)

In October 1134 AD a strong storm surge eroded an old inlet of the Sincfal, up to an old creek ridge on which (Honts-) Damme (Dam on the Honte) was later founded. Initially, this tidal channel, the Zwin, was more navigable for seagoing vessels – at least up to the transshipment harbor of Damme – than the Oude Zwin Canal, which was silting up. A canal was dug from Damme to near Bruges: the Reie. Another canal, the Lieve, connected Ghent, Damme and the Zwin from 1269 AD. Thanks in part to the Zwin, Bruges grew from the middle of the 12th century to the 15th century AD into an international harbor city.

However, the natural accretion of the salt marshes along the Zwin and their subsequent embankment reduced the tidal area. This accelerated the natural silting from the inland towards the mouth. The decreased navigability of the Zwin channel strengthened the development of outer ports, such as Sint Anna Ter Muiden, Monnikerede, Hoeke and especially Sluis. As a result, activities of outer ports of Bruges moved gradually towards the mouth. At the same time, Bruges' economic power diminished and 16th century attempts to revive the Zwin by increasing the flow rate and digging new canals, such as the Verse Vaart, also failed.

Due to its economic importance, the Zwin was also the scene of international conflicts fought during naval battles (in 1213, 1340 and 1603 AD) in the tidal channel. During the Eighty Years' War (1568-1648 AD) Damme was provided with bastions and during the War of the Spanish Succession (1702-1713 AD), the fortress of Beieren was reinforced. The Zwin mouth always formed part of the front line in these conflicts. Flooding was also a war tactic and the dikes around the former Zwin were breached at Sluis. As a result, new tidal channels developed from the Lapscheuregat and Coxydegat and part of the polders flooded again.

In the 17th and 18th centuries, the flooded area was reclaimed again into large, rectangular plots, suitable for more intensive agriculture. The 18th century landscape was very similar to todays in terms of land use, location of dikes, watercourses and settlement pattern.

The Damse Vaart was built between 1810 and 1824 AD, partly on the old bed of the Zwin. Between 1843 and 1854, the Leopold Canal was constructed across the Damse Vaart. In the 20th century, brick industry locally had a major impact on the landscape through the excavation of clay pits.

Today the geosite is a largely open to semi-open polder landscape, in which canals, dikes (often combined with roads), rows of trees and watercourses determine the landscape structure. The current parcel patterns, from irregular to straight, reflect the reclamation history of the area.

Relation with other geosites

- The polders around Damme are historically part of the Zwin region. The Zwin creek remnants and Passageule (geosite 20) are part of the same system.
- The northern branches of the Maldegem-Stekene coversand ridge (geosite 37) are located just south-east of the Zwin polders near Damme and continue under the polders.

Fig. 21.2. Topographic map of the Zwin polders near Damme. Source: OpenStreetMap & contributors. CC-BY-SA.

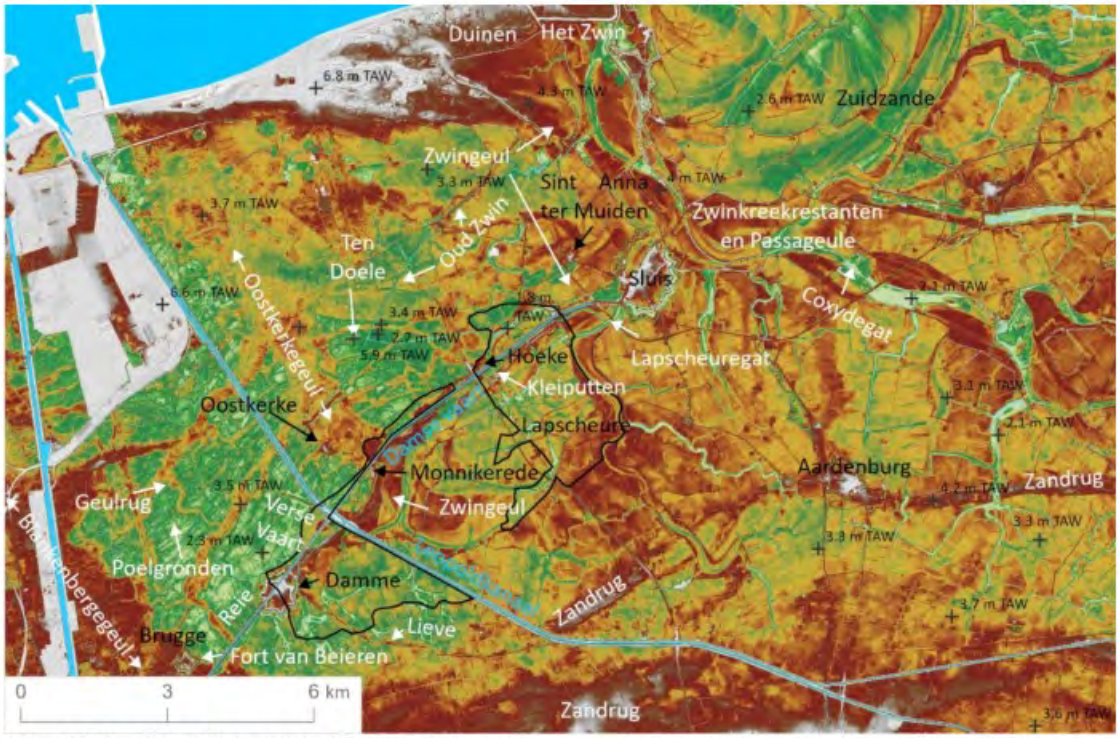

Fig. 21.3. Elevation map of the Zwin polders near Damme, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency; AHN3 Rijkswaterstaat.

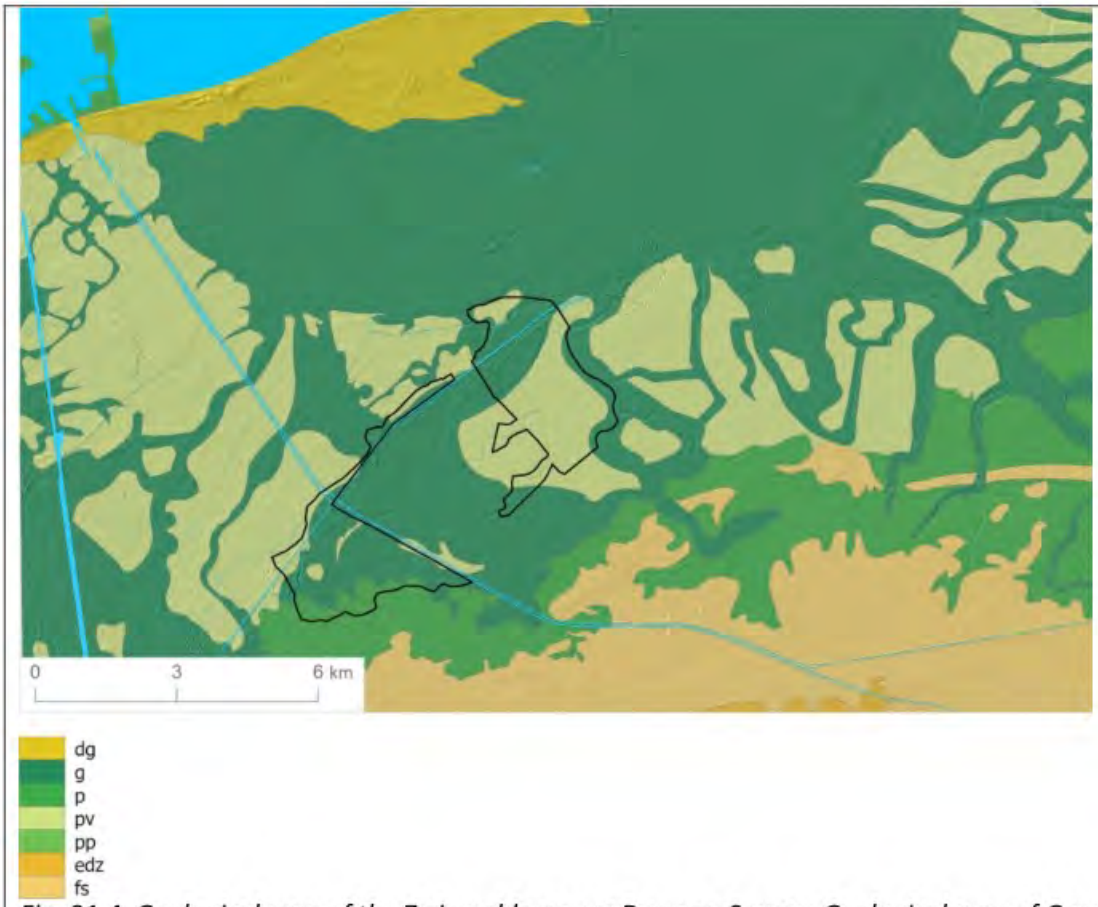

Fig. 21.4. Geological map of the Zwin polders near Damme. Source: Geological map of Geopark Schelde Delta, TNO.

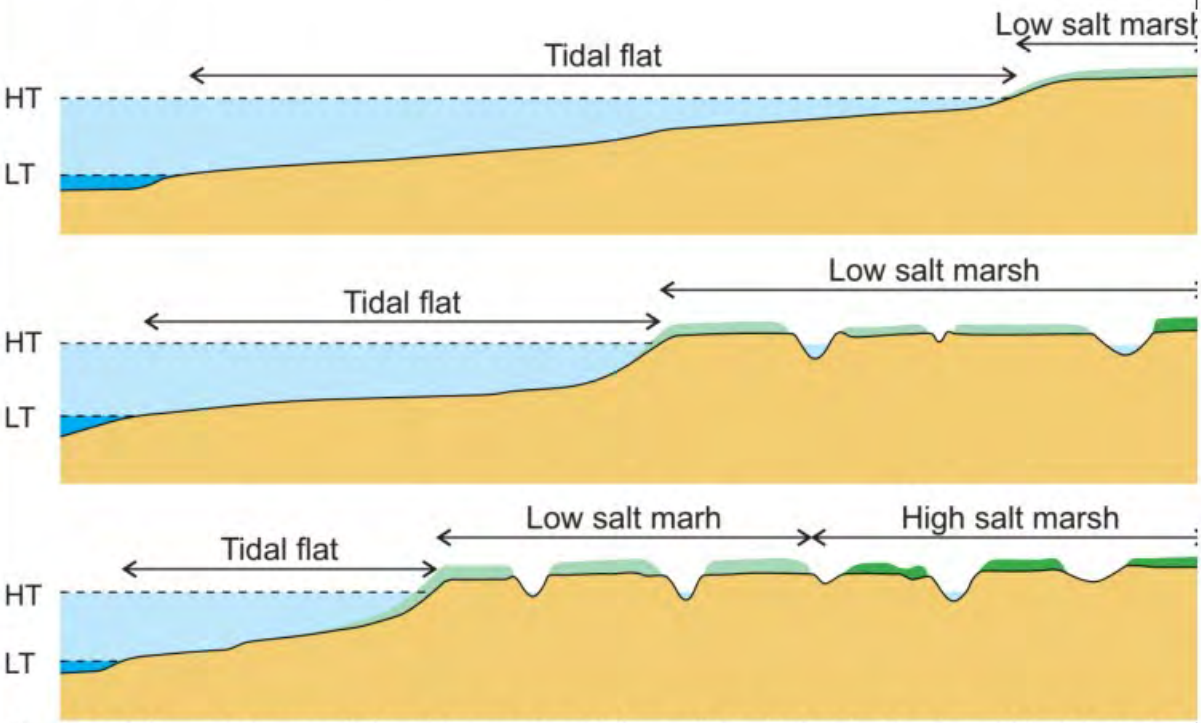

Fig. 21.5. Schematic image of the silting up of a tidal area (HT = high tide, LT = low tide). Adapted after Verhulst (1995).

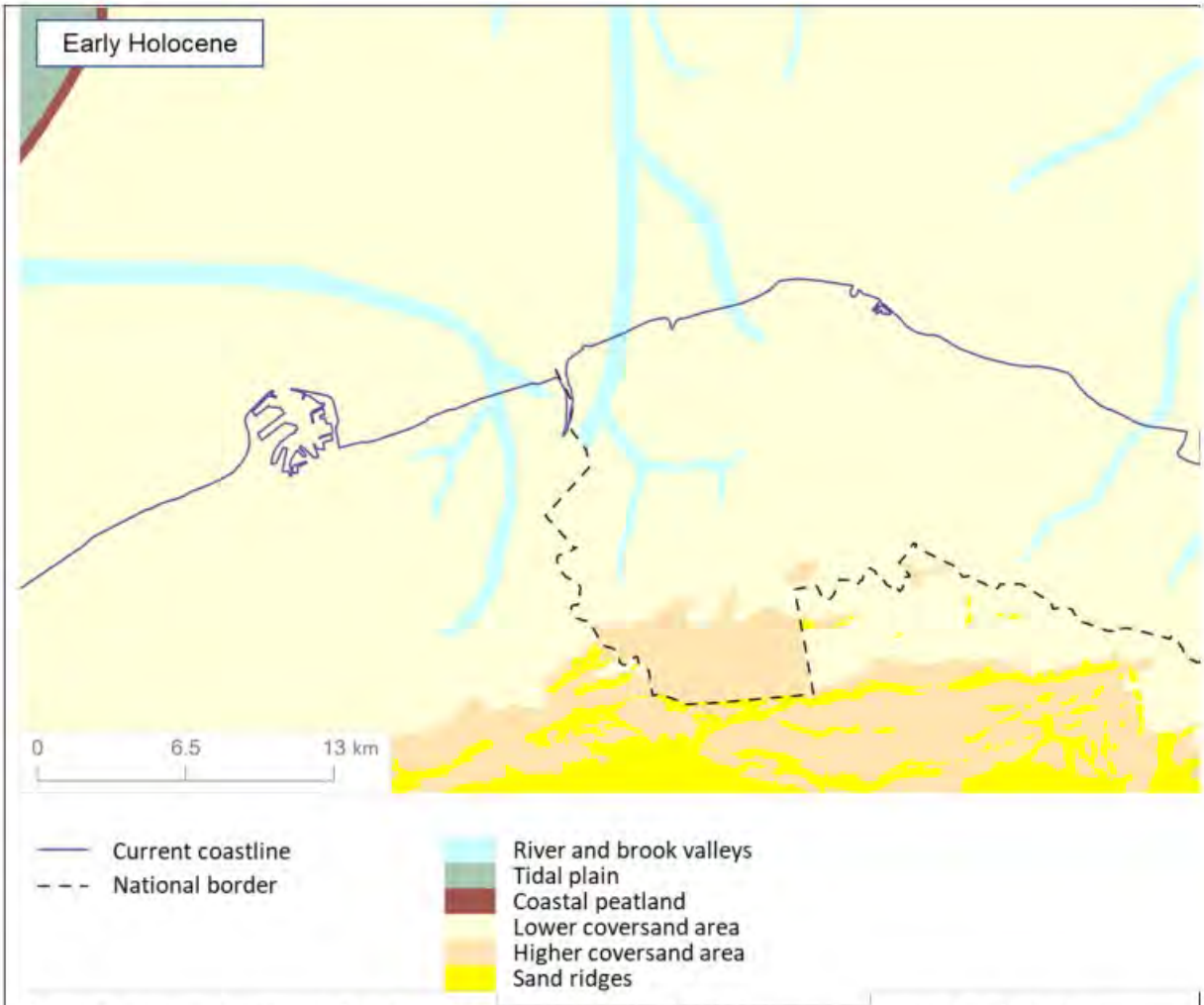

Fig. 21.6. Schematic map of the Zwin region during the Early Holocene. The sea level is rising rapidly and is gaining influence in the mapped area. As a result, basal peat forms on the edge of a distant tidal area. Rivers and brooks cross the coversand area. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

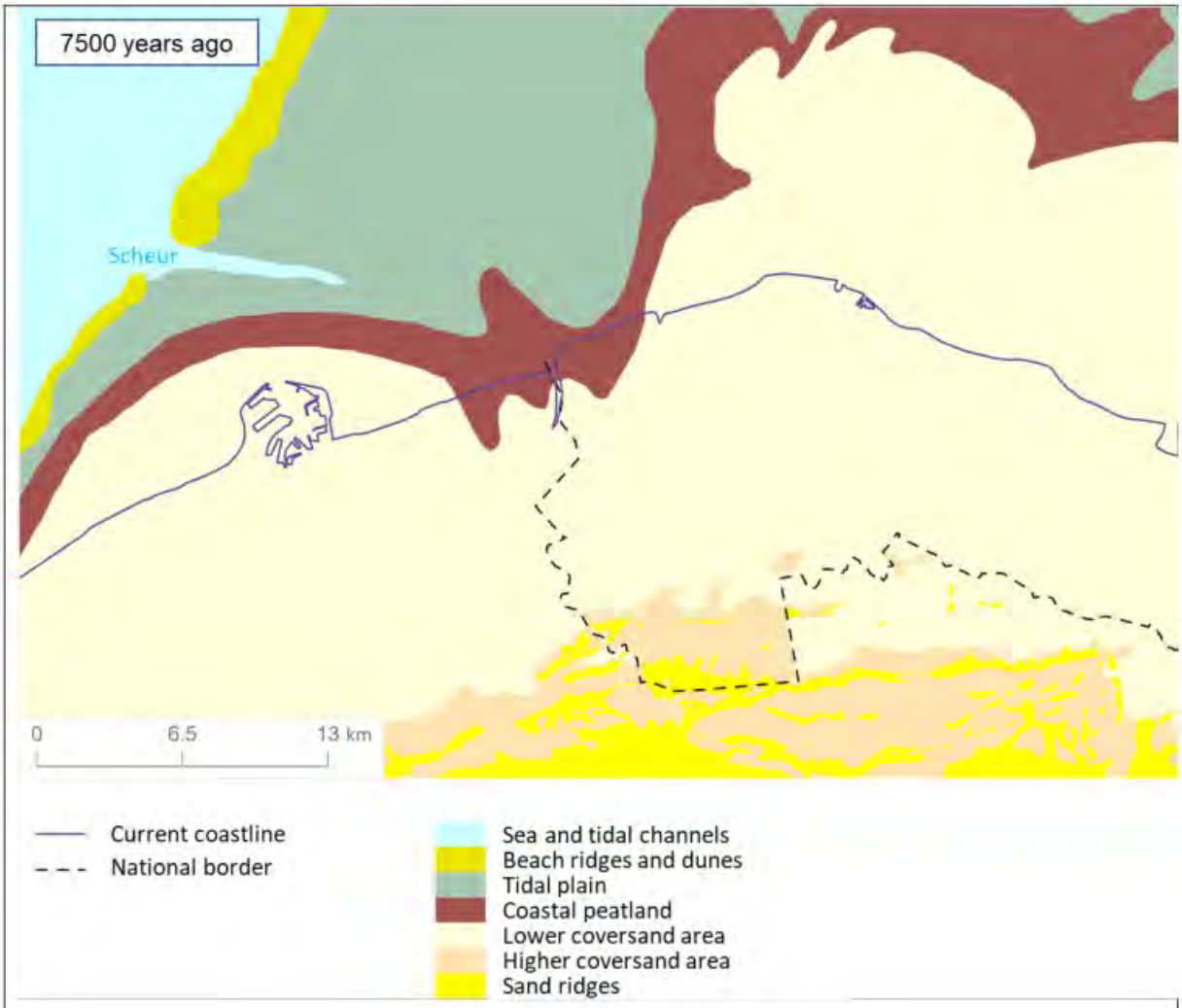

Fig. 21.7. Schematic map of the Zwin region about 7500 years ago. Due to the slowdown in sea level rise, the tidal area is starting to silt up. This stabilizes the coastal barrier (beach ridges and dunes) and the coastal marshes gradually evolve from saltwater to freshwater marshes, with peat formation. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

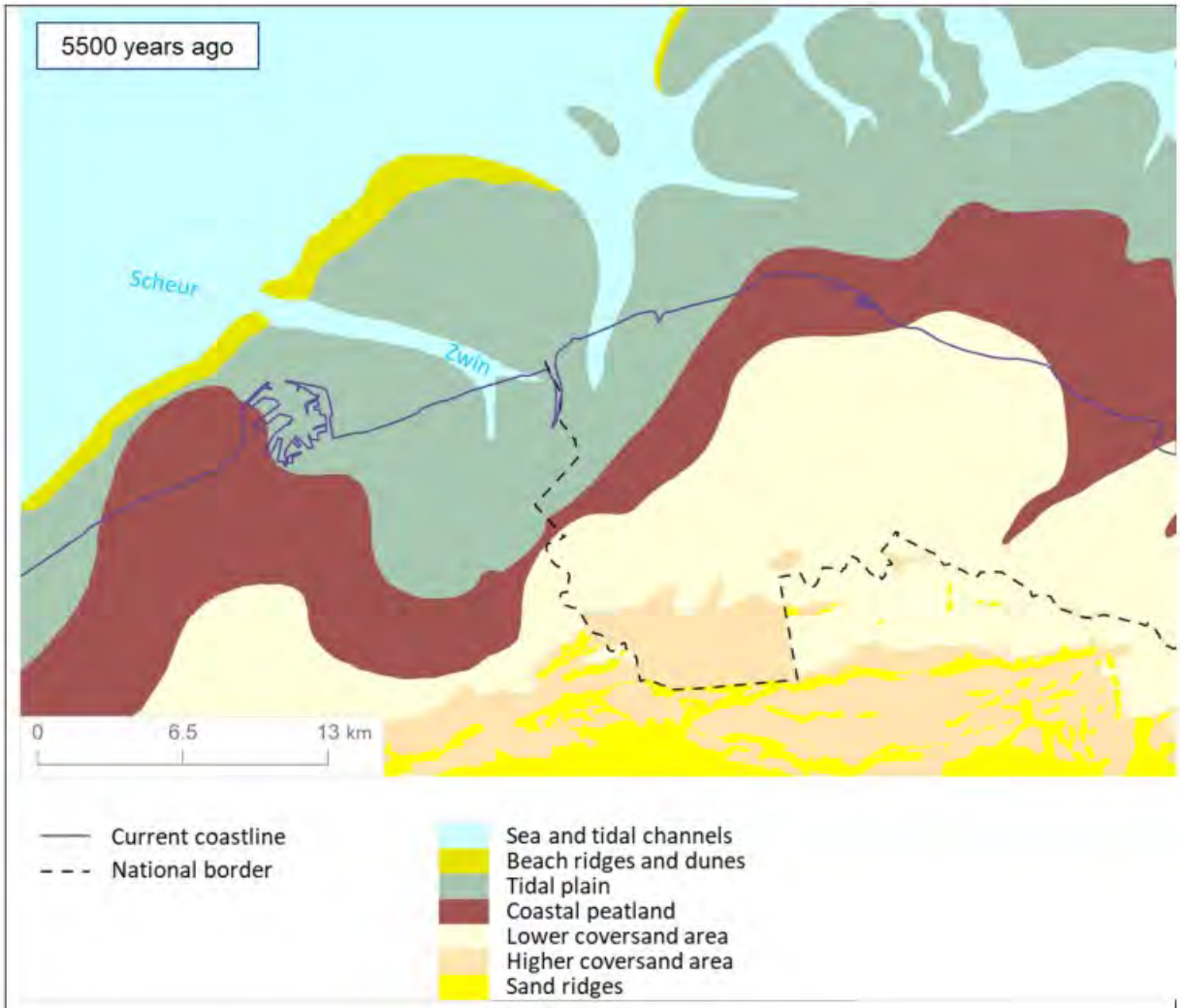

Fig. 21.8. Schematic map of the Zwin region about 5500 years ago. The coastal peat swamp is expanding due to the further slowing of sea level rise and the tidal area is further silting up, while the tidal channels are narrowing. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

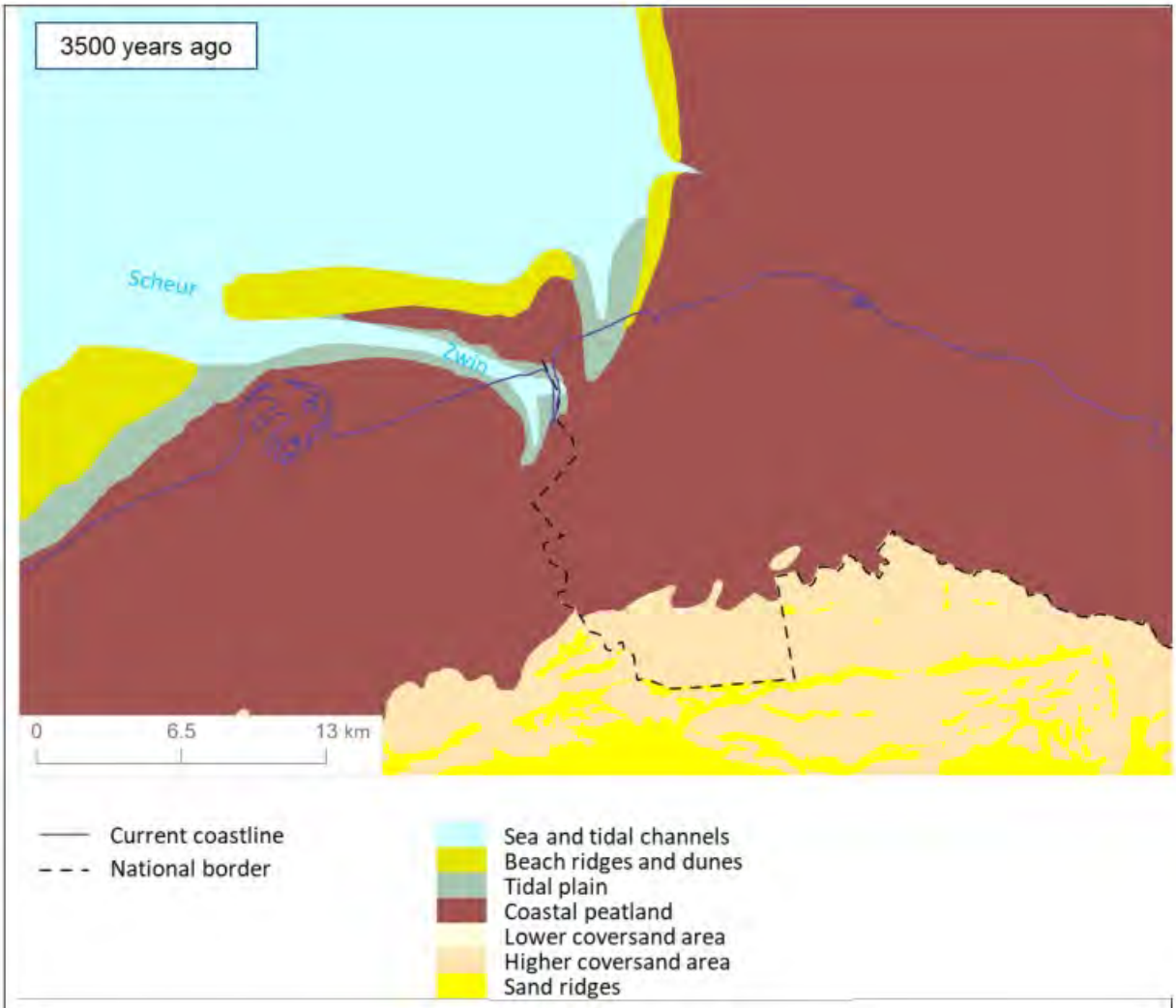

Fig. 21.9. Schematic map of the Zwin region about 3500 years ago. Almost the entire coastal area is covered by a coastal peat swamp. The tidal area has been reduced to the margins of some large tidal channels. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

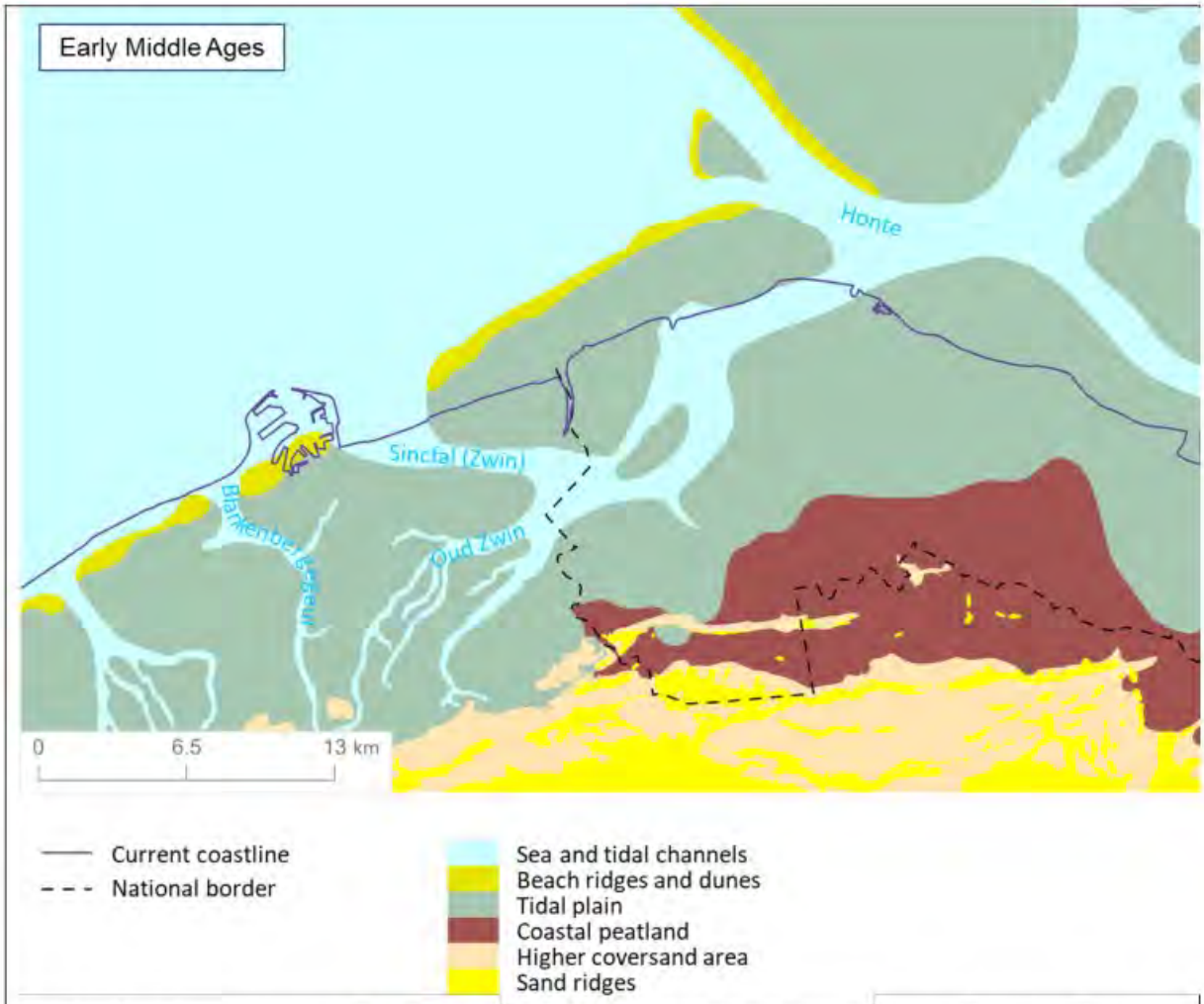

Fig. 21.10. Schematic map of the Zwin region in the early Middle Ages. From the late Iron Age to the early Middle Ages, several tidal channels are once again forming in the coastal area due to climate change, inland deforestation and human interventions in the coastal landscape. The tidal area is expanding and the coastal belt is shifting inland as a result. The Oud Zwin channel forms the connection with Bruges. The Honte inlet expands in the direction of the Scheldt. Adapted from: HisGISKust: paleogeographic reconstruction; Vos et al (2018).

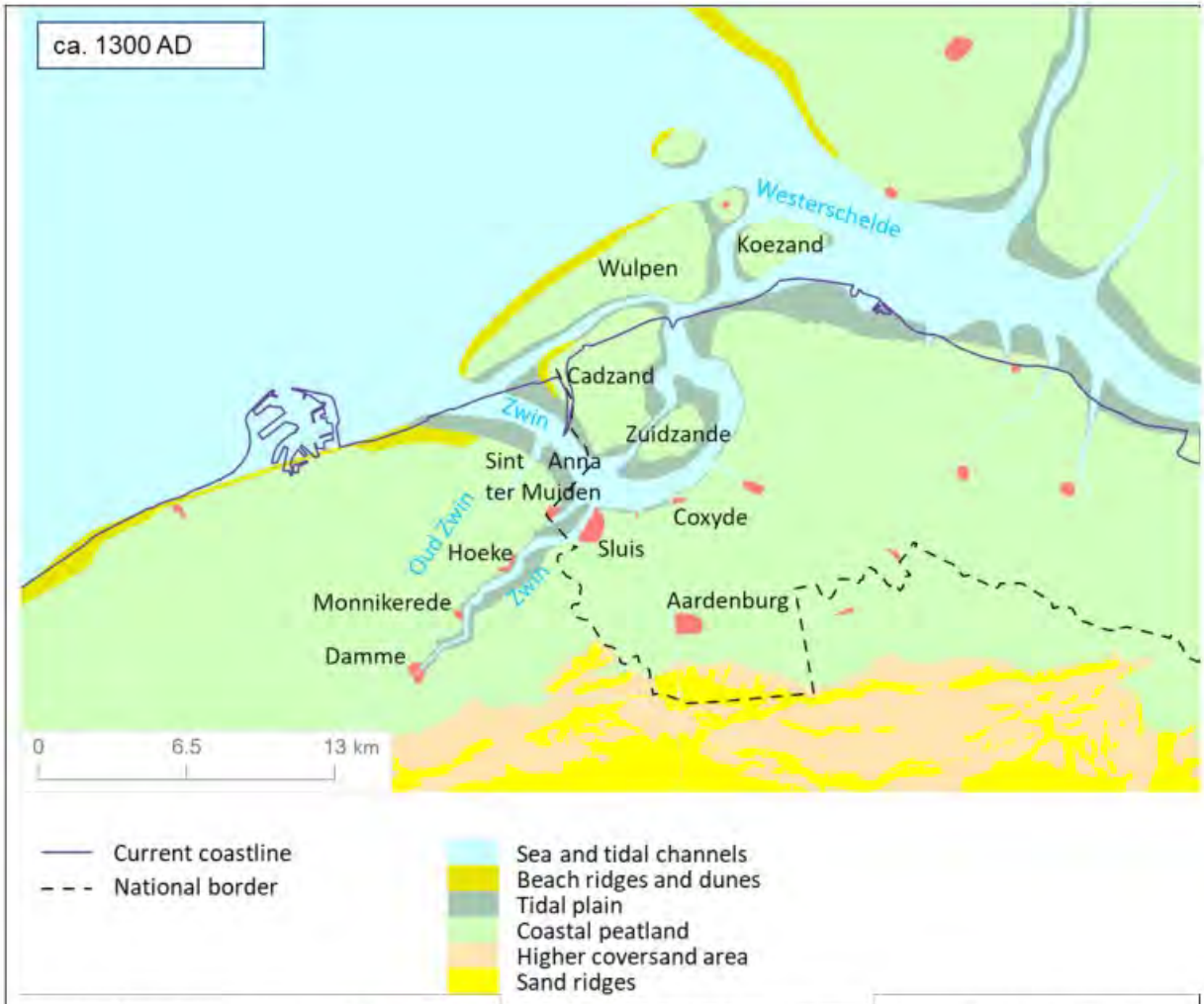

Fig. 21.11. Schematic map of the Zwin region around 1300 AD. The coastal area has been diked and impoldered. The Zwin inlet has incised up to Damme and various transhipment harbors are established along the tidal channel. Several islands (Wulpen, Koezand) are still present in front of the current coastline, but the coastal barrier is weakening. The Honte has connected with the (Western) Scheldt. Adapted from the Ruijsscher, D. (2019) (© Ghent University Department of Archaeology).

Fig. 21.12. Schematic map of the Zwin region around 1500 AD. The Zwin inlet continues to silt up and is being reclaimed. The islands (Wulpen, Koezand) off the current coast are flooded. Cadzand and Zuidzande are connected to the mainland by land reclamation. Adapted from the Ruijsscher, D. (2019) (© Ghent University Department of Archaeology).

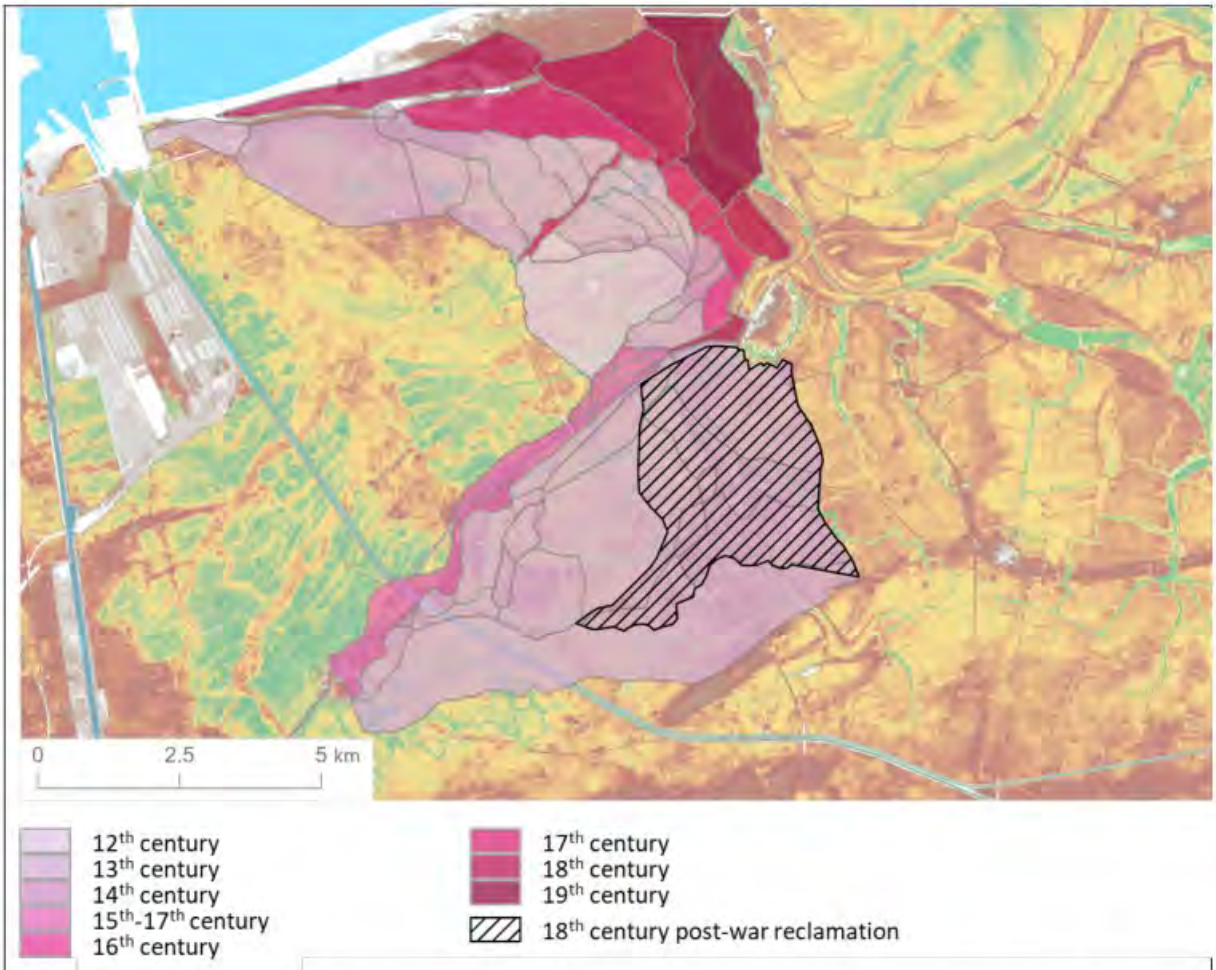

Fig. 21.13. The chronological overview map of the reclamation of the Zwin region shows the continuously advancing embankments from the Zwin channel towards its mouth. The reclamation was interrupted by the religious wars, after which re-embankments were necessary. Adapted to Trachet (2016), Econnection, Province of West-Vlaanderen and DHMVII Agentschap Informatie Vlaanderen; AHN3 Rijkswaterstaat.

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Geosite n°22	**Creek and coversand area Sint-Margriete – Aardenburg** A landscape from two eras: a tidal area with a medieval parcel structure cuts through a blown-up sand ridge landscape from the end of the last ice age.
 Fig. 22.1. Map of Geopark Schelde Delta. Creek and coversand area Sint-Margriete - Aardenburg is number 22.	**Scientific importance and valuation of the geosite** While the processes of landscape formation are quite simple, the resulting landscape morphologies are quite peculiar. The sand ridges breached by marine creeks are rare in the Netherlands and therefore have a national geographic importance. The Moershoofd van Aardenburg is the subject of the oldest known map of the entire Dutch-Belgian territory and probably dates from the second half of the 12th century. The morphology of the creek system reflects a medieval, relatively irregular parcel structure that has often disappeared elsewhere due to younger, more systematic land reclamation. The Boerekreek (39 ha) is the largest creek in the Meetjesland and regionally important. The wet meadow complexes are largely registered as European Birds Directive area.
Municipality	Sint-Laureins, Sluis
Province and country	Oost-Vlaanderen, Belgium and Zeeland, the Netherlands
Protection status	Belgian part: Natura-2000; Graaf Jansdijk: protected cultural-historical landscape; Dutch part: provincial geologically valuable area Zeeland, Natuurnetwerk Zeeland, provincial valuable landscape, Nationaal Landschap Zuidwest-Nederland-deelgebied West-Zeeuws-Vlaanderen
Site management organizations	Staatsbosbeheer, Waterschap Scheldestromen, Natuurpunt en Partners Meetjesland vzw, Province of Oost-Vlaanderen, Municipality Sint-Laureins, Municipality Sluis
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center - Excursions/guided tours - Routes one can travel independently
Relevance for education	- Visitor center - Excursions/guided tours - Routes one can travel independently - Educational programme for children

Teaching equipment	Site is accessible with and without a guide. The visitor center de Boerekreek provides educational and sports activities for school classes. There is among other things, a yoga path. The area is equipped with information panels.

Code	**Significance**
G-22	National

Geological interest(s)

Paleontology: not applicable.

Stratigraphy: not applicable.

Geomorphology: In this area on the border between coastal plain and coversand region, two low coversand ridges locally limit the extent of the coastal sediments but at other places are breached by much more recent tidal channels, which are present in a wide variety of sizes and types, from completely open to completely filled, and partly reflect a pre-existing medieval, relatively irregular parcel structure.

Sedimentology: not applicable.

DETAILED DESCRIPTION

1. **Location**

This cross-border geosite comprises an almost rectangular area of approximately 12 by 4 km in the north of the province of Oost-Vlaanderen (B) and the south of Zeeland (NL). The area is located between Aardenburg (NL), Middelburg (B), Watervliet (B), Bentille (B) and Sint-Laureins (B) and is flanked on the south by the Leopold Canal. The villages of Sint-Margriete (B), Sint-Jan-in-Eremo (B), Heille (NL), Sint-Kruis (NL) and Eede (NL) are within this geosite. On the Dutch side, the entire area has been delimited as geologically valuable area, while on the Belgian side mainly creeks are protected as landscape relics. The average elevation of the polders fluctuates around 3 to 3.5 m TAW / 0.5 to 1 m NAP. Creeks are lower (1 to 2 m TAW / -1.5 to -0.5 m NAP) and low (micro) coversand ridges and dikes are higher (5 to 6 m TAW / 2.5 to 3.5 m NAP). A difference in micro-relief can also be observed between the different polders (ca. 20-30 cm).

2. Landscape formation

Coversand ridges

The geosite is located on the northern border of the Flemish Valley. After Pleistocene, braided river deposits had filled the Flemish Valley, a thin layer of coversand (ca. 0.5 m) with a northerly slope was blown over it at the end of the last ice age. During cold phases of the lateglacial, the wind formed two elongated, parallel sand ridges with an east-west orientation and a height of ca. 2 m and a width of ca. 300 m on top of the coversand. These ridges can still be recognized at the surface in the creek area. A northern, lower ridge is situated on the line between Aardenburg and Sint Kruis (the Aardenburg sand ridge) and a southern, slightly higher ridge on the line between Sint-Laureins and Boekhoute (sand ridge Sint-Laureins-Boekhoute). This relief has had a significant influence on the later landscape formation. During much of the Holocene, these ridges remained virtually untouched. From the Middle Ages, however, they were affected by tidal channels, construction of roads, dikes and buildings.

Sea level rise

The groundwater level in the geosite rose along with the sea level rise during the Holocene. This created a swamp vegetation in the depressions between the sand ridges. Where groundwater seepage occurred, peat was formed on the coversand. The thickness of this peat varied from more than half a metres in the lower north of the area to a thin, humus-rich layer on top of the coversand in the higher south and on the sand ridges. In the highest positions within the landscape

there was a poor sand soil. Where no peat is present today, peat may never have formed or peat may have disappeared after drainage due to peat extraction or oxidation. That is why there is much discussion among historians, archaeologists and earth scientists about the precise past extent of this peat. It is currently assumed that peat certainly existed north of the northernmost Aardenburg sand ridge. There is less agreement about the occurrence of peat or humus-rich sand between the two sand ridges (later called Moershoofd van Aardenburg). Indeed, based on historical sources, large-scale peat extraction for use as fuel is assumed here, while physical-geographical observations contradict this.

Medieval reclamations

Although older human land use is likely, it is only ascertained in the creek area from the Middle Ages onward. In the 11th and 12th century AD the landscape was deforested. The wastelands with heath were used as grazing grounds for sheep, because they were unsuitable as arable land. The systematic reclamation of the current creek area only started at the end of the medieval reclamation period, in the 13th century AD, when the urban elite also invested in (the edges of) the coastal area and had this region reclaimed starting from small settlement centers on the sand ridges. A system of elevated roads (primitive dikes) and drainage ditches made it possible to cultivate the humus-rich sand soil of the (extracted) Moershoofd of Aardenburg. South of the creek area, from the middle of the 14th century AD, part of the infertile sandy soils was used for forestry.

Late medieval and early modern floods, embankments and dike breaches

Drainage and reclamation of the (covered) peat area north of the geosite lowered the soil surface. Moreover, maintenance of the dikes and waterways did not happen systematically and proved inadequate. This also made the hinterland vulnerable to storms and spring tides along the estuary of the Western Scheldt (Westerschelde). At the end of the 14th and beginning of the 15th century, the autumn and winter storms breached the dikes and through the Aardenburg sand ridge, which until then formed a natural sea wall. On the one hand, the water of the South Sea that was formed in this period (later called Braakman) was halted by a raised road on the line between Cadzand and Kaprijke: the Woutersweg or Waredijk (possible fragment on Fig. 22.4.). On the other hand, the water was stopped by a raised dike on the Sint-Laureins-Boekhoute sand ridge. This dike was fortified at the beginning of the 15th century AD and later became known as the Graaf Jansdijk. A fragment of this dike has been preserved between Zonne and Bentille. The gradual reclamation of the flooded area started from these two axes, until a sea wall was built in the late 15th century AD and previously constructed dikes became redundant.

The 16th century storms were again very destructive. For example, the All-Saints Flood of 1570 AD caused a breach of the dike on the Aardenburg sand ridge near Hondseinde. During the Eighty Years' War (1568-1648 AD) the dikes of the Zwin inlet were breached for strategic reasons and the large Coxydegat was created in the Zwin area. The (south) eastern branches of this inlet also reached the geosite and breached the northern sand ridge, thus creating the Groote Gat near Sint Kruis, the Brandkreek north of Sint-Margriete and the Hollandse Gat with the Blokkreek and Boerekreek (Grote Geule). A defence line has been established along the winding Brandkreek, where the national border is today.

North of the Aardenburg sand ridge, the creeks had a fairly natural branched pattern and they meandered due to the horizontal displacement of the tidal channels (e.g. Brandkreek). This was a result of the high flow rate in this low-lying area. Between the two coversand ridges, the flood water flowed into the area at a lower speed, via the drainage ditches along roads and dikes, so tidal channels and creeks incised almost exclusively in a vertical direction and the rectangular shape of the flooded plots was therefore preserved in the creek pattern (Blokkreek, Boerekreek,

and Bentillekreek). That is why creek names often go back to old street names (for example Roeselare Creek at the location of Roeselarestraat).

Final land reclamation in early modern and modern times

After a dike breach, a thin layer of silt was often deposited on the polders outside the creeks. Due to the location of the area between the two coversand ridges on the edge of the polders, this land was quickly (re-)diked and there was only a limited sedimentation period and thickness. North of the Aardenburg sand ridge, the deposition lasted longer, so the surface here is higher there.

After the Eighty Years' War, the flooded landscape between the late 17th and 18th centuries was gradually re-embanked and systematically reclaimed in large and regular parcels, which were mainly used as arable land. Less suitable, wet locations along filled-in creeks or in depressions parallel to the dikes (so-called cart fields) were used as pasture. The cart fields were created by extracting clay for the construction of the flanking dike. Remaining creeks, such as Blokkreek, Roeselarekreek and Boerekreek, however, remained open. Where dikes breached, deep kolk lakes were created by the swirling water. These breaches were repaired with ring dikes around them, mainly at the end of the 17th century AD (e.g. Zouteput).

On the one hand, this land reclamation took place north of the Aardenburg sand ridge in a new systematic plot pattern, in which virtually no traces of the old landscape can be recognized. On the other hand, the medieval plot pattern was simply reused during the re-diking between the two sand ridges because of the thinner sedimentation. These polders therefore have a smaller surface area and consist of a combination of regular and irregular parcel blocks and strips.

Also in the 18th, 19th and 20th centuries, the polders were flooded for strategic reasons, during independence or world wars. After Belgium's independence, the Leopold Canal even had to be constructed to drain the area in an east-west direction. After WWII, the increase in scale of agriculture made many old landscape traces disappear. Today, often only a micro-relief remains. The contemporary landscape is therefore predominantly flat and open, with the exception of the habitation, which occurs mainly on the sand ridges and on or along dikes. Locally pollarded willows around meadows and rows of trees on (no longer functioning) dikes ensure a more closed character. This contrasts not only with the more open polder landscape north of the geosite, but also with the small-scale parcels and the more closed landscape south of the creek area in sandy Flanders (Vlaanderen).

The variety in (fossil) tidal channels and creeks

The area is characterized by a wide variety of fossilized creek types, from completely open to completely silt. The tidal channels differ from tidal creeks by their size and position within the stream network. Not only the filling sediment, shape, width and depth, but also the presence of active channels and bank edges determine different the types. The shape of the fossil creeks also depends on the combination of the location in the tidal system, the sedimentation phase in which natural evolution has stopped, the vegetation and subsequent sediment cover.

Relation with other geosites

- The two coversand ridges in the creek area run parallel to the coversand ridge (geosite 37) and, despite their more modest size, have a similar origin.
- In the west, the eastern branches of the Zwin creek remnant system (geosite 19) extend into this geosite.
- Furthermore, the geological formation processes of the Braakman region (geosite 23) are comparable to this geosite. The influence of the Braakman (South Sea) has determined the reclamation history of the geosite.

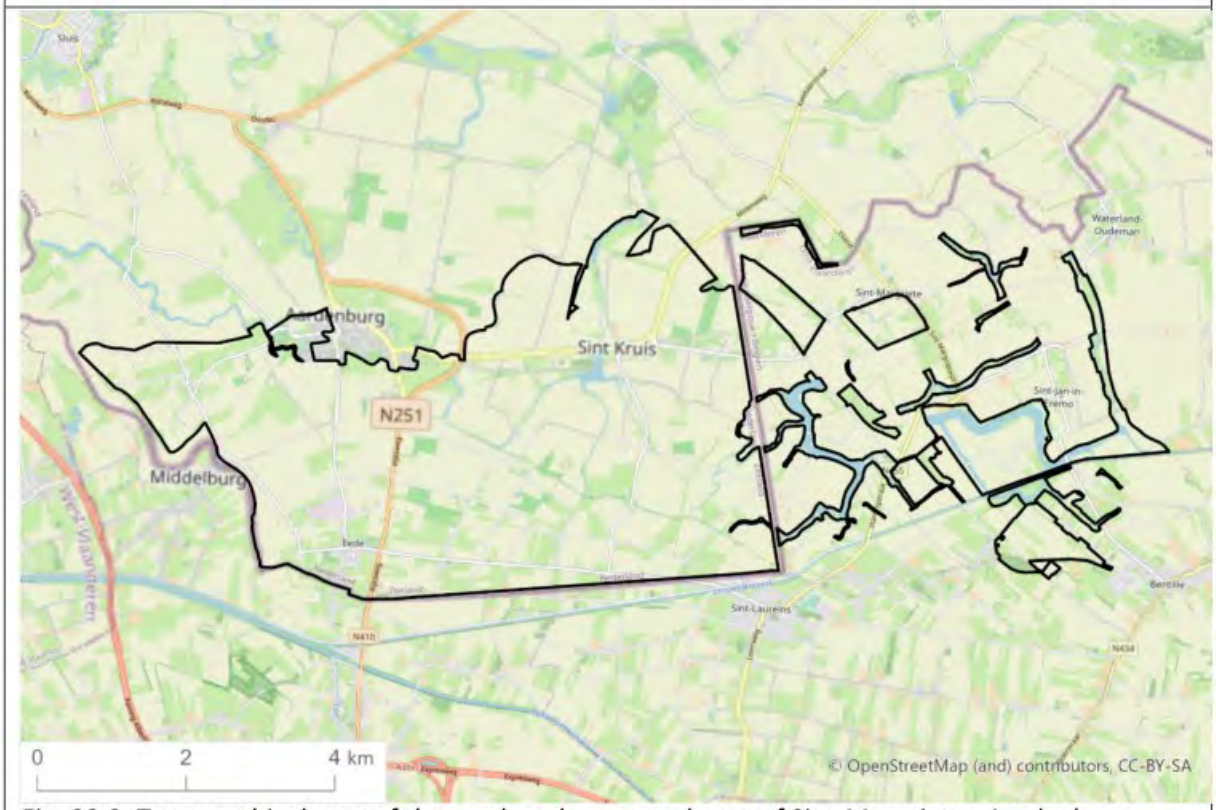

Fig. 22.2. Topographical map of the creek and coversand area of Sint-Margriete - Aardenburg. Source: OpenStreetMap & contributors. CC-BY-SA.

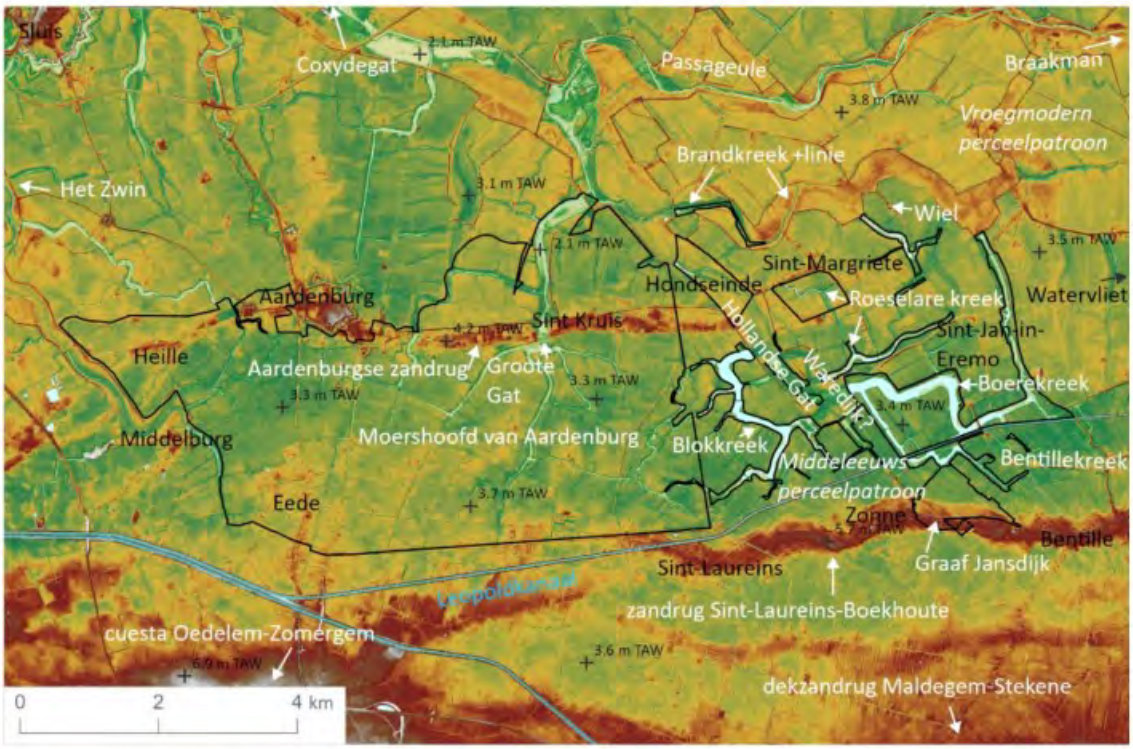

Fig. 22.3. Elevation map of the creek and coversand area of Sint-Margriete - Aardenburg, indicating the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency; AHN3 Rijkswaterstaat.

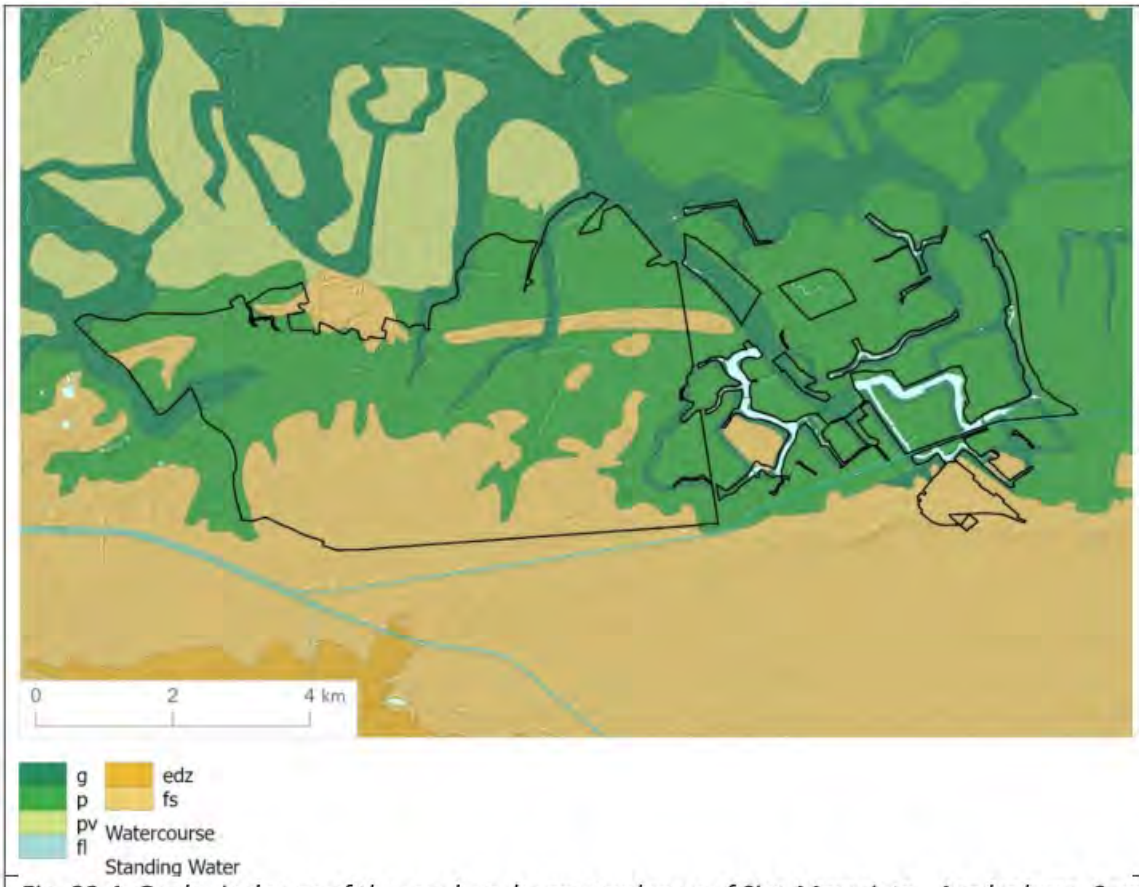

Fig. 22.4. Geological map of the creek and cove sand area of Sint-Margriete - Aardenburg. Source: Geological overview map of the Scheldt Delta Geopark, TNO.

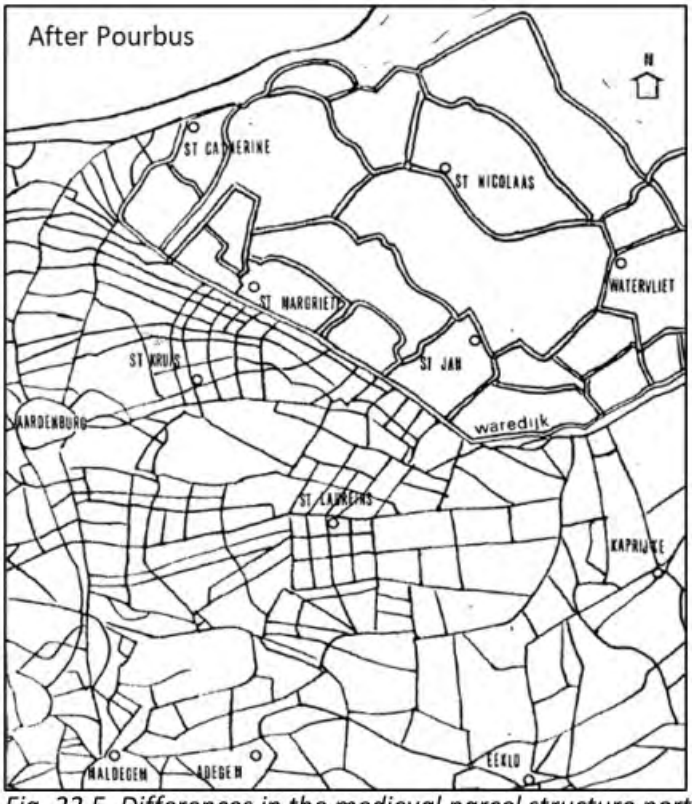

Fig. 22.5. Differences in the medieval parcel structure north and south of the Waredijk/Woutersweg, after Pourbus. Source: Augustyn & Thoen (1987).

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Geosite n°23	**Braakman region** Remnants of the large estuary that divided Zeeuws-Vlaanderen (Zeelandic Flanders) in two for centuries.
 Fig. 23.1. Map of Geopark Schelde Delta. Braakman region is number 23.	**Scientific importance and valuation of the geosite** The current geosite 'Braakman region' is only a small remnant of an important inlet and tidal area that, due to its vastness and long existence (ca. 600 years), exerted a major influence on the geological, pedological, economic and cultural-historical development of Zeeuws-Vlaanderen. The traces in the landscape are often still clearly visible within the geosite, but also in its wider surroundings, in the form of creeks and old channel, polder and dike patterns, emphasized by elevation differences. The Braakman was one of the last diked tidal areas in Zeeuws-Vlaanderen. The Dutch part of the geosite is a geologically valuable area of the Province of Zeeland. The creek and polder areas of the Belgian part are included in the Inventory of the Flanders Heritage Agency.
Municipality	Terneuzen, Assenede, Sint-Laureins
Province and country	Zeeland, the Netherlands and Oost-Vlaanderen, Belgium
Protection status	Belgian part: Natura 2000, protected cultural-historical landscape; Dutch part: provincial geologically valuable area, Natuurnetwerk Zeeland; Northern part of Braakman: PMV environmental protection area, provincial valuable landscape
Site management organizations	Staatsbosbeheer, Waterschap Scheldestromen, Natuurpunt en Partners Meetjesland vzw, Municipality Sluis, Municipality Sint-Laureins, Municipality Assenede
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center - Excursions/guided tours - Educational programme for children
Relevance for education	- Visitor center - Excursions/guided tours - Routes one can travel independently - Educational programme for children
Teaching equipment	Not applicable.

Code	Significance
G-23	Provincial
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: A nice example of the remnants of a very large, long-lived, and historically important tidal inlet and channel system, presently consisting of polders and fossil channels (some of which are still partly open) at different elevations which reflect the time of their embankment and thus shutoff from sediment supply.	
Sedimentology: not applicable.	

DETAILED DESCRIPTION

1. **Location**

The Braakman is a very large former tidal system that discharged into the Western Scheldt (Westerschelde) approximately 4 kilometers west of Terneuzen and divided Zeeuws-Vlaanderen into a western and eastern part. The remaining open-water part of this system is the Braakmankreek, locally still about 800 m wide. However, in the past, the entire system extended further south and east and was connected via Philippine and Sluiskil to the Hellegat, which debouched into the Western Scheldt 8 km east of Terneuzen. In between was the smaller Otheense Kreek. On the west side, the Braakman inlet was once connected to the Zwin inlet via the Passageule. The geosite consists of several low-lying parts of the Braakman that are remnants from the channels in the tidal area. In the past, these low-lying parts formed a connected system, but the natural connection is no longer clearly visible everywhere in the landscape due to human interventions. The southernmost of these isolated subareas are located south of the national border in Belgium.

NB. Some of the westernmost small areas that are part of this geosite seem to have been connected not to the Braakman, but to the Passageule, which formed the connection between the Braakman and Zwin inlets.

2. **Landscape formation**

Origin of the landscape

During the last ice age, this region was part of a vast sandy area with coversand ridges blown by the wind. Due to climate change, the sea level and the water table rose in the Holocene. As a result, further inland a coastal swamp developed, in which peat accumulated. As the sea level rose further, the swamp changed into a tidal landscape with tidal flats and salt marshes. Tidal deposits covered the peat in large parts of Zeeland.

A large part of the barren coversand area of Zeeuws-Vlaanderen was also covered with coastal marsh peat. However, the sea did not penetrate far enough inland to cover it with tidal deposits in this region. When the rate of sea level rise slowed during the Holocene, a continuous protective barrier of beach ridges formed along the coast, which shielded the hinterland from marine influence from about 3800 years ago. The peat area continued to grow. However, the protective coastal barrier was gradually broken down again from about 2600 years ago. In the following centuries, the tide entered further inland.

Initially, the peat river the Honte was probably located at the location of the mouth of the current Western Scheldt. Due to marine intrusions, this river grew further and further to the east into a sea inlet. The Honte also developed a connection with the Scheldt, which at that time still flowed to the sea via the Eastern Scheldt (Oosterschelde). A large part of Zeeuws-Vlaanderen thus turned into a tidal area, which was confronted with severe flooding during storm surges. Since the storm

surges in the 16th century AD, the Honte, then called the Western Scheldt, took over the role of the Eastern Scheldt as the main drainage channel of the river Scheldt.

Formation of the Braakman

De Braakman developed in several phases. During the storm surge in the winter of 1375-1376 AD, a huge breach is said to have occurred in the low-lying, wet area east of Biervliet. Attempts were made to reclaim the area by re-diking, but during the disastrous first St. Elisabeth flood in 1404 AD, the tidal branch extended its reach. It expanded even further during a storm surge in 1477 AD. Over time, channels incised far into the hinterland. The maximum reach of the Braakman was probably established in 1570 AD, when the connection to the Zwin inlet was created during a storm surge. Maps indicate that a connection to the smaller tidal system of the Hellegat was also established around 1650.

Drowned villages

In the immediate vicinity of the Braakman, the parishes of Coudekerke, Wevelswaele, De Piet and Boterzande disappeared into the sea during the storm surge of 1375-1376 AD. The first St. Elisabeth flood in 1404 AD also led to the loss of villages in the immediate and wider area. This catastrophe has been repeated over the centuries during great storm surges. The exact location of many of these disappeared villages is unknown. Where archaeological remains have been found, they mainly consist of remains of churches and graveyards. These were often on the highest part of the village and were well protected because of their important function. Churches were one of the few buildings built of stone with heavy foundations. They were therefore more resistant to the force of the tide than the vulnerable houses of the population.

Navigation and land reclamation

The location of villages and towns on the Zeeland coast was dangerous, but also useful in certain respects. With the creation of the connection with Het Zwin, the large inlet on the Flemish coast, a new waterway was created between the Western Scheldt and Ghent via the Braakman and the Passageule, with a natural harbor on the Scheldt. In the 18th and 19th centuries AD, however, the Braakman was increasingly reclaimed. As a result, the system was able to store less and less water at high tide. As a result, major changes took place in the mouth area, with the broad mouth splitting in two into an eastern and a western channel. The flow rate decreased and the tidal system silted up. A new canal was therefore constructed for shipping from Terneuzen to Sas (on the Belgian-Dutch border), which was completed in 1826.

De Braakman is one of the last reclaimed tidal areas in Zeeuws-Vlaanderen. The mouth of the main channel was not dammed until 1952. The wide Braakmankreek is the last remnant of the large tidal channel.

Elevation differences

In the Braakman region, elevation differences are visible between the channels and the surrounding areas. The channel forms the lowest part of the young tidal system and is several decimeters to several metres lower than the surrounding tidal flats – depending on the depth of the channel.

Elevation differences can also exist between polders. The earlier a part of the channel and the surrounding flats was embanked, the shorter the period in which the tides could deposit sediment (sand and clay) in the area. The first diked branches of the tidal area (such as the smaller inland channels and flats of the Braakman in Belgium) are therefore relatively low. The polders that were embanked later are raised by the sea for a longer period of time and are now higher. The largest and most recently diked channels of the Braakman can therefore be recognized in the elevation map as broad zones.

Channel patterns

The elevation image shows that a number of tidal channels do not drain to the north in the direction of the Western Scheldt, but to the south or southwest. These smaller channels were branches of the Braakman system and drained into the main branch of the Braakman, which was located more inland and ran eastwards, parallel to the Western Scheldt.

Mussel culture

Philippine, now located about 6 km inland from the Western Scheldt as the crow flies, is known for its mussel culture. In the past, when the Braakman was still active further inland, the fishing village was in open connection with the Western Scheldt and the sea. This connection deteriorated due to the reclamation and silting of the Braakman. That is why the Philippine Canal was dug. Since the closing of the Braakman in 1952, the connection with open water has been definitively broken and mussel culture came to an end. However, Philippine is still famous for its mussels, which can be eaten in many mussel restaurants.

Relation with other geosites

- Western Scheldt – estuary in which the Braakman debouched.
- Passageule – the connection of the Braakman with the Zwin inlet.
- Otheense Kreek – well-preserved small tidal system, east of the Braakman.

Fig. 23.2. Location map of the geosite.

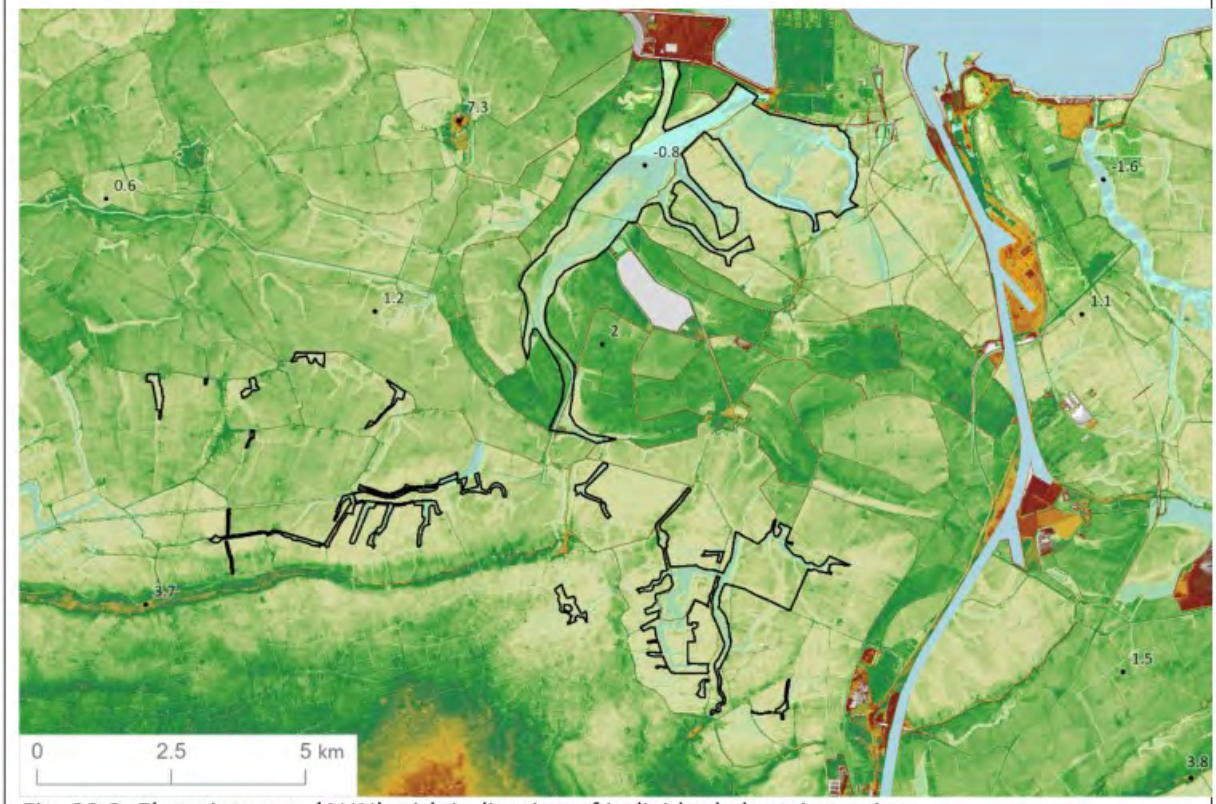

Fig. 23.3. Elevation map (AHN) with indication of individual elevation points.

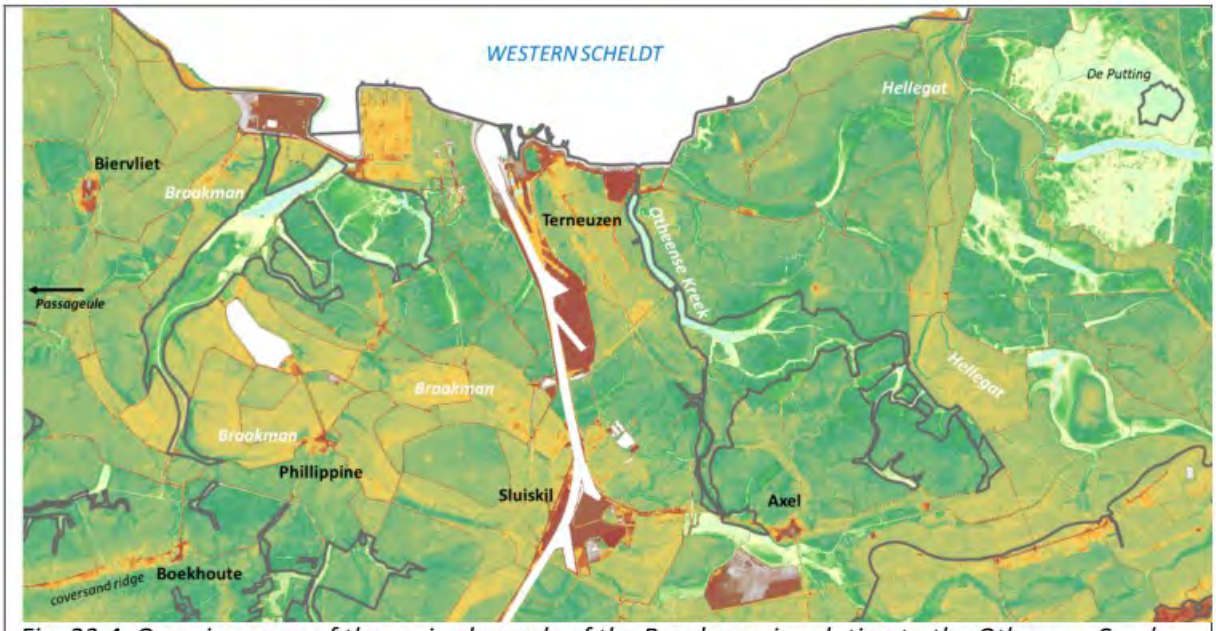

Fig. 23.4. Overview map of the main channels of the Braakman in relation to the Otheense Creek and Hellegat, with all the toponyms mentioned in the text. Boundary of different geosites is outlined in grey. The entire tidal system of the Braakman covers a wider area, including the higher (yellow) parts of the map.

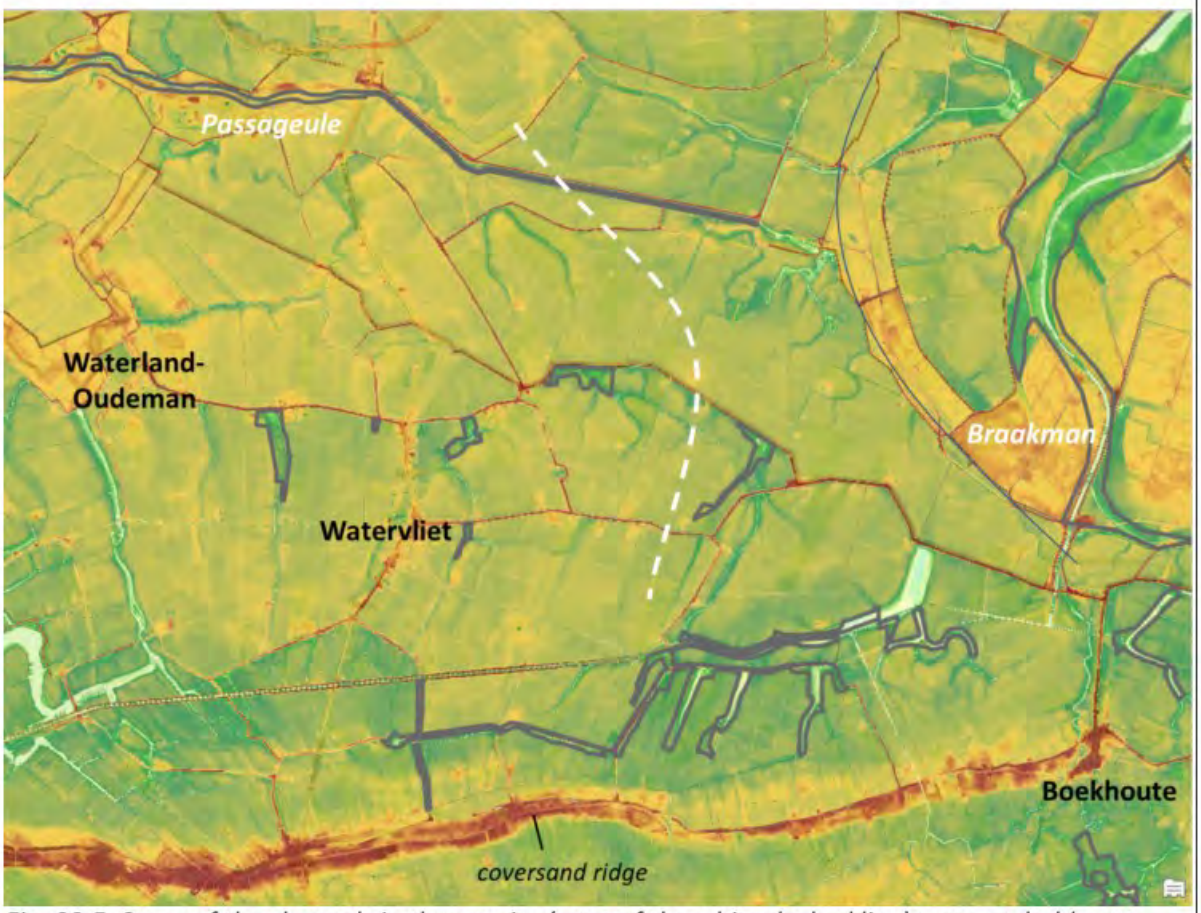

Fig. 23.5. Some of the channels in the geosite (west of the white dashed line) were probably not directly connected to the Braakman, but to the Passageule. NB. The strikingly elevated west-east oriented ridge south of the geosite is a coversand ridge, a high Pleistocene surface that is not covered by tidal deposits.

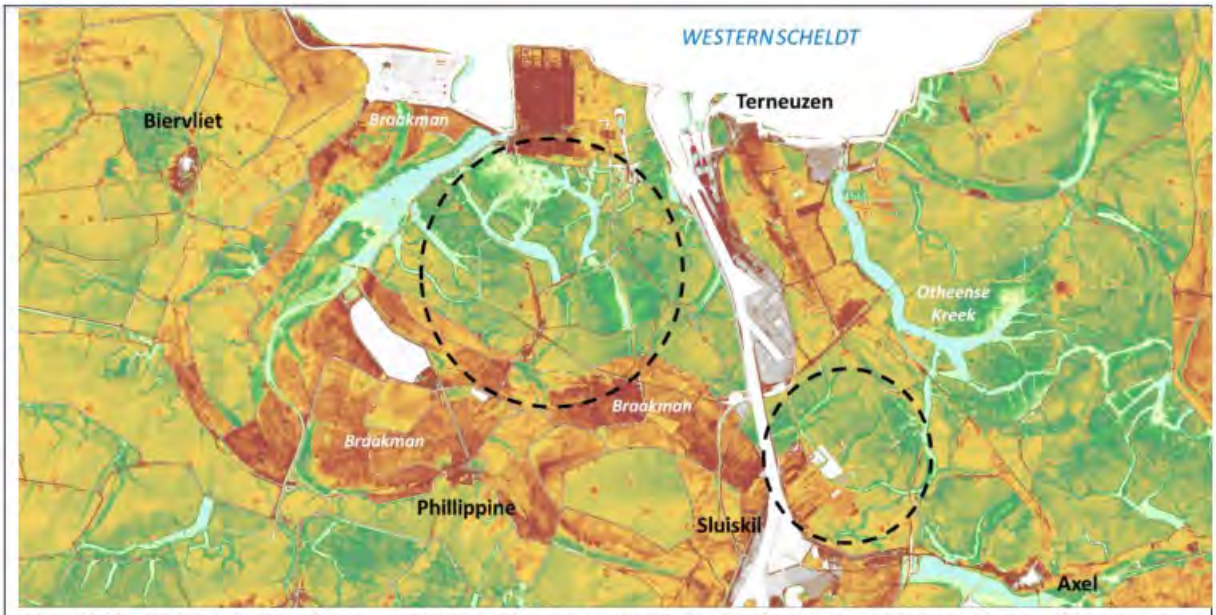

Fig. 23.6. In the interior of Zeeuws-Vlaanderen, several channels drain not towards the Western Scheldt in the north, but towards the main branch of the Braakman located south of it, nowadays recognizable as a higher part of the landscape (red shades).

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Geosite n°24	**Otheense Kreek** A beautifully preserved creek system originated as a result of military inundation.
 Fig. 24.1. Map of Geopark Schelde Delta. Otheense Kreek is number 24.	**Scientific importance and valuation of the geosite** Due to the one-time closure and reclamation of the area, a very nicely preserved tidal system – that was created as a result of military inundation – is preserved. Geographically valuable area of the Province of Zeeland, of national importance.
Municipality	Terneuzen
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Zeeland, provincially valuable landscape
Site management organizations	Staatsbosbeheer, Waterschap Scheldestromen, Municipality Terneuzen
Accessibility	Site is accessible to the general public.
Relevance for tourism	Routes that one can travel independently
Relevance for education	None.
Teaching equipment	People are allowed to wander through the area. There are no permanent footpaths. However, an organized walk from Terneuzen is included along the borders of the site.

Code	**Significance**
G-24	National
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: A beautifully preserved tidal creek system resulting from military inundation, this former channel system is open water even kilometers inland and clearly shows the original elevation differences between the water level in the channel and the surrounding polder area.	
Sedimentology: not applicable.	
DETAILED DESCRIPTION 1. **Location**	

The Otheense Kreek is a creek system located in Zeeuws-Vlaanderen. The mouth of the creek is just east of Terneuzen. At this point, the creek is about 180 metres wide. About a mile inland, the creek splits into two branches. The southern branch runs through the village of Spui to Axel. The eastern branch runs south via Zaamslag. The deeper inland, the narrower and shallower the creeks become. The creek system still ensures drainage of the hinterland and is connected to the Western Scheldt (Westerschelde) on the north side via a lock and a short canal.

Much of this creek system is still under open water and it continues for many miles inland without interruption. The channels are up to a few metres below NAP and are therefore much lower than the surrounding land, which lies at a maximum of ca. 1.5 m + NAP. In total, the geosite covers an area of ca. 9 km².

2. **Landscape formation**

Origin of the landscape

The landscape of Zeeuws-Vlaanderen consists of a sandy subsoil from the last ice age that was covered by an extensive peat swamp between 6500 and 2800 years ago as a result of sea level and groundwater rise. From about 2600 years ago, major sea breaches took place and over a thousand years, large tidal channels formed, including the Honte, the predecessor of the current Western Scheldt. Through these tidal channels, the sea deposited a clay layer on the peat. A salt marsh area developed.

De Honte had several smaller branches. At the location of the current Otheense Kreek, there was a natural branch of the Honte, called the Notense Geul, where the village of Noten was also located. The earliest known written record of this village, also known as Othene, dates back to 1160 AD. The village disappeared into the sea during a storm surge in 1214 AD, after which Nieuw-Othene was founded. In the 13th century, dikes around the medieval village of Saemslach created the island of Zaamslag, which over time expanded in almost all directions by further reclamation. In this and subsequent centuries, the polder area was flooded several times during storm surges.

Military inundations

In the Eighty Years' War (1568 – 1648 AD) the Northern Netherlands fought for their independence of from the Spanish king. The States, the rebels against Spanish rule, dominated de Honte and Antwerp between 1583 and 1586 AD. In order to drive out the Spanish army and secure recaptured cities, they breached dikes and locks at various locations in Zeeuws-Vlaanderen, causing the sea to flood no less than 19,000 hectares of the land. Such a breach was also made at Nieuw-Othene in 1584 AD. From there, the seawater reached Zouterspuije (present-day Spui), which is kilometers inland, and the present-day Otheense Kreek developed. Tidal action turned the first channel into a large creek system.

During these military inundations, the village of Nieuw-Othene completely disappeared into the sea. Remnants of this village surfaced in the Otheense Kreek during the drought in 1842. Todays (and thus the third) Othene, also known locally as Noten, developed on the eastern bank of the creek. Today, Othene is completely included in the surrounding residential areas of the city of Terneuzen.

An inundation in 1586 AD to protect the recaptured city of Axel caused the medieval settlement of Saemslach to disappear into the waves. For a long time, the tower of the old Zaamslag served as a beacon for skippers who sailed the eastern tidal channel Hellegat, but it was demolished in 1697. The current Zaamslag is on the same location as the old village.

Damming and the original relief

Unlike many other tidal channels, where land reclamation often took place earlier and through various small reclamations, the 1350-hectare area around the Otheense Kreek was reclaimed in one go in 1650 AD, by damming the creek itself. This is how the Zaamslag polder was created. Because the creek system was completely closed off, the entire area was simultaneously cut off from the supply of sediment (sand and clay). As a result, the original relief has been preserved in its entirety and many of the creeks are still under water – since the sea no longer had access to supply sediment for accretion.

<u>High- and low-lying zones in the region</u>

The Zaamslagpolder is relatively low compared to the surrounding polders. This is because the tidal system of the Otheense Kreek was diked earlier than the tidal systems in the area. The Braakman in the west and south and the Hellegat in the east were only reclaimed in the 18th, 19th and 20th centuries. The sea influenced the latter areas for a longer time. Because the land around the Otheense Kreek was protected against the water after it was dammed in 1650 AD, no sediment (sand and clay) was subsequently supplied by the sea. The difference in height between the polder of the Otheense Kreek and that of the surrounding tidal systems is approximately half a metres to a metres.

<u>Relation with other geosites</u>

- Braakman – large former tidal system west of the Otheense Kreek.
- Oudland area De Putting – adjacent area that has never been affected by young tidal channels; Oudland.
- Drowned Land of Saeftinghe – lost land, previously subject to military inundations.
- Western Scheldt – marine inlet from which the Otheense Kreek branched.

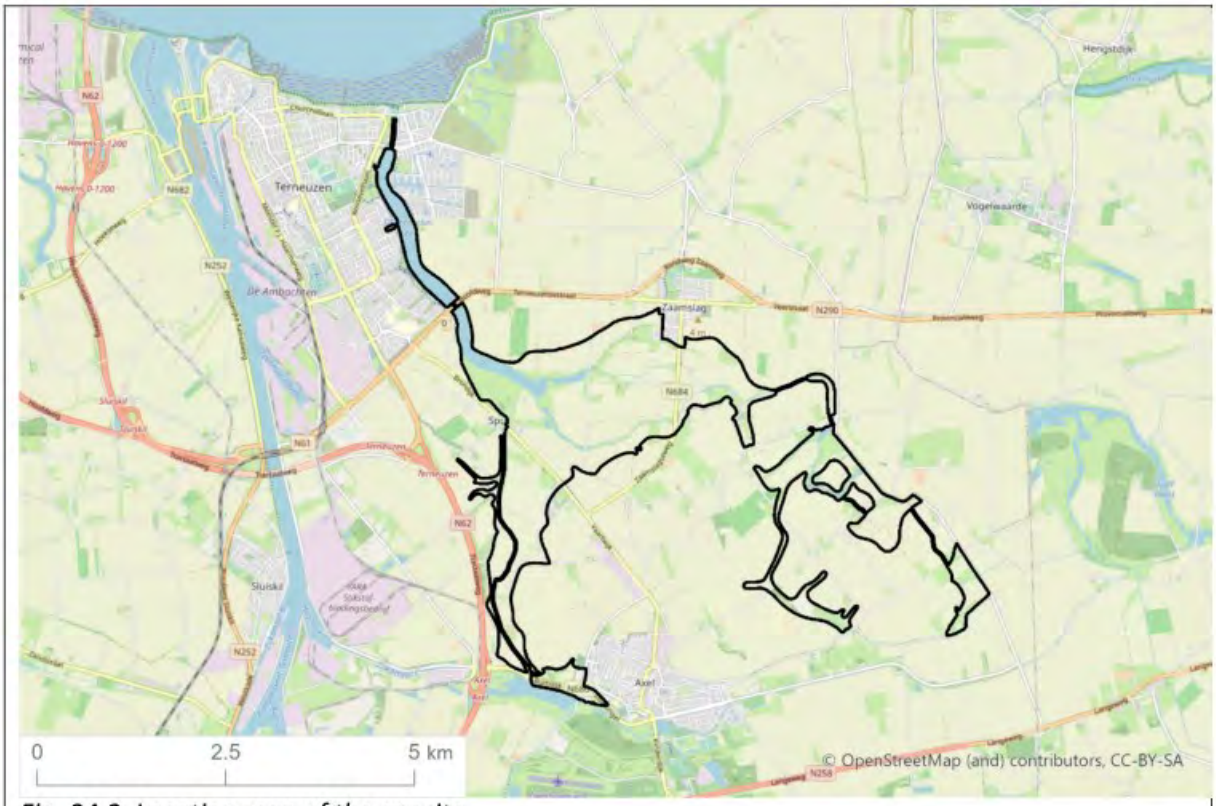

Fig. 24.2. Location map of the geosite.

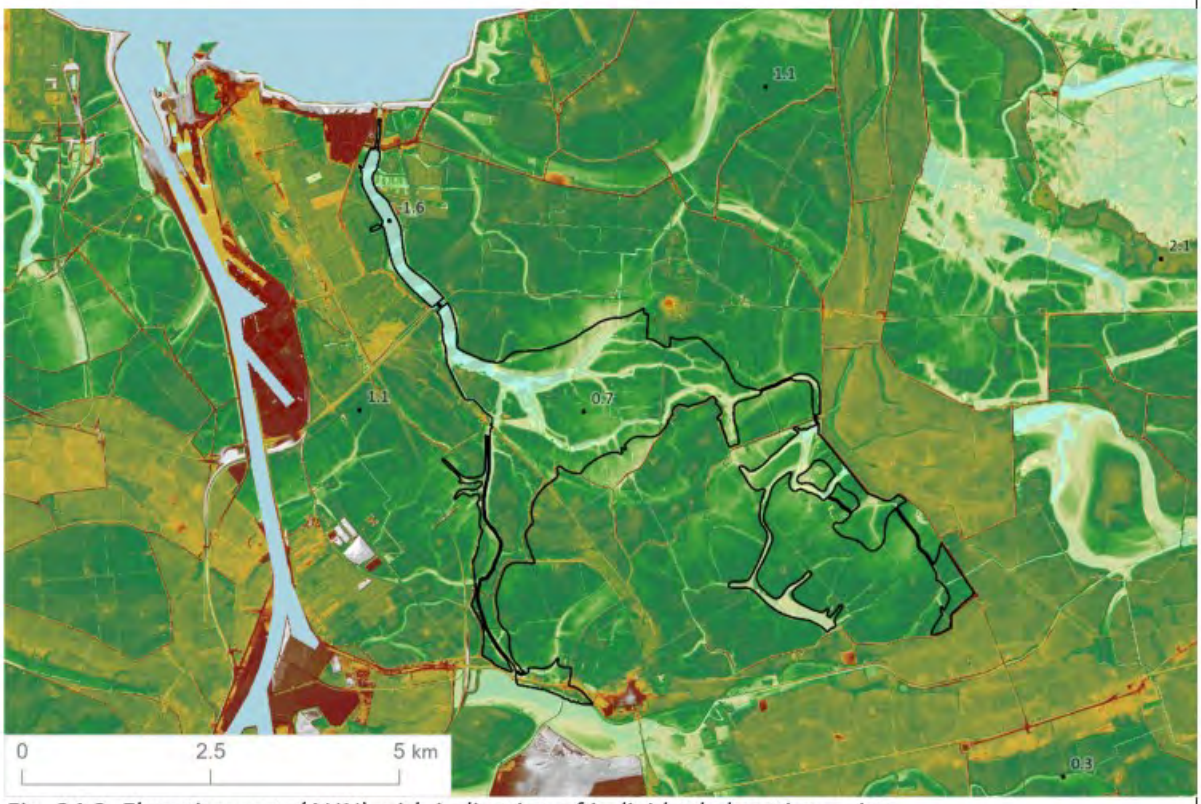

Fig. 24.3. Elevation map (AHN) with indication of individual elevation points.

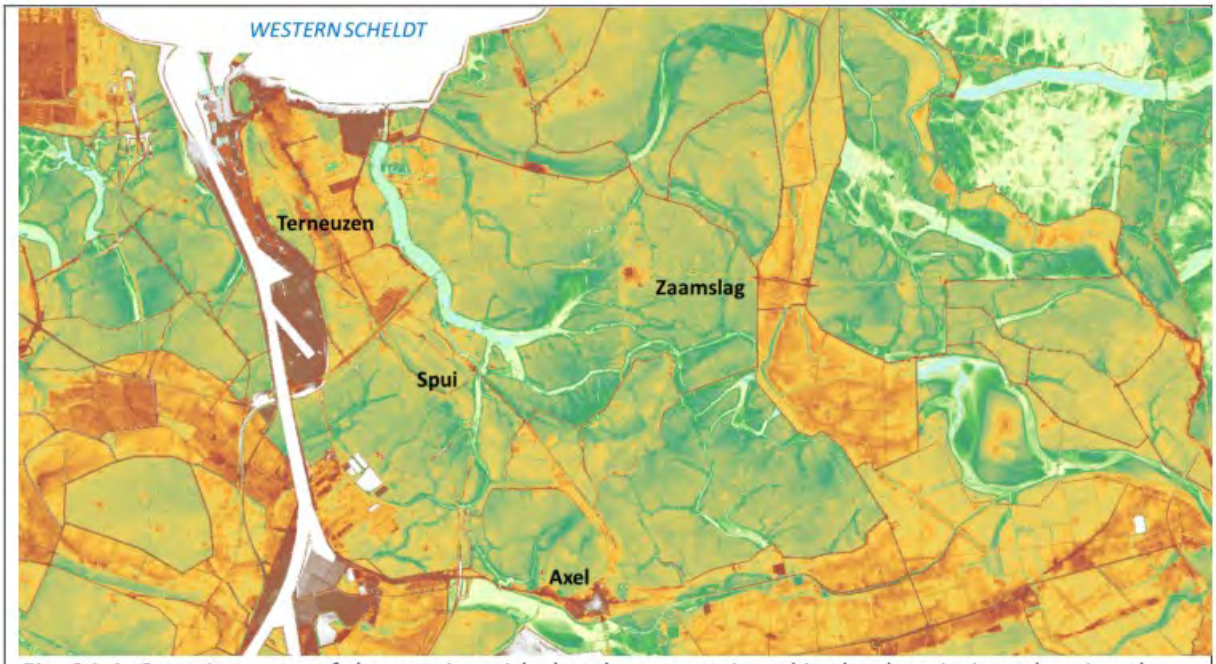

Fig. 24.4. Overview map of the geosite with the places mentioned in the description, showing the elevation differences in relation to the surrounding tidal systems the Braakman (south side) and the Hellegat (east side).

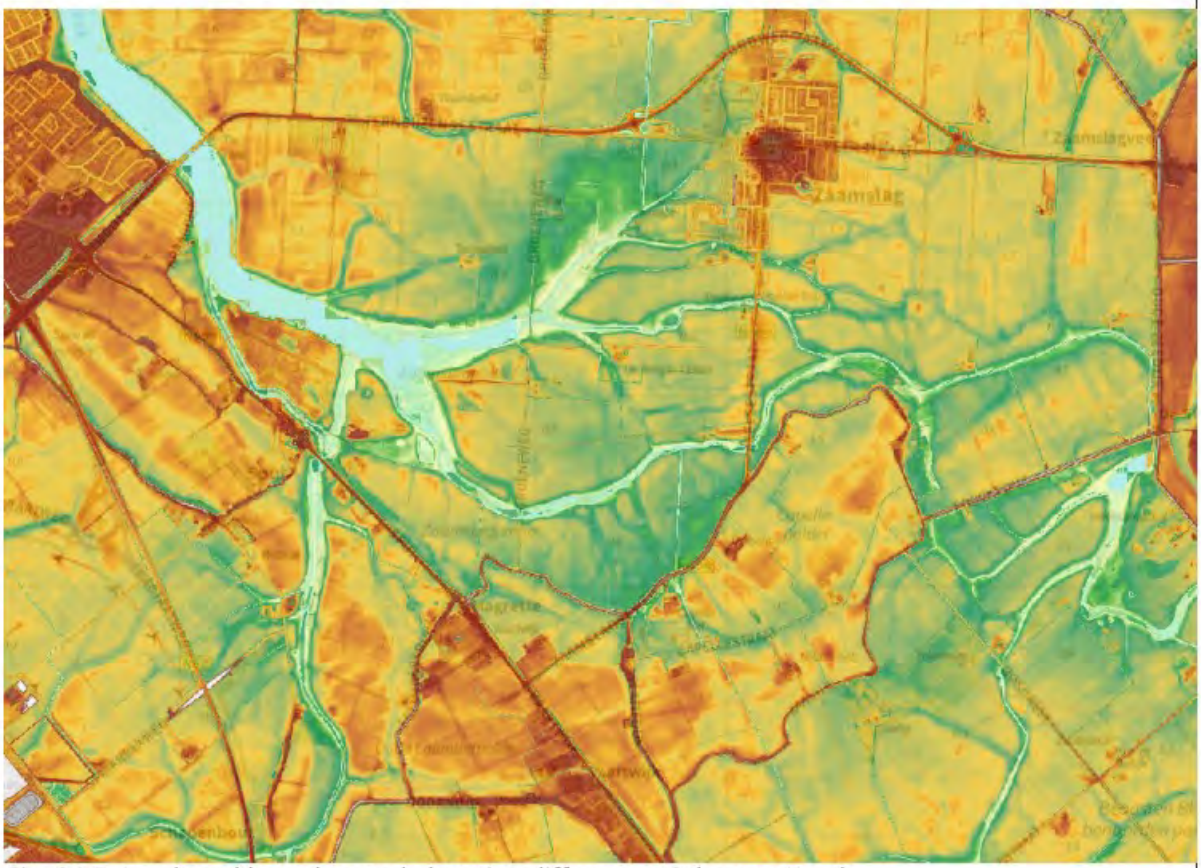

Fig. 24.5. Landward branches and elevation differences Otheense Kreek.

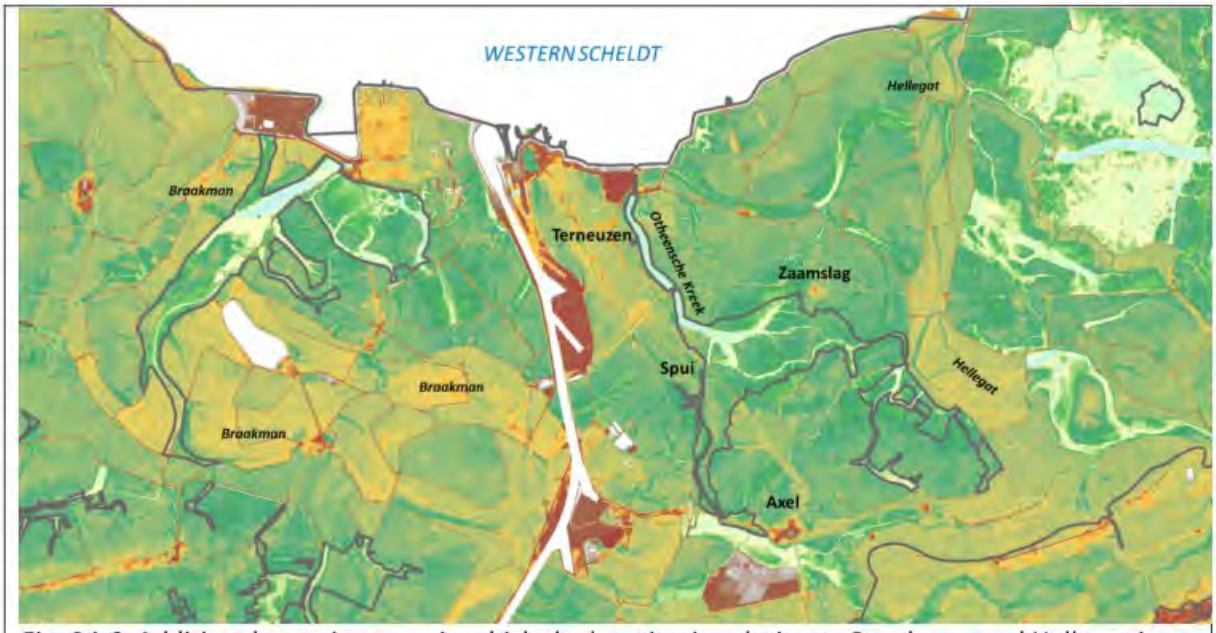

Fig. 24.6. Additional overview map in which the location in relation to Braakman and Hellegat is more visible.

Documentation

- De Kraker A.M.J., 1997. Landschap uit balans. De invloed van de natuur, de economie en de politiek op de ontwikkeling van het landschap in de Vier Ambachten en het Land van Saeftinghe tussen 1488 en 1609. Uitgeverij Matrijs, Utrecht, 464 pp.
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- Wilderom M.H., 1973. Tussen Afsluitdammen en Deltadijken – IV. Zeeuwsch Vlaanderen. Vlissingen, 567 pp.
- Bestemmingsplan Terneuzen, Othene Oost. Bijlage 2, Archeologische Toets.

Geosite n°25	**Coversand area Sint Jansteen** Low creeks and high sand ridges.
 Fig. 25.1. Map of Geopark Schelde Delta. Coversand area Sint Jansteen is number 25.	**Scientific importance** Geographically valuable area of the Province of Zeeland of national importance. Transition area between higher coversand ridges that developed during the last ice age, and lower polders with creek systems that cut through the coversand ridges.
Municipality	Terneuzen, Hulst
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Zeeland, PMV environmental protection area; Forests at Clinge and Sint-Jansteen: groundwater protection area, provincial valuable landscape
Site management organizations	Staatsbosbeheer; Stichting Het Zeeuwse Landschap; Evides, Waterschap Scheldestromen; Municipality Terneuzen; Municipality Hulst
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions - Routes that one can travel independently - Information panels - Viewpoint with information facilities
Relevance for education	- Excursions - Routes that one can travel independently - Information panels - Viewpoint with information facilities
Teaching equipment	- Guided walking for people with (chronic) pain - The water extraction company Evides is the owner of the water extraction area between Clinge and Heikant. The water extraction function was retained and nature and recreational values were developed in addition. There are opportunities for jogging, walking, Nordic

	walking, cycling, mountain biking, horse riding, skating, and nature observation. - Information leaflet "Het ontstaan van Zeeland"

Code	Significance
G-25	National

Geological interest(s)

Paleontology: not applicable.

Stratigraphy: not applicable.

Geomorphology: In this area in the transition zone from coastal plain to coversand region, conspicuous coversand ridges locally limit the extent of the coastal sediments but at other places are breached by much more recent tidal channels, which are clearly visible in the landscape due to elevation differences or the presence of open water in the residual channel. Some creeks follow a rectangular pattern inherited from the pre-existing medieval parcel structure.

Sedimentology: not applicable.

DETAILED DESCRIPTION

1. **Location**

The geosite is located on the transition zone from a higher sandy landscape, formed during the last ice age, to a lower creek area. The geosite, with a total area of ca. 50 km² extends between Zelzate in the west and Hulst in the east and contains several west-southwest - east-northeast oriented coversand ridges. These ridges reach a maximum of 4 m + NAP and are intersected by several creeks from the Braakman tidal system. The surface between these coversand ridges is generally around 1 m + NAP, containing a number of creek remnants that can be approximately half a metres below NAP.

2. **Landscape formation**

Origin of the landscape

During the last ice age, the landscape in large parts of the Netherlands consisted of a polar desert, an extensive coversand landscape with little vegetation and slightly higher coversand ridges blown up by the wind. After the ice age, the climate got gradually warmer, causing the large land ice caps to melt and global sea levels to rise. As a result, a large part of the lower coversand landscape drowned and Zeeland largely changed into a tidal area with extensive peatlands on the edges.

As a result of the slowdown in sea level rise, an almost continuous beach ridge had formed around 3800 years ago, protecting the area behind against marine intrusions. The tidal area turned into a vast peat swamp. The peat spread further and further inland. In Zeeuws-Vlaanderen (Zeelandic Flanders), only the higher elevated coversand ridges stuck out above the peat surface. The protective coastal barrier was gradually breached in the Late Iron Age, about 600 BC, so over time, large parts of the peat landscape were again influenced by the sea. Around 800 AD, the Western Scheldt (Westerschelde) developed, which began as an inlet that reached further and further inland and eventually connected with the River Scheldt. In Zeeuws-Vlaanderen, several major marine intrusions took place from the Western Scheldt, resulting in the loss of agricultural land and the drowning of villages. In the 13th century, a tidal system formed here, which for centuries divided Zeeuws-Vlaanderen into two parts and included the Braakman and the Hellegat. The last tidal channels of this system were only dammed and reclaimed in the 20th century. This tidal system was created by various storm surges and dike breaches, and from the large tidal channels, creeks were eventually able to force their way far inland through the peatlands of the geosite, along and sometimes right through the higher coversand ridges.

The coversand ridges remained prominently above ground level and formed the areas on which medieval settlement was initially concentrated. Flint objects, left behind by hunter-gatherers on

these high ridges, show that they have been attractive for humans for thousands of years. Villages such as Sint Jansteen and Koewacht have a narrow and elongated shape, because they follow the shape of the coversand ridges. From these villages, the peat in the area of the geosite was eventually extracted in the Middle Ages and transported to cities such as Ghent via inland peat canals such as the Zoute Vaart.

Creek courses

The creek courses come from the Braakman from a northerly direction and are often still clearly visible in the landscape, because they are lower than the surrounding area. The shape of the 16th-century southern bank of the Braakman itself is also clearly visible. This bank is characterized by a line of Spanish fortifications, the remains of which can still be recognized as elevations in the landscape. The fortifications were built in the 16th century along the salt marshes of the Braakman to stop the invasion of States troops from the Axel region.

Due to persistent tidal activity, creeks that originated from the Braakman were even able to break through parts of the coversand ridges. For example, a large, visible breach is located just southeast of the former Spanish fortification of St Nicolaas. Here, the Groote Gat cuts through the northernmost coversand ridge and continues into the polder further south. The Boskreek is a branch of this system and it even managed to work its way through the southern coversand ridge of Koewacht. Today, this breakthrough is still recognizable as an open residual channel.
Some creeks that run through the geosite have an unnatural, rectangular pattern, such as the Moerspuische Watergang. This is because these creeks were created while the low-lying peat areas were already drained by a network of ditches and locks. During their formation, the creeks managed to tap a few ditches, gradually widened them and incised them deeper. These creeks are silent witnesses of the former division of agricultural parcels.

Elevation differences

The salt marsh area that developed on the flanks of the Braakman tidal system was embanked in several phases. Because the salt marshes outside the dikes have been able to silt up much longer than those that had already been embanked, the difference in elevation between different polders can be almost 1 metres. For example, the surface of the Zuiddorpe polder, which was diked in 1698 AD, is at approximately 1 m + NAP, while the adjacent Kanisvliet Binnen polder, which was embanked some 90 years later, is at approximately 1.5 m + NAP.

The greatest elevation difference is, of course, at the transitions of the various coversand ridges and the adjacent polders. The coversand ridges have elevations of about 2 to 4 m + NAP and change abruptly to the polders about 2 metres lower. The polders directly adjacent to the coversand ridges are generally diked in relatively early and have a height of less than 1 m + NAP.
The southeast - northwest orientation of the coversand ridges is determined by the dominant wind direction. This has been the same in the area for thousands of years and has determined the orientation of almost all coversand ridges in the Netherlands and Flanders (Vlaanderen). Near the geosite, the coversand ridges are mostly still on the surface, but such ridges must have once dominated the landscape in the rest of Zeeland as well. Today, however, these are buried under metres thick layers of clay and peat.

Relation with other geosites

- Braakman region (nr. 23): former tidal area where the creeks of this geosite spring.
- Otheense Kreek (nr. 24): creek system in Zeeuws-Vlaanderen.
- Creek and coversand area Sint-Margriete – Aardenburg (nr. 22): comparable coversand area intersected by creeks, on the border between Zeeuws-Vlaanderen and Belgium.
- Drowned Land of Saeftinghe: outer-dike salt marsh area in Zeeuws-Vlaanderen with drowned villages.

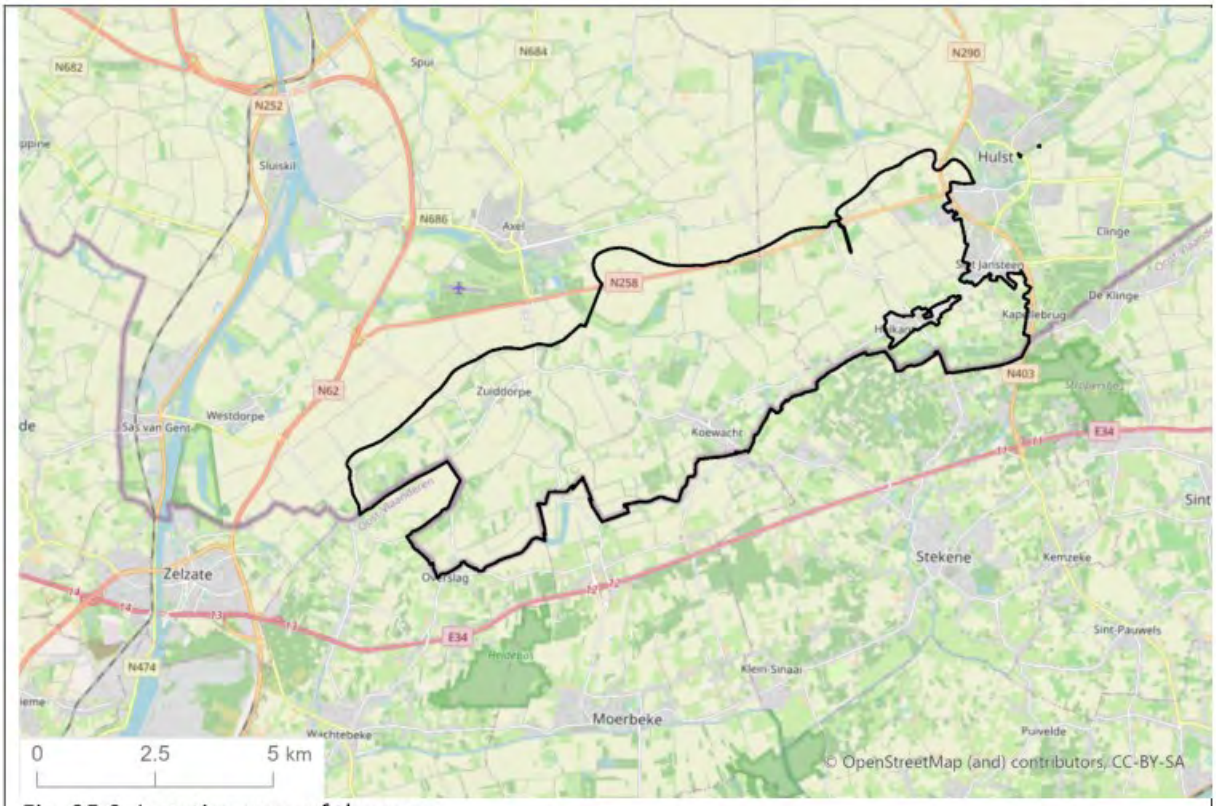

Fig. 25.2. Location map of the area

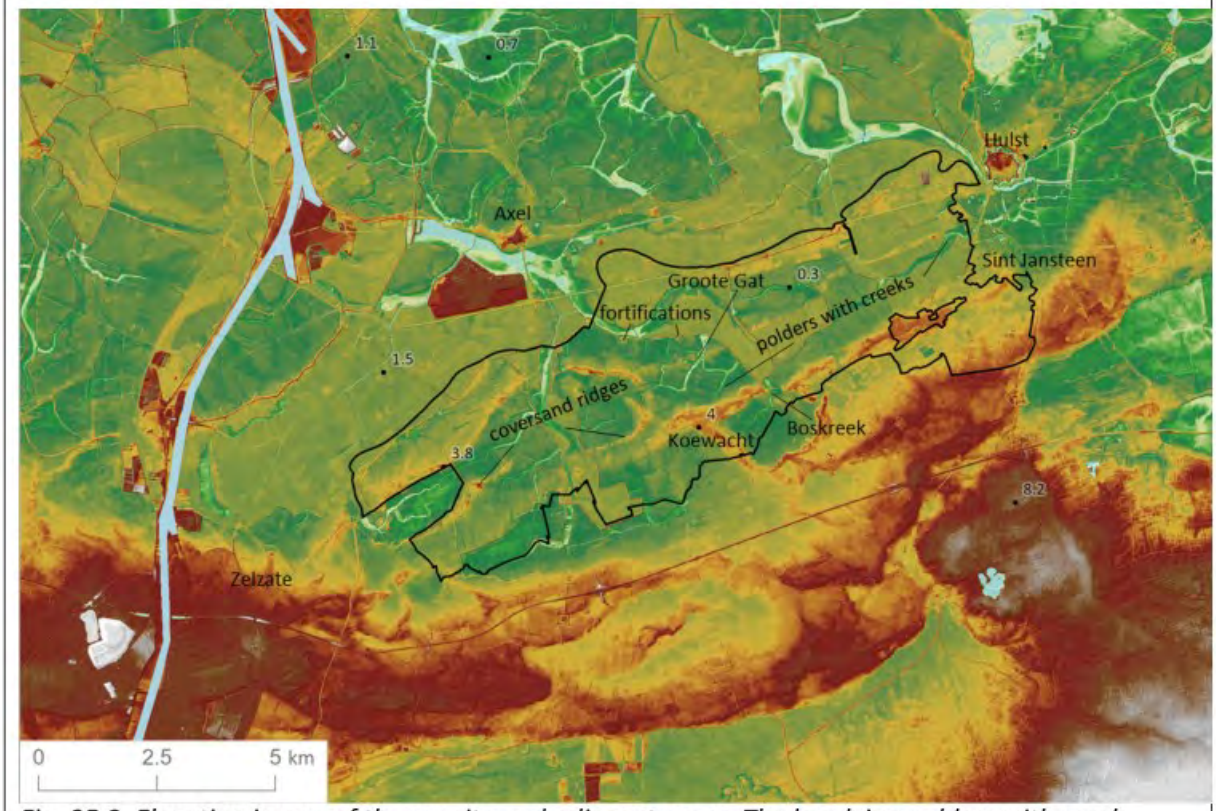

Fig. 25.3. Elevation image of the geosite and adjacent areas. The low-lying polders with creek courses are shown in green, and the high coversand ridges in yellow and red.

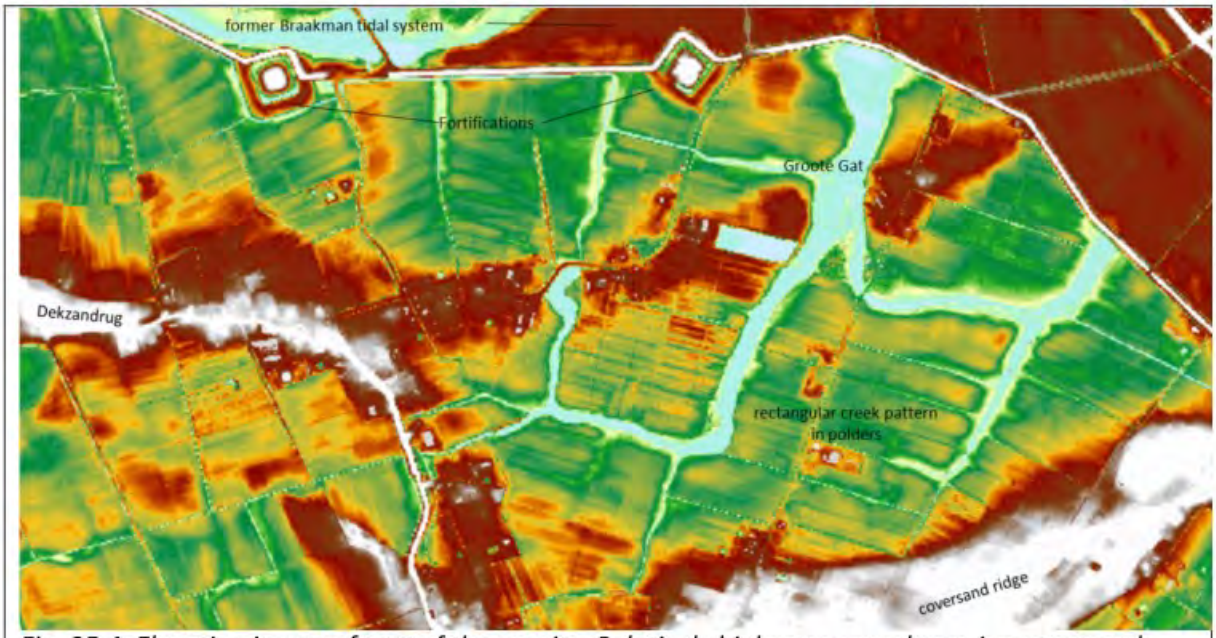

Fig. 25.4. Elevation image of part of the geosite. Relatively high areas are shown in orange and yellow, low-lying areas in green and light blue. Several landforms named in text are shown here.

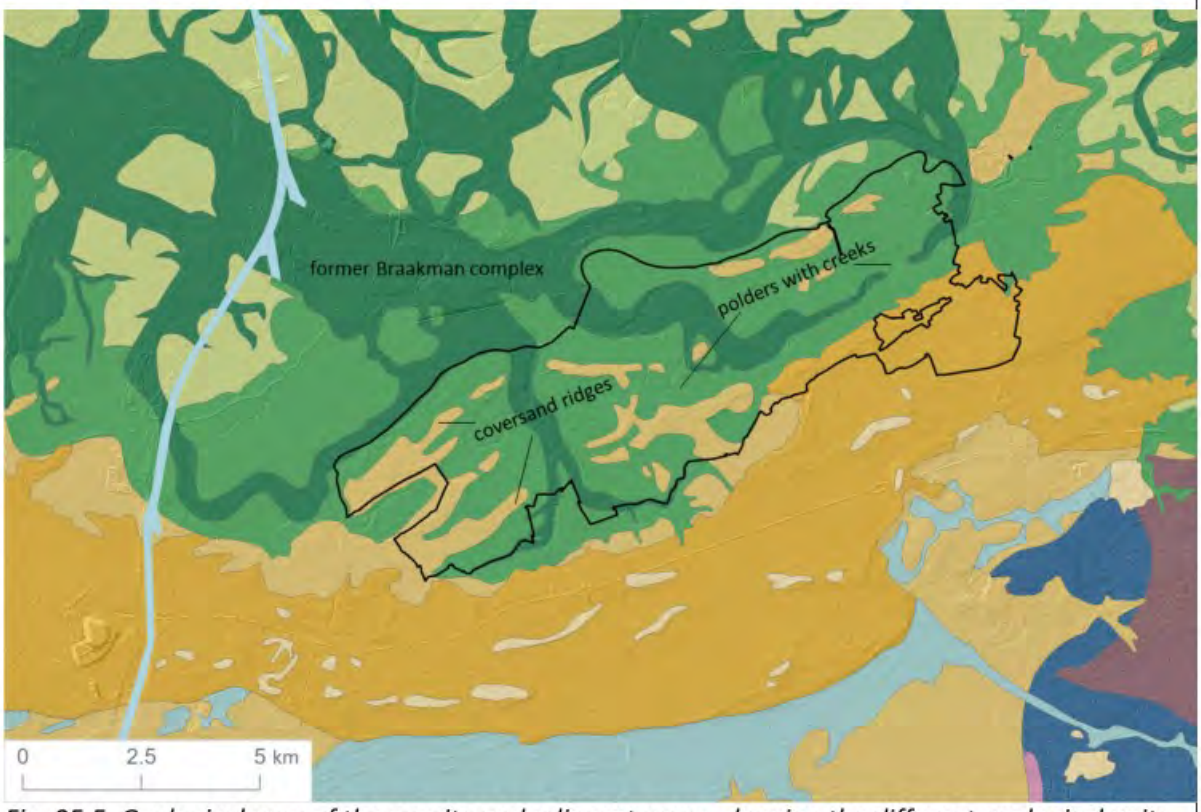

Fig. 25.5. Geological map of the geosite and adjacent areas, showing the different geological units mentioned in the text.

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- De Kraker A., 1996. De Forten in oostelijk Zeeuws-Vlaanderen. Zeeland 5, 14-21
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Geosite n°26	**Oudland area De Putting** A concave-convex landscape of nearly 1000 years old.
 Fig. 26.1: Map of Geopark Schelde Delta. Oudland area De Putting is number 26.	**Scientific importance and valuation of the geosite** One of the few areas in Zeeland where the original irregular relief of the peat extraction area is still visible. Also physical geographically valuable area of the Province of Zeeland.
Municipality	Hulst
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area, Natuurnetwerk Zeeland, provincially valuable landscape
Site management organizations	Staatsbosbeheer
Accessibility	The area is not accessible to the general public, it is only possible to walk around it.
Relevance for tourism	- Route that one can travel independently - Information panels
Relevance for education	- Route that one can travel independently - Information panels
Teaching equipment	- A viewing hill at the edge of the area - Information panels

Code	**Significance**
G-26	Provincial
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: Situated in one of the oldest polders in the Geopark and hardly flooded since the 12th century AD, this is a rare example of an area of 'old land' ('Oudland') where the original small-scale irregular relief resulting from medieval peat extraction and salt production is still visible.	
Sedimentology: not applicable.	
DETAILED DESCRIPTION 1. **Location**	

The geosite is located in the eastern part of Zeeuws-Vlaanderen (Zeelandic Flanders) and has an area of 59 ha. It is part of the larger nature reserve De Grote Putting between Hengstdijk, Kloosterzande and Lamswaarde.

2. **Landscape formation**

Origin of the landscape

The barren, glacial landscape of the final Pleistocene got covered by tidal deposits (sand and clay) during the warmer Holocene as a result of the melting ice sheets and rising sea level. Initially the coast was open: there was no barrier protecting the inland from marine influence.

During the Holocene, the rate of sea level rise decreased and about 3800 years ago an almost closed coastal barrier of beach ridges and dunes was created. Because of this somewhat higher zone on the coast, the hinterland was protected from the tide and a large freshwater swamp was created, in which peat accumulated. That way a vast peat area developed in Zeeland, with peat up to several metres thick.

From a few centuries BC, the protective coastal barrier was locally breached and the influence of the sea increased once again. Especially since Roman times, sea breaches penetrated ever deeper inland. Over the centuries, part of the peat was eroded by large tidal channels, but in some areas, such as Oudland area De Putting and its surroundings, there was no such deep erosion. Here, the sea only deposited a thin layer of sediment (clay and sand) on top of the peat, which was buried and more and more compressed.

Oudland

The exact moment of construction of the Hengstdijkpolder, in which Oudland area De Putting is located, is unknown, but it is in any case before 1161 AD. Since then, the area has hardly been flooded by the sea. This type of land is also called *Oudland* (old land). With this age, the Hengstdijkpolder is one of the oldest polders in Zeeuws-Vlaanderen, while most of the polders were only created more than 500 years later. The old landscape around the nature reserve has been levelled, but in Oudland area De Putting the irregular relief of the *Oudland* has partly been preserved.

Creek ridges and clay-covered peatlands

Although large-scale erosion has not taken place in this area, small creeks have eroded into the peat in the *Oudland*. Those creeks ensured drainage of the peat area, as a result of which the peat partially decayed. As a result, the peat surface was lowered and a thin layer of clay was deposited on the peat from the creeks during high-water. The weight of the clay further compressed the peat, thus further lowering the land area. In this way, a new salt marsh landscape could develop.

The tidal current within the creeks of this salt marsh landscape was stronger than outside the creeks. Therefore, in addition to clay particles, they were also able to transport the heavier sand grains. As a result, during the accretion phase, only clay was deposited outside the channel, but the channels were filled with (clayey) sand, with only a thin clay cover on top.

Over the centuries, the peat and clay outside the creeks were compressed, thus lowering the land surface. This compression affected the sandy creek infill to a much lesser extent. That is why the former channels now form higher elevations in the landscape. We call these higher parts creek ridges. This is often where the oldest roads and settlement centers are located. Because of their higher and drier location, creek ridges were also used as arable land. The low-lying clay-covered peatlands outside the creek ridges are called *poelgronden* in the region. These soils are often under water for a long time in winter and are almost exclusively suitable for pasturage.

Peat extraction and salt production

When the peat in the region was flooded by seawater after breaching of the coastal barrier, salt was left behind in the peat. The peat was therefore not only suitable as fuel, but also for salt production. The extraction of peat for salt production is called *moernering*, *selnering* or *darinkdelven* in the region.

Initially, the extraction of the peat under the clay layer was not yet regulated. This is called 'wild' *moernering*. After digging away the peat, a bumpy terrain was left behind that was hardly usable anymore as agricultural land. Locally, this is also referred to as a *hollebollig* (concave-convex) landscape.

During later, and better regulated, peat excavations, rectangular blocks or long and narrow strips were dug out. The layer of young marine clay was first dug out. Between the pits, a strip of peat remained, on which the excavated clay was placed. That strip also served as a water barrier for the adjacent pit. The peat under the clay layer was extracted. The unevenness in the landscape due to this type of peat extraction follows more regular patterns.

Elevation differences

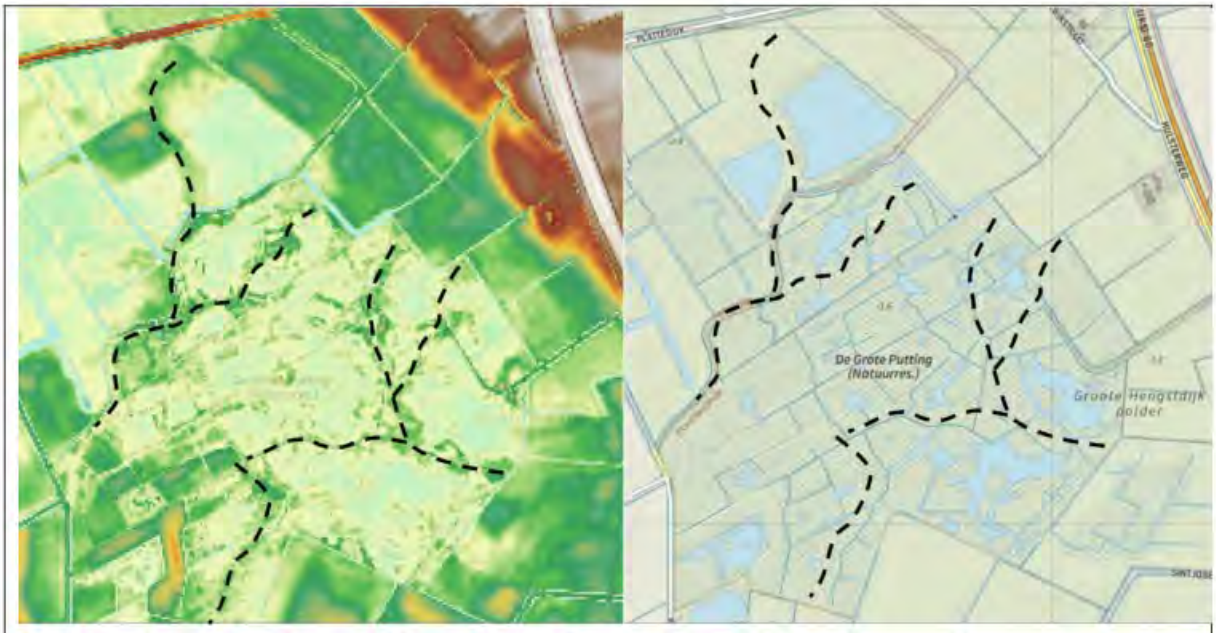
Oudland area De Putting is characterized by an irregular relief. In this case, the elevation differences can have several causes. Higher ridges in the landscape are either small creek ridges or heaps of clay that were placed as small ridges next to the peat extraction pits during excavation. Outside Oudland area De Putting, the subtle elevation differences are difficult to track, since here, levelling has disrupted the original landscape and relief.

Relation with other geosites

- Yerseke and Kapelse Moer – peat extraction on Zuid-Beveland near Yerseke.
- De Poel – peat extraction on Zuid-Beveland near Goes.

Fig. 26.2. Location map of the geosite.

Fig. 26.3. Elevation map (AHN) with indication of individual elevation points.



creek ridges or ridges with excavated clay

Fig. 26.4. Elevation map with indication of the most noticeable higher zones (left) and a topographic map with the adjacent clay-covered peatlands that are now under water (right).

Documentation and resources

- Laban C., 2009. Darinkdelven. Grondboor & Hamer 63, 3/4, p. 98-102.
- Rijkswaterstaat, 1971. Beschrijving van de provincie Zeeland behorende bij de waterstaatskaart. Directie Algemene Dienst van de Rijkswaterstaat, Staatsuitgeverij 's Gravenhage, 139 pp.
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- Wilderom M.H., 1973. Tussen Afsluitdammen en Deltadijken – IV. Zeeuwsch Vlaanderen. Vlissingen, 567 pp.

Geosite n°27	**Nieuw-Namen** From beach to remnant hill in 3 million years.
 Fig. 27.1. Map of Geopark Schelde Delta. Nieuw-Namen is number 27.	**Scientific importance** Nieuw-Namen is the only place in the Netherlands where Pliocene beach deposits of the so-called Oosterhout Formation come to the surface and can be viewed and studied in a well-maintained and accessible outcrop. The Meester van der Heijden quarry is very suitable for educational purposes: a fascinating story of climate and sea level changes, deposition and erosion (and associated landscape elements), frost processes and soil formation can be told and demonstrated. Many dozens of scientific and popular publications shed light on the different aspects of the deposits exposed in the quarry. Nieuw-Namen is a geologically valuable area of the Province of Zeeland, of national importance.
Municipality	Hulst
Province and country	Zeeland, the Netherlands
Protection status	Provincial geologically valuable area; Quarry: Natuurnetwerk Zeeland, Gemeentelijk Geologische monument Hulst
Site management organizations	Staatsbosbeheer; Municipality Hulst
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Routes that one can travel independently - Educational programme for children
Teaching equipment	The quarry can be visited. There are information panels, routes and activities.

Code	**Significance**
G-27	National
Geological interest(s)	
Paleontology: Studies of the exposed Pliocene deposits at Nieuw-Namen show that they hold a rich and diverse fossil record, comprising a.o. 28 species of molluscs, sea urchins, foraminifera, ostracods and other microfauna such as Crustacea and Bryozoa; conspicuous trace fossils such as burrows and bioturbated horizons are present as well.	
Stratigraphy: The sedimentological and paleontological research listed above has enabled to reconstruct the depositional and paleoenvironmental conditions and correlation with regional and international litho-, bio and chronostratigraphic classifications.	

Geomorphology: This small-scale example of a remnant hill or inselberg consists of Pliocene sediments deposits, surrounded by the much younger Holocene marine clay deposits of the Scheldt polders, which are about 4 m lower.

Sedimentology: The Pliocene beach deposits and overlying Pleistocene sediments can be observed and studied in a well-maintained and accessible former sand quarry, which is very suitable for educational purposes and where the sediments have been the subject of extensive research. The well-exposed deposits clearly show sedimentary structures and features indicative of a.o. beach and near-shore depositional environments, periglacial conditions (frost cracks), decalcification, iron cementation, soil formation and erosion (lag deposits).

DETAILED DESCRIPTION

1. **Location**

Nieuw-Namen, on the border of Zeeuws-Vlaanderen (Zeelandic Flanders) and Belgium, is unique from a geological point of view. It is the only place in the Netherlands where Upper Pliocene deposits of the so-called Oosterhout Formation occur at the surface. They crop out in the 'Meester Van der Heijden' quarry, a well-maintained geological monument in a former sand quarry on the west side of the village. The deposits were originally formed on the beach of a shallow sea and subsequently shaped by erosion of the surrounding landscape, leaving behind a remnant hill at 5 to 6 m above NAP. This hill is now surrounded on all sides by the much younger marine clay of the Scheldt polders, which are about 4 m lower. On the hill, which is about 1 km long in an east-west direction and 500 m north-south, lies the village of Nieuw-Namen and the adjacent Kieldrecht in Belgium. The Belgian part of the hill was not included in this geosite.

2. **Landscape formation**

<u>The deposits in and around the quarry of Nieuw-Namen</u>

The 'Meester Van der Heijden quarry' is 4 to 5 m deep and is located approximately at the highest point of Nieuw-Namen, at 5 m above NAP. The main deposits visible in the quarry are shell-bearing sands, which are called the Oosterhout Formation (Pliocene) in the Netherlands and the Lillo Formation in Belgium.

Remarkable elements in the quarry are the rust-brown sands at the top and the yellow, stratified sands at the bottom, containing a number of hard ironstone banks that protrude from the outcrop. The two sand layers are separated by a few tens of centimeters thick layer of shell fragments cemented together by lime (a so-called shell breccia). Therefore, there is a clear distinction: sand that was deposited during the warm Pliocene at the bottom, and sand that was blown over the landscape by the wind during the Ice Age above that. There is a large time gap of about three million years between the two, represented only by the thin layer of shell breccia.

The Pliocene deposits below the shell breccia are about 3 m thick. They consist of calcareous sand with shells, showing a parallel, horizontal stratification and containing distinct traces of burrowing animals, especially at the bottom of the quarry. Furthermore, fragments of sea urchins (usually microscopically small) and microfossils such as foraminifera and ostracods are present. The characteristics and composition of the sand and the nature and position of the shells in it (with the convex side up) show that it is a beach deposit. In this sand, striking, reddish-brown ironstone banks were later formed as a result of iron cementation of the sand under influence of circulating groundwater.

A drilling close to the quarry shows that the shell-bearing sands of the Oosterhout Formation continue to a depth of approximately 18.5 m below NAP. Below is 5.5 m of green, glauconitic sand from the Breda Formation. The drilling ends at 26 m - NAP, 2 m deep in the clay of the Boom Formation (Oligocene).

The hill of Nieuw-Namen is surrounded on all sides by Holocene marine clay that reaches a level of about 1.7 m + NAP and usually lies on a layer of peat. Fragments of weathered flint and archaeological flint artefacts are found locally in the sand, immediately below the peat. Two Bronze Age pots have been found in the wall of the 'Meester Van der Heijden quarry' itself; the only Bronze Age pottery found in Zeeland.

Origin of the landscape

Neogene: marine, coastal and beach deposits

During the Paleogene (56 to 23 million years ago) and the Neogene (23 to 2.6 million years ago), the Netherlands and Lower and Central Belgium were largely covered by a shallow sea, in which mainly sand and clay were deposited (e.g. the clay of the Boom Formation). Towards the end of the Neogene, the sea slowly retreated northward from Belgium, towards the present-day Belgian-Dutch border. The shell-bearing sands of Nieuw-Namen were deposited on a beach of this sea around 3 million years ago. The deposition of these sands probably did not stop there, and similar shell sands have been deposited on top of the deposits that can be seen in the quarry. Later erosion of these deposits during the Pleistocene (see below) left the shells from this layer behind, resulting in a concentration of shells in the thin layer of shell breccia, while the sand has largely been washed out.

Pleistocene river erosion

After the final disappearance of the sea from the area, northward flowing rivers from the Scheldt Basin have lowered the land surface by at least 10 to 20 metres during the last 1 million years. In Nieuw-Namen, the shell breccia layer bears witness to this prolonged period of erosion. The layer reflects the large gap between the Pliocene beach deposits below and the coversand from the last ice age above. Such an erosional gap is also known from the Boudewijn quarry on the Brabant Escarpment in Ossendrecht. There lies a thin layer of 'Scheldt gravel' between the top of the Early Pleistocene Waalre Formation, which builds the Brabant Escarpment (Brabantse Wal), and the coversands and river dune sands from the end of the last ice age, deposited between 20,000 and 12,000 years ago.

The absence of intermediate deposits makes it impossible to reconstruct in detail the landscape evolution during this period; only the broad outlines are known. The ironstone banks may have been formed during this long period of time by iron cementation of the sand under the influence of circulating groundwater. The preservation of the hill of Nieuw-Namen, while the surrounding area has been lowered by erosion, is probably partly due to the presence of these hard and more resistant ironstone layers in the Pliocene sand.

The last ice age: coversand and ice wedges

During the last ice age (the Weichselian), the area of Nieuw-Namen was a tundra where only grasses, mosses and dwarf shrubs grew during the coldest phases. The soil was partially or completely frozen. The winds blew over the almost unprotected land and blanketed the landscape with a thin layer of coversand.

It was only towards the end of the Weichselian that the Scheldt took its current course along Antwerp instead of flowing to the sea via the Flemish Valley north of Ghent. Downstream from Antwerp, it cut into a narrow, but deep valley (down to -12 m at the Belgian-Dutch border). The local streams that drained into this valley also incised and probably caused some local erosion again, giving Nieuw-Namen its eventual present form as a remnant hill.

Holocene warming and sea level rise

With the warming of the climate and the expansion of vegetation at the beginning of the Holocene, about 12,000 years ago, the erosion phase of the last ice age came to an end. The

landscape stabilized. In coversands and Pliocene beach deposits that are at the surface in the Nieuw-Namen quarry, a soil was formed and iron leaching and enrichment took place. The sea level rise as a result of the melting of the large ice sheets caused a general increase in the groundwater level in the coversand area, causing peat to grow in the lower parts of the landscape around Nieuw-Namen. After the Roman period, the landscape around the remnant hill changed into a tidal area with tidal flats, salt marshes and channels. A thin layer of marine clay was deposited on the peat or, slightly higher up the hill, directly on the Pleistocene and Pliocene sands. However, the deposition did not reach the highest parts of the remnant hill, which remained as a sandy island in the polder landscape.

Relation with other geosites

- Western Scheldt (geosite 17) and Waasland Scheldt Polders (geosite 28): the lower polders around the inlier hill and the clayey and peaty deposits that occur there belong to the larger whole of the historical and current Scheldt area.
- Brabant Escarpment – Kalmthoutse Heide (geosite 15): just like the low hill of Nieuw-Namen, the escarpment of the Brabant Escarpment is a witness to the deep erosion of the landscape during the Pleistocene.
- Coversand area Sint Jansteen (geosite 25): like Nieuw-Namen, this is an area on the transition from coversand to polder landscape.

Fig. 27.2. Location map of the geosite.

Fig. 27.3. Elevation map (AHN) with indication of individual elevation points.

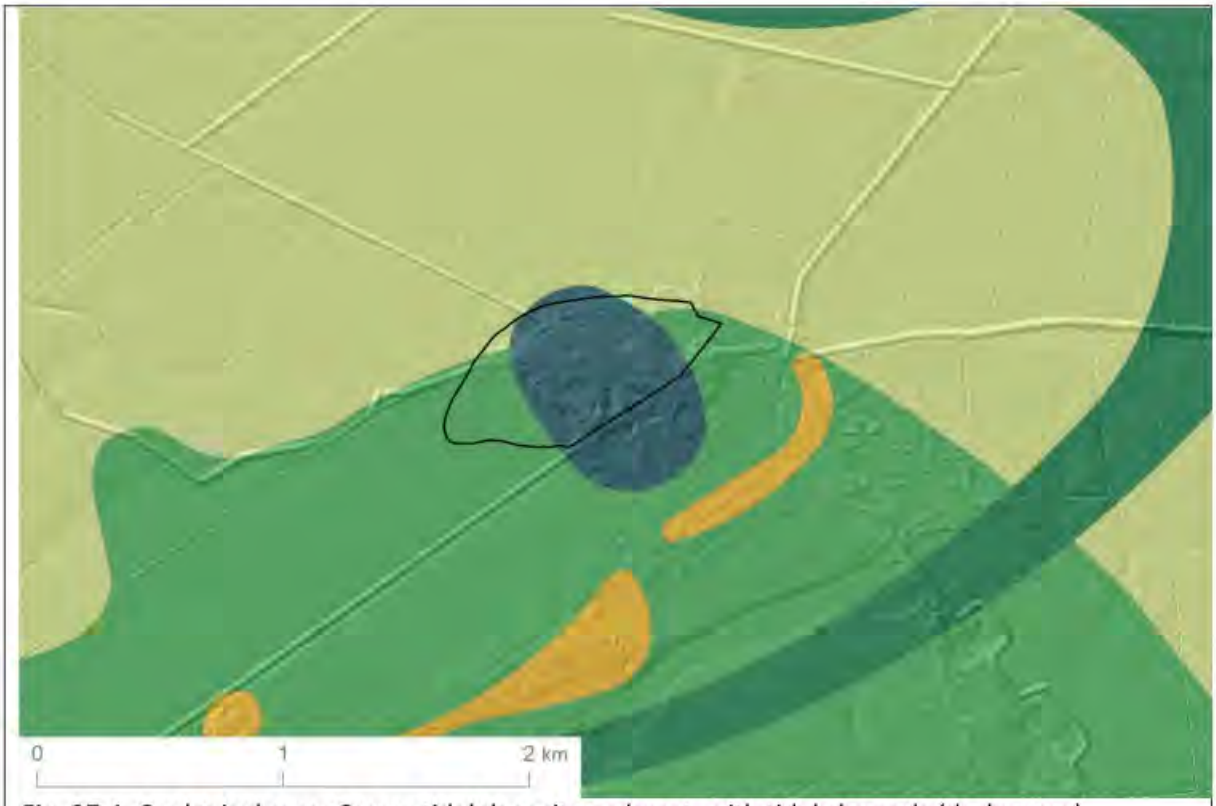

Fig. 27.4. Geological map. Green: tidal deposits and peat, with tidal channels (dark green) (Holocene); orange: coversand ridges (Late Pleistocene); dark blue: Oosterhout/Lillo Formation (Upper Pliocene).

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Geosite n°28	**Waasland Scheldt Polders** Historic polders located on the front between land and sea, between man and nature and between stagnation and change, but also a drowned, prehistoric coversand landscape.
 Fig. 28.1. Map of Geopark Schelde Delta. Waasland Scheldt Polders is number 28.	**Scientific importance and valuation of the geosites** The geological value of the area lies mainly in the preservation of a lateglacial coversand landscape and a Middle Holocene peat landscape under a Late Holocene tidal landscape. As a result, the geosite also has an international (archaeological) heritage value, as it belongs, for example, to the best preserved and researched prehistoric landscapes in north-western Europe. Recent research also shows that the medieval and early modern reclamation and embankment landscape has been well preserved. In addition, the geosite also has important natural values as a Natura 2000 area. Moreover, the area also has a particularly high economic value thanks to the presence of the port of Antwerp/Waasland port. The importance of the Waasland Scheldt polders mainly expresses itself through the knowledge we have of the area. However, this value has only been established thanks to the development of the area and thus also the partial destruction of the physical values. This continuous balance between preservation and development is therefore characteristic of the geosite.
Municipality	Beveren, Sint-Gillis-Waas, Hulst
Province and country	Oost-Vlaanderen, Belgium and Zeeland, the Netherlands
Protection status	Natura 2000; Kreek De Grote Geule: protected cultural-historical landscape; Vrasenepolder: established archaeological zone; Zeeland (Hewdwigepolder): Natuurnetwerk Zeeland
Site management organizations	Stichting Het Zeeuwse Landschap, Natuurpunt vzw, Province of Oost-Vlaanderen, Agentschap voor Natuur en Bos, Maatschappij Linkerscheldeoever, Municipality Hulst, Municipality Beveren, Municipality Sint-Gillis-Waas
Accessibility	Site is accessible to the general public
Relevance for tourism	- Routes one can travel independently - Guided excursions in Grenspark Groot-Saeftinghe - Reception gate Prosperhoeve

Relevance for education	- Routes one can travel independently - Guided excursions in Grenspark Groot-Saeftinghe - Reception gate Prosperhoeve
Teaching equipment	- Walk with explanations - Reception gate Prosperhoeve

Code	**Significance**
G-28	International

Geological interest(s)

Paleontology: The Holocene and Late Weichselian deposits as well as the underlying Neogene strata have been the subject of many detailed macro- and micropaleontological investigations, a.o. in large temporary exposures for the construction of docks and locks for Antwerp harbor. A paleontological/paleobiological internationally recognized element of the Neogene in the Antwerp area is the presence of a rich content in large marine mammal fossils (Dr. Olivier Lambert of the Royal Institute of Natural Sciences in Brussels as leading researcher).

Stratigraphy: The detailed lithological, sedimentological, and paleontological studies of the Neogene deposits in the area (see above) have considerably contributed to the knowledge on a.o. their paleogeography, biostratigraphic position and sequence stratigraphic interpretation.

Geomorphology: A typical estuarine, largely man-made polder landscape dating from the 14th to 15th century AD, with locally striking elevation differences of up to 2.5 m between historical polders related to time of embankment and sedimentation duration, dike patterns and evidence of dike breaches (kolk holes), and embanked remnants of tidal channels and creeks. Locally, traces of earlier 11th to 12th century peat exploitation are recognizable in the long, narrow strip parcelling.

Sedimentology: The geosite contains a sequence of Neogene deposits and a well-preserved Lateglacial coversand landscape under Middle Holocene peat and Late Holocene tidal deposits, of which the distribution has been mapped and the sedimentology studied in detail in numerous studies by multiple methods (outcrop observations, corings, geotechnical and geophysical, laboratory analyses...).

DETAILED DESCRIPTION

1. **Location**

Between the city of Antwerp and the land of Saeftinghe are the Waasland Scheldt Polders: a flat and low region on the left bank of the Scheldt. This region mainly consists of agricultural land, with small-scale habitation, which over the past 50 years has gradually given way to nature, industry and port infrastructure. The region covers an area of ca. 80 km² and is roughly located in a triangle between the Belgian-Dutch border in the northwest, the Scheldt in the east and the outcropping Neogene sediments of the Waasland cuesta in the south. The relief in the Waasland Scheldt Polders was mainly created by man and without dikes the polders would regularly flood at high-water. The artificial elevation of the surface in the Waasland port – part of the port of Antwerp on the left bank – has caused the greatest elevation differences (6 to 10 m TAW). In addition, the elevation differences between the different polders are striking (between 1.5 and 4 m TAW), with younger polders being increasingly higher. The historic creeks, closed off from the tides by reclamation, are the most conspicuous lower-lying zones (about 0.5 m TAW).

2. Landscape formation

Coversand landscape

The low elevation of the Waasland Scheldt Polders has its roots in the Pleistocene, when an eastern branch of the Flemish Valley eroded the Neogene sediments that still outcrop on the Waasland (sub-) cuesta today. This valley was filled with sandy deposits by a braided river during

the last ice age (Weichselian glacial). The wind reworked some of these river sediments and deposited a new layer of (cover) sand on top of it, but also low coversand ridges and dunes were formed at the end of the last ice age. Today, these coversand ridges still crop out in Kieldrecht and Verrebroek, where they extend further west and connect to the coversand ridge Maldegem-Stekene. During this period, the tributary of the Scheldt, which drained the Waasland region, was promoted to being the main course of the Scheldt by the breaching of the Hoboken gap, which is located more upstream. At that moment, the Scheldt flowed northwards from Antwerp, towards the Meuse and the Rhine. During warmer interstadials of the lateglacial, small lakes formed in the depressions on and between the sandy ridges. This landscape was covered once more by windblown sand during colder interstadials of the lateglacial. The oldest known traces of temporary human habitation by Final Palaeolithic hunter-gatherers date from a warmer interstadial of the lateglacial, about 12,000-13,000 years ago. The limited deposition of sediment during the Early Holocene led to stabilization of the landscape and soil formation on the ridges along a slow-flowing, tributary of the meandering Scheldt that has disappeared at present. Early Mesolithic hunter-gatherers frequented these sites.

Peat formation and extraction

From 7500-8000 years ago, the Holocene sea level rise also affected this region. The groundwater rose and drainage decreased. This lead to the formation of swamp forests and peat: first in the lowest parts of the landscape, along the Scheldt, but gradually also in the depressions between the coversand ridges. As a result, middle and late Mesolithic hunter-gatherers retreated to the higher coversand ridges on the edge of the Waasland Scheldt Polders and the dry banks along the Scheldt. About 6500 years ago, the tide first reached this region and interrupted the peat development, because a shorter connection between the Scheldt and the North Sea was created by the formation of a new tidal inlet at the location of the current Eastern Scheldt (Oosterschelde). At that moment, the first farmers and stock breeders (Early Neolithic) also appeared in this freshwater tidal area. About 500 years later, this tide disappeared again and the formation of peat in a swamp resumed. This swamp already covered the entire region by 5000 years ago. There are no known human traces in this peat area from the period between the end of the Neolithic and Roman times, but it has probably been used extensively, for example for animal husbandry. The human impact on this peat landscape started from the 11th or 12th century with the exploitation of peat as a fuel. The first low dikes were built with roads on them and canals and sluices were constructed to drain the peat. The traces of this peat extraction are recognizable in the long, narrow strip parcelling (Blockstreifen) west of Verrebroek.

Dike breaches and floods

The extraction and drainage of the peat caused a lowering of the surface (peat compaction), making the region more vulnerable to flooding. Moreover, between 800 and 1000 AD, the new, shorter Western Scheldt (Westerschelde) connection was formed, so the tides increased. From the late Middle Ages, the Waasland Scheldt Polders were regularly flooded. During the 14th and 15th centuries, larger dikes were built to stop these floods and to create agricultural land on the embanked tidal area. However, this reduced the area of the natural flood plain and increased the tide, resulting in further dike breaches and flooding. Initially, these floods were of natural origin, but during the Eighty Years' War (late 16th century) dike breaches were also used as a weapon during the Siege of Antwerp. As a result, the entire region drowned, with the exception of the slightly higher Doelpolder and villages on a sand ridge, such as Kieldrecht. The Grote Geule is a remnant of the tidal erosion during this flooding.

Impoldering en depoldering

From the 17th century onwards, the gradual and definitive reclamation of the region and the formation of the definitive polder landscape started. In each phase, a part of the creek area was diked, turning the former tidal zone dry: the clay soil on the former salt marsh, the sandy loam soil

on the tidal flats and the sandy soil in the filled tidal channels. At the same time, the tidal action and sedimentation continued in the area outside the dikes, causing the surface to be higher there. This process was successively repeated for the construction of Konings-Kieldrechtpolder, Oud-Arenbergpolder, Nieuw-Arenbergpolder, Prosperpolder and Hedwigepolder, which is clearly recognizable on the soil map and elevation map. The complex flooding history has therefore clearly left traces in the polder landscape. In this way, various creeks and canal patterns can be recognized, as can dike breaches with kolk lakes and later dike repairs.

From the 1960s and 1970s, the port of Antwerp also continued to grow on the left bank of the Scheldt, under the name 'Waasland port'. Docks were dug, polders were raised and creeks disappeared. In recent decades, part of the polders has been transformed into tidal areas by creating nature reserves to compensate for lost natural values and to absorb current and future flood risks due to the recently accelerated sea level rise.

Relation with other geosites

- Geographically, chronologically and thematically, the Waasland Scheldt Polders are embedded between different geosites. The outcropping Neogene sediments on the dip slope of the Waasland cuesta (geosite 35) form the substrate in which the depression has been eroded in which the Waasland Scheldt Polders formed later.
- The coversand ridge (geosite 37) still crops out on the southwestern side of the geosite (e.g. at Verrebroek) but descends towards the Scheldt, where the coversand is covered with younger deposits.
- The Drowned Land of Saeftinghe (geosite 16) was created during one of the flood phases that also affected the Waasland Scheldt Polders. Together they formed one tidal landscape in the late 16th - 17th century AD. Recent and current nature developments are designed to partly restore this tidal landscape, but they do have a different layout than the historical landscape.
- The brackish salt marshes of the Scheldt (geosite 29) on the left bank comprise the current outer-dike area of the Waasland Scheldt Polders.
- Similar polders and creek remnants, but with a possibly different history, can be found throughout the geopark (e.g. geosites 8, 12, 18, 19, 20, 21, 22, 23 and 24).

Fig. 28.2. Topographic map of the Waasland Scheldt Polders. Source: OpenStreetMap & contributors. CC-BY-SA.

Fig. 28.3. Elevation map of the Waasland Scheldt Polders, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency; AHN3 Rijkswaterstaat

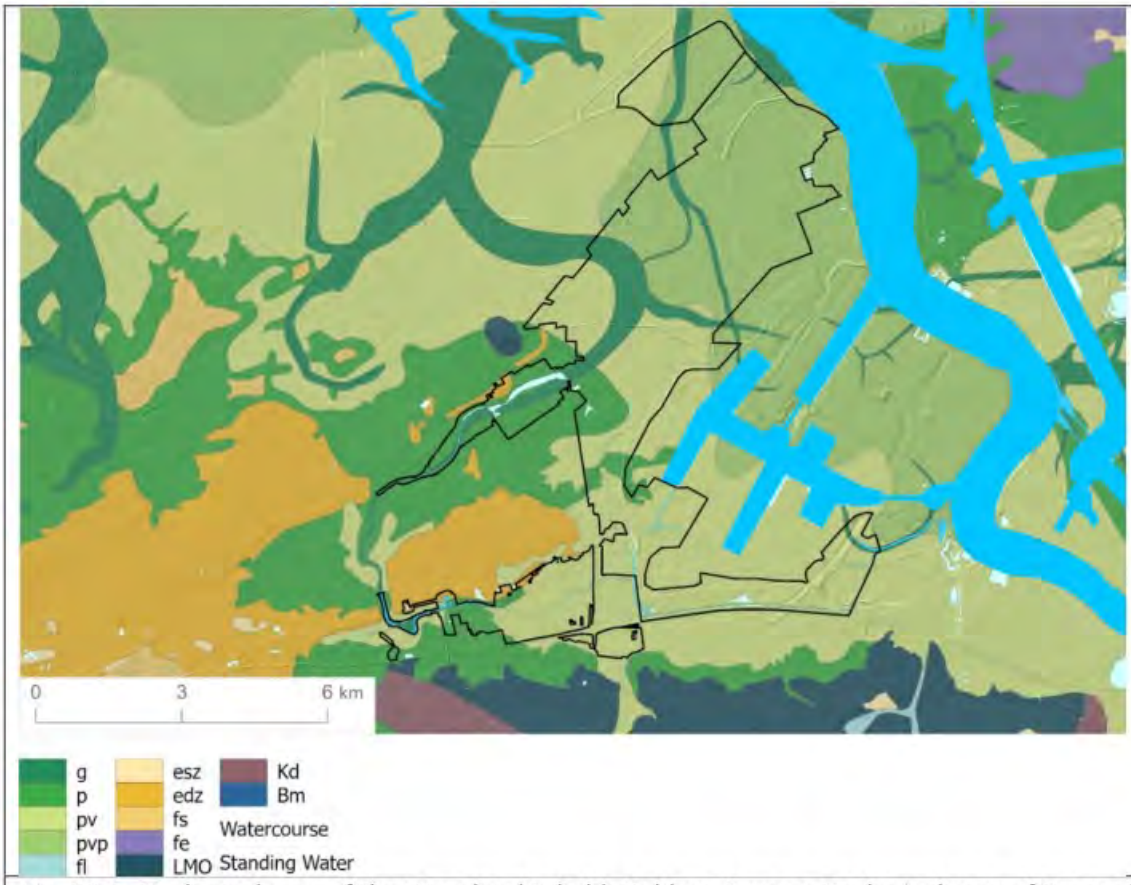

Fig. 28.4. Geological map of the Waasland Scheldt Polders. Source: Geological map of Geopark Schelde Delta, TNO.

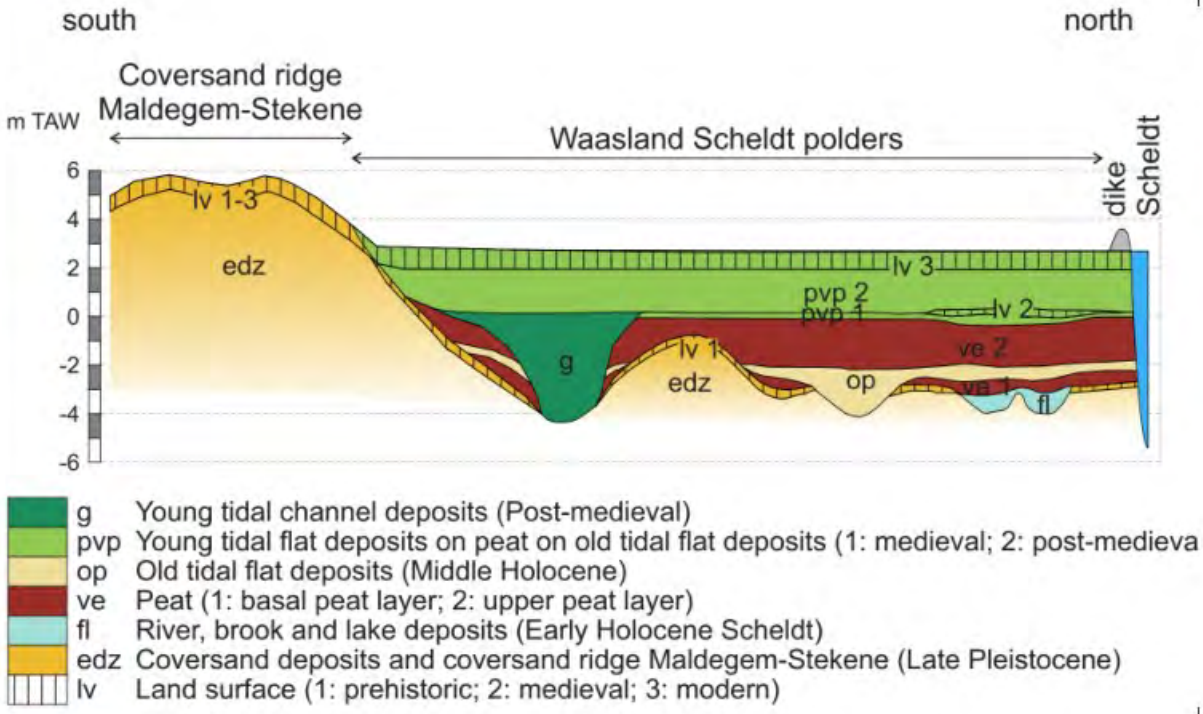

Fig. 28.5. Schematic, synthetic profile between the cove sand ridge Maldegem-Stekene in Verrebroek and the Scheldt near Doel. Adapted from Gelorini et al. (2006).

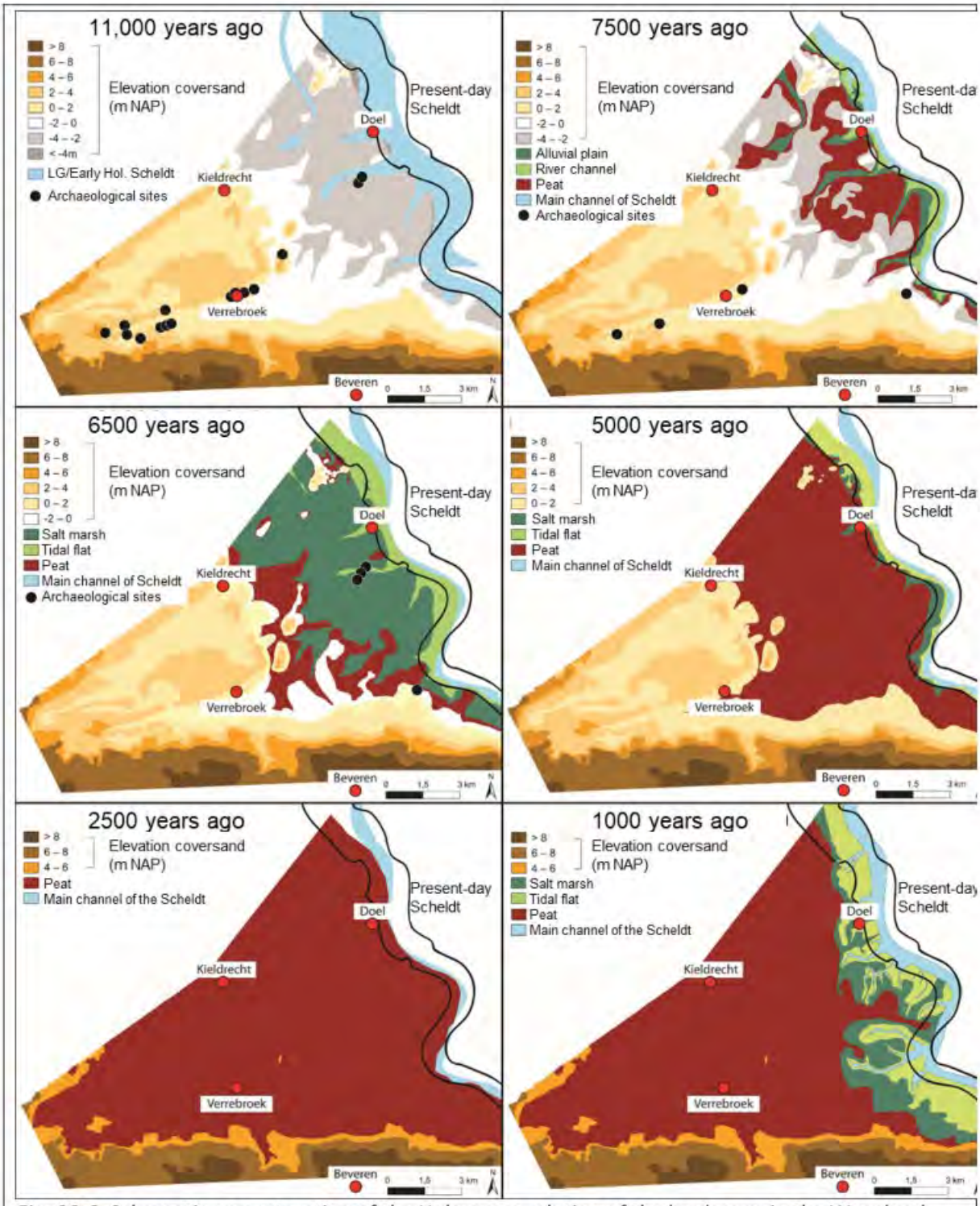

Fig. 28.6. Schematic reconstruction of the Holocene evolution of the landscape in the Waasland Scheldt Polders, with indication of locations of known archaeological sites from the Stone Age. The map series shows an elevation map of the coversand area at the start of the Holocene (ca. 11,000 years ago); the start of peat growth in the coversand area due to groundwater rise and sea level rise (ca. 7500 years ago); the first freshwater tidal influence in the region (ca. 6500 years ago); the decrease of the tidal influence and the restart of peat growth (ca. 5000 years ago); the maximum expansion of the peat (ca. 2500 years ago), the end of peat growth and the return of the tidal influence (ca. 1000 years ago). Adapted from Missiaen et al 2016.

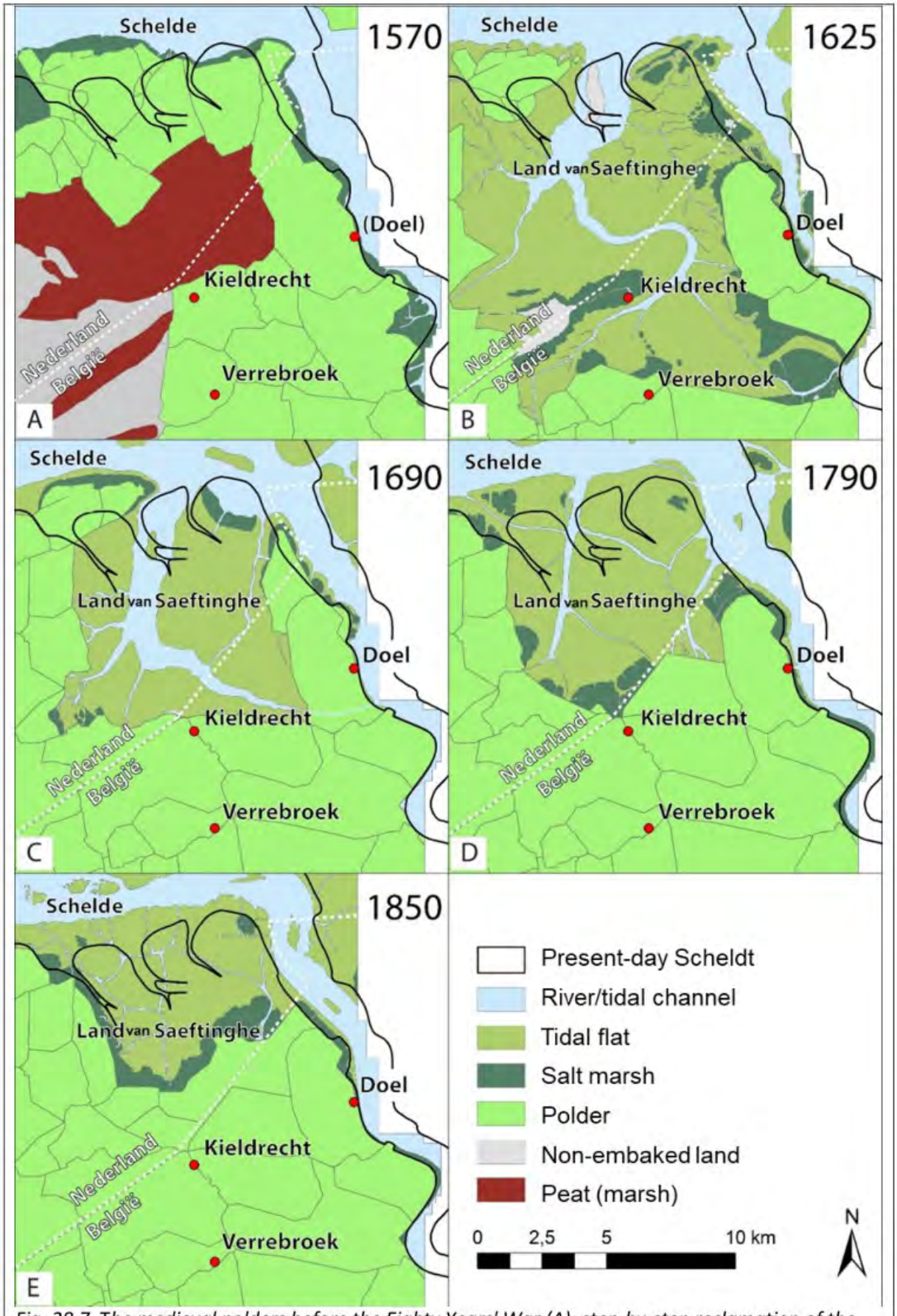

Fig. 28.7. The medieval polders before the Eighty Years' War (A); step-by-step reclamation of the Waasland Scheldt Polders in the early modern period (B-E). Adapted from Missiaen et al 2016.

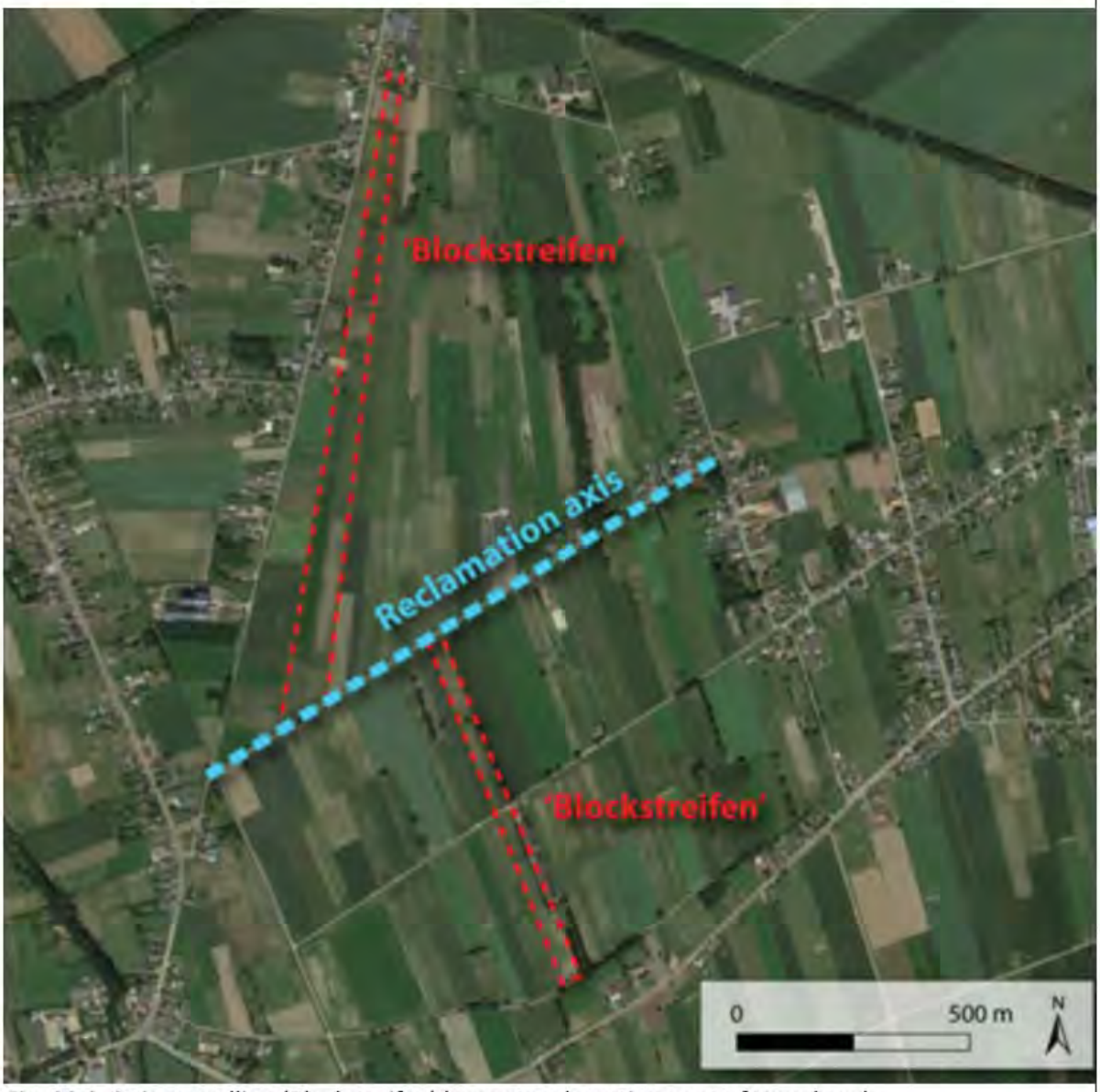

Fig. 28.8. Strip parcelling (Blockstreifen) by peat reclamation west of Verrebroek.

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Geosite n°29	**Brackish tidal marshes of the Scheldt** A narrow strip on the banks of the Scheldt, where the tide can run its course.
 Fig. 29.1. Map of Geopark Schelde Delta. *Brackish tidal marshes of the Scheldt* is number 29.	**Scientific importance and valuation of the geosite** The development of the tidal marshes after embankment has hardly been disturbed by humans, so they are the result of the typical natural sedimentation of a tidal river. The strong gradient in salinity (upstream vs. downstream) and inundation frequency (tidal flat vs. tidal marsh) ensure a very varied fauna and flora.
Municipality	Beveren, Zwijndrecht, Antwerp
Province and country	Oost-Vlaanderen and Antwerp, Belgium
Protection status	Natura 2000
Site management organizations	Natuurpunt vzw, De Vlaamse Waterweg nv, Maatschappij Linkerscheldeoever, city of Antwerp, Municipality Beveren, Municipality Zwijndrecht, Waterwegen en Zeekanaal, De Vlaamse Waterweg nv, Agenschap Natuur en Bos, Vlaams Gewest, Havenbedrijf van Antwerpen-Brugge
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Museums with information about fort Lillo and fort Liefkenshoek - Excursions - Information panels
Relevance for education	- Museums with information about fort Lillo and fort Liefkenshoek - Excursions - Information panels
Teaching equipment	- Museums with information about fort Lillo and fort Liefkenshoek - Excursions - At the bird watching cabin of Groot Buitenschoor are information panels

Code	Significance
G-29	International

Geological interest(s)

Paleontology: not applicable.

Stratigraphy: not applicable.

Geomorphology: The brackish water tidal flats and marshes are mostly limited to a narrow strip along the Scheldt estuary due to embankments to the landward but are a diverse and dynamic landscape situated in the middle along the estuarine salinity gradient, which makes them unique in Belgium and the Netherlands from a geomorphological and ecological perspective.

Sedimentology: Rare example of a brackish water tidal environment, where the specific sedimentary processes are being observed, investigated, and monitored in semi-natural conditions in detailed field studies (e.g., on the relation between sedimentation and vegetation type, water level and flooding frequencies), a.o. for scientific, environmental protection or estuarine management purposes.

DETAILED DESCRIPTION

1. **Location**

The geosite includes the Scheldt, including the tidal marshes outside the dikes, from Burcht to the Belgian-Dutch border. The tidal marshes in this geosite only cover a very limited area: they form a narrow strip (100 to 350 m wide) in the inner bends of the Scheldt. The tidal marshes outside the dikes are located at 5 to 6 m TAW. This is higher than the inner-dike areas of the Waasland Scheldt Polders (1.5 to 4 m TAW) and lower than the artificially raised industrial and urban zones (6.5 to 8.5 m TAW).

In this zone, the Scheldt is 350 m to more than 1 km wide and is influenced by the tide. The part of the estuary concerned has a large gradient in salinity over a short distance and strong fluctuations in salinity throughout the year. It is therefore the zone where tidal vegetation with reeds and willow occur next to salt-tolerant plant species. The latter increase in the downstream direction. There is also a gradient across the bank, depending on the flooding frequency: from intertidal flats (flooded daily; hardly any vegetation) to supratidal marshes (only flooded at high tide; vegetated).

2. Landscape formation

Formation of the Scheldt valley

During a large part of the Pleistocene (2.6 million to 11,700 years ago) the Scheldt did not flow through the area. The drainage of Flanders took place via a braided river system within the Flemish Valley. At the end of the last ice age, this valley north of Ghent was blocked by the Maldegem-Stekene coversand ridge and the Scheldt took its current course, through the Hoboken gap, via Antwerp, in the direction of the Meuse-Rhine system. It is therefore only since the beginning of the lateglacial (about 14,700 years ago) that the Scheldt passes along present-day Antwerp. During the lateglacial period, the Scheldt was a wide, meandering river with a deep channel and a high discharge. When a forest vegetation developed about 14,000 years ago, the system stabilized and the filling of the meander channels started. The position of the bends in the current Scheldt was already more or less fixed at that time. A very last cold phase, from 12,900 to 11,700 years ago, caused the development of a barren landscape and was accompanied by the formation of coversand ridges along the Scheldt. These are now partly present in the subsoil of the Waasland Scheldt Polders. From the Early Holocene onwards, forests developed again. Because these retained the precipitation better and prevented erosion, the flow of the Scheldt decreased and it turned into a small stream within a swamp forest.

The sea level rise is being felt: peat formation and a first tidal phase

At the start of the Holocene, the sea level was still several tens of metres below the present level. The Channel and a large part of the North Sea were dry. During the early Holocene, however, global warming caused a sharp sea level rise, pushing the coastline ever closer. About 8,000 years ago, the sea reached the current Dutch coastal zone and a wide belt of tidal flats and salt marshes formed behind a barrier of coastal dunes. In this period, the tidal influence was limited to Dutch territory. Near Antwerp, the river has been spared from tidal influence for the time being. The rising water level here caused reduced drainage, resulting in the formation of swamp forests and peat. This first happened in the lowest parts of the landscape, along the Scheldt, but from 7500-8000 years ago, gradually spread to the depressions between the coversand ridges as well.

About 6500 years ago, a shorter connection between the Scheldt and the North Sea was created by the formation of a new inlet near the current Eastern Scheldt (Oosterschelde). As a result, the tide reached the region around Antwerp for the first time since the last ice age. The boundary between the fresh and brackish water zone was then slightly further downstream than it is today. During this first phase of tidal influence, peat development was interrupted by the formation of tidal flats and tidal marshes. This is visible in the subsoil of the Waasland polders as a layer of clay within the peat. About 500 years later, the tidal activity disappeared again from this area and the formation of a peat swamp resumed and had already covered the entire valley by 5000 years ago.

<u>Formation of tidal flats and tidal marshes during a second tidal phase</u>

About 2500 years ago the coastal dune barrier was breached in Zeeland. This made it easier for the tide to enter the country. Peatland once more gave way to tidal flats and tidal marshes, initially only near the coast, but with time increasingly deeper inland. In the region around Antwerp, this second phase of tidal influence became noticeable from the High Middle Ages (10^{th} - 11^{th} century AD). Creeks, tidal flats and tidal marshes formed in a strip of approximately 2.5 km along both banks of the Scheldt. From the 13^{th} century AD, the areas along the Scheldt were reclaimed and the tidal flat and tidal marsh landscape was limited to a narrow zone along the Scheldt, as is still the case today. On the border between the vegetated tidal marshes and the daily flooded tidal flats, there is often a microcliff of a few tens of centimeters high. Several small tidal creeks cut through the tidal marshes, transverse to the current direction of the Scheldt. The more regular ditch patterns that can be seen in the tidal marsh of for instance Ouden Doel and the Galgeschoor testify to the use of the tidal marshes as grazing meadows. At the harbor of the Prosperpolder we see a remnant of a larger tidal channel.

<u>Relation with other geosites</u>

- The brackish marshes connect upstream to the freshwater tidal area and polders of the Scheldt (geosite 30)
- And downstream to the Drowned Land of Saeftinghe (geosite 16).
- The development of the area before reclamation runs parallel to that of the Waasland Scheldt Polders (geosite 28).

Fig. 29.2. Topographic map of the brackish tidal marshes along the Scheldt. Source: OpenStreetMap & contributors. CC-BY-SA.

Fig. 29.3. Elevation map of the brackish tidal marshes along the Scheldt, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency; AHN3 Rijkswaterstaat. Red dashed line indicates the area that is currently under tidal influence.

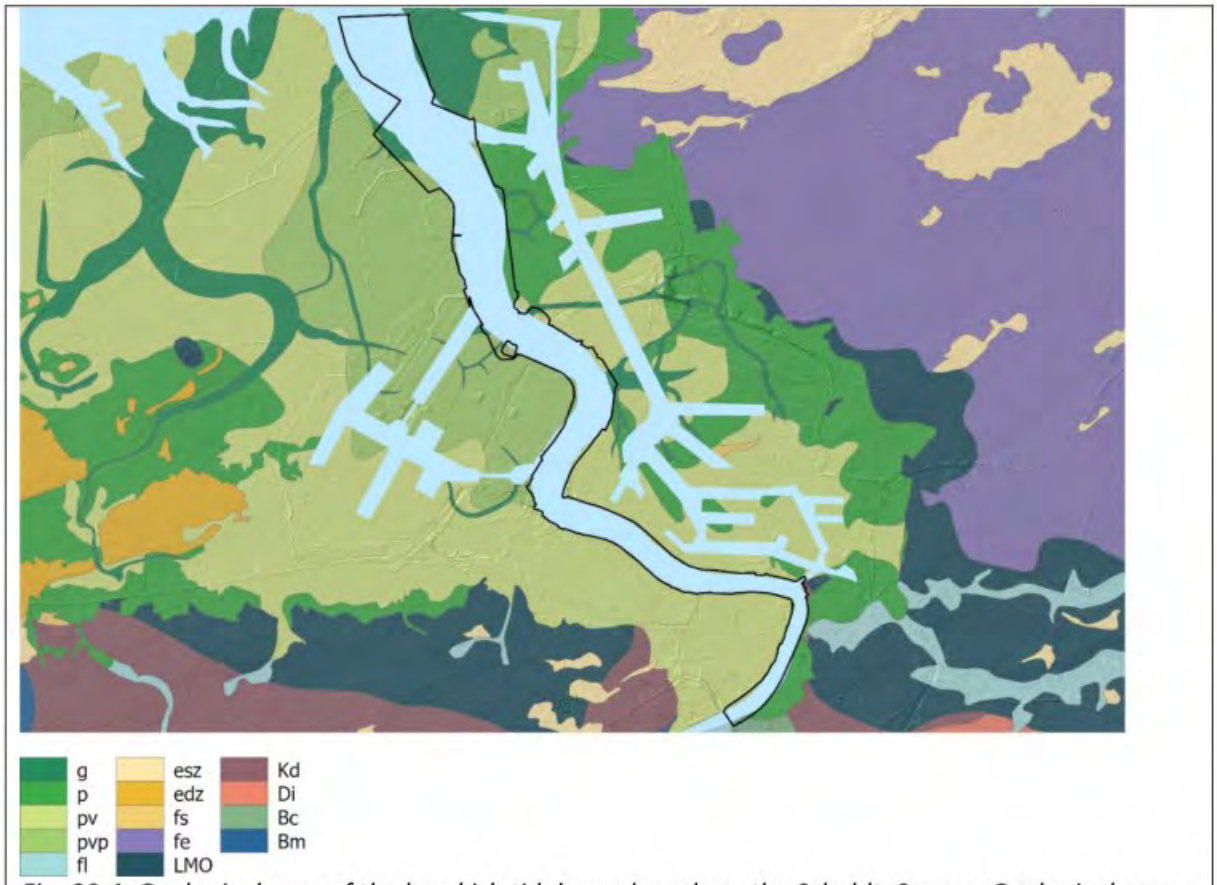

Fig. 29.4. Geological map of the brackish tidal marshes along the Scheldt. Source: Geological map of Geopark Schelde Delta, TNO.

Fig. 29.5. Examples of tidal zones along the Scheldt. Above: Hedwig-Prosperpolder; below: Galgeschoor. Source: Google Earth.

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Geosite n°30	**Freshwater tidal area and polders of the Scheldt** Swamps and tidal marshes along the freshwater tidal Scheldt: a cultural landscape that bears witness to the giving and taking of man and river.
 Fig. 30.1. Map of Geopark Schelde Delta. Freshwater tidal area and polders of the Scheldt is number 30.	**Scientific importance** The landscape in the freshwater tidal zone of the Scheldt Valley was shaped by the interaction between man and tidal river. Few rivers in north-western Europe are subject to tidal action this far inland. This had a major impact on land use in the polders. This historic landscape development is still legible in the landscape at many locations.
Municipality	Zwijndrecht, Antwerp, Hemiksen, Schelle, Bornem, Dendermonde, Hamme, Kruibeke, Puurs-St-Amands, Temse
Province and country	Antwerp and Oost-Vlaanderen, Belgium
Protection status	Natura 2000; Domain d'Ursel: protected cultural-historical landscape; Salt marshes of Drume: protected cultural-historical landscape; Scheldeschorren near Moerzeke-Kastel: protected cultura-historical landscape; Pastoor-Huveneersheuvel: protected archeological site; Polder and castle estate of Hingene: established landscape atlas relict; Landscape of the Old Scheldt: established landscape atlas relict; Willow tree and willow taxa: protected monument; Tidal water mill and miller's house: Rupelmonde: protected monument; Wissekerke castle: protected monument; Tidal water mill and miller's house Rupelmonde: protected monument; Kapel and Graventoren with environment: protected town or village scape
Site management organizations	Natuurpunt Beheer, Waterwegen en Zeeknaal, Vlaams Gewest, Domein van Bornem, De Vlaamse Waterweg

	nv, Agentschap voor Natuur en Bos, Maatschappij Linkerscheldeoever, city of Dendermonde, city of Antwerp, Municipality Zwijndrecht, Municipality, Hemiksen, Municipality Schelle, Municipality Bornem, Municipality Hamme, Municipality Kruibeke, Municipality Puurs-St-Amands, Municipality Temse
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center - Excursions/guided tours - Routes that one can travel independently Remark: Geosites 30 till 35 are quite close to each other and are connected. There is no general information center, only one in the Durme Valley that has a focus on water projects in the area. Parts of the Scheldt are included in lager hiking and biking trails by the City of Antwerp. Some parts are owned by Natuurpunt that offers guided as well as unguided trails. A visitor center with focus on art and nature and some information points. Guided, thematic tours.
Relevance for education	- Visitor center - Excursions/guided tours - Routes that one can travel independently
Teaching equipment	- Parts of the Scheldt are included in a cycle and walking routes. - Guided and unguided walks are available in a number of places - Visitor center De Notelear - Three information points along the Scheldt
Code	**Significance**
G-30	International
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: The freshwater tidal flats and marshes along the Scheldt tidal river are a diverse and dynamic landscape situated at the landward end of the estuarine salinity gradient, which makes them unique in Belgium and the Netherlands from a geomorphological and ecological perspective. The embanked historical polder landscape in the floodplain shows old dike and parcelling patterns and the effects of floods and dike breaches such as kolk lakes ('wielen'), embanked tidal channels and elevation differences between polders. Some former polders are being reshaped in tidal wetlands ('depoldered') for flood protection and nature conservation reasons.	
Sedimentology: The non-embanked tidal marshes and flats are a rare example of a freshwater tidal environment, where the specific sedimentary processes can be observed, studied, and monitored	

in semi-natural conditions. The Weichselian Lateglacial and Holocene deposits in the embanked polders have been the subject of extensive and detailed geological and geo-archeological research in which a.o. their distribution has been mapped and sedimentology investigated.

DETAILED DESCRIPTION

1. **Location**

The geosite includes the Lower Scheldt Valley between the mouth of the Dender and the Antwerp ring road. The Scheldt is a freshwater tidal river in that zone. In the upstream part of the geosite, the valley is 2 to 3 km wide and lies in a relatively flat area (up to 10 m TAW in the interfluves). On the left bank of the Scheldt, between the mouth of the Durme and the Rupel, the escarpment of the Waasland cuesta, which extends to 30 m TAW, can be seen. Between Rupelmonde and Brucht, the Scheldt flows through the Hoboken gap. The valley narrows to about 1.5 km width. Within the diked Scheldt polders, the surface is around 2.0 m TAW. The tidal marshes outside the dikes are between 5.5 and 6.0 m TAW.

2. Landscape formation

Formation and infill of the Scheldt Valley

During the Pleistocene (2.6 million to 11,700 years ago) the precursors of the current rivers of the Scheldt Basin north of Ghent converged in the Flemish Valley. At the end of the last ice age, however, this course was dammed by the Maldegem-Stekene coversand ridge, as a result of which the Scheldt sought a new path and at the confluence with the Rupel made use of the previously existing 'Hoboken gap' through the Waasland cuesta between Rupelmonde and Hoboken. This reversed the drainage direction between Ghent and Rupelmonde. During the lateglacial transition from the Weichsel ice age to the current interglacial period (ca. 14,700 to 11,700 years ago), the braided river system changed to a wide meandering river that cut deep into the substrate. The meandering Scheldt initially migrated strongly, leaving behind sandy point bar deposits (Figure 30 5-1). In the part of the geosite upstream of the Rupel mouth, we can still see this meandering pattern in the winding course of the Scheldt. Within the Hoboken gap, the river had less space to form well-pronounced loops.

When a forest vegetation developed about 14,000 years ago, the system stabilized and the filling of the meander channels started (Fig. 30.6-2, -1). A very last cold phase, from 12,900 to 11,700 years ago, created a barren landscape and was accompanied by dune formation in and along the Scheldt Valley, including at the location of the current village centers of Vlassenbroek and Kastel and in the polders near Bornem and Bazel. From the Early Holocene onwards, forests developed again. Because these retained the precipitation better and prevented erosion, the flow of the Scheldt decreased and it turned into a small stream within a swamp forest. The rising water level caused the deep lateglacial channels to be completely filled with peat during the Middle Holocene (Fig. 30.6-2). Between 5800 and 5300 years ago, the tides temporarily reached the north of the geosite, locally causing the deposition of a clay layer in the peat. Ultimately, an inaccessible, marshy zone with swamp forests formed over the entire width of the Scheldt valley (Fig. 30.6-3).

New incision of the Scheldt

When farmers started to clear more forests and create arable fields since the Neolithic age (about 5000 years ago), soil erosion again led to more sediment entering the stream. Initially, this made the peat more clayey and around 2800 years ago a new meandering system developed, with smaller dimensions of the channel (about 75 m wide) and of the meander bends than its lateglacial predecessor. This river largely corresponded to the current course of the Scheldt, except at Weert, where the Scheldt later shifted its course and the Old Scheldt marks the former course (Fig. 30.5). Where these meanders have moved, sandy point bar deposits can be found in the subsoil in the inner bends (Fig. 30.6-4, Fig. 30.5-2).

The peat in the floodplains is now covered with 0.5 to 2 m of clay (Fig. 30.6-5). This clay was deposited in the more upstream parts of the geosite during frequent flooding of the meandering Scheldt. From the Roman period and especially since the major reclamations during the Middle Ages, the river transported much more sediment due to soil erosion as a result of agriculture in the Scheldt Basin. The further downstream, the smaller the sediment load of the river and the smaller the share of river flooding in the clay deposit.

Tides played a more important role in the clay deposition in the downstream part of the geosite: since the breaching of the coastal barrier in Zeeland a few centuries BC, the tide has continued to penetrate further inland. In the early Middle Ages, it reached the region around Kruibeke. To the south of the cuesta, tidal influence remains very limited until about 1100 AD. Tidal flats and tidal marshes were then formed under the influence of tidal activity. Tidal flats are flooded daily at high tide. As the accretion gets higher, they get vegetated with pioneer vegetation and slowly form a tidal marsh, which is only flooded during storm surges or spring tides.

Embankment and reclamation of the valley in the Middle Ages and the early modern era

Embankments

The tidal marshes formed a great potential for fertile agricultural land. Due to the increasing flooding and tidal activity during the High Middle Ages, the need arose to embank the tidal marshes. These dike constructions took place from the 11th to the 13th century. In many cases they started from a residential center, founded on lateglacial dunes in the valley (e.g. Moerzeke, Kastel), or on the steep edge along the valley (e.g. Tielrode, Hingene, Bazel). Different stages of embankment gradually covered an increasing part of the valley, creating small blocks of irregular parcels. In other polders, the parcelling was more organized, in straight strips, such as in the polder of Kruibeke (the current controlled flood area (GOG) Kruibeke), north of the Barbierbeek. After embankment, the landscape developed differently in the inner-dike polders and the outer-dike tidal zone along the river.

Polders

The resulting polders are drained by brooks and ditches. Due to this drainage, the peat in the subsoil dried out and compacted, causing a lowering of the surface. The polders were mostly used as hay meadows. Hay yields were increased by deliberately cutting the dikes in winter, so that flooding water could leave a fertile layer of silt behind. Thanks to this system of so-called *vloeimeersen* or water-meadows, the polders formed profitable land.

Tidal marshes

Outside the dikes, along the Scheldt, flood deposits still accumulated and new tidal flats and tidal marshes were created, which eventually became higher than the compacted polders and were later also embanked. The tidal marshes outside the dikes were very suitable for the cultivation of wijmen (withies): the annual twigs of willow trees that were used in basketry and for the reinforcement of dikes. These former osier beds (willow plantations) have now been reforested in many places, but the great diversity of willow species still points to the former coppice management (e.g. on the Island of Mariekerke, on both banks between Branst and Weert, at the sluice on the Old Scheldt near Bornem).

Battle against the water in the (early) modern era

The river bed of the Scheldt was considerably deepened and widened over time due to the increasing tide, as evidenced by the difference in size between the tidal-free Old Scheldt near Weert (ca. 75 m wide) and the current Scheldt (ca. 250 m wide). Historical maps show that since the Middle Ages the bed of the Scheldt has moved to the outer bends. This was the result of natural accretion, in combination with the progressive reclamation. Here and there, elongated islands occurred in the middle of the river (e.g. Island of Mariekerke). Due to the increasingly

narrow floodplain, the river had less space during storms or spring tides, and the flood pressure increased. The dikes were raised and reinforced, but dike breaches were inevitable.

Initially, the dikes along the Scheldt were much lower and more rectilinear than the current ones. The irregular shape is the result of the many dike breaches in (early) modern times. During such a breach, the powerful inflowing water forms a vortex that erodes a kolk hole (called *weel* or *wiel* in the region). During the repair, the dike was placed in a bend around the kolk hole. These bends in the dikes are still clearly recognizable in the landscape. A kolk hole outside the dikes was quickly filled up again by sedimentation from the Scheldt. Inner-dike kolks remain visible in the landscape for a long time as a lake on the edge of the polder. Creeks formed behind the largest breaches, including the Rupelmondse Kreek, which extends 1 kilometre into the polder landscape.

Design as floodplains and tidal nature

Parts of this geosite have been included in the Sigma Plan and will be depoldered or converted into flood control areas with locks in the historic dikes along the Scheldt and new ring dikes around. This is the case in Vlassenbroek, Wal-Zwijn, Lippenbroek, Schouselbroek, the Bornem cluster, the polders of Kruibeke, Bazel and Rupelmonde and Burchtse Weel. As a result of these interventions, the tide will gradually blur the historic parcelling pattern.

Relation with other geosites

- Within the Geopark Schelde Delta, the geosites of the Palaeomeanders Kalkense Meersen and Berlare (geosite 36), the Durme Valley (geosite 31) and the Rupel Valley (geosite 33) also belong to the freshwater tidal zone. At Berlare, the tide was not felt until after the Middle Ages. There, the lateglacial evolution is easier to read in the landscape and is therefore described in more detail in the text about geosite 36.
- Further downstream, north of the Hoboken gap, the Scheldt valley widens again. The Waasland Scheldt Polders (geosite 28) and brackish tidal marshes of the Scheldt (geosite 29) are located in the brackish water tidal zone of the Scheldt. The tidal influence is even more pronounced there, both in the Middle Holocene and in the historical period.

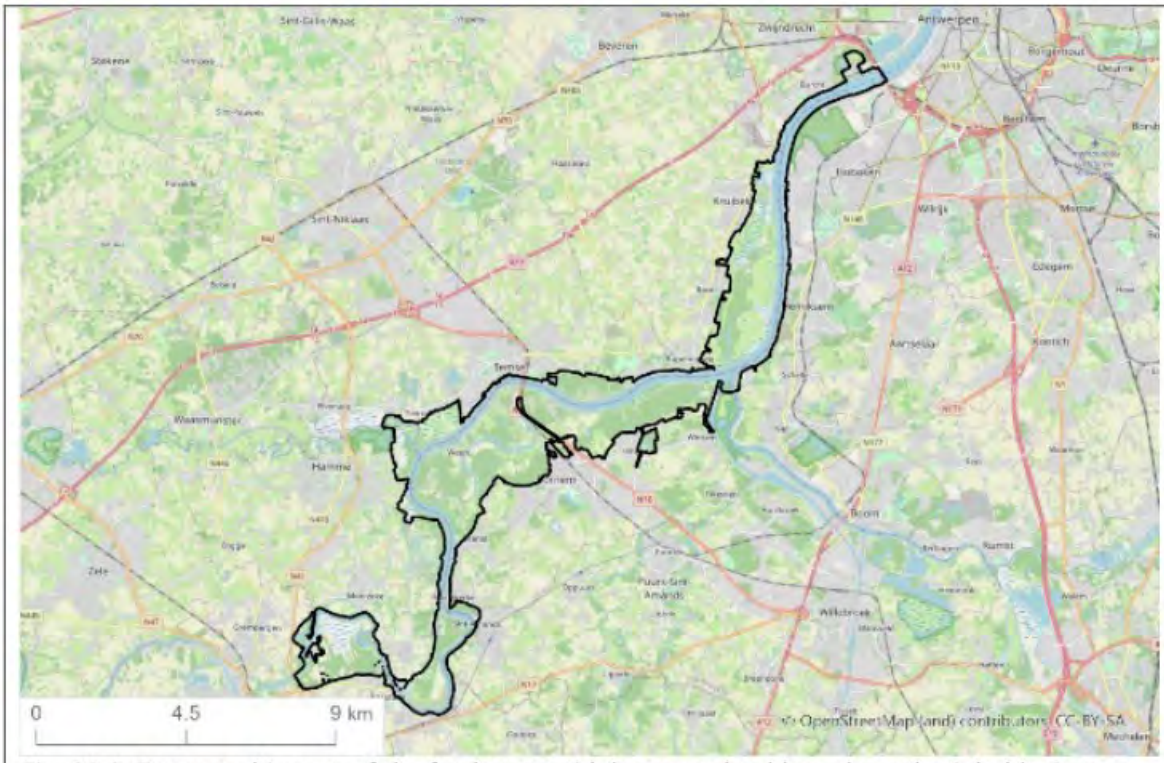

Fig. 30.2. Topographic map of the freshwater tidal area and polders along the Scheldt. Source: OpenStreetMap & contributors. CC-BY-SA.

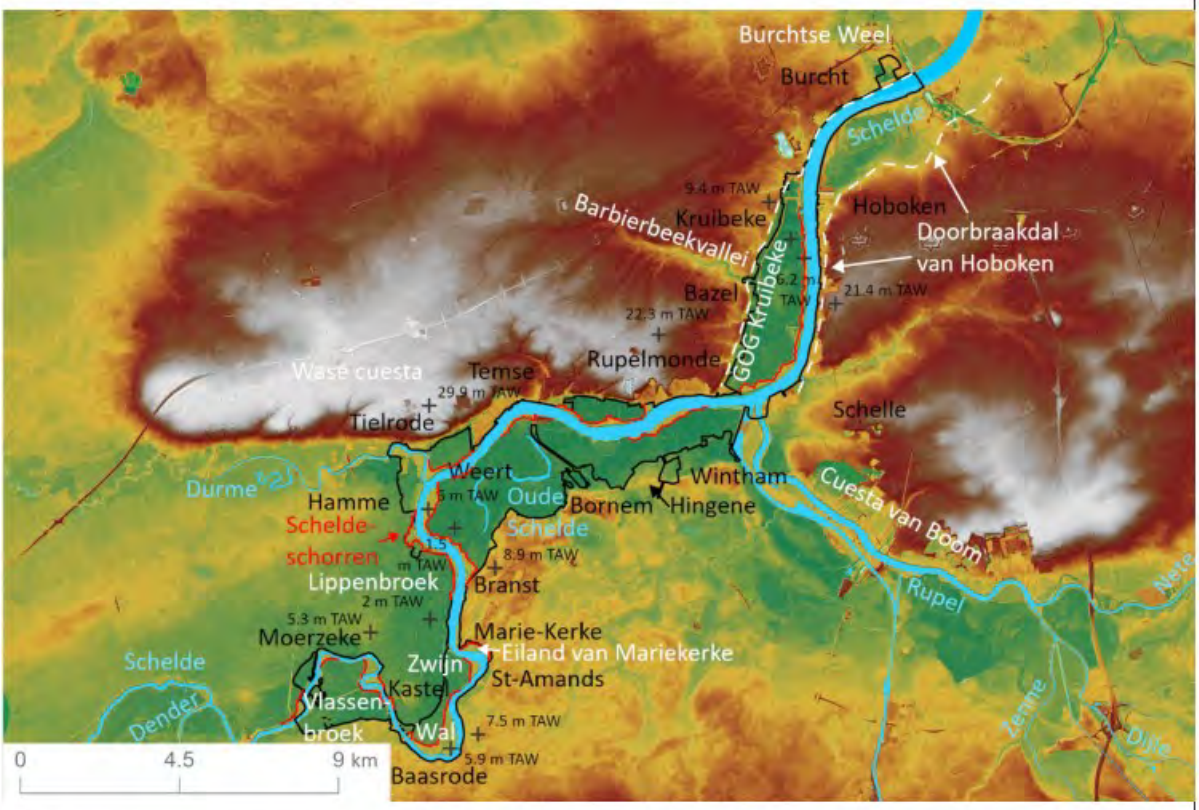

Fig. 30.3. Elevation map of the freshwater tidal area and polders along the Scheldt, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency. Red line indicates the areas that are currently under tidal influence.

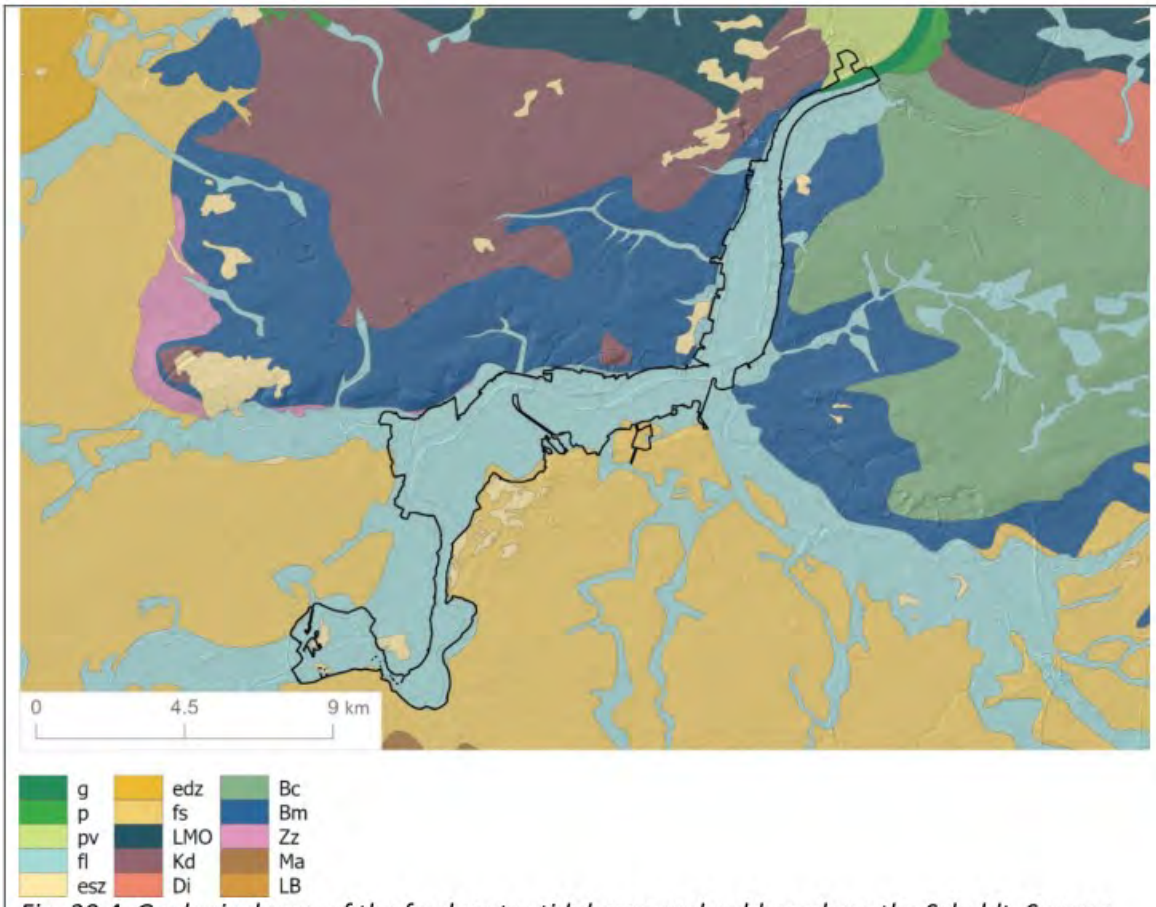

Fig. 30.4. Geological map of the freshwater tidal area and polders along the Scheldt. Source: Geological map of Geopark Schelde Delta, TNO.

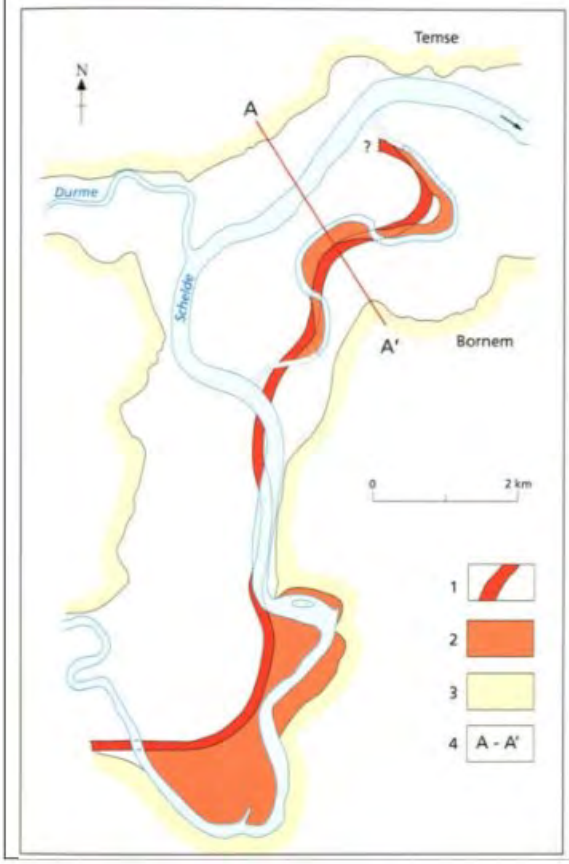

Fig. 30.5. The location of the meandering Scheldt between Kastel and Bornem. (1) Lateglacial riverbed (now filled with sediment); (2) Point bars of the post-Roman Scheldt; (3) Edge of the river valley; (4) Location of the profile from figure 30 5. Source: Van Strydonck et al. 2000.

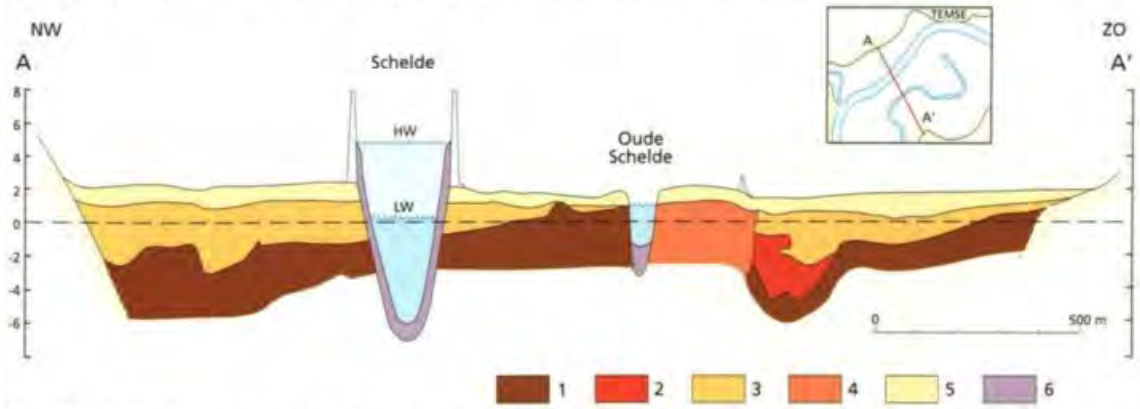

Fig. 30.6. Geological profile through the alluvial plain of the Scheldt between Temse-Tielrode and Bornem (location: see Figure 30-4). This situation is a model for the evolution of the Scheldt Valley throughout the geosite. (1) Lateglacial sandy river deposits of the meandering Scheldt; (2) Lateglacial and Early Holocene channel fill (clay, peat, marl); (3) Holocene peat; (4) Post-Roman sandy point bar deposits of the Scheldt; (5) (Post)medieval clay; (6) Recent tidal deposits of the current Scheldt. Source: Van Strydonck et al. 2000.

Fig. 30.7. Detail of the reclamations at Kastel, with different phases of embankments and remnants of dike breaches ("welen"). Source: geopunt.be; Bogemans et al (2010).

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Geosite n°31	**Durme Valley** Tidal river as a vein for agriculture and trade.
 Fig. 31.1. Map of Geopark Schelde Delta. Durme Valley is number 31.	**Scientific importance and valuation of the geosite** The landscape in the freshwater tidal zone of the Durme Valley was shaped by the interaction between man and tidal river. Few rivers in north-western Europe are subject to tidal action this far inland. This had a major impact on the land use in the polders. This historic landscape development is still clearly legible in the landscape, especially in the polders along the Old Durme, south of Sombeke.
Municipality	Hamme, Lokeren, Temse, Waasmunster, Zele
Province and country	Oost-Vlaanderen, Belgium
Protection status	Natura 2000; Molsbroek: protected cultural-historical landscape; Durmeschorren near Meulendijk; protected cultural-historical landscape
Site management organizations	vzw Durme, Natuurpunt vzw, Agentschap voor Natuur en Bos, Province of Oost-Vlaanderen, Municipality Hamme, Municipality Lokeren, Municipality Temse, Municipality Waasmunster, Municipality Zele
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center - Excursions/guided tours - Routes that one can travel independently The visitor center is part of the Sigmaplan-projects: Projects to improve protection for Flanders (Vlaanderen) against the flooding of the river Scheldt and its tributaries. At the same time, boosting the valuable nature surrounding the river Scheldt.
Relevance for education	- Visitor center - Excursions/guided tours - Routes that one can travel independently - Educational programme for children

Teaching equipment	- Molsbroek: educational packages for schools and groups https://www.vzwdurme.be/index.php/voor-scholen-en-groepen - Information point at Hamme about Sigmaplan	
Code		**Significance**
G-31		National

Geological interest(s)

Paleontology: not applicable.

Stratigraphy: not applicable.

Geomorphology: The freshwater tidal flats and marshes along the Durme tidal river are a diverse and dynamic landscape situated at the landward end of the estuarine salinity gradient, which makes them unique in Belgium and the Netherlands from a geomorphological and ecological perspective. In the embanked polders, the historical landscape development is still clearly legible in the landscape, e.g., old dike and parcelling patterns and the effects of floods and dike breaches such as kolk lakes ('wielen').

Sedimentology: not applicable.

DETAILED DESCRIPTION

1. **Location**

The present-day Durme runs from the confluence of the Zuidlede and Moervaart, south of Klein Sinaai, to its mouth in the Scheldt at Tielrode. The geosite includes the Durme Valley from Lokeren to the mouth. The Durme is under the influence of the tide here, with a tidal amplitude of more than 5 m at the mouth, 2 m at Waasmunster, fading away until the dams at Lokeren. This part of the Durme belongs to the freshwater tidal zone. Upstream from Waasmunster the river is usually 15 to 20 m wide, but towards the mouth it widens to about 80 m. At low tide the water only fills a narrow zone within the Durme channel. The polders along the Durme are at 3 to 4 m TAW; the tidal marshes along the river are at ca. 6 m TAW. The southern transition from the valley to the interfluve between Scheldt and Durme is very gradual. By contrast, the northern edge is very sharply delineated by the escarpment of the Waasland cuesta, which extends to ca. 30 m TAW.

2. Landscape formation

Formation and infill of the lateglacial Durme

During the Pleistocene (2.6 million to 11,700 years ago), the precursors of the current rivers of the Scheldt Basin converged north of Ghent in the Flemish Valley. However, at the end of the last ice age (about 14,700 years ago), this valley was dammed by the Maldegem-Stekene coversand ridge and the current course of the Scheldt was created, through the 'Hoboken gap' and along Antwerp. During the warmer phases of the lateglacial (interstadial GI-1) a series of lakes formed at the foot of the coversand ridge, including in the Moervaart depression. At the end of this warmer period, a meandering river formed that drained the lake in the Moervaart depression and flowed into the Scheldt via the current Durme Valley near Temse. The Durme then belonged to a much larger river system: the current Durme formed the lower course and was connected to the upper course via the lateglacial lake in the Moervaart depression, which today consists of the Mandel, Poekebeek, Hoogkale, Neerkale and Kruiskale. This river system incised almost 10 m deep and formed large meanders, comparable to those of the Lys and the Scheldt.

Around 12,850 years ago, with the transition from interstadial GI-1 to stadial GS-1, the last cold peak of the Pleistocene, the Moervaart depression gradually dried up and the flow of the river draining the lake decreased significantly. From the end of the lateglacial and during the Holocene, the large meander channels slowly got filled with sediment and later peat, while

there was hardly any river activity left. These old meanders are no longer visible on the surface, but can be found as bands of peat under the clay cover of the Durme Valley.

New incision of the Durme

During the Late Holocene, the discharge of water and sediment increased again under the influence of increasing agriculture and associated erosion. A new meandering system developed, with much smaller dimensions than its lateglacial precursor. This river roughly corresponded to the current course of the Durme, except where the river was straightened in the 20th century. At this time, the mouth of the Durme was still near Temse. The Durme Valley was vegetated with alder swamp forests and human activity was very limited before the Middle Ages.

The tidal Durme since the Middle Ages

In the early Middle Ages, the population started to increase and the wetlands in the floodplain were gradually converted into pasture land.

When the Scheldt developed a new connection with the North Sea via the Western Scheldt (Westerschelde) during the High Middle Ages, the tidal activity entered the Scheldt Basin much deeper. This forced farmers from the 13th century to also dike the floodplains of the Durme, starting from the mouth at Temse, where the tidal range was greatest.

The resulting polders are drained by brooks and ditches. Due to this drainage, the peat in the subsoil dried out and compacted, causing a lowering of the surface. The polders were mostly used as hay meadows. Hay yields were increased by deliberately cutting the dikes in winter, so that flooding water could leave a fertile layer of silt behind. Thanks to this system of so-called vloeimeersen or 'flow marshes', the polders formed profitable land. In the polders around the Old Durme branch south of Sombeke, there are still relics of this traditional meadow irrigation, such as ditches, gullies and old inland dikes, which still have their original height and width in this area.

Tidal deposits still accumulated outside the dikes and new tidal flats and tidal marshes were created, which eventually became higher than the polders and were later also diked (e.g. Gemene Schoren van Hamme). The tidal marshes outside the dikes were very suitable for the cultivation of wijmen (withies): the annual twigs of willow trees that were used in basketry and for the reinforcement of dikes.

In the (early) modern era, many other economic activities took place in the Durme Valley in addition to hay and willow cultivation. In De Bunt, between 1795 and 1830 AD, peat was extracted on a large scale. The excavated pits are now used as fish ponds. Elsewhere in the Durme Valley, peat extraction was conducted on a smaller scale.

The Durme was an important waterway during this period: cargo ships took advantage of high tides to sail up or down the river and were pulled by horses or human boat pullers on the towpaths. In the 18th – 19th century, this mainly concerned ships that supplied manure from Antwerp. At the quays along the Durme, this was transferred to pits where the farmers came to collect the manure.

This manure was used, among other things, for flax cultivation. The flax was retted locally in ditches, covered with straw and silt. The silt of the Durme was very suitable for this, so the polders around Hamme, such as the Noubroek, were known for retting flax. Hemp, used in the rope industry, was also grown in the area and retted in the pits that resulted from the peat

extraction in the Bunt. Lokeren was known for its bleaching meadows, where pieces of woven linen were bleached by the sun in the wet meadows along the Durme.

Increase of tidal activity and silting of the Durme in the 19th and 20th centuries

Until the beginning of the 19th century, the tidal range in the Durme was small (about 3 m at its mouth in the Scheldt; less upstream) and the summer dikes were sufficient to keep the meadows dry in the summer. Since then, however, the tidal range has steadily increased, partly as a result of straightening of bends, to about 6 m today. At spring tides, the exceptional combination of a large tidal range with a narrow river causes the rare phenomenon of 'tidal bore' or 'mascaret' in the Durme: the tidal wave enters the river upstream like a wall of water.

In addition, the Durme was cut off from its sources in 1827 by the construction of the Ghent-Terneuzen canal. As a result, the flow of the river decreased sharply and more sand and silt remained behind. This process of silting was further enhanced by the straightening of a few meander bends in the Durme in the 1930s, allowing the silt-rich Scheldt water to flow more quickly upstream at high tide.

The combination of increasing tides and silting riverbed created an increasing risk of flooding. That is why, in the middle of the 20th century, potpolders were constructed: flood control areas that were flooded at high tide (e.g. Sombeke, 1939; Molsbroek, 1959). The Durme was also dammed, first near Lokeren, later opposite the Molsbroek and the dikes were raised and reinforced with concrete locks. In order to protect the Durme polders against future flooding, dikes with a height of 8 m TAW are provided in the context of the Sigma Plan.

Relation with other geosites

- In the past, the evolution of the lower course of the Durme was related to that of, among others, the Oude Kale (geosite 39) and the Zuidlede (geosite 37), as they together formed one river system.
- The land use in the meadows and the problems associated with a tidal river are very similar to the polders in the freshwater tidal area of the Scheldt (geosite 30).

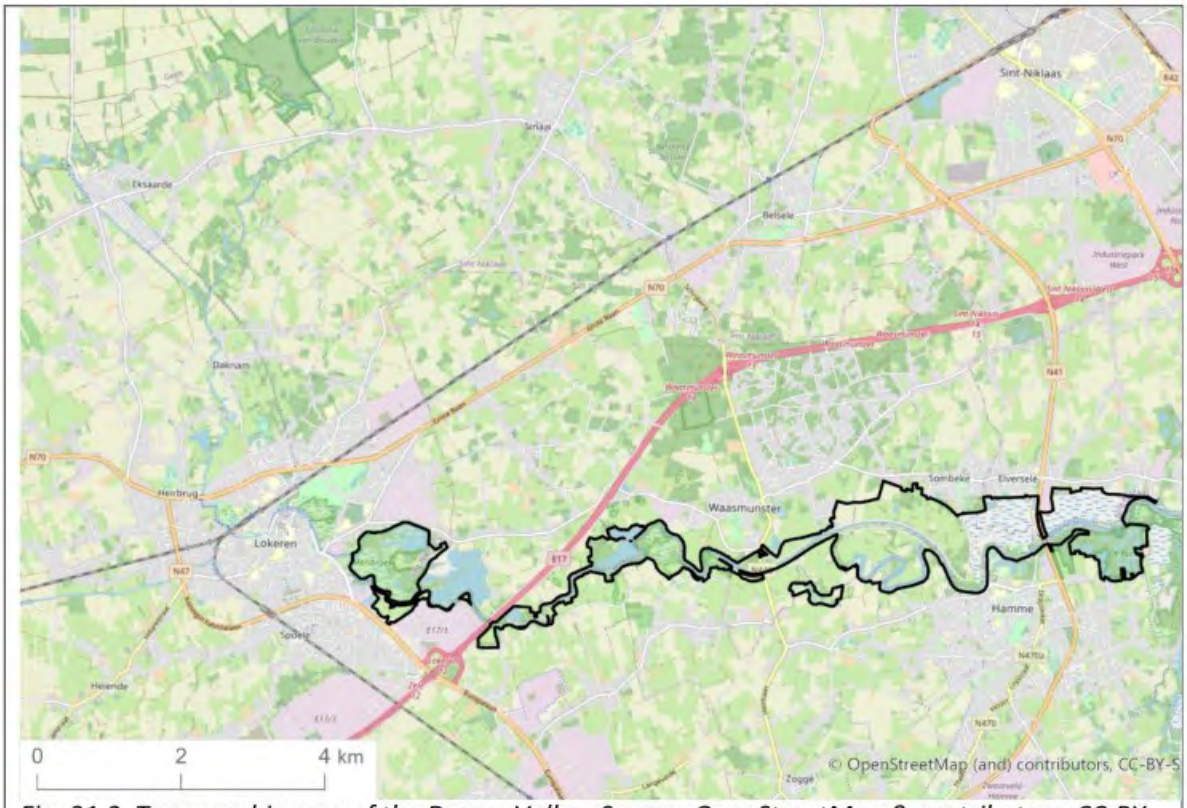

Fig. 31.2. Topographic map of the Durme Valley. Source: OpenStreetMap & contributors. CC-BY-SA.

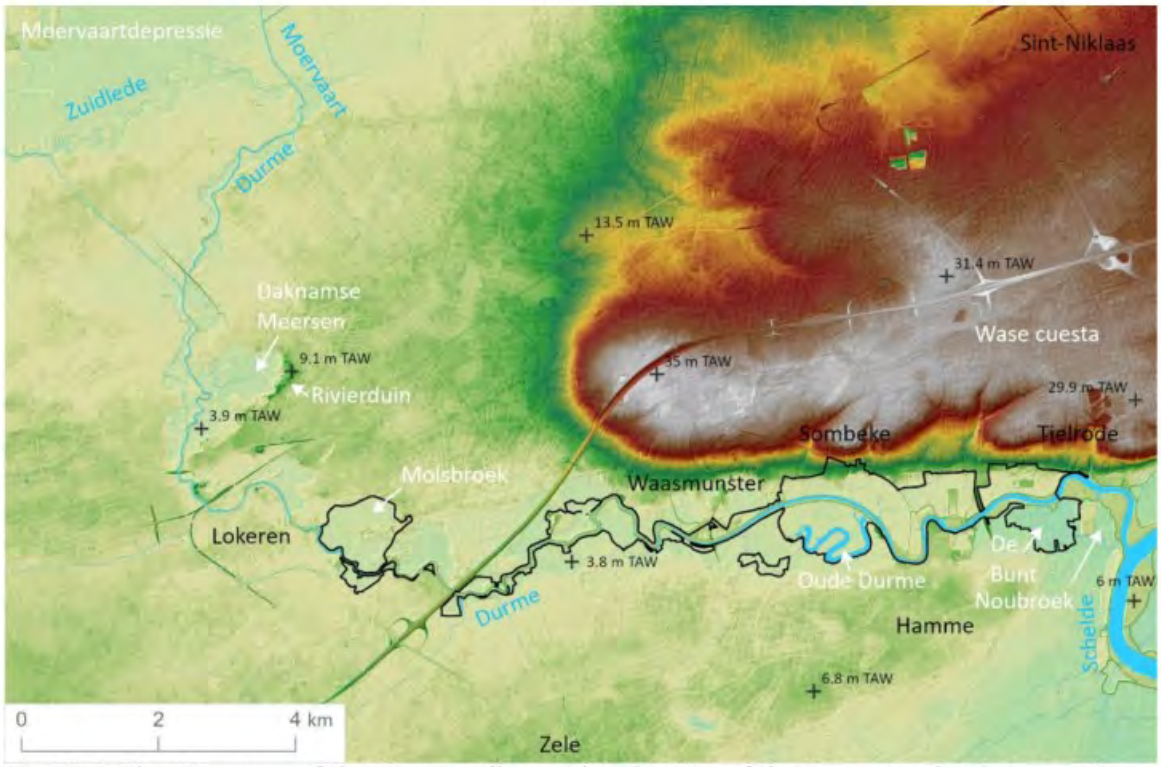

Fig. 31.3. Elevation map of the Durme valley, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency.

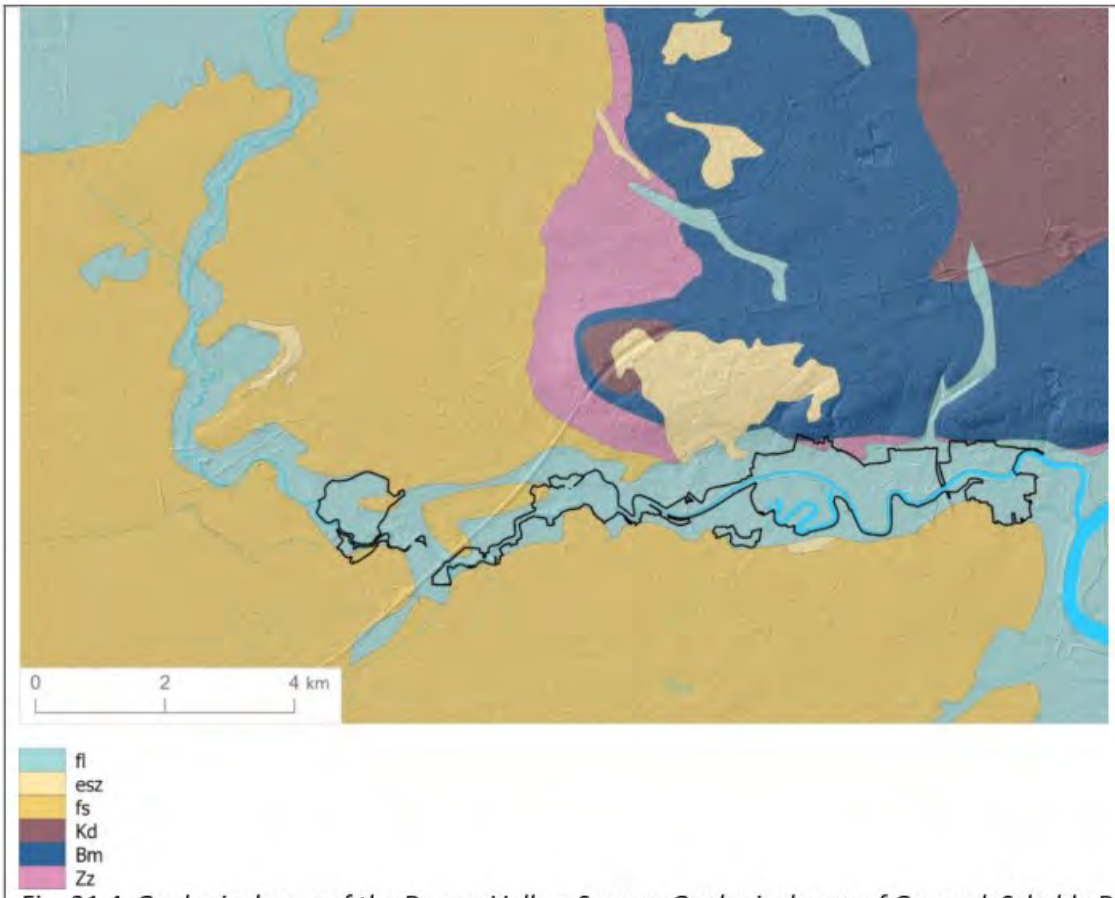

Fig. 31.4. Geological map of the Durme Valley. Source: Geological map of Geopark Schelde Delta, TNO.

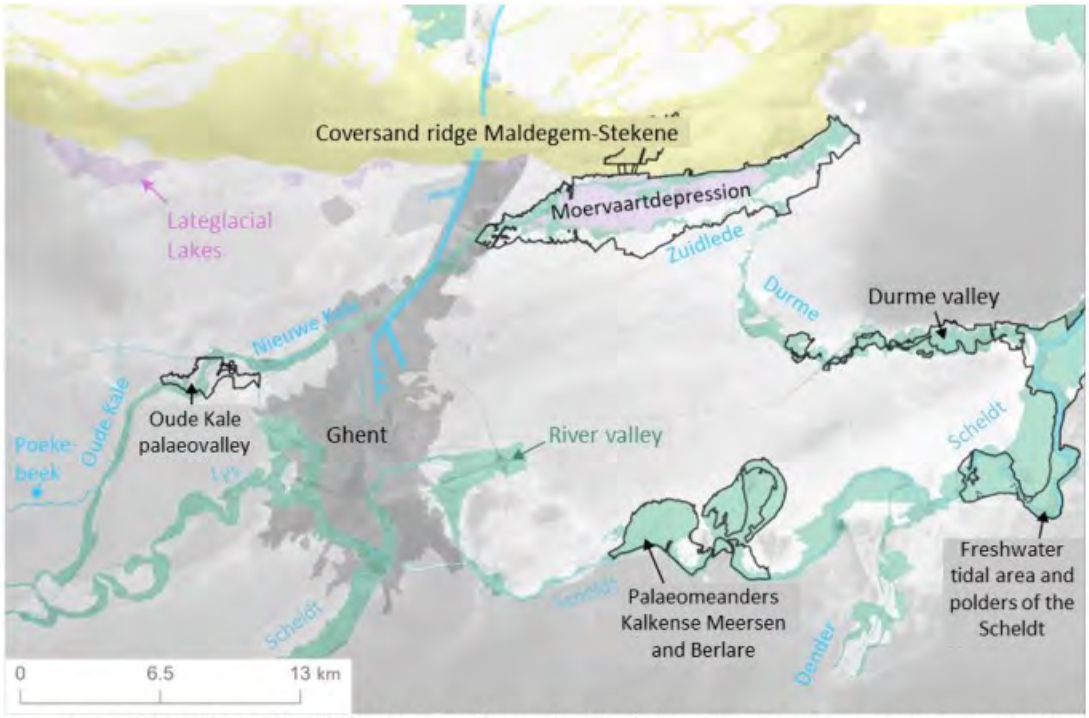

Fig. 31.5. Original course of the Durme: from the Poekebeek as its upper course, via the Oude Kale and the Nieuwe Kale, through the Moervaart Depression to the current Durme.

Documentation and resources

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Geosite n°32	**Boom Cuesta** Brick industry at the location where 30-milion-year-old marine clay surfaces.
 Fig. 32.1. Map of Geopark Schelde Delta. Boom Cuesta is number 32.	**Scientific importance and valuation of the geosite** As shown by the synthesis by Vandenberghe et al. (2014), the Boom Formation has been exceptionally long and extensively studied by geologists, both paleontologically and lithologically. Not only did the municipality of Boom give its name to the formation at a national level, but the Rupel, which defines the outcrop area of the formation, also gave its name to the Rupelian. The term 'Rupelian' was introduced in the 19th century by the Belgian geologist André Dumont and has since become the internationally accepted name for the period between 33.9 and 27.8 million years ago and forms the earliest part of the Oligocene. More recent research has been stimulated by the potential of the Boom Formation for the long-term disposal of radioactive waste in the deeper subsurface. The quarries along the Rupel are known among fossil collectors for the snails, bivalves and fish remains, including shark teeth from the Boom and Berchem Formations and at the boundary with the overlying Pleistocene coversands. The Boom Formation also appeals to mineral enthusiasts looking for septaria and pyrite crystals. The current landscape in the Rupel region is very closely intertwined with its (early) modern industrial history. The clay pits have a far-reaching influence on the appearance of the landscape, which can also be clearly seen on the elevation map. Thanks to the mining, the stratification of the Boom Formation can be clearly seen on the surface. More recent research has been stimulated by the potential of the Boom Formation for long-term deep disposal of radioactive waste.
Municipality	Boom, Niel
Province and country	Antwerp, Belgium
Protection status	Walenhoek: Vlaams Ecologisch Netwerk; District Noeveren: protected town or village scape; Steenbakkerij Frateur: established architectural heritage

Site management organizations	De Vlaamse Waterweg nv, Waterwegen en Zeekanaal, Agentschap Natuur en Bos, Municipality Boom, Municipality Niel
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center, museums - Excursions/guided routes - Routes that one can travel independently
Relevance for education	- Visitor center, museums - Excursions/guided routes - Routes that one can travel independently - Educational programme for children
Teaching equipment	- Site is part of several walks - Museum Rupelklei focuses on the geology of the area

Code	**Significance**
G-32	International

Geological interest(s)

Paleontology: The Boom Formation and the Rupelian stratotype, exposed in the clay quarries on the cuesta, have been the topic of many micropaleontological investigations (foraminifera, ostracods, pollen, spores, and dinoflagellates), while macrofossil studies have focused on bivalves, decapods and fish remains. The quarries are also known among fossil collectors for the snails, bivalves and fish remains, including shark teeth from the Boom and overlying Berchem Formation and at the boundary with the Pleistocene coversands at the top.

Stratigraphy: The research outlined above in this area and at geosite 35 has led to the establishment of the stage name Rupelian in the International Commission of Stratigraphy reference chronostratigraphic chart, pointing to the importance of this Oligocene historical unit-stratotype area in the Rupel area (see also the Geological Time Scale editions of 2012 and 2020). The Boom Clay in the Rupel area has been visited by countless groups of geologists and engineers for all the above-mentioned different aspects of its geology. Amongst the numerous field trips, those related to the establishment of the global sequence stratigraphic chart could be selected as a highlight.

Geomorphology: The prominent asymmetrical landform or cuesta was formed in the resistant clay layers of the Oligocene Boom Formation and testifies of the deep differential erosion of the Paleogene sequence of alternating clay and sand layers by rivers of the Scheldt basin during the Middle and Late Pleistocene. The original relief of the steep cuesta front has been disturbed by the many quarries for the exploitation of the clay of the Boom Formation.

Sedimentology: Many aspects of the sedimentology, mineralogy, and geochemistry of the Rupelian Boom Formation, exposed in the clay quarries on the cuesta, have been studied in detail and with up-to-date methodologies in international collaboration studies, to identify a.o. depositional environments, sea-level changes, and tectonic and climatic signals, as well as for application purposes such as coarse ceramics, civil engineering, discontinuity structures etc.

DETAILED DESCRIPTION

1. **Location**

This geosite includes the southern edge of the Boom Cuesta, where it is defined by the Rupel. On the elevation map we see that the Boom Cuesta forms a whole, together with the Waasland cuesta. The Hoboken gap divides the cuesta in two and forms a passage for the Scheldt. The top of the escarpment, at over 30 m TAW, is remarkably higher than the plain south of the Rupel. The

original relief of the cuesta escarpment has been greatly disturbed by the many clay quarries. At the level of the residential areas of Boom and Niel, for example, the original height (approx. 10 m) has still been preserved. Between the villages, in a strip of about 1.5 km on the right bank of the Rupel, we find excavations from 5 to more than 20 m below the original surface.

2. **Landscape formation**

A cuesta is an asymmetric ridge and arises when geological layers tilt and then erode at different rates due to their different composition. The sloping layer, which erodes less quickly, partly remains as an elevation in the landscape. Where the softer layer has eroded, a steep slope is created transverse to the hard layer: the escarpment. Parallel to the sloping, erosion-resistant layer, a gentler slope is created: the dipslope (Fig. 32.6).

Clay deposition in the Oligocene North Sea

The formation of the Boom Cuesta started about 32 million years ago, during the Early Oligocene. In this period, the continents were not quite arranged as they are today. South of the geopark, the Artois axis formed a land bridge between Great Britain and the Ardennes. The Netherlands and the north of Belgium were below sea level (Fig. 32.5). Via the Rhine graben, the North Sea of that time was connected to the Paratethys, a sea that no longer exists.

Sediment originating from the erosion of the surrounding continents was deposited in the Oligocene North Sea. The coarser particles (sand) mainly ended up close to the coasts. Finer particles (silt and clay) drifted further and settled in the deeper parts of the basin. During periods of low relative sea level, the area around Boom was close to the coast. This resulted, for instance, in the deposition of sand in the Ruisbroek Member (upper part of the Zelzate Formation, Fig. 32.6). Between about 32 million and 30 million years ago, there was a period in which the sea in northern Belgium and the Netherlands was 50 to 150 m deep and in which clay was deposited. Water depths fluctuated frequently due to a combination of plate tectonics and climatic variations from astronomical cycles that affected the Antarctic ice sheets and, consequently, global sea levels. This resulted in a varying supply of organic and mineral material from the land in the North Sea. As a result, the Boom Formation does not consist of a homogeneous deposit of clay, but of an alternation of layers of several tens of cm thick with more or less silt, carbonate and organic material. The result is the Boom Formation: a clay layer about 100 m thick with a characteristic pattern of horizontal light and dark grey bands, the sequence of which can be read as a kind of bar code (Fig. 32.6). In the calcareous layers, bread-shaped calcareous concretions of several decimeters in horizontal cross-section formed after burial: the so-called septaria of the Boom clay. Minerals such as pyrite crystallized in the cracks of these septaria.

Formation of a cuesta by tectonics and erosion

While sedimentation was taking place in the North Sea Basin, plate tectonics in southern Europe triggered important changes: the collision of the African and Eurasian plates caused the closure of the Tethys Sea and the formation of several mountain ranges, such as the Pyrenees and the Alps. Due to the uplift of the land in the south, the crust in the north sank over millions of years and the deposits of the Boom Formation, among others, tilted into a north-easterly inclined position (Fig. 32.6).

South of the present-day Rupel, the layer rose above sea level and was exposed to erosion. The firm clay of the Boom Formation was more resistant to erosion than the underlying and overlying sand layers. As a result, the rivers of the Flemish Valley – the Pleistocene predecessor of the rivers of the Scheldt Basin – could cut into the sand of the Ruisbroek Member more quickly than in the Boom clay. The result is a cuesta: an asymmetrical hill with a steep slope to the south (the cuesta escarpment) and a gentle slope to the north (Fig. 32.6).

Neogene North Sea sediments are found on the dipslope of the Boom Cuesta. To the north, in the Campine area and in the Netherlands, where the Boom Formation has sunk deeper, these Neogene sediments become thicker. Later erosion largely effaced these Neogene sediments, leaving behind only a gravel layer with shark teeth and weathered bones of marine mammals under the later wind deposits of the Pleistocene.

Brick industry

Where the Boom Formation surfaces at the escarpment along the Rupel, the clay has been mined since the Middle Ages and a large-scale industry arose in the early modern period, culminating in the 20th century. The region is internationally known for its brickyards, mainly producing bricks, but also roof tiles and tiles. In addition, sulfuric acid was previously extracted from the pyrite in the clay and cement was produced.

The oldest quarries were located close to the Rupel. The finished bricks were transported by ship over the Rupel. To transport the clay from the pits to the river, streams and canals across the Rupel were originally used.

As these clay pits got exhausted, they moved further and further north. The former clay pits along the water were then used for drying sheds, ovens, machine halls and workers' houses. During the 19th century, the area north of the main road from Niel, across Boom to Rumst was reached. This road remained at the old level and thus formed a barrier for the transport of the clay to the industrial zone along the river. Tunnels were therefore constructed for the clay to be brought from the clay pits to the Rupel with carts over a narrow-gauge track. Even today clay is still mined on a large scale for the brick industry in the vicinity of Rumst.

Relation with other geosites

- The Boom Cuesta forms a whole with the Waasland cuesta (geosite 35), where the same clay surfaces.
- The brickyards along the Scheldt and the Durme (geosite 35) and in Steengelaag (geosite 38) therefore mined the same clay layer as in the Rupel region.
- The river development in the Rupel Valley (geosite 33) is responsible for the erosion that formed the cuesta escarpment.

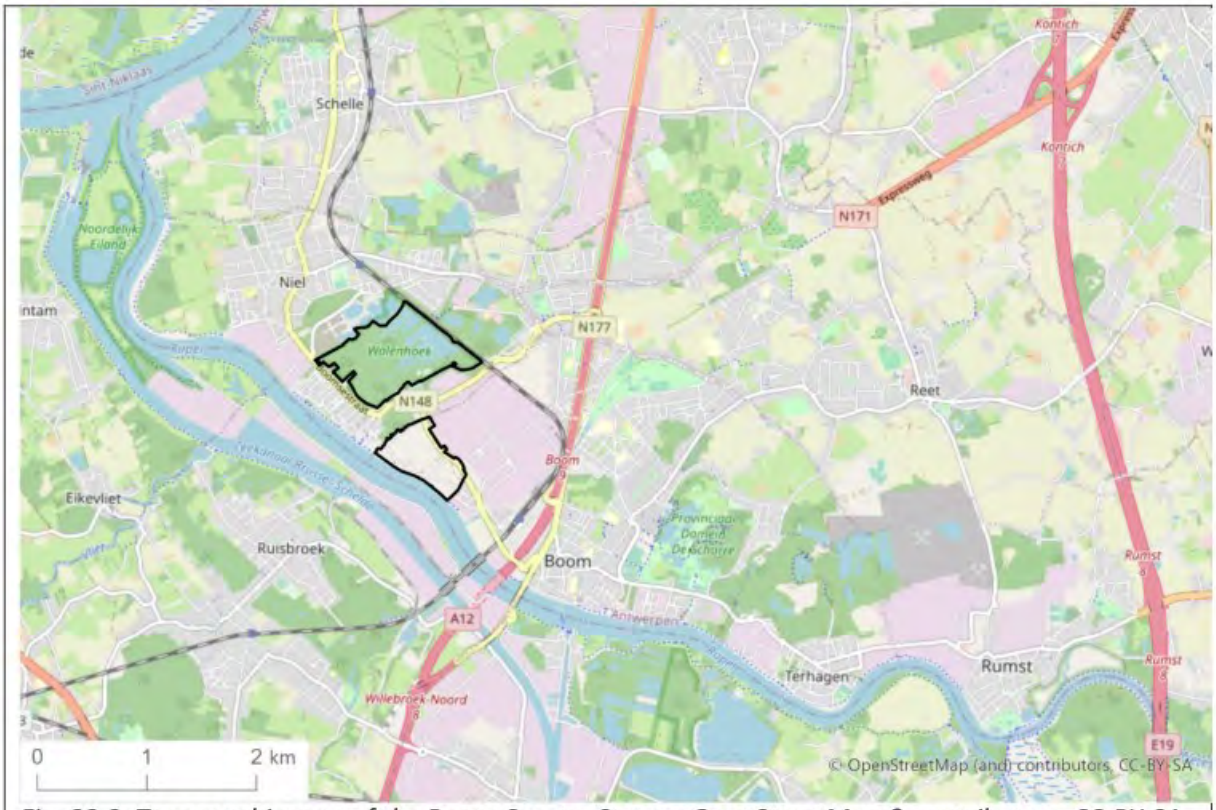

Fig. 32.2. Topographic map of the Boom Cuesta. Source: OpenStreetMap & contributors. CC-BY-SA.

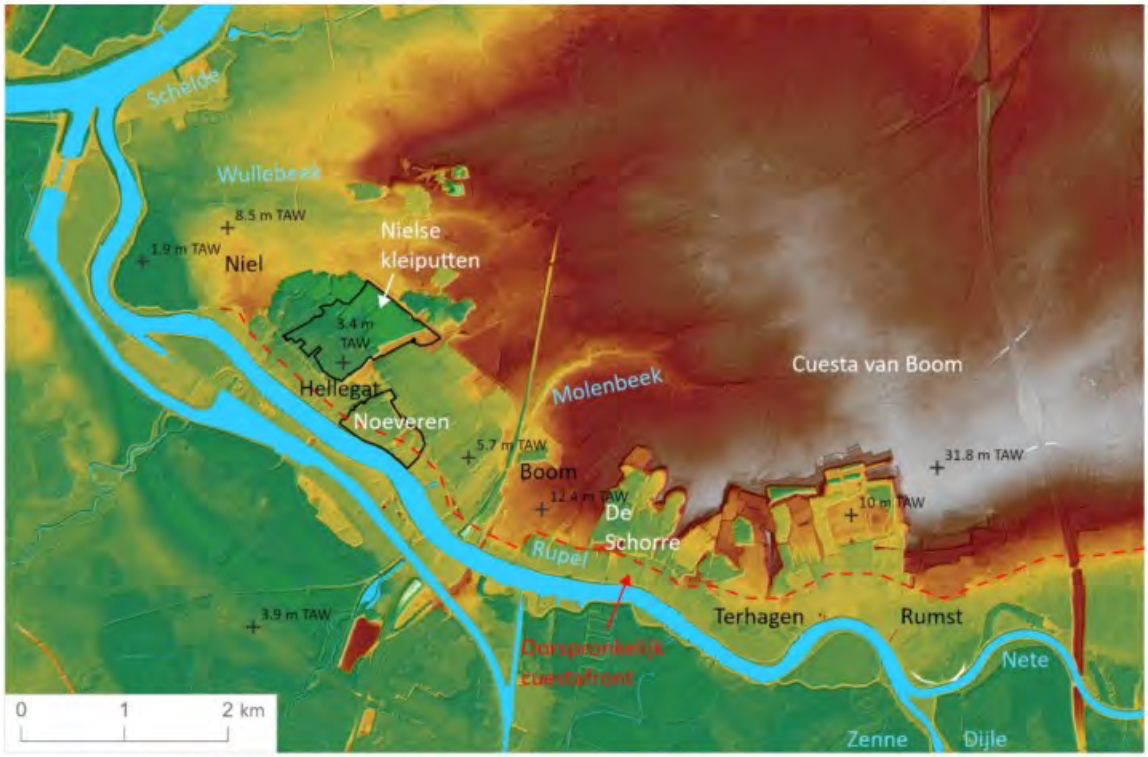

Fig. 32.3. Elevation map of the Boom cuesta, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency. Red dashed line indicates the original escarpment.

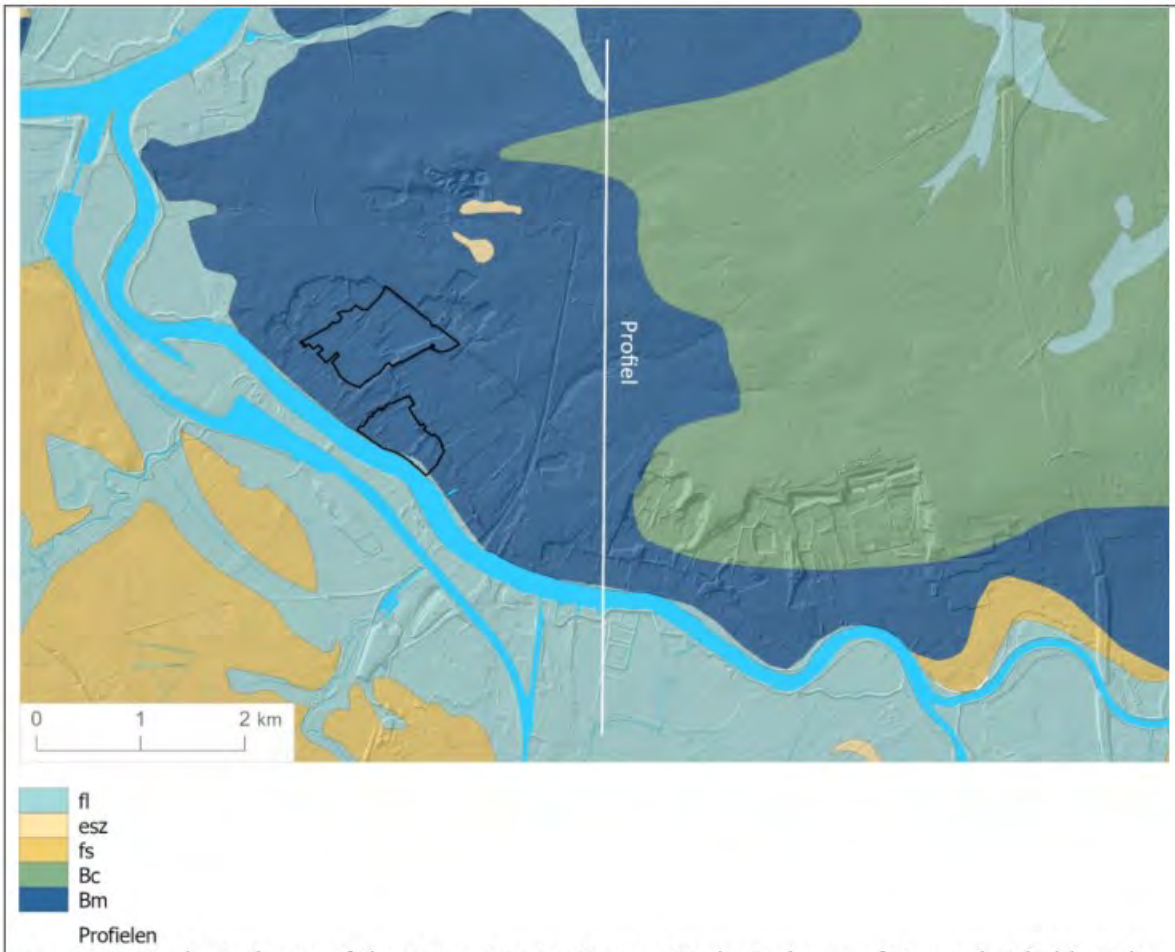

Fig. 32.4. Geological map of the Boom Cuesta. Source: Geological map of Geopark Schelde Delta, TNO.

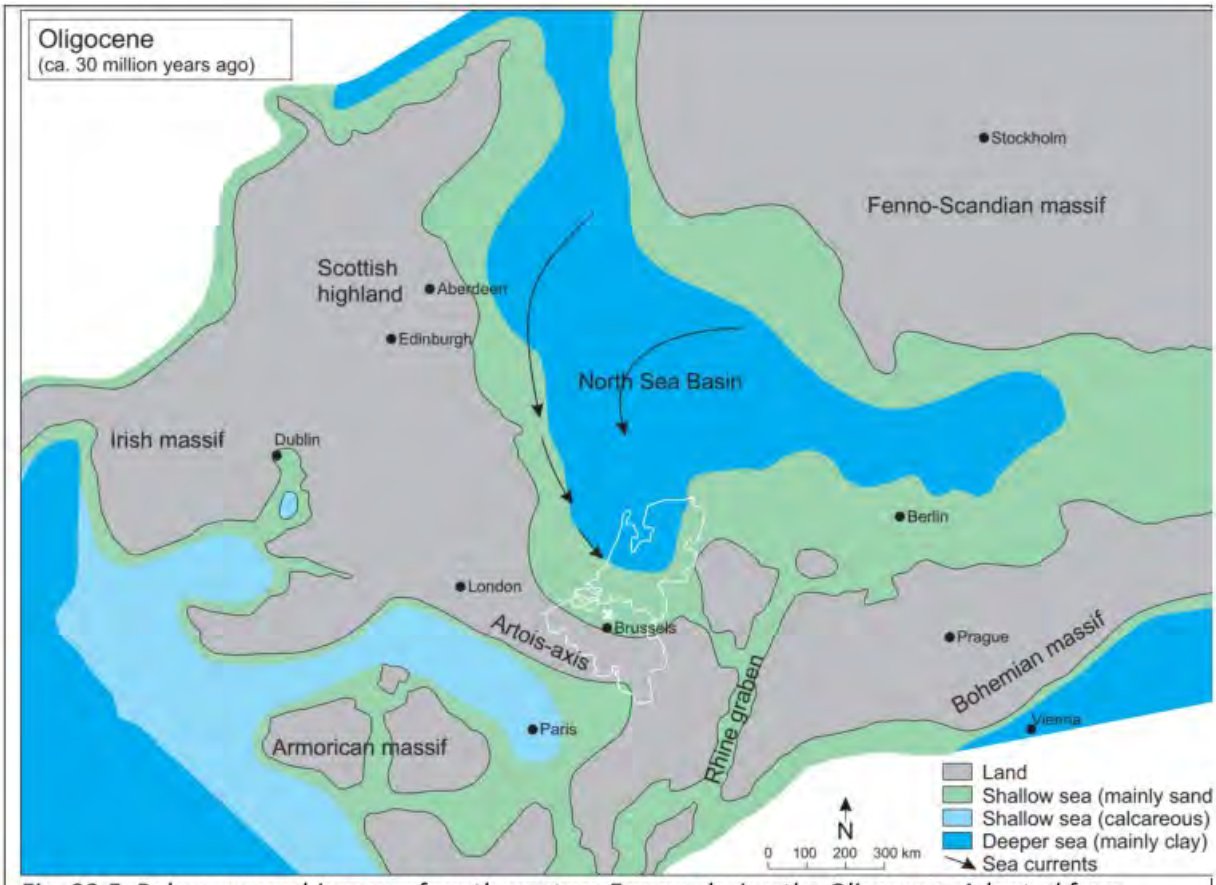

Fig. 32.5. Paleogeographic map of north-western Europe during the Oligocene. Adapted from Vandenberghe, De Craen & Wouters, 2014.

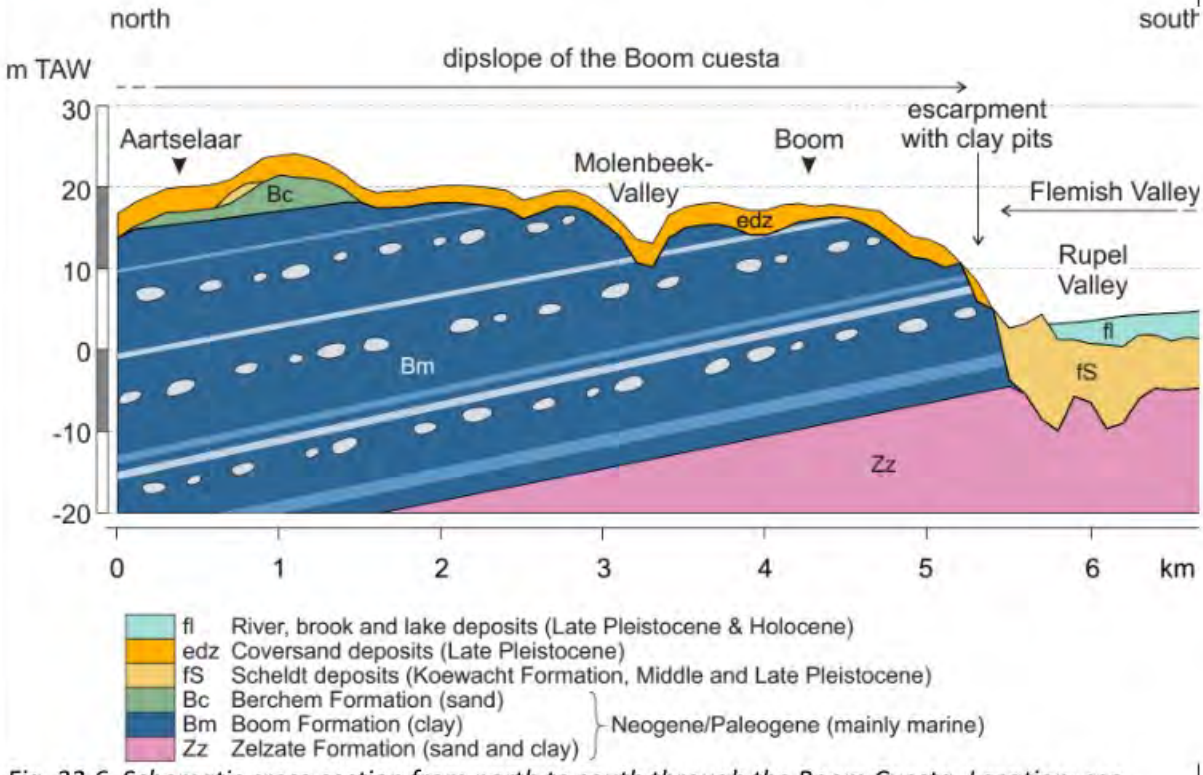

Fig. 32.6. Schematic cross-section from north to south through the Boom Cuesta. Location: see geological map (Fig. 32.4). Based on a virtual profile (dov.vlaanderen.be).

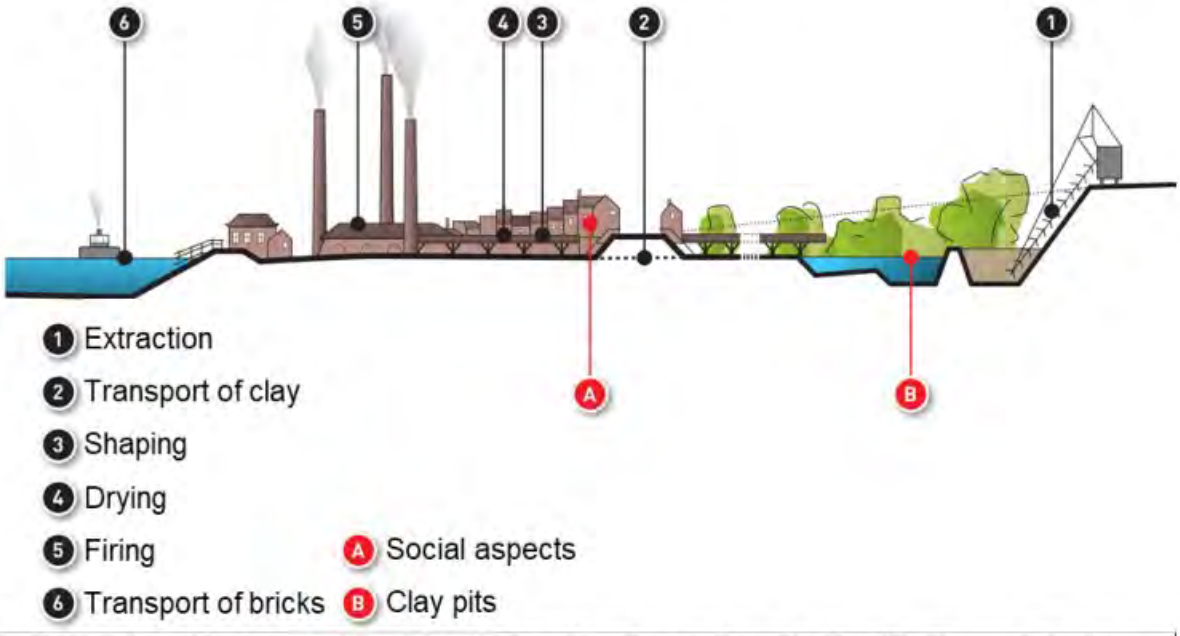

Fig. 32.7. Schematic cross-section of the brickyard landscape, from the Rupel in the south to the mined cuesta escarpment in the north. Source: Walking brochure 'steenbakkerstunnels herontdekt', figure based on a diagram by Hugo Lejon.

Fig. 32.8. Picture of mechanized reclamation of a clay quarry in Terhagen (Photo: Noël Vandenberghe).

Documentation and resources

- Agentschap Onroerend Erfgoed (2021) Wijk Noeveren. In: Inventaris onroerend erfgoed. https://inventaris.onroerenderfgoed.be/erfgoedobjecten/120944
- Vandenberghe N, De Craen M, Wouters L (2014) The Boom Clay Geology from sedimentation to present-day occurrence - a review. Memoirs of the Geological Survey of Belgium 60:76.

Geosite n°33	**Rupel Valley** Patchwork of heights and depressions on the left bank of the Rupel.
 Fig. 33.1. Map of Geopark Schelde Delta. Rupel Valley is number 33.	**Scientific importance and valuation of the geosite** In the swampy zones within the Rupel Valley, valuable wet biotopes exist, which in turn attract numerous bird species.
Municipality	Niel, Schelle, Boom, Willebroek, Rumst, Bornem, Puurs-Sint-Amands
Province and country	Antwerp, Belgium
Protection status	Natura 2000; Het Moer: protected cultural-historical landscape; Zennegat-Battenbroek: protected cultural-historical landscape
Site management organizations	Natuurpunt Beheer, De Vlaamse Waterweg nv, Waterwegen en Zeekanaal, Province of Antwerp, Municipality Niel, Municipality Boom, Municipality Rumst, Municipality Willebroek, Municipality Bornem
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Routes that one can travel independently - Educational programme for children
Teaching equipment	- Nature and culture offer

Code	**Significance**
G-33	National
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	

Geomorphology: The site demonstrates the effect of eolian activity at the end of the last glacial which formed the coversand ridges that separate the present floodplain from several shallow depressions to the south, while the Rupel floodplain itself testifies of the transition from a braided into a large-scale meandering river system during the Weichselian Lateglacial, with traces of large meandering channels in between low point bar ridges visible in the microrelief.

Sedimentology: not applicable.

DETAILED DESCRIPTION

1. **Location**

The Rupel is the 12 km long tributary of the Scheldt in which the Dijle, the Zenne and the Nete merge. Today the Rupel is a freshwater tidal river with strong tidal currents. On the left bank, the Brussels-Scheldt Maritime Canal runs parallel to the Rupel from Klein Willebroek.

The geosite includes the alluvial plain of the Rupel. This plain is about 3.5 km wide on the left bank, with a height around 4 to 5 m TAW and depressions down to 1 m TAW. Between Bornem and Willebroek, the alluvial plain is more or less bordered by the N16. The right bank of the Rupel Valley is steep and is formed by escarpment of the Boom Cuesta.

The residential areas, such as the villages of Wintam, Eikevliet, Ruisbroek, Sauvegarde, Puurs, Kalfort, Willebroek, Blaasveld and Heindonk, are located on heights on the edge of or enclosed between the depressions of the alluvial plain of the Rupel. The lowest parts of the alluvial plain (usually 2 to 3 m TAW) are characterized by small pools and a dense network of canals and are often wooded (e.g. Moer near Eikevliet and Kalfort, depressions north and south of Ruisbroek, Biezenweiden, and Blaasveldbroek). Between Heindonk and the Brussels-Scheldt Maritime Canal, we find some larger lakes (e.g. Hazewinkelvijver, Bocht) where water sports are practiced. Several streams intersect the alluvial plain from south to north (east).

2. Landscape formation

Formation and infill of the Rupel Valley

During the Pleistocene (2.6 million to 11,700 years ago) the precursors of the current rivers of the Scheldt Basin converged in the Flemish Valley north of Ghent. At that time, the current Rupel Valley formed an eastern branch of the Flemish Valley, within which flowed a braided river that deposited a thick layer of sand over time. During the Late Pleistocene, strong north-westerly winds brought in large amounts of sand and the relief of the Flemish Valley was covered by a metres-thick layer of coversand.

At the end of the last ice age, the Scheldt took its current course, and the Rupel and Scheldt merged at Rupelmonde and flowed towards Antwerp through the 'Hoboken gap', which separates the Waasland cuesta from the Boom Cuesta.

During the lateglacial transition from the Weichsel glacial to the current interglacial period (ca. 14,700 to 11,700 years ago), the braided river system changed into a wide meandering river that incised deep into the substrate. Along these meandering channels, levees and/or point bars developed: elongated sandy ridges, parallel to the river. These old channels and ridges are buried in the Rupel Valley under younger deposits, but are sometimes still recognizable in the micro-relief. For example, near Heindonk we still recognize a river bend (approx. 2 m TAW) with a point bar ridge in the inner bend (ca. 4 m TAW). The low-lying zones between the village centers of Ruisbroek and Sauvegarde and between Ruisbroek and the Brussels-Scheldt Maritime Canal (1 m TAW) are probably remnants of channels that were formed in this period as well.

When a forest vegetation developed about 14,000 years ago, the system stabilized and the filling of the meander channels started. A very last cold phase, from 12,900 to 11,700 years ago, created

a barren landscape and was accompanied by the formation of river dunes in and along the flood plains of the Scheldt Basin. In the Rupel Valley, for instance the elevations within the Blaasveldbroek are attributed to lateglacial wind activity.

From the Early Holocene onwards, forests developed again. Because these forests retained more precipitation and prevented erosion, the flow of the rivers decreased and they turned into a small stream within a swamp forest. The rising water level caused the deep lateglacial channels to be completely filled with peat during the Middle Holocene.

The historical Rupel Valley

When farmers started to clear more forests and create fields since the Neolithic age (ca. 5000 years ago), more sediment from the Scheldt Basin again ended up in the streams due to soil erosion. A new meandering system was created, which broadly corresponds to the current course of the Rupel. Until the Early Middle Ages, the Rupel Valley consisted of a wide, shallow river with extensive peat-rich swamps on the left bank. This river overflowed more and more often and from the High Middle Ages onwards, the tidal activity was added. Because of the growing pressure of the water, simultaneously with an ever-increasing population pressure, the floodplain of the Rupel was embanked and cultivated between ca. 1100 and 1300 AD. Villages and arable fields were located on the higher sand ridges, while the wet polders were mainly used as water-meadows: by deliberately breaching the dikes in winter, floods left behind a fertile layer of silt and the hay yield could be significantly increased.

In the most peat-rich zones, peat has been extracted since at least the Late Middle Ages. Wet depressions were left behind as a result of this relatively large-scale peat extraction. In the 17th century, among others, the Moer at Eikevliet and the Moer at Kalfort were diked and drained by means of a network of ditches. Today, these wet zones can be recognized as wet, wooded zones, often with ponds that are frequently used as fishing ponds (e.g. Moer near Eikevliet, Moer near Kalfort, Blaasveldbroek, depressions north and south of Ruisbroek, Broek De Naeyer and Biezenweiden). These forests often still show remnants of poplar plantations from the 20th century, but have been given free rein in recent decades, thus developing valuable alluvial forests.

The Hazewinkel water sports course and the Bocht sailing pond have different origins: these sand extraction pits were dug in the 1970s to fill a number of clay pits in the Boom Cuesta, on the other side of the Rupel.

The original Willebroek Canal was already dug in the 16th century and connected Brussels with the Rupel via Klein-Willebroek. In the 20th century, the canal was modernized and connected directly to the Scheldt at Wintam, leaving the port of Brussels accessible for seagoing vessels.

Relation with other geosites

- The history of the Rupel within the Flemish Valley runs parallel to that of the Scheldt (geosite 30, 31). The land use and the reclamation history in the historical period are also comparable.
- The valley landscape on the left bank of the Rupel contrasts strongly with the cuesta landscape of the Boom Cuesta (geosite 32) on the right bank.

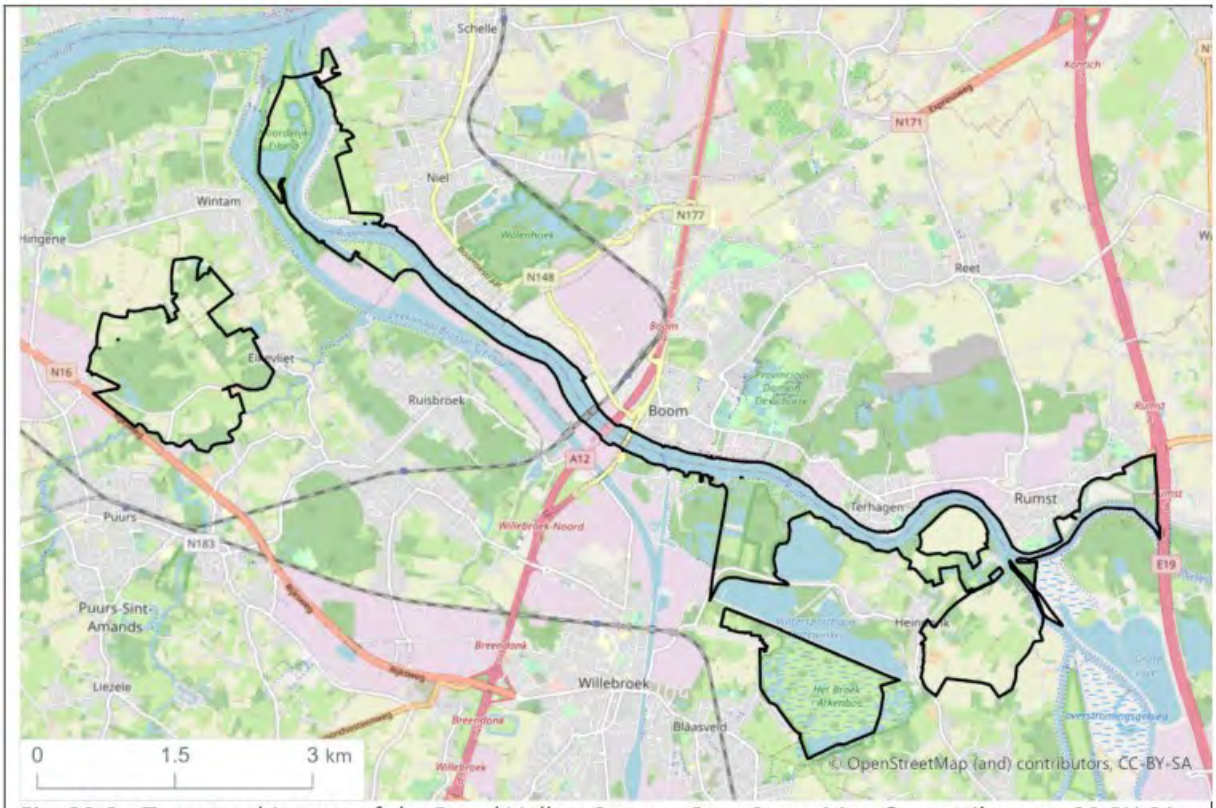

Fig. 33.2. *Topographic map of the Rupel Valley. Source: OpenStreetMap & contributors. CC-BY-SA.*

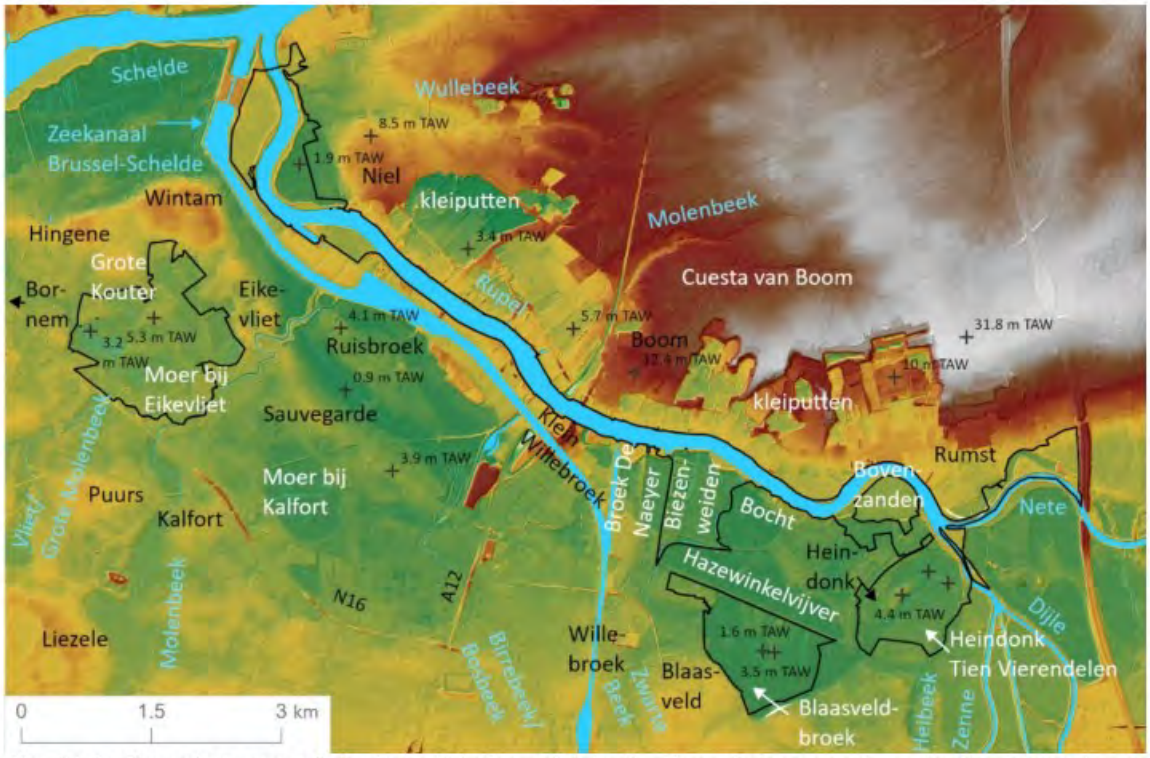

Fig. 33.3. Elevation map of the Rupel Valley, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency.

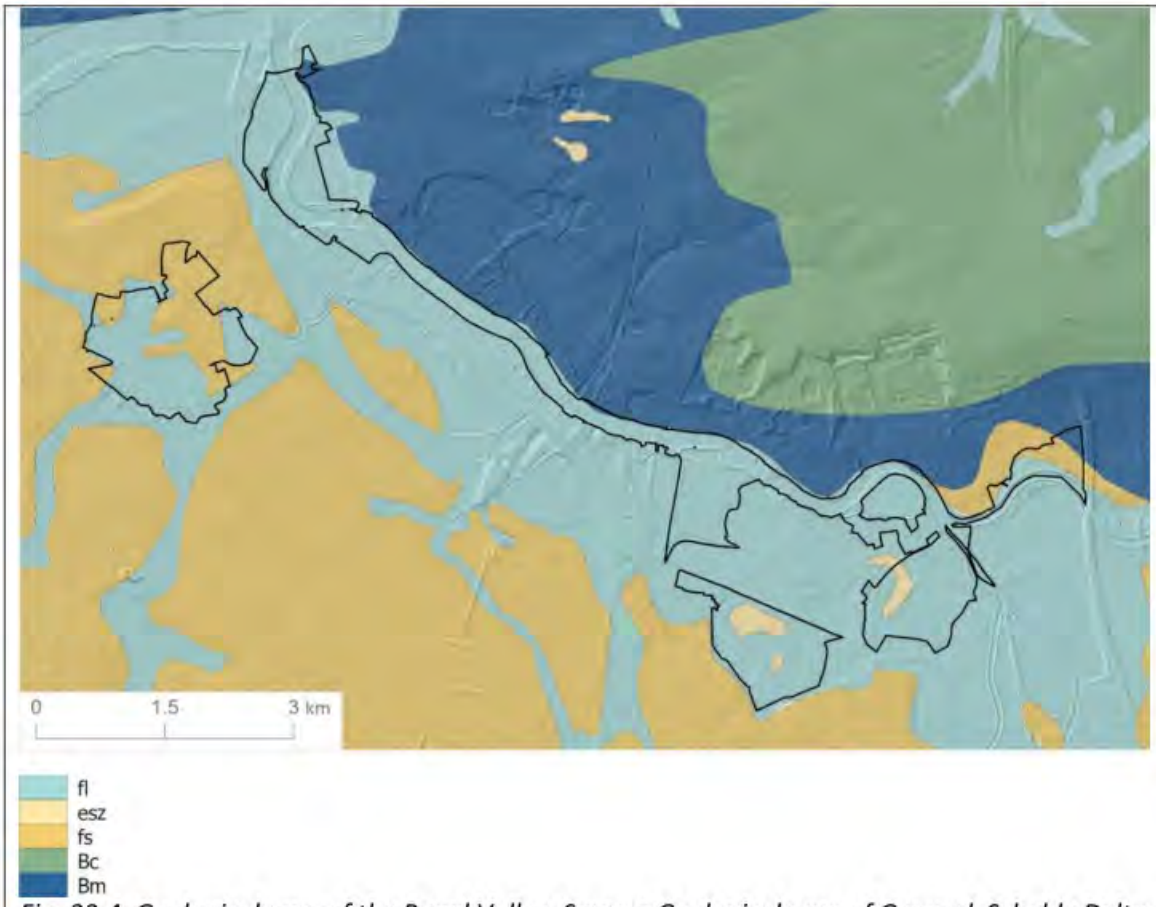

Fig. 33.4. Geological map of the Rupel Valley. Source: Geological map of Geopark Schelde Delta, TNO.

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Geosite n°34	**Barbierbeek Valley** A strongly meandering stream in the convex field area.
 Fig. 34.1. Map of Geopark Schelde Delta. Barbierbeek Valley is number 34.	**Scientific importance and valuation of the geosite** Meandering streams are rare in Flanders (Vlaanderen). Most brooks have been straightened. In the Barbierbeek Valley, however, the meanders have been nicely preserved. What's more: the processes of meandering are still active there. The convex fields are preserved at their best along the edges of the valley. The parcel boundaries, which largely coincide with the historical parcel boundaries, are also of great botanical value.
Municipality	Kruibeke
Province and country	Oost-Vlaanderen, Belgium
Protection status	Protected cultural-historical landscape
Site management organizations	Natuurpunt vzw, De Vlaamse Waterweg nv, Province of Oost-Vlaanderen, Municipality Kruibeke
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Occasional excursions/guided tours - Route that one can travel independently - Information panels
Relevance for education	- Occasional excursions/guided tours - Route that one can travel independently - Information panels
Teaching equipment	The Barber Guides provide guided tours in and around Kruibeke.

Cod	**Significance**
G-34	Provincial
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: The Barbierbeek is the largest stream draining the dip slope of the Waasland cuesta and this downstream reach shows a marked incision of up to 10 m into the resistant Oligocene clay of the Boom Formation as well as an actively meandering course with meander cutoffs and small-scale point bars and levees. Along the edges of the valley, convex fields ('bolle akkers') are well preserved, which are unique to the Waasland region and result from Late Medieval agricultural practices to improve soil drainage and fertility.	

Sedimentology: not applicable.

DETAILED DESCRIPTION

1. **Location**

The Barbierbeek is a 20 km long watercourse in the Scheldt Basin and is the largest brook in the Waasland. The brook runs from the border between Elversele and Waasmunster north-eastwards towards Velle and consists in that part of a series of rectilinear canals. From Velle, the Barbierbeek takes the form of a strongly meandering stream that runs eastwards towards the Scheldt. Between the village centers of Bazel and Kruibeke, the Barbierbeek crosses the ring dike of the Kruibeke flood control area and runs through the flood plain for a kilometre, before flowing into the Scheldt. The catchment area of the Barbierbeek and its tributaries covers approximately 3700 ha and is located entirely on the dipslope of the Waasland cuesta.

2. Landscape formation

To understand the origin of the Barbierbeek Valley, we must first outline the formation of the Waasland cuesta.

Clay deposition in the Oligocene North Sea

The formation of the Boom Cuesta started about 32 million years ago, during the Early Oligocene. In this period, the continents were not quite arranged as they are today. South of the geopark, the Artois axis formed a land bridge between Great Britain and the Ardennes. The Netherlands and the north of Belgium were below sea level (Fig. 34.5).

Sediment originating from the erosion of the surrounding continents was deposited in the Oligocene North Sea. The coarser particles (sand) mainly ended up close to the coasts. Finer particles (silt and clay) drifted further and settled in the deeper parts of the basin. During periods of low relative sea level, the area around Boom was close to the coast. This resulted, for instance, in the deposition of sand in the Ruisbroek Member (upper part of the Zelzate Formation, Fig. 34.6). Between about 32 million and 30 million years ago, there was a period in which the sea in northern Belgium and the Netherlands was 50 to 150 m deep and in which clay was deposited. The result is the Boom Formation: a clay layer about 100 m thick with a characteristic pattern of horizontal light and dark grey bands (Fig. 34.6).

Formation of a cuesta by tectonics and erosion

While sedimentation was taking place in the North Sea Basin, plate tectonics in southern Europe triggered important changes: the collision of the African and Eurasian plates caused the formation of several mountain ranges, such as the Pyrenees and the Alps. Due to the uplift of the land in the south, the crust in the north sank over millions of years and the deposits of the Boom Formation, among others, tilted into a north-easterly inclined position (Fig. 34.6).

South of the line Waasmunster – Temse – Rupelmonde, at the present-day Durme and Scheldt, the layer rose above sea level and was exposed to erosion. The firm clay of the Boom Formation was more resistant to erosion than the underlying and overlying sand layers. As a result, the rivers of the Flemish Valley – the Pleistocene predecessor of the rivers of the Scheldt Basin – could cut into the sand of the Ruisbroek Member more quickly than in the Boom clay. The result is a cuesta: an asymmetrical hill with a steep slope to the south (the cuesta escarpment) and a gentle slope to the north (Fig. 34.6).

Covering of the dipslope of the cuesta

Neogene North Sea sediments are found on the dipslope of the Waasland cuesta. To the north, in the Campine area and in the Netherlands, where the Boom Formation has sunk deeper, these Neogene sediments become thicker. Later erosion largely effaced these Neogene sediments, leaving behind only a gravel layer with shark teeth and weathered bones of marine mammals.

North of the Barbierbeek, the sands of the Kattendijk Formation (Early Pliocene, ca. 5 million years ago) have been preserved (Fig. 34.6).

During the last ice age, at the end of the Pleistocene, strong north-westerly winds carried large amounts of sediment and not only filled in most of the river valleys, but also formed a thin layer of coversand on top of the dipslope of the cuesta.

Meandering stream

It is not possible to determine exactly when the Barbierbeek Valley originated. Presumably the valley was already formed during the lateglacial, between about 15,000 and 12,000 years ago, by a predecessor of the Barbierbeek. In any case, the Barbierbeek became an increasingly important watercourse in the last few thousand years: the groundwater level rose during the Holocene and the water discharge increased. The poor permeability of the clay layer of the Boom Formation enhanced this effect. Due to the increasing deforestation during the Late Holocene, the soil in the catchment area was also increasingly exposed to erosion and the sediment load of the stream increased. This resulted in very active sedimentation and erosion processes in the Barbierbeek Valley: meanders developed because the stream eroded the outer bends further and further and sediment was deposited in the inner bends – where the steam velocity is low. In the 20th century this process was only amplified by the increase in impermeable surface, especially the E17 motorway. In case of heavy precipitation, a lot of water has to be drained in a short time. In view of the poor drainage in the area, this causes flooding problems and further bank erosion on the outer edges of the meanders.

Formation of the convex fields

The landscapes on the Waasland cuesta were not suitable for intensive agriculture until the Middle Ages because of the unfavorable soil, namely a poor sandy soil and – due to the shallow clay – also wet. From the late 15th century, in the region around the Barbierbeek Valley, the practice arose to create deep ditches around block-shaped plots, often smaller than 1 ha, to improve drainage and run-off. The excavated loamy and calcareous soil was brought onto the fields and thus improved the soil fertility. This made the arable soil up to 1.2-1.6 m higher than the edges of the plot and therefore also at a greater distance from the shallow groundwater table and thus drier. The fields were ploughed in such a way that the spherical profile was preserved. Hence the name bolle akkers or 'convex fields'. Despite the fact that similar techniques were also applied elsewhere in Flanders, this spherical shape was most pronounced and symmetrical on the dipslope of the Waasland cuesta, where the clay substrate was located at a shallow depth (2-4 m). No major changes have taken place in the rural parcelling structure since the Late Middle Ages, so that the convex field landscape has largely been preserved to this day. There is a risk of erosion along the Barbierbeek because ploughing is carried out to the edge of the stream and felled trees and shrubs are not replanted.

Relation with other geosites

- The Barbierbeek springs on the escarpment of the Waasland cuesta (geosite 35) and, together with its tributaries, drains a large part of this cuesta.
- Between Kruibeke and Rupelmonde, the Barbierbeek flows into the Scheldt valley, crossing the former Kruibeke polders (Kruibeke flood control area, part of geosite 30), before debouching into the Scheldt.

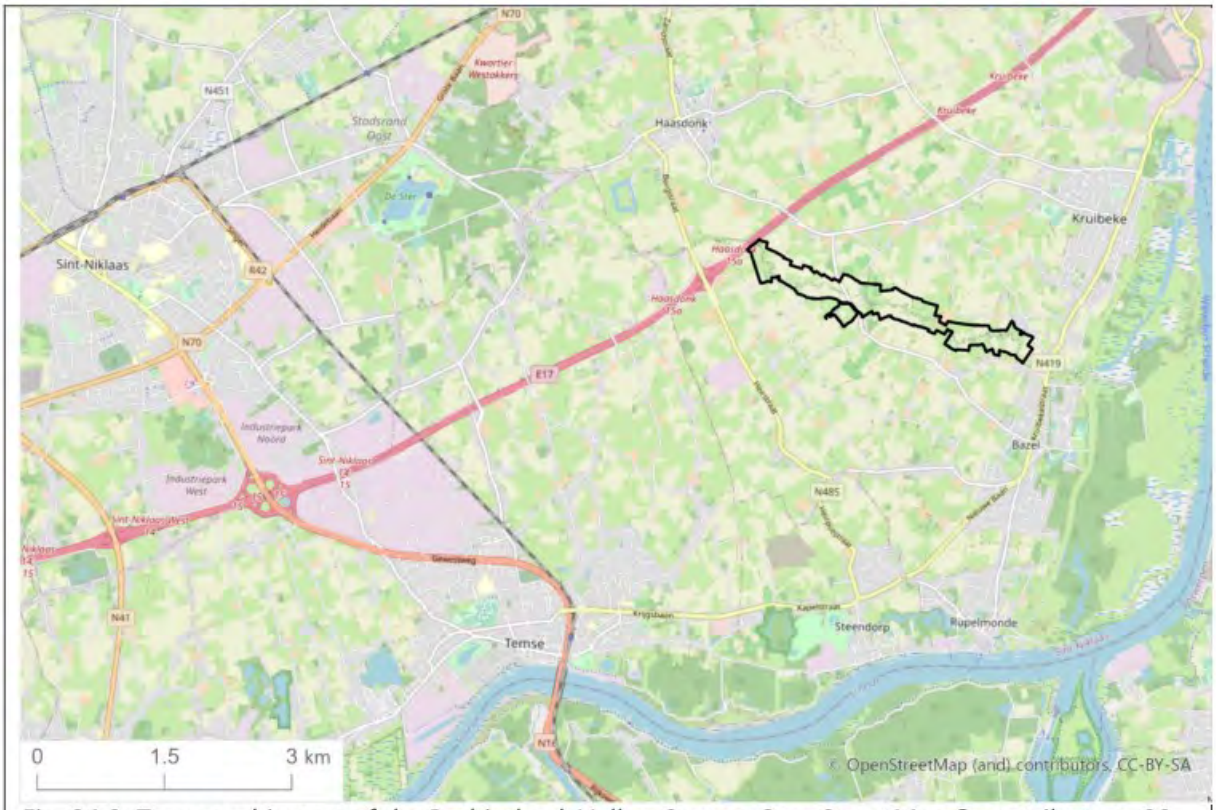

Fig. 34.2. Topographic map of the Barbierbeek Valley. Source: OpenStreetMap & contributors. CC-BY-SA.

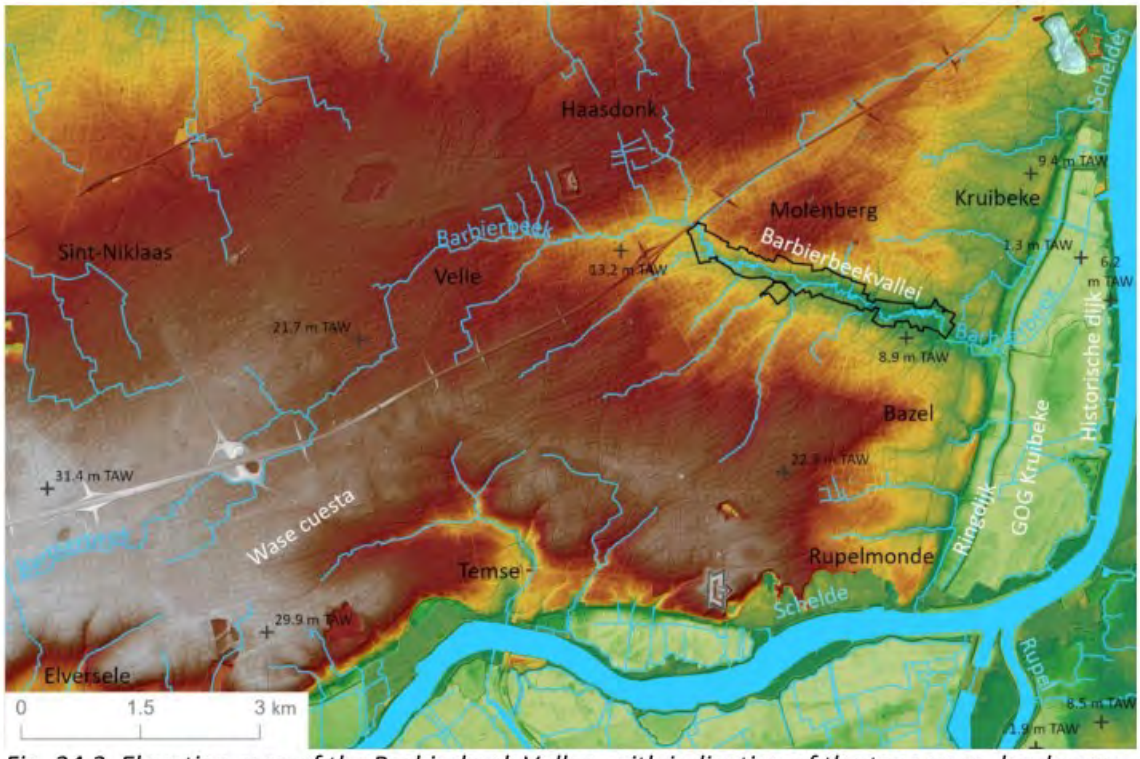

Fig. 34.3. Elevation map of the Barbierbeek Valley, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency.

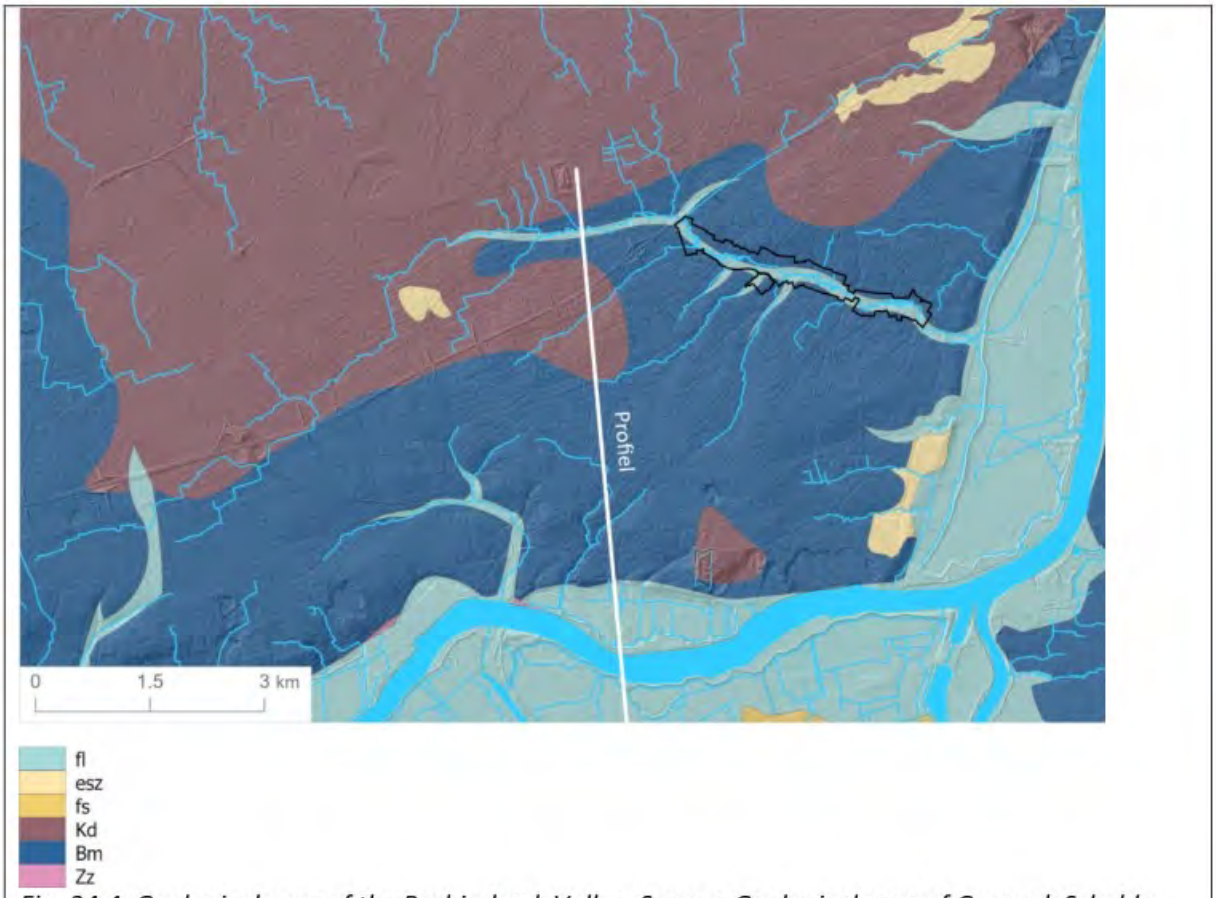

Fig. 34.4. Geological map of the Barbierbeek Valley. Source: Geological map of Geopark Schelde Delta, TNO.

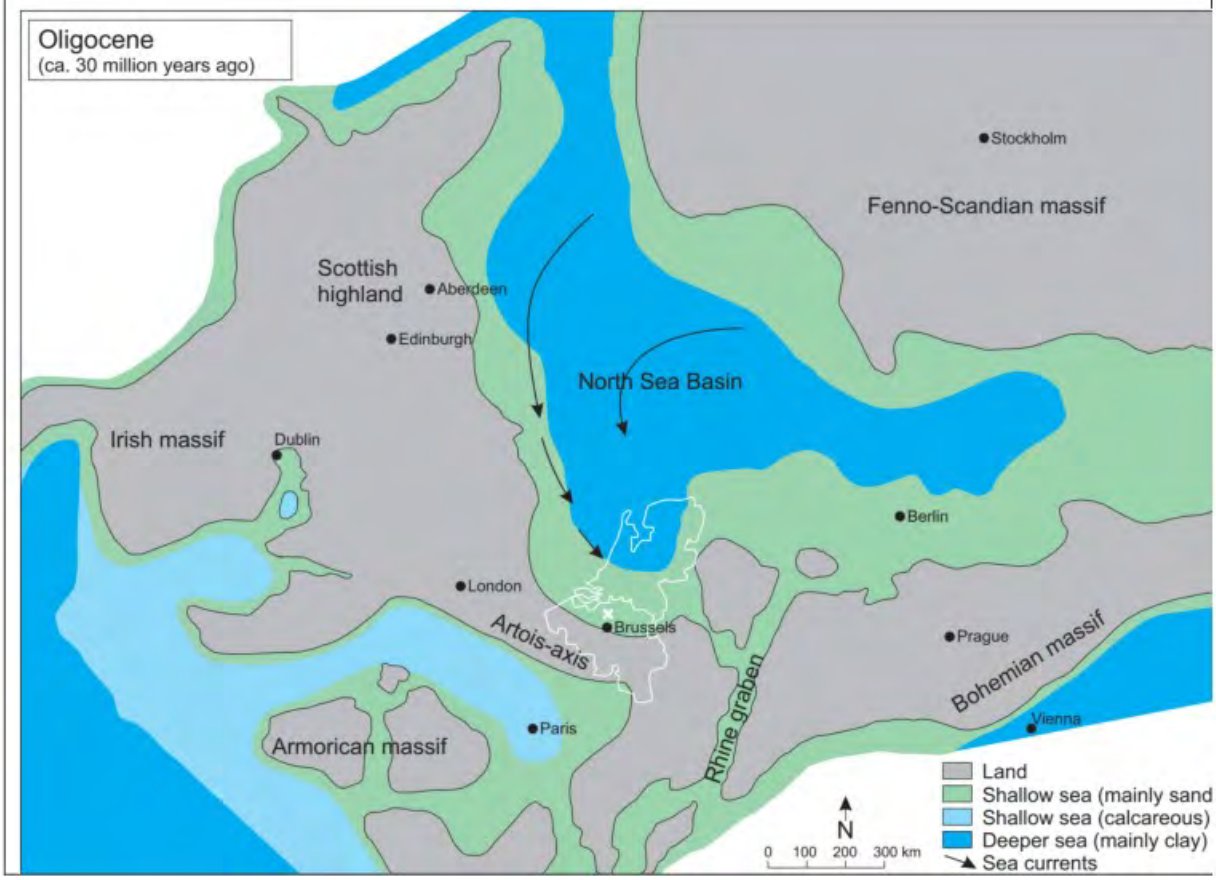

Fig. 34.5. Paleogeographic map of north-western Europe during the Oligocene. Adapted from Vandenberghe, De Craen & Wouters, 2014.

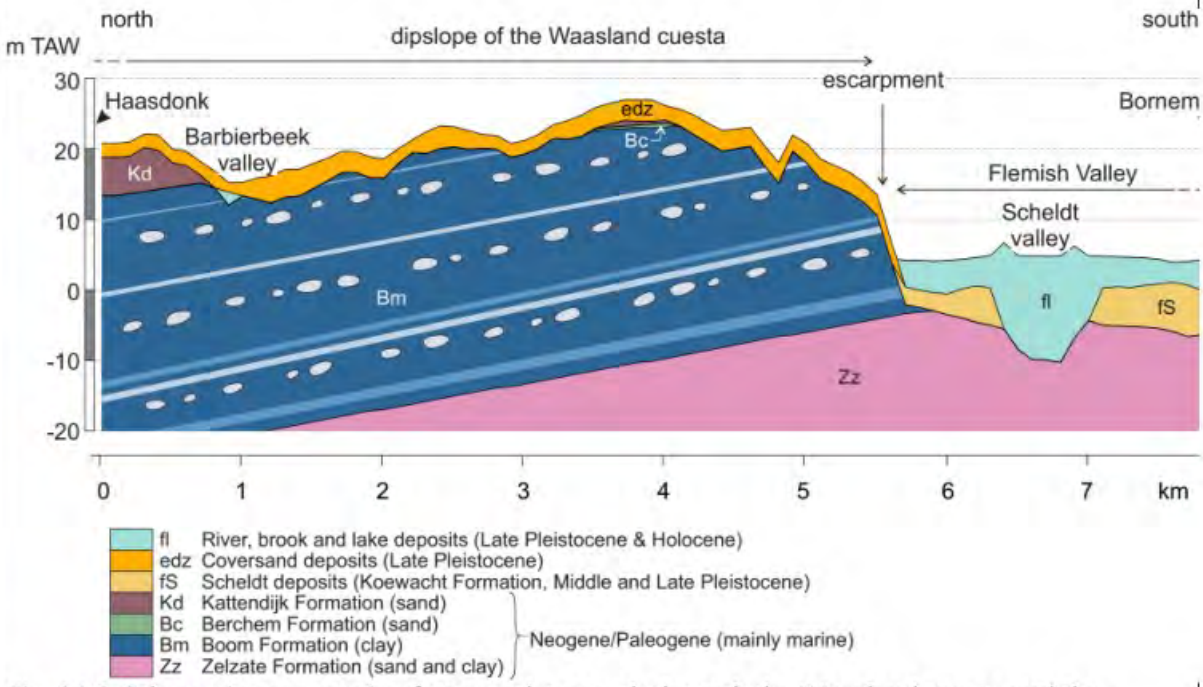

Fig. 34.6. Schematic cross-section from north to south through the Waasland cuesta and the Barbierbeek Valley. Location: see geological map (Figure 34 3). Based on a virtual profile (dov.vlaanderen.be).

Fig. 34.7. Aerial photograph with hillshade effect of the relief of the convex fields around the strongly meandering Barbierbeek just before it flows into the polder of Bazel. Source: geopunt.be.

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Geosite n°35	**Waasland cuesta** An asymmetrical clay hill provides an important (pre)historical mineral resource and leads to a cultural landscape with characteristic convex fields.
 Fig. 35.1. Map of Geopark Schelde Delta. Waasland cuesta is number 35.	**Scientific importance** The Waasland cuesta is less internationally known than its Boom counterpart on the right bank of the Scheldt and Rupel. In the 19th century, however, the convex fields of the Waasland were internationally known among agronomists and today still have an (inter)national geographic and heritage value, since this type cultural landscape is most pronounced here. The current landscape on the escarpment is strongly intertwined with its (early) modern industrial history. The clay pits have a far-reaching influence on the appearance of the landscape. Their modern use has given them a national natural importance, just like the Steendorp Fort. This fortification also has an important architectural heritage value. The quarries on the escarpment are known among fossil collectors for the snails, bivalves and fish remains, including shark teeth from the Boom and Berchem Formations and at the boundary with the overlying Pleistocene coversands. The Boom Formation also appeals to mineral enthusiasts looking for septaria and pyrite crystals.
Municipality	Temse
Province and country	Oost-Vlaanderen, Belgium
Protection status	Waasland cuesta: protected cultural-historical landscape; Fort Steendorp: protected monument
Site management organizations	Agentschap voor Natuur en Bos, municipality Temse
Accessibility	Site is accessible to the general public.
Relevance for tourism	Routes that one can travel independently as part of longer hiking and cycling trails.
Relevance for education	- Excursions - Route that one can travel independently - Information panels
Teaching equipment	The Waasland cuesta originally formed one entity with the Cuesta of Boom (geosite 32), where the same clay

	comes to the surface. Today, both cuesta are separated by the freshwater tidal flats and the polders of the Scheldt (geosite 30).There are several information panels.

Code	Significance
G-35	International

Geological interest(s)

Paleontology: The Boom Formation and the Rupelian stratotype, exposed in the clay quarries on the cuesta, have been the topic of many micropaleontological investigations (foraminifera, ostracods, pollen, spores, and dinoflagellates), while macrofossil studies have focused on bivalves, decapods and fish remains.

Stratigraphy: The research outlined above in this area and at geosite 32 has led to the establishment of the stage name Rupelian in the International Commission of Stratigraphy reference chronostratigraphic chart, pointing to the importance of this Oligocene historical unit-stratotype area in this area (see also the Geological Time Scale editions of 2012 and 2020).

Geomorphology: The prominent asymmetrical landform or cuesta was formed in the resistant clay layers of the Oligocene Boom Formation and testifies of the deep differential erosion of the Paleogene sequence of alternating clay and sand layers by rivers of the Scheldt basin during the Middle and Late Pleistocene.

Sedimentology: Many aspects of the sedimentology, mineralogy, and geochemistry of the Rupelian Boom Formation, exposed in the clay quarries on the cuesta, have been studied in detail and with up-to-date methodologies in international collaboration studies, to identify a.o. depositional environments, sea-level changes, and tectonic and climatic signals, as well as for application purposes such as coarse ceramics, civil engineering, discontinuity structures etc.

DETAILED DESCRIPTION

1. **Location**

The geosite is located on the south side of the Waasland cuesta between Waasmunster and Rupelmonde and borders the Durme and the Scheldt to the south. On the elevation map, the Waasland cuesta is the extension of the Boom Cuesta, which is located on the right bank of the Scheldt and the Rupel. The Hoboken gap is the border between the two cuestas and a passage for the Scheldt. At over 30 m TAW, the top of the cuesta is remarkably higher than the floodplain of the Scheldt (1 to 2 m TAW) to the south of it. The original relief of the steep escarpment has been disturbed locally by several stream valleys, clay quarries and the Steendorp Fort. The cuesta descends with a gentler slope to the north and is covered there by the Waasland Scheldt Polders.

2. Landscape formation

The Waasland cuesta developed in three geological steps. The outcropping clay formed an important (pre)historical mineral resource and the shallow clay was decisive for the development of the typical Waasland landscape with convex fields.

3. Formation of the cuesta

A cuesta is an asymmetric ridge that arises when geological layers tilt and then erode at different rates due to their different composition. The sloping layer, which erodes less quickly, partly remains as an elevation in the landscape. Where the softer layer has eroded, a steep slope is created transverse to the hard layer: the escarpment. Parallel to the sloping, erosion-resistant layer, a gentler slope is created: the dipslope.

<u>An alternating depositional environment in the Oligocene North Sea</u>

The formation of the Waasland cuesta started about 32 million years ago, during the Early Oligocene. In this period, the continents were not quite arranged as they are today. South of the

geopark, the Artois axis formed a land bridge between Great Britain and the Ardennes. The Netherlands and the north of Belgium were below sea level (Fig. 35.5).

Sediment originating from the erosion of the surrounding continents was deposited in the Oligocene North Sea. The coarser particles (sand) mainly ended up close to the coasts. Finer particles (silt and clay) drifted further and settled in the deeper parts of the basin. During periods of low relative sea level, the area around Boom was close to the coast. This resulted, for instance, in the deposition of sand in the Ruisbroek Member (upper part of the Zelzate Formation, Fig. 35.6) between the Eocene and the beginning of the Oligocene (ca. 38-33 million years ago). Between about 32 million and 30 million years ago, there was a period in which the sea in northern Belgium and the Netherlands was 50 to 150 m deep and in which mainly clay-rich layers were deposited on the sea floor. These clay layers are known as the clay of the Boom Formation.

Water depths fluctuated frequently due to a combination of plate tectonics and climatic variations. This resulted in a varying supply of organic and mineral material from the land in the North Sea Basin. As a result, the Boom Formation does not consist of a homogeneous deposit of clay. It consists, however, of an approximately 100 m thick layer of alternating beds (tens of cm thick) with more or less silt, carbonate and organic material. The result is the Boom Formation: a clay layer about 100 m thick with a characteristic pattern of horizontal light and dark grey bands, the sequence of which can be read as a kind of bar code (Fig. 35.6). In the calcareous layers, bread-shaped calcareous concretions of several decimeters in horizontal cross-section formed after burial: the so-called septaria of the Boom clay. Minerals such as pyrite crystallized in the cracks of these septaria.

<u>Tilting of the Eocene layers by plate tectonics</u>
While sedimentation was taking place in the North Sea Basin, plate tectonics in southern Europe triggered important changes: the collision of the African and Eurasian plates caused the formation of several mountain ranges, such as the Pyrenees and the Alps. Due to the uplift of the land in the south, the crust in the north sank over millions of years and the deposits of, among others, the Boom Formation, tilted from their original horizontal stratification into a north-easterly inclined position (Fig. 35.6).

North of the escarpment, the Boom Formation now lies in the (deep) subsurface. South of the present-day Scheldt and Durme, the layer rose above sea level and was exposed to erosion. Miocene North Sea sediments are found on the dipslope of the Waasland cuesta. Later erosion by the advancing sea largely effaced these sediments, leaving behind only a gravel layer with shark teeth and weathered bones. The sands of the Kattendijk Formation (Early Pliocene, ca. 5 million years ago) were deposited on top of this and have been preserved locally on the Waasland cuesta (Fig. 35.6).

<u>Forming of a cuesta by tectonics and erosion</u>
The tilting to above sea level exposed the Neogene marine sediment layers to erosion. However, the firm, clayey layers of the Boom formation were more resistant to this than the underlying and overlying sand layers. As a result, the Flemish Valley – the Pleistocene predecessor of the rivers of the Scheldt Basin – was able to incise faster into the sandy Ruisbroek Member (Zelzate Formation) than into the Boom clay. Throughout the Pleistocene, the Flemish Valley was gradually filled up. At the end of the last ice age and during the Holocene, the current Scheldt valley developed just south of the Waasland cuesta. During the last ice age, a thin layer of (cover) sand (and sandy loam in the south-east), was deposited, separated by a south-west-northeast oriented sand ridge. However, due to the impermeable clay layer, the area has a high groundwater level.'

4. Human use of the cuesta

Creation of a cultural landscape on the cuesta: the convex fields of the Waasland

The landscapes on the Waasland cuesta were not suitable for intensive agriculture until the Middle Ages because of the unfavorable soil. The sandy soil is not only poor, but also wet due to the shallow clay. Etymologically, the word “Waas” goes back to terms that indicate mud and/or barren, waste ground. This can refer either to the cuesta or to the former tidal area in the Waasland Scheldt Polders. Still, in slightly more fertile locations on the cuesta, such as sandy loam soils, there are indications of local habitation, agriculture and artisanal activities from the Metal Ages, Roman times and Early Middle Ages.

Until the 13th century, however, more than half of the Waasland remained covered by a large "primal forest", known as the Koningsforeest (king’s forest). This originally Carolingian royal hunting ground was owned by the Counts of Flanders (Vlaanderen) during the High Middle Ages. The conversion to cultivated land only started in the late 12th century when farmers acquired property rights over long, wide parcels of land. In the 13th to 15th century, these were split into smaller, squarer parcels.

From the late 15th century and during the 16th century, which was a period of agricultural individualization and strong fragmentation of farms, further intensification and maximization of agricultural work took place on these block-shaped parcels, often smaller than 1 ha. Canals were dug at the edges of these plots to improve drainage and run-off. The excavated loamy and calcareous soil was brought onto the fields to improve the soil fertility. As a result, the arable soil was up to 1.2-1.6 m higher than at the edges of the plot and therefore also at a greater distance from the shallow groundwater table and thus drier. The fields were ploughed in such a way that the spherical profile was preserved. Hence the name ‘convex fields'. Despite the fact that similar techniques were also applied elsewhere in Flanders, this convex shape was most pronounced and symmetrical on the dipslope of the Waasland cuesta, where the clay substrate was located at a shallow depth (2-4 m). On the driftsand ridges and in closed depressions, the fields are less arched (0.3-0.6 m difference in height). At the beginning of the 17th century, the Waasland cuesta had about 35,000 such fields and the original forest landscape had almost completely disappeared. In later times, there were no major changes in the rural parcelling structure. In the early 19th century, the intensity of the tillage and the beauty of the convex fields with surrounding vegetation on the margins of the fields were even praised by foreign agronomists.

The present more or less continuous forest area on the cuesta between Waasmunster and Belsele was only created around the middle of the 19th century, when the remaining heathland was systematically replaced by conifer plantations.

The cuesta clay as a mineral resources

The clay of the Waasland cuesta is one of the oldest known resources for the production of pottery in sandy Flanders. The oldest earthenware pots from this region date from the early Neolithic and were made, among others, from Boom clay around 4500 BC. The use of this clay only really took off during Roman times. Temse may have had a central function in this period. Archaeological finds point to for instance artisanal activities, such as pottery and roof tile making, in which Boom clay served as a raw material. The clay was also mined for pottery production in the Middle Ages.

The brick industry started in the 16th century but until the mid-18th century it was mainly for local use. However, during the 19th century brick production flourished, partly due to the construction of a defensive belt of fortifications around Antwerp. Steendorp Fort (built from 1882 to 1892 AD and initially called Rupelmonde Fort) is located at the highest point of the cuesta and has a deep, dry moat. It is the last brick fortress to be built in Belgium and was the pinnacle of military brick fortification between the 13th and 19th centuries. Today the fortress is an important bat habitat.

Until the 1980s, clay mining continued in the Roomkouter quarry, located just east of the Steendorp Fort. However, the later use of the clay pits as a dumping ground for waste and mud was locally controversial. In 2006-2007 the Roomkouter was filled with dredged material and today the partly filled quarry is used as a park and nature reserve. The industrial clay mining on the Waasland cuesta escarpment has created scars that are visible in the landscape to this day. However, just west of the Steendorp Fort, along Scouselestraat, the escarpment is virtually untouched, with the exception of a few shallow, small-scale mining pits.

Relation with other geosites

- The Waasland cuesta originally formed a whole with the Boom Cuesta (geosite 32), where the same clay surfaces.
- Today, both cuestas are separated by the freshwater tidal area and the polders of the Scheldt (geosite 30).
- Both cuestas have also undergone intense mining. The Oedelem-Zomergem cuesta (geosite 40) is a similar landform but consists of older geological layers.
- In the north, the dipslope of the Waasland cuesta disappears beneath the Waasland Scheldt Polders (geosite 28) and borders the coversand ridge in the northwest (geosite 37).
- The Barbierbeek Valley (geosite 34) is a separate geosite but forms the main stream valley on the dipslope of the Waasland cuesta.
- The Steengelaag (geosite 38) is a clay quarry near the western edge of the Waasland cuesta.

Fig. 35.2. Topographic map of the Waasland cuesta. Source: OpenStreetMap & contributors. CC-BY-SA.

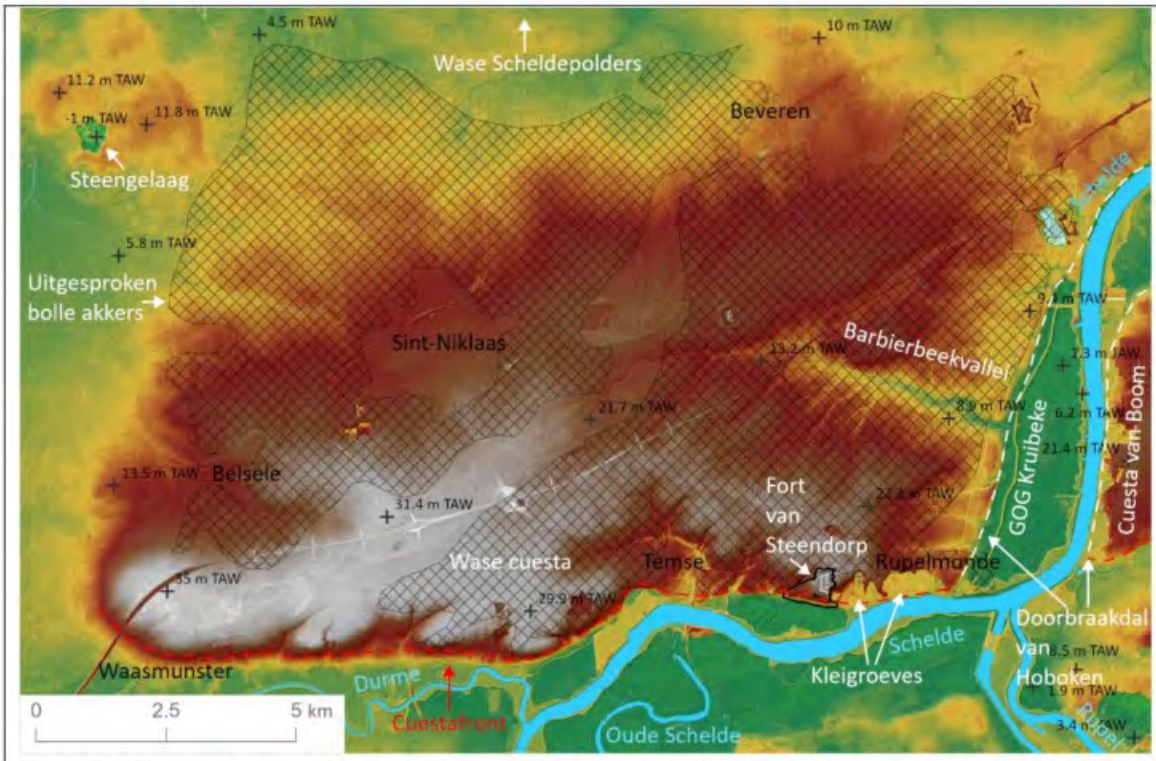

Fig. 35.3. Elevation map of the Waasland cuesta, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency.

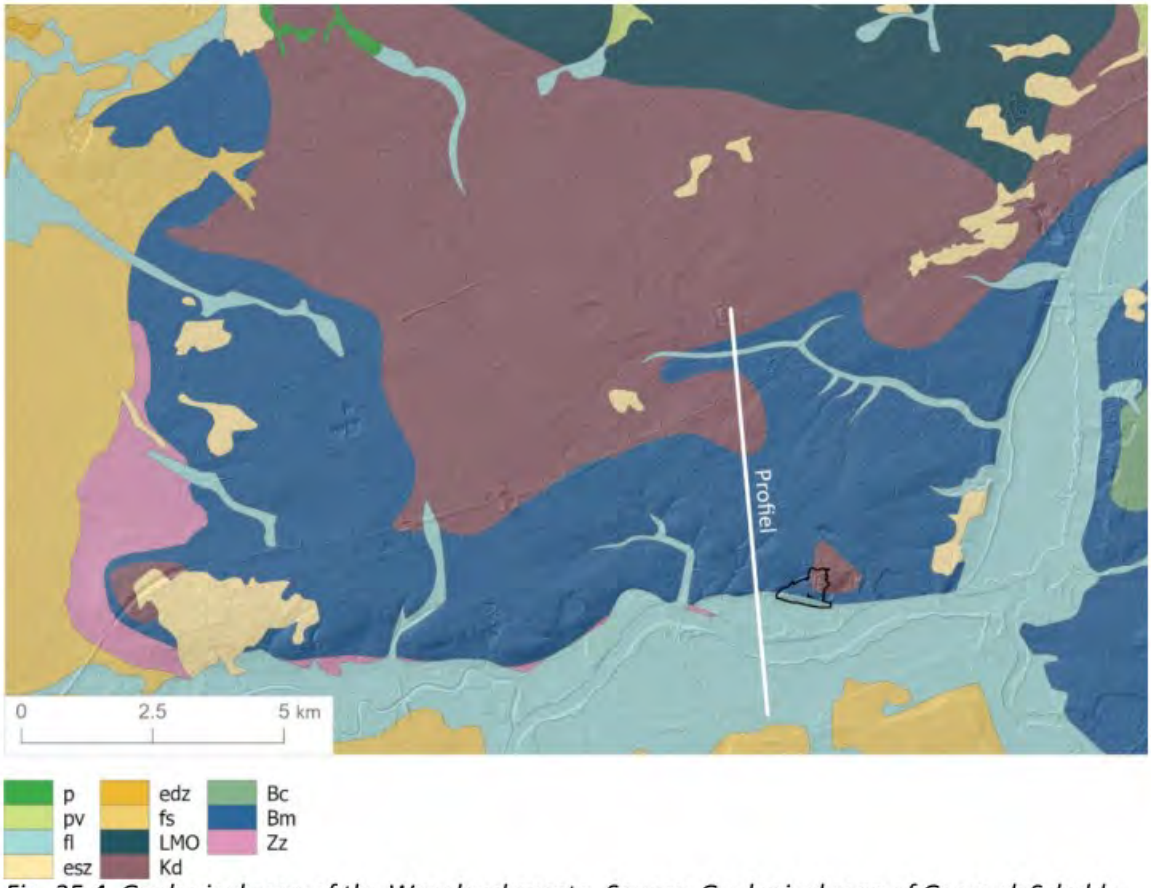

Fig. 35.4. Geological map of the Waasland cuesta. Source: Geological map of Geopark Schelde Delta, TNO.

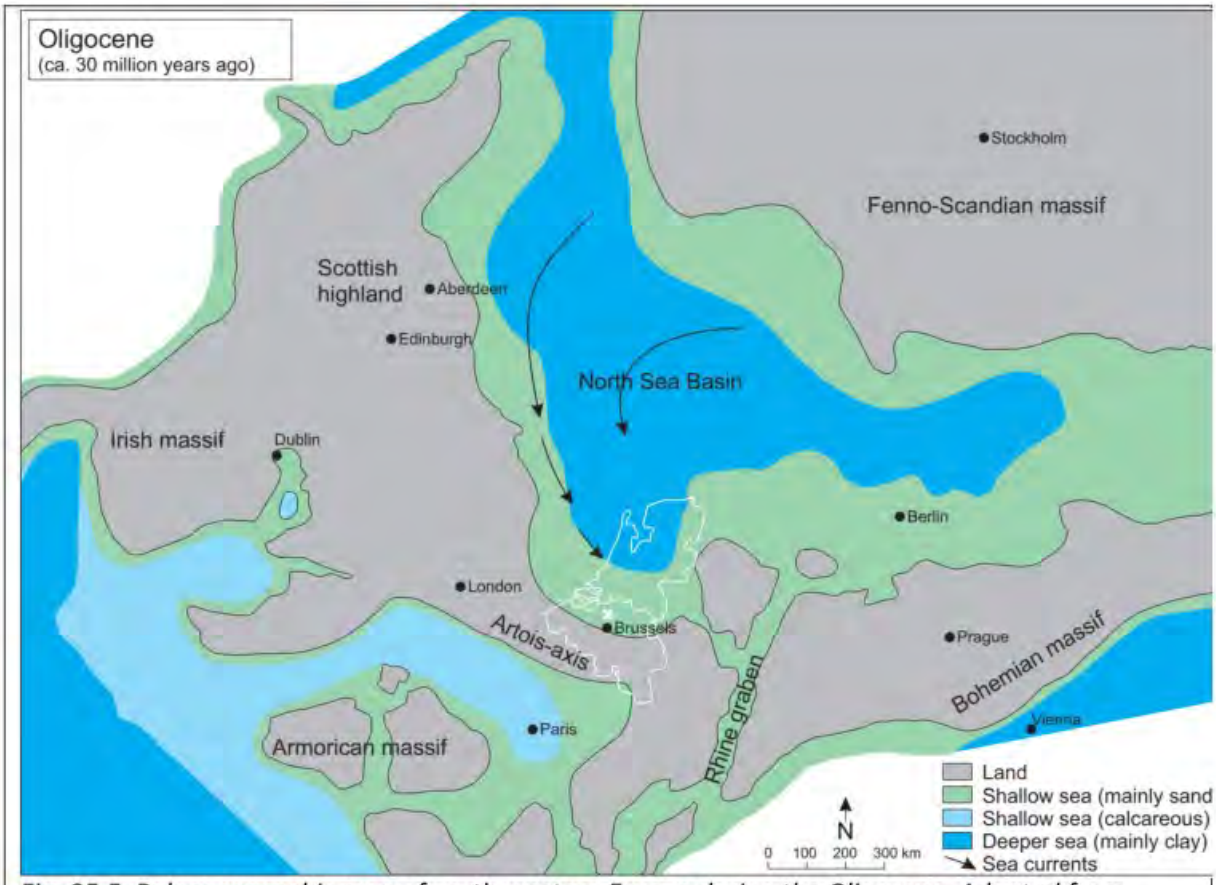

Fig. 35.5. Paleogeographic map of north-western Europe during the Oligocene. Adapted from Vandenberghe, De Craen & Wouters, 2014.

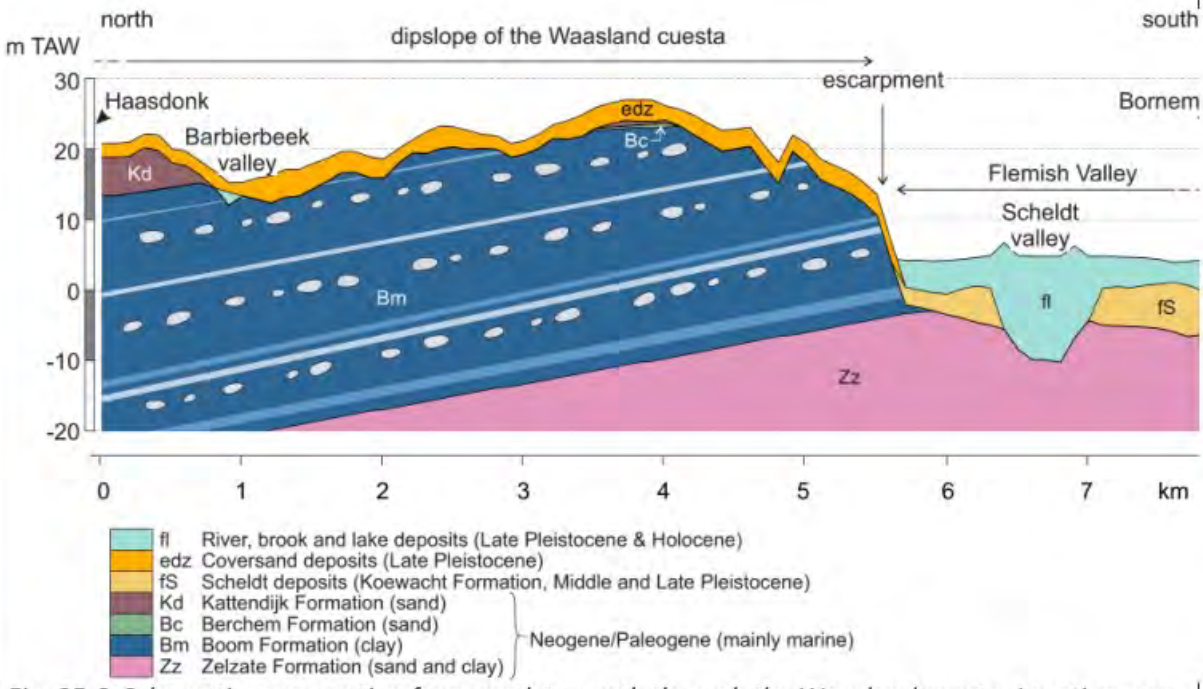

Fig. 35.6. Schematic cross-section from north to south through the Waasland cuesta. Location: see geological map (Fig. 35.4). Based on a virtual profile (dov.vlaanderen.be).

Fig. 35.7. Picture of mechanized reclamation of a clay quarry in Steendorp (Photo: Noël Vandenberghe).

Fig. 35.8. Landscape picture of the convex field landscape of the Waasland (source: Bibliotheca Wasiana vzw, by Robert Delestine).

Fig. 35.9. Aerial photograph with hillshade effect of the relief of the convex fields around the strongly meandering Barbierbeek just before it flows into the polder of Bazel. Source: geopunt.be.

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Geosite n°36	**Paleomeanders Kalkense Meersen and Berlare** The most beautiful lateglacial meandering bends in the Scheldt Valley, with point bar ridges in the inner bends and a history of peat extraction in the peat-filled residual channels.
 Fig. 36.1. Map of Geopark Schelde Delta. Paleomeanders Kalkense Meersen and Berlare is number 36.	**Scientific importance and valuation of the geosite** Palaeomeanders and point bar ridges occur in several places in the Scheldt Valley, but are usually covered by a thick layer of river deposits, making them invisible on the surface. Here the meander bends are exceptionally well developed, and locally well preserved. Moreover, the point bare ridges within the Berlare meander loop are still clearly visible on the surface, because the clay cover is less thick at a certain distance from the current Scheldt. The lakes created by peat extraction emphasize this shape. This makes this geosite the most beautiful location in Flanders (Vlaanderen) to show the meandering to the public, both on the map and in the landscape. In the alluvial plains, peat sequences are preserved within residual channels of the Scheldt, in which most of the Holocene is represented. These provide the opportunity to study the ecological development of the area. In the past, the high sandy zones within the valley attracted human activity and are therefore of great archaeological importance (cf. protected prehistoric site Bergenmeersen; Roman site Wijmeersen, medieval motte Bergenmeersen).
Municipality	Berlare, Laarne, Wetteren, Wichelen
Province and country	Oost-Vlaanderen, Belgium
Protection status	Natura 2000; Het Broek: protected cultural-historical landscape; Turfput: protected cultural-historical landscape; Puddels of Overmere-Donk: protected cultural-historical landscape
Site management organizations	vzw Durme, Natuurpunt vzw, Agentschap voor Natuur en Bos, Vlaamse Landmaatschappij, Municipality Berlare, Municipality Laarne, Municipality Wetteren, Municipality Wichelen
Accessibility	Site is accessible to the general public.
Relevance for tourism	-Visitor center - Excursions/guided tours

	- Routes that one can travel independently
Relevance for education	-Visitor center - Excursions/guided tours - Routes that one can travel independently
Teaching equipment	- Donkmeer Berlare Visitor Centre - Natuurpunt offers guides

Code	**Significance**
G-36	National

Geological interest(s)

Paleontology: The floodplain sediments and residual channel fills, in which most of the Holocene is represented, have been studied on several occasions for paleoenvironmental reconstructions. Moreover, a former sand extraction pit in the Berlare meander has yielded a rich fossil fauna of a.o. Weichselian mammals which is now being re-evaluated for a.o. exposition at a local information center.

Stratigraphy: not applicable.

Geomorphology: This textbook example of Weichselian Lateglacial meanders, much larger than those of the present-day Scheldt and with exceptionally well-preserved and clearly visible point bars and overlying eolian dunes, shows the dynamics of the river system and of environmental change at the transition from glacial to interglacial climate conditions.

Sedimentology: The sedimentology and lithology of the point bar, channel, floodplain and overlying dune deposits has been investigated in several studies and their distribution mapped. This site also offers excellent opportunities to observe and demonstrate the sedimentological and geomorphological products of fluvial processes such as lateral accretion and erosion and channel migration and aggradation both on the map and in the field.

DETAILED DESCRIPTION

1. Location

The geosite is located along the Lower Scheldt, in the freshwater tidal zone. All sub-areas lie entirely within the Scheldt Valley, which is 3 to 5 km wide at the fossil meander loops of the Kalkense Meersen and of Berlare.

The southern edge of the Scheldt Valley is bordered by a clearly defined steep ridge, which bridges an elevation difference of about 6 m. The northern edge of the valley is slightly less pronounced, with an elevation difference of 2 to 4 m. Within the valley, three higher zones are present with elevations up to ca. 10 m TAW. This is where the village centers of Donk, Uitbergen and Berlare are located. The lower parts of the valley are also not flat: there we see an alternation of elongated, arc-shaped heights and depressions with elevation differences of about 0.5 m. The outer bends are under water in some places, for example at Berlare Broek and the Donkmeer.

2. Landscape formation

Formation of the Pleistocene substratum

The substratum into which the current Scheldt Valley is incised, was formed by the filling in of the Pleistocene Flemish Valley. The fill consists of river sediments, deposited by a braided river system. During the Late Pleistocene, strong north-westerly winds brought in large amounts of sand and covered the entire landscape with a layer of coversand.

The lateglacial meandering Scheldt

During the lateglacial, the last 3000 years of the last ice age (14,700 to 11,700 years ago), cold and warmer phases of several hundreds of years alternated. At the beginning of this transitional period, the course of the river adapted to the changing climate: under the influence of the

vegetation cover and a low sea level, at the start of the lateglacial the Scheldt developed from a braided river into a wide meandering stream. Its channel incised more than 10 m deep into the substrate. In addition, over time the river eroded the outer bends of its meanders, causing the channel to shift outwards. As the river migrated, the slower flow rate in the inner bends caused deposition of sediment. By alternating high and low flow rates, point bar ridges and depressions formed parallel to the channel (Fig. 36.6a). These ridges are usually covered by younger sediments, but can still be recognized as elongated, curved ridges in the landscape in for instance the Kalkense Meersen and Overmere Donk.

Finally, the river took a shorter course and the loops were cut off (Figure 36.6b). At the outer bend of the last position of these meander loops we now see an escarpment of 2 to 4 m. The abandoned meander loop then formed an elongated horseshoe lake. Such cut-off residual paleo channels, with a depth of up to about 10 m, can be found in the subsoil of Kalkense Meersen, Wijmeersen, Bergenmeersen, Donk and Berlare Broek.

Under the influence of increasing forest vegetation and soil stabilization between 14,000 and 13,000 years ago, the sediment load and the flow rate of the Scheldt decreased. This put an end to the meander migration.

Dune formation

During the very last cold phase of the lateglacial, from 12,850 to 11,650 cal BP, the vegetation was transformed into an open tundra for the last time. During this period, the wind had free rein again and picked up sand from the riverbed. This driftsand formed sand ridges and dunes along the course of the major rivers (Fig. 36.6c). These river dunes still form remarkable heights within the valley and are often referred to as 'donk'. Along with the point bar ridges, these river dunes remained the only dry locations in the river valleys for a long time during the Holocene. That is why they were very attractive for prehistoric humans, who preferred to stay on dry ground in the immediate vicinity of water. Even in historical periods we see that these dunes are attractive settlement locations.

Holocene infill of the valley

From the Early Holocene onwards, forests developed again. Because these retained more precipitation and prevented erosion, the flow rate of the Scheldt decreased and it turned into a small stream within a swamp forest. The rising water level caused the deep lateglacial channels to be completely filled with peat during the Middle Holocene (Fig. 36.6d-e). Ultimately, an inaccessible, marshy zone with swamp forests formed over the entire width of the Scheldt valley (Fig. 36.6f).

When farmers started to clear more forests and create fields since the Neolithic age (ca. 5000 years ago), soil erosion caused more sediment to end up in the Scheldt again. This ended peat growth and created a new meandering system (Fig. 36.6g) around 2800 years ago, much smaller in size than its lateglacial precursor. This river more or less corresponded to the current course of the Scheldt, except where it was later straightened (e.g. at the Old Scheldt in the Kalkense Meersen and a bend northeast of the Bergenmeersen).

Regular floods from the Roman period onward each left behind a thin sediment layer, so that by the High Middle Ages (1000-1200 AD) a clay layer of about 2m had been formed (Fig. 36.6g). This is the cover layer that still lies at the surface, because from the 11th to the 13th century dikes were systematically built along the rivers, thus ending the flooding.

Exploitation of the valley in the (early) modern era

The reclaimed floodplains in the Kalkense Meersen were used as water-meadows from the 16th century to the 1960s. In addition, the polders in the area were used for mining of natural resources. The peat from the lateglacial channels in Berlare Broek, Turfput, Donkmeer and the Kalkense Meersen was largely excavated from the late 17th century to the early 19th century. Most of the ponds in the area are remains of this peat extraction. The Nieuwdonkvijver is an exception and was created at the end of the 20th century by sand extraction, for among others the construction of the E17 motorway.

Design as flood control areas and nature

Parts of this geosite are included in the Sigma Plan: the Bergenmeersen and part of the Wijmeersen are designed as freshwater tidal nature; the Paardenweide and the rest of the Wijmeersen form flood control areas and the Kalkense Meersen and Paardenbroek are being developed as wetlands. Berlare Broek's poplar plantations are being transformed into native swamp forest.

Relation with other geosites

- Within the Geopark Scheldt Delta, this geosite is the most upstream area in the Scheldt Valley. The development history is very similar in the Scheldt Valley between Dendermonde and Antwerp (geosite 30), the Durme Valley (geosite 31) and the Rupel Valley (geosite 33).

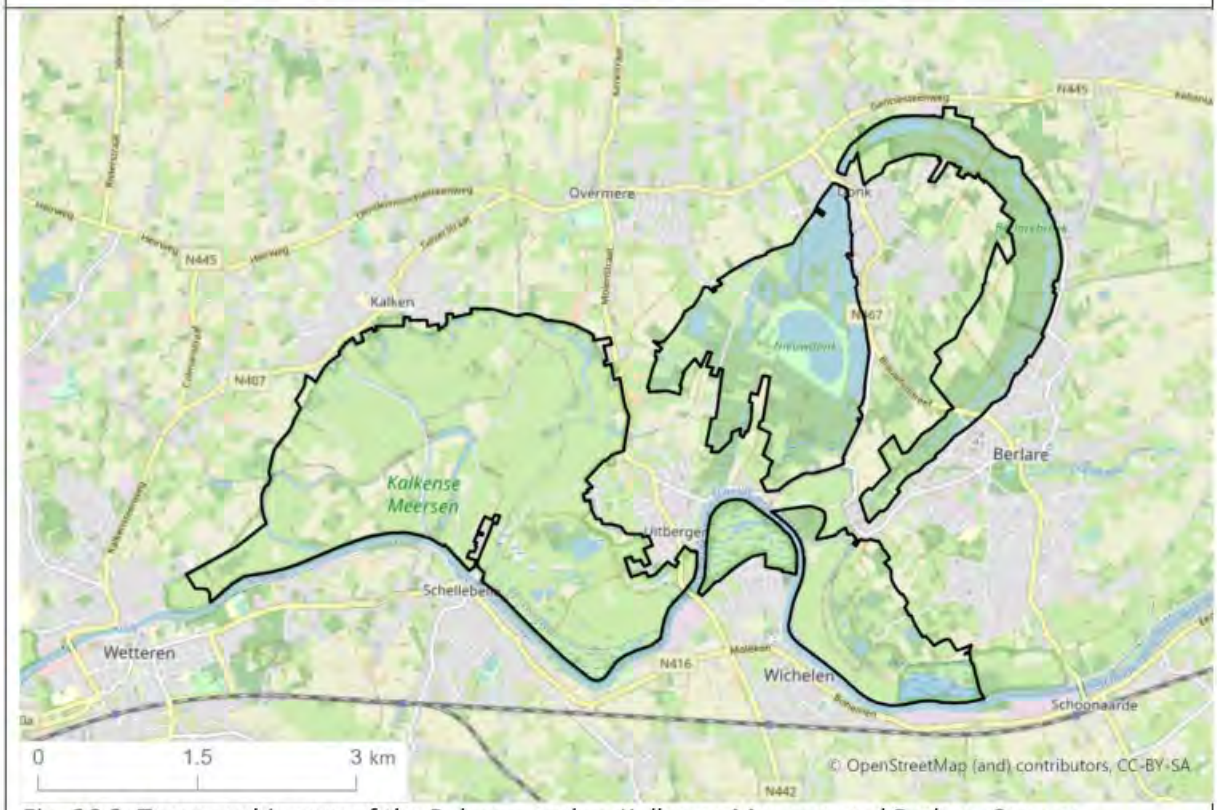


Fig. 36.2. Topographic map of the Paleomeanders Kalkense Meersen and Berlare. Source: OpenStreetMap & contributors. CC-BY-SA.

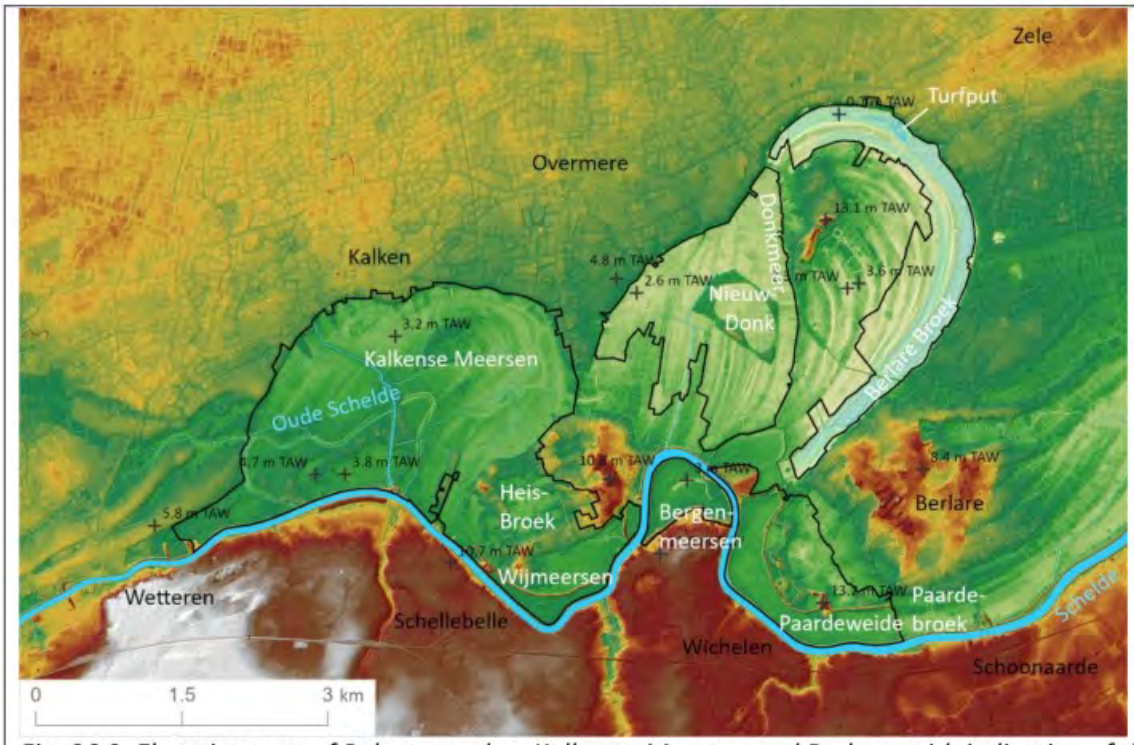


Fig. 36.3. Elevation map of Paleomeanders Kalkense Meersen and Berlare, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency.

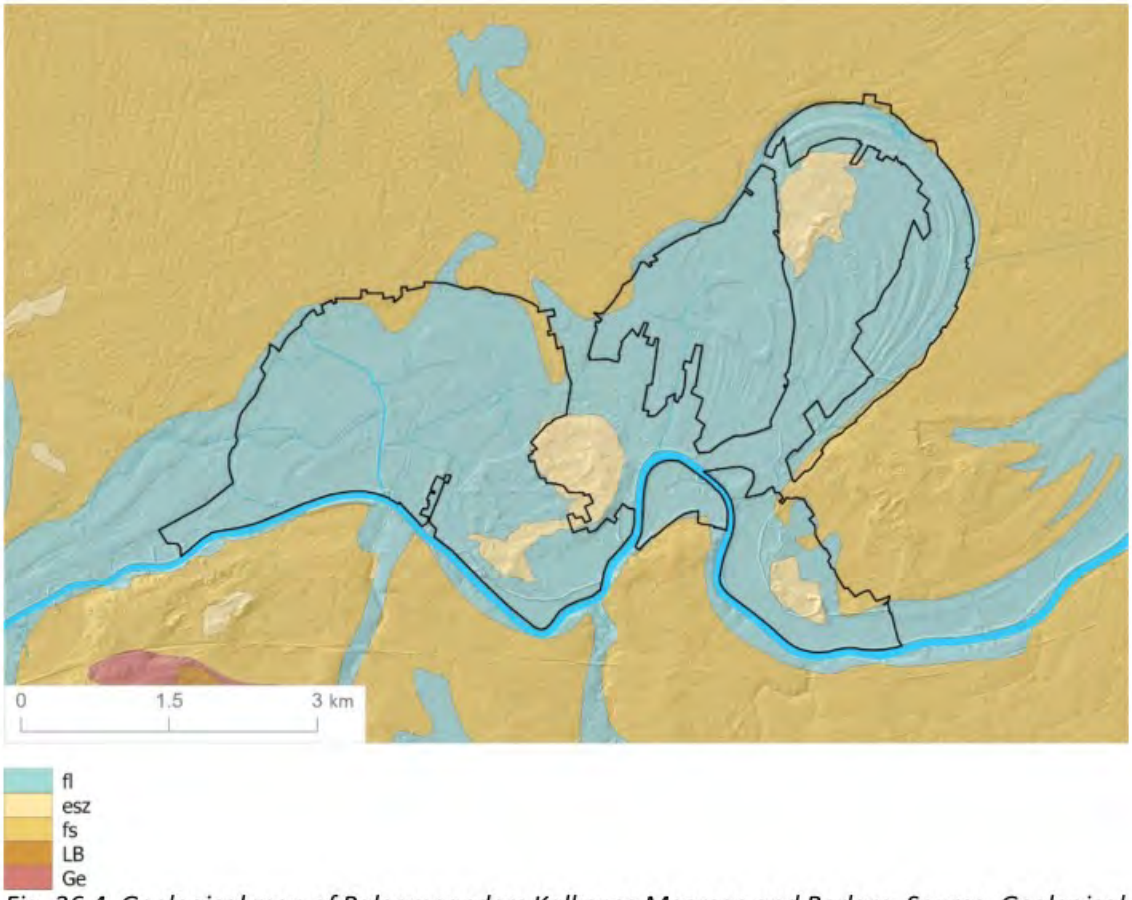
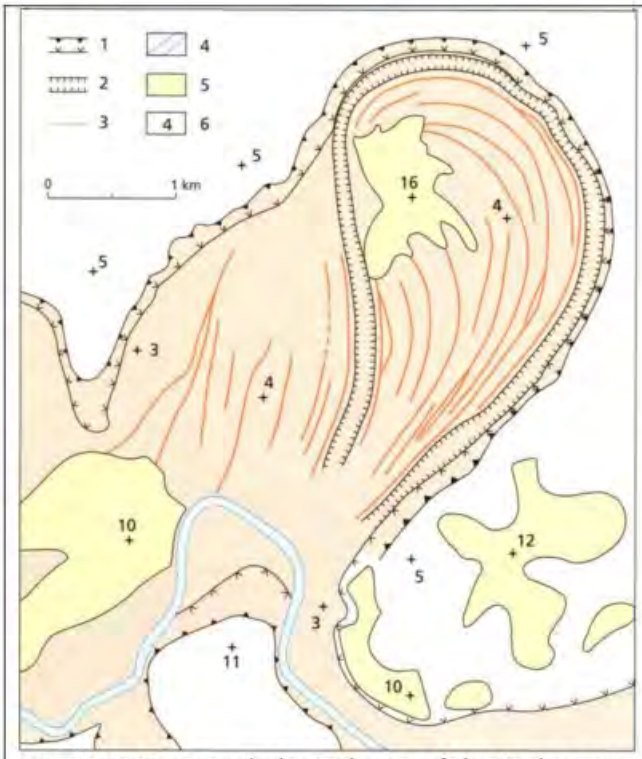


Fig. 36.4. Geological map of Paleomeanders Kalkense Meersen and Berlare. Source: Geological map of Geopark Schelde Delta, TNO.



(1) edge of the lateglacial alluvial plain, incised in the pleniglacial plain;

(2) fossil river channel;

(3) fossil point bar;

(4) present-day Scheldt;

(5) river dunes;

(6) elevation (m TAW).

Fig. 36.5. Geomorphological map of the Berlare meander. Source: Van Strydonck et al. 2000.

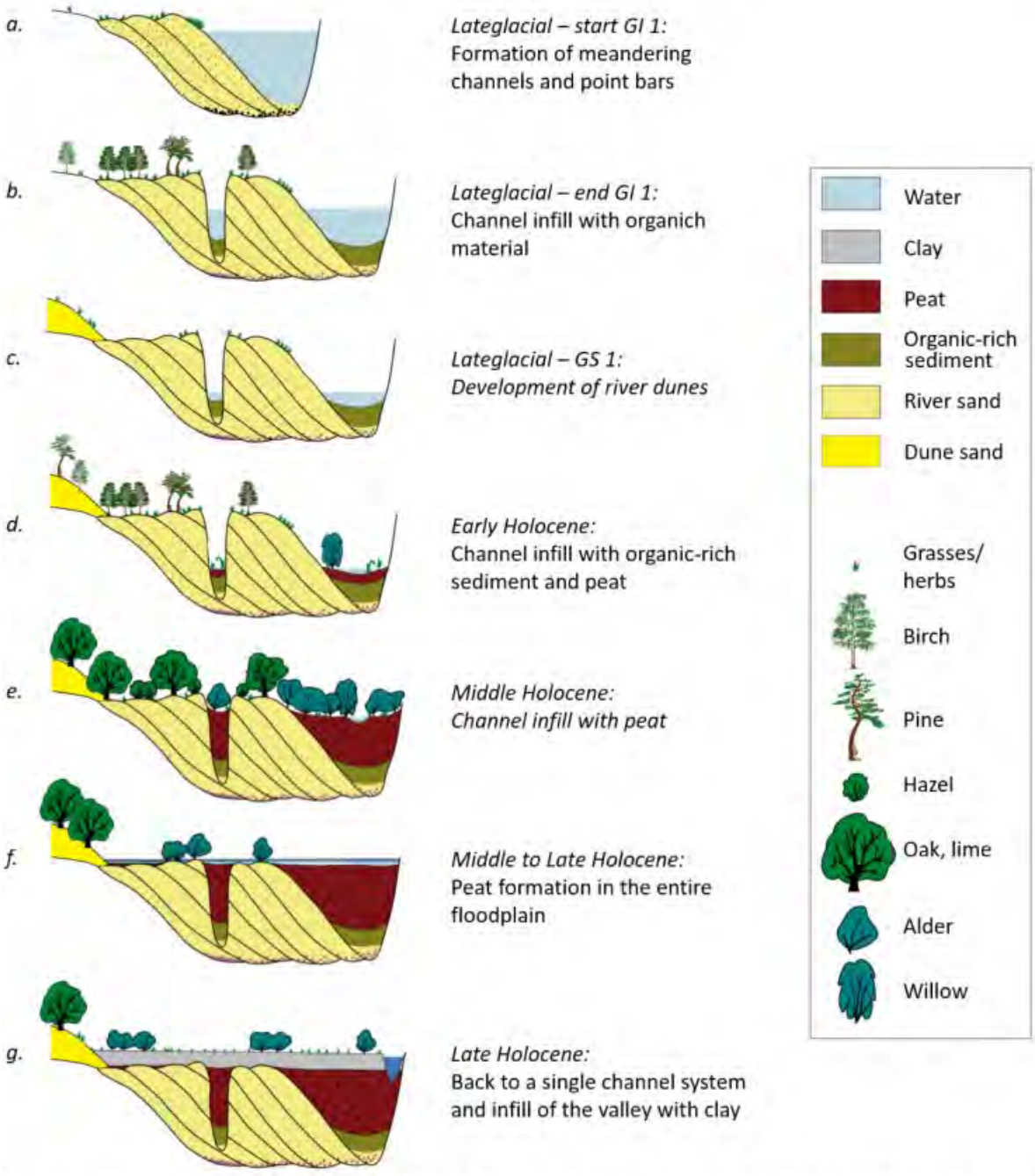


Fig. 36.6. Schematic evolution of landscape and vegetation development in the Lower Scheldt Valley during the lateglacial and the Holocene. Adapted from Pertain et al. 2011.

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Geosite n°37	**Moervaart depression and coversand ridge** A metronome for the impact of rapid climate change at the end of the last ice age at the western end of the European sand belt and a well-preserved, rational medieval reclamation landscape.
 Fig. 37.1. Map of Geopark Schelde Delta. Moervaart depression and coversand ridge is number 37.	**Scientific importance and valuation of the geosite** The Moervaart depression and the coversand ridge have a unique (inter)national geographic and cultural-historical importance. The coversand ridge also forms the westernmost end of the European coversand belt. Intense research over the past decades has shown that these geosites are a unique soil archive. They show not only traces of environmental changes in response to rapid and short climate changes at the end of the last ice age and the start of the Holocene, but also the human response to this. The presence of calcareous gyttja in the soil is nowhere more important in Flanders (Vlaanderen). This also leads to an important natural value as a Natura 2000 area. Finally, the preservation of the cultural landscape provides a great aesthetic and amenity value, because the developed landscape also reflects the geomorphological zones of the coversand ridge and the Moervaart depression.
Municipality	Ghent, Lochristi, Lokeren, Moerbeke, Sint-Niklaas, Stekene, Wachtebeke
Province and country	Oost-Vlaanderen, Belgium
Protection status	Southern part of the site and Heidebos: Natura 2000; Moervaart depression: established landscape atlas relict; Prehistorical site complex in alluvial context of the Moervaart depression: established archeological zone
Site management organizations	vzw Durme; Natuurpunt vzw; Agentschap voor Natuur en Bos; Vlaamse Landmaatschappij; Vlaamse Milieumaatschappij; Province of Oost-Vlaanderen; city of Ghent, Municipality Ghent, Municipality Lochristi, Municipality Lokeren, Municipality Moerbeke, Municipality Sint-Niklaas, Municipality Stekene, Municipality Wachtebeke
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Routes that one can travel independently

Teaching equipment	Guided and unguided walking tours

Code	**Significance**
G-3	International

Geological interest(s)

Paleontology: Comprehensive multi-proxy studies, including botanical (pollen, macrofossils, diatoms) and zoological (ostracods, molluscs, chironomids) analyses has resulted in a detailed reconstruction of the Lateglacial and early Holocene landscape, the local conditions that prevailed in the Moervaart paleolake itself, and the human response to this.

Stratigraphy: Detailed bio- and chronostratigraphic research at this geosite has enabled correlation of paleoenvironmental and paleoclimatic events at the end of the last ice age with other sites in the region, in Europe, and beyond (e.g., Greenland ice core stratigraphy).

Geomorphology: Especially the marked and in places relatively steep northern edge of the Moervaart depression shows the contrast between the low-lying flat depression of the large paleolake to the south and the 4 to 5 m higher coversand ridge to the north, with a more irregular relief of shallow deflation hollows. Traces of braided and meandering rivers draining into or out of the lake during the Lateglacial and Holocene are still recognizable in the microrelief of the Moervaart depression.

Sedimentology: The deposits of both the Moervaart paleolake and the coversand ridge have been extensively mapped and their sedimentology and other physical characteristics has been studied in detail to reconstruct their depositional environment and its evolution.

DETAILED DESCRIPTION

1. Location

The Moervaart depression is a large, low area (ca. 25 km²) between Mendonk and Stekene in the north of the Province of Oost-Vlaanderen. The elevation (3.5 to 4 m TAW) shows a microrelief due to the different lateglacial landforms within this depression. Today the Zuidlede flows along the southern edge and the Moervaart crosses the north of the depression. The southern edge is gently sloping and borders a flat area with low sandy ridges. The northern edge is steeper and borders the steep southern edge of the Maldegem-Stekene coversand ridge.

The Maldegem-Stekene coversand ridge is part of a larger complex of parallel sand ridges with an east-west orientation and an elevation between 4 m and 8 m TAW. Between the northern edge of the Meetjesland cuesta in the west (Maldegem) and the Waasland cuesta in the east (Stekene), these sand ridges are fairly continuous and are therefore known as the Maldegem-Stekene coversand ridge. However, the sand ridge complex is larger and recognizable on the surface from Gistel to Verrebroek. The width of the sand ridges in the complex varies greatly, but the most extensive ridges are usually in the south, while narrower and lower microridges are mainly present north of the larger coversand ridge, on the edge of the polders. The southern edge of the most extensive coversand ridge is relatively steep and visible in the landscape. In a northerly direction the slope is less steep and slightly undulating (Fig. 37.6).

2. Landscape formation

<u>End of the Weichselian pleiglaciaal</u>

The formation of the Maldegem-Stekene coversand ridge and the Moervaart depression at the end of the Weichsel pleniglacial is related to a reversal in the flow direction of the Scheldt from the Flemish Valley to the Hoboken gap. It has not yet been established with certainty whether the formation of the sand ridge was the cause or the result of the changed flow direction. However, it is established that during the final phase of the Weichsel pleniglacial (15,000-20,000 years ago), the wind formed a continuous series of parallel sand ridges with a west-southwest - east-northeast orientation by reworking the pre-existing sand plain. Where the sand was blown away (deflation),

large deflation plains developed, such as north of the Maldegem-Stekene coversand ridge. Between the Meetjesland cuesta and the Waasland cuesta, a larger, almost continuous sand ridge formed a kind of natural dam over the largely filled-in Flemish Valley. This blocked the northward drainage and created several shallow lakes along the steep southern flanks of this sandy ridge. The Moervaart depression is a remnant of the largest and best studied of these lakes.

Lateglacial interstadial (GI-1)

During a warmer period at the beginning of the Weichsel lateglacial (GI-1) the landscape evolved from a tundra without high vegetation to an open birch forest and finally to a boreal coniferous forest. This evolution was not linear but happened through repeated, rapid transitions to a colder and drier climate, each lasting about a century. Every time, the sand that had already been deposited was partly blown up again and redeposited.

Coversand ridge

Small, shallow deflation hollows formed on the coversand ridge during the first half of lateglacial (from 14,500 years ago). The wet vegetation that appeared in and around these small lakes has been preserved as thin, peaty layers that were later covered with sand again by the wind. During the short, colder and drier intervals within the interstadial, these lakes partially disappeared. They reached their maximum depth about 13,500 years ago. In the second half of the lateglacial (from 13,500 to 13,000 years ago), however, the sand deposition by the wind increased during cold phases to such an extent that the lakes in these deflation basins filled and disappeared.

Lake

The lateglacial lake of the Moervaart depression is recognizable in the subsoil as a layer of maximum 2 m thick, which consists of an alternation of calcareous, peaty and sandy deposits (Fig. 37.7). The calcareous, peaty sediments formed during the warm, wetter phases of the lateglacial (from about 14,500 years ago) in a shallow lake surrounded by a tundra landscape. This gradually evolved into a deeper lake (max. 3-4 m deep) in an open birch forest. The increased precipitation, vegetation and soil formation ensured that carbonates present in the coversand ridge were mobilized, transported via the (ground) water to the lake and subsequently precipitated on the lake bed. An alternative hypothesis points to a biological origin for the carbonates.

This development was briefly interrupted during the colder phases, when the lake became temporarily shallower and sand was blown into the lake. From about 13,300 years ago, during a colder phase, a (temporary) overflow formed on the southeast side of the lake by the incision of the Durme, which emptied into the Scheldt. This caused the lake level to gradually lower until a swamp developed, in which peat developed.

The braided river currents that fed the now shallower lake from the west gradually retreated, filled with peat until only one inlet in the north remained. This latter stream evolved into a meandering river about 13,000 years ago, which incised in the disappeared lake and joined the former overflow (Durme) (Fig. 37.8). The old riverbeds that fed the lake and the (stream) ridges in between are still recognizable today in the microrelief west of the Moervaart depression.

A hotspot for final Palaeolithic hunter-gatherers

Within the Geopark and in sandy Flanders, the lateglacial interstadial is considered the oldest period with numerous traces of human habitation. Repeated visits by Final Palaeolithic hunter-gatherers to the shores of the lake have created a quasi-continuous chain of archaeological sites, (Fig. 37.9). This is due to the diversity of food resources and freshwater availability in the lateglacial landscape.

Lateglacial stadial (GS-1) to Early Holocene

The last flare-up of the Weichsel glacial (GS-1), about 12,800 to 11,700 years ago, was a very cold and dry phase with strong influence of wind activity on the landscape. Thanks to the more open vegetation, the wind caused significant erosion of the coversand and the formation of new ridges and dunes. Sand was blown away on the north side of the Maldegem-Stekene coversand ridge, while a layer of 1 to 3.5 m of sand ended up in the last dune slacks and over the northern bank of the disappearing Moervaart depression. The meandering precursor of the Durme was still active during the start of the lateglacial stadial but began to fill with organic sediments as the lake disappeared. This process was further accelerated by increasing forestation and a decrease of the river flow in the Early Holocene. During the cold stadial (GS-1) and the beginning of the Holocene, there was little human presence in the region, but during the Early Mesolithic, settlement increased again, this time along the banks of the Durme.

Middle to Late Holocene

The meandering river channels of the Durme were completely filled with peat during the Middle Holocene. In addition, flooding in the west of the Moervaart depression later also resulted in the deposition of clay and sand outside the incised channel. There was also peat development in the lowest deflation plains north of the large coversand ridge. The forest and heath development on the coversand ridges led to the formation of poor soils that were not very suitable for early farming. Nevertheless, the larger ridges (and to a lesser extent also the microridges) formed important sites for the establishment of small (migratory) agricultural settlements during the Neolithic, the Metal Ages and the Roman period in an otherwise fairly wet landscape. Gradually, deforestation led to a strongly open heath- and grasslands on the coversand ridges during Roman times. Wetter areas, such as the Moervaart depression, were used less intensively and remained more forested. The Maldegem-Stekene coversand ridge was also important as a traffic axis, for example due to the construction of the Roman road (heirweg) to Antwerp. The lower population density during the late Roman period and the Early Middle Ages allowed the restoration of the natural landscape and an almost continuous forest area with heathland developed on the dry and poor soils.

Intensive, systematic exploitation of this forest and heathland landscape started quite late in the Middle Ages, namely from the 11th century AD, under the impulse of the Counts of Flanders. Over-exploitation and exhaustion of the poor sandy soil soon led to fallow 'wastelands' with heath. From the 13th century, abbeys (e.g. Boudelo abbey) also reclaimed the Moervaart depression. This area was drained by means of canals and transformed into pastureland. The peat channels also served to transport peat that was extracted as fuel from the peat-filled channels in the north of the Moervaart depression, in the deflation plains north of the large coversand ridge and in the polders. The traces of medieval reclamation are recognizable today as large landscape structures, such as road patterns, waterways and parcelling in strips and regular blocks.

The impact of the abbeys on land use diminished from the late 16th century onwards, partly due to military disturbances and floods. The defence line of the Nieuwe Vaart and Fort Francipani date from the Eighty Years' War. During the War of the Spanish Succession, the Bedmar Line was constructed through the Moervaart depression and across the east of the coversand ridge. Traces of this are recognizable in the landscape as eroded earth walls, canals or paths.

In the second half of the 18th century, a new cultural landscape was created in part of the Moervaart depression: ditches were excavated, strips for forestry were raised (rabatten) and non-wooded monastic grounds were privatized. This cultural landscape remained fairly stable until WWII, after which improvements in agriculture, water management and habitation gradually changed the cultural landscape. Today, the Moervaart depression mainly contains mosaic landscapes of grassland and forest between settlement centers. The recently developed nature

reserves in the Moervaart depression and on the coversand ridge partly serve as compensation for lost natural values in Ghent harbor.

Relation with other geosites

- The Maldegem-Stekene coversand ridge is part of a larger coversand ridge area that extends from the coastal polders (Geosite 21: Zwin polders near Damme) to the Waasland Scheldt Polders (Geosite 28).
- The coversand ridge also forms the connection between the Oedelem-Zomergem cuesta (Geosite 40) and the Waasland cuesta (Geosite 35).
- The Moervaart depression was the largest of a series of lateglacial lakes south of the coversand ridge and also partly overlaps with the Durme Valley (Geosite 31).

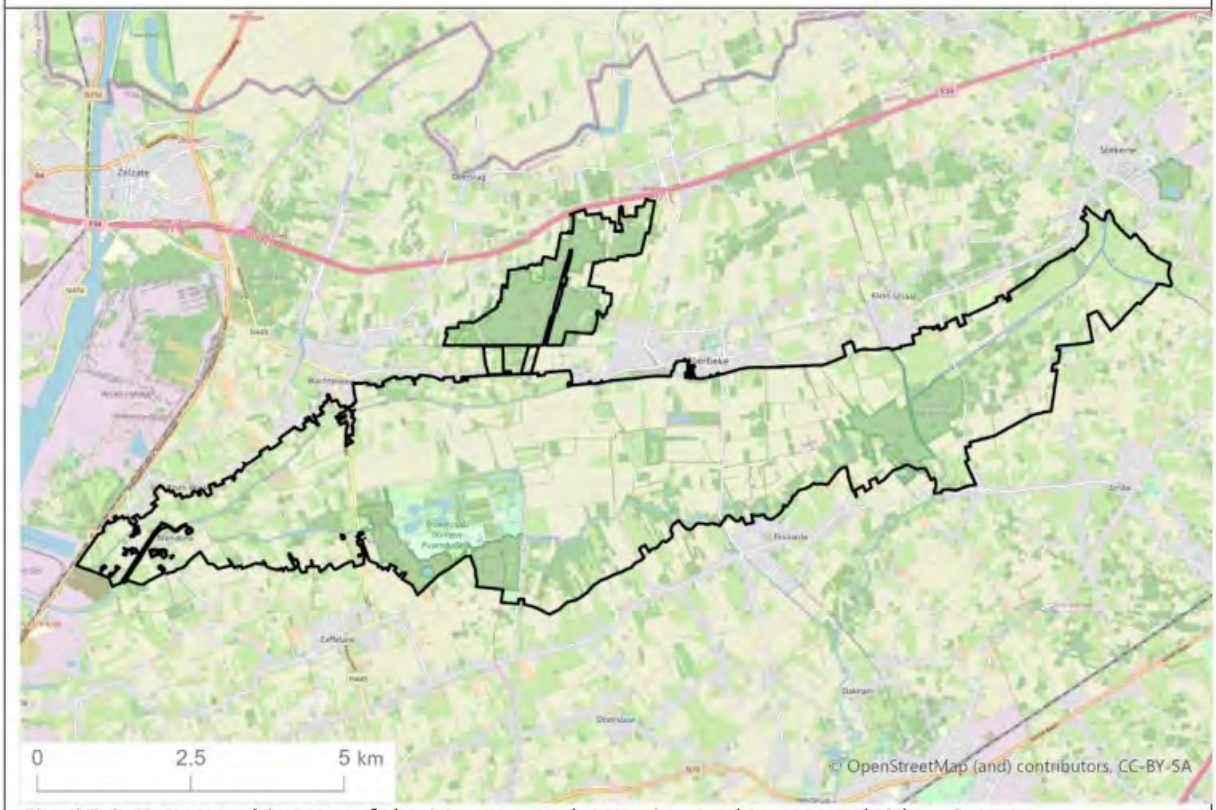


Fig. 37.2. Topographic map of the Moervaart depression and coversand ridge. Source: OpenStreetMap & contributors. CC-BY-SA.

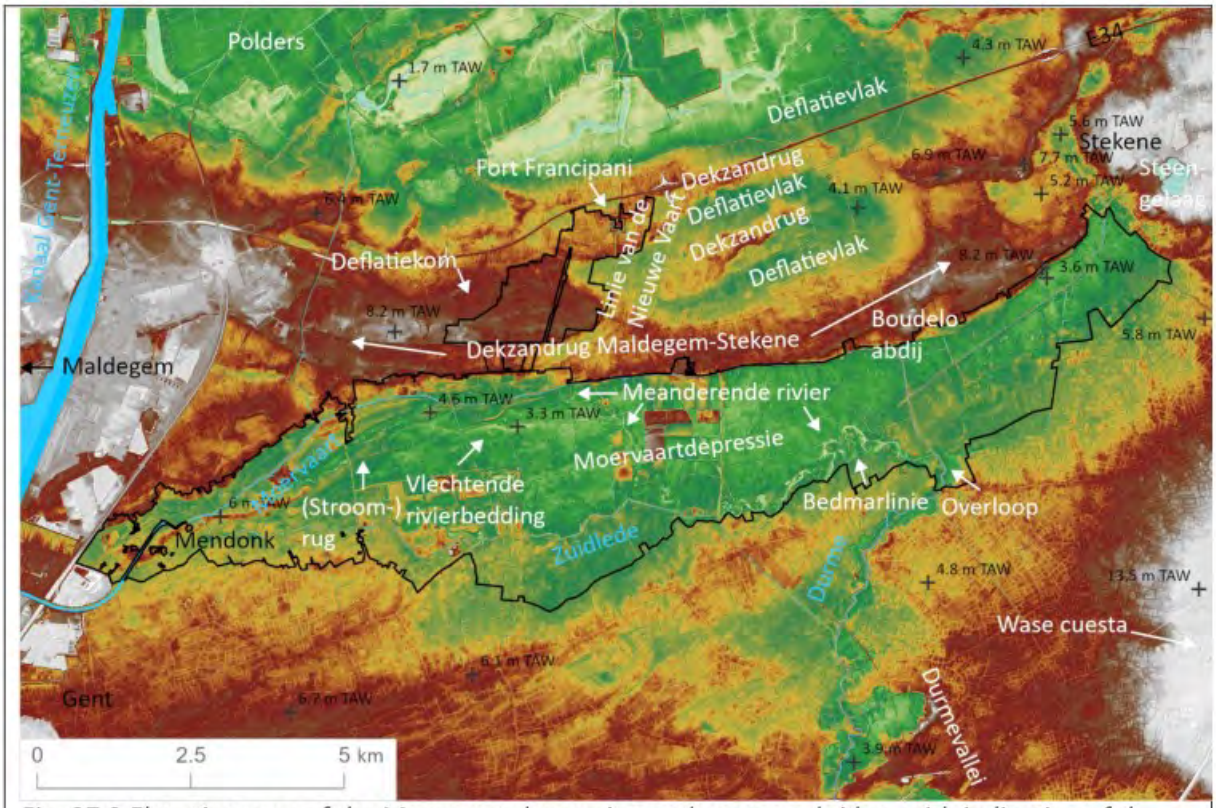


Fig. 37.3 Elevation map of the Moervaart depression and coversand ridge, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency; AHN3 Rijkswaterstaat.

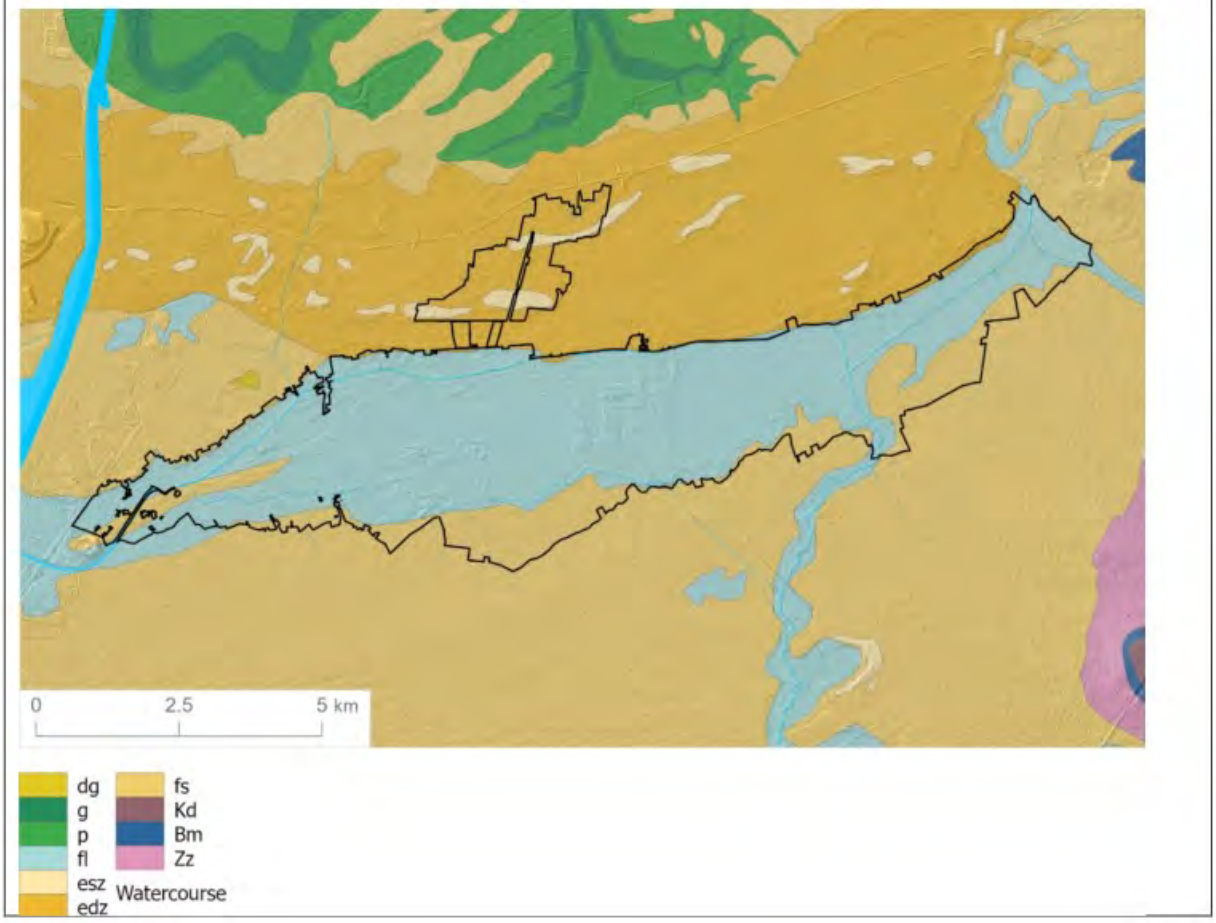


Fig. 37.4. Geological map of the Moervaart depression and coversand ridge. Source: Geological map of Geopark Schelde Delta, TNO.

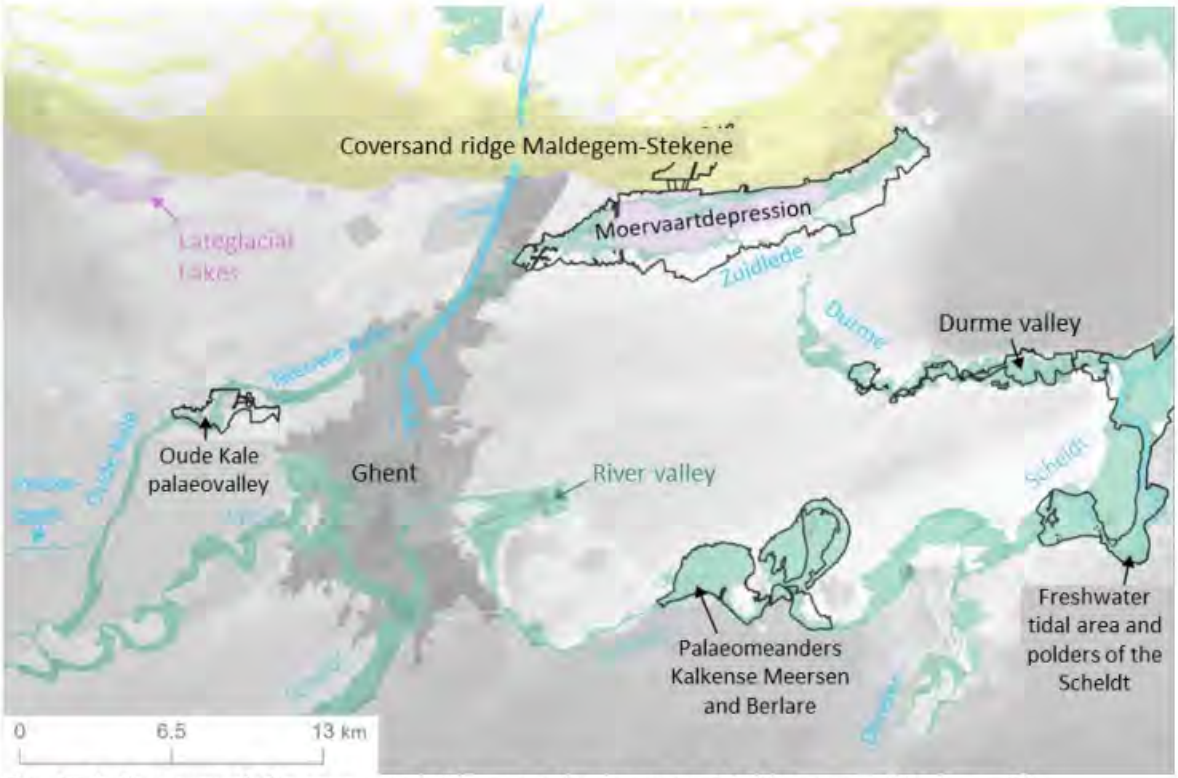


Fig. 37.5. The part of the coversand ridge complex between Maldegem and Stekene. The Moervaart depression and other lateglacial lakes south of the sand ridge. The Holocene valleys that drain the Moervaart Depression after the disappearance of the lake.

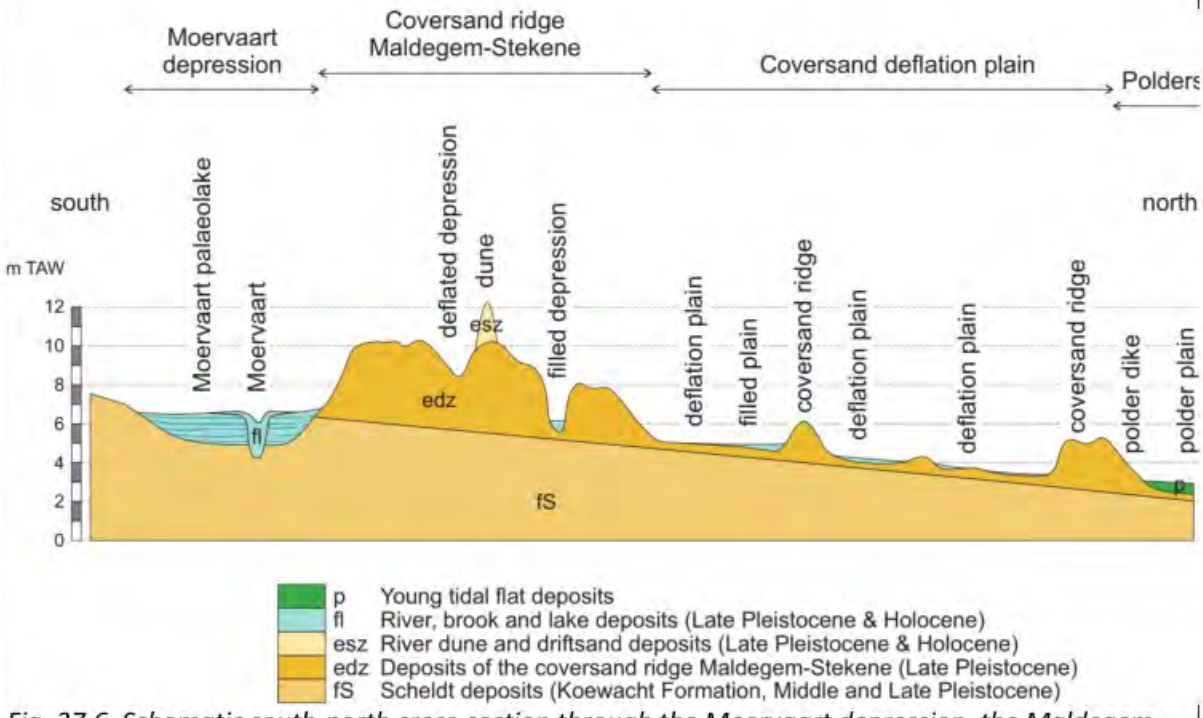
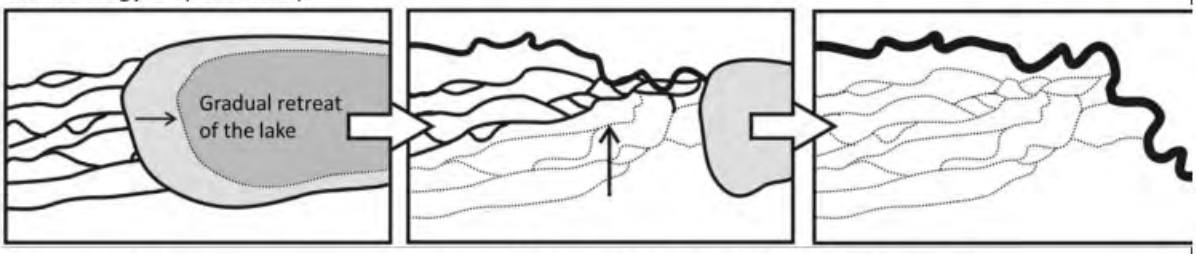


Fig. 37.6. Schematic south-north cross-section through the Moervaart depression, the Maldegem-Stekene coversand ridge and the corresponding deflation plain. Adapted after Heyse (1979).

Fig. 37.7. Picture of a trench dug through the lake sediments near Moerbeke (© Ghent University - Archaeology Department).



13,300 years ago:
- The lake retreats eastward.
- Water and sediment are supplied from a slow-flowing, braided channel system.

Between 13,300 en 13,000 years ago:
- The lake is getting smaller.
- The southern channels dry up while the flow of the northern channels increases.

13,000 years ago:
- The lake disappears completely.
- A single meandering channel develops.

Fig. 37.8. Conceptual model of the changing flow patterns during the drying out of the lateglacial lake in the Moervaart depression (13,300 to 13,000 years ago). Adapted from Crombé et al. (2013). Dotted lines: abandoned riverbeds, solid lines: active channels.

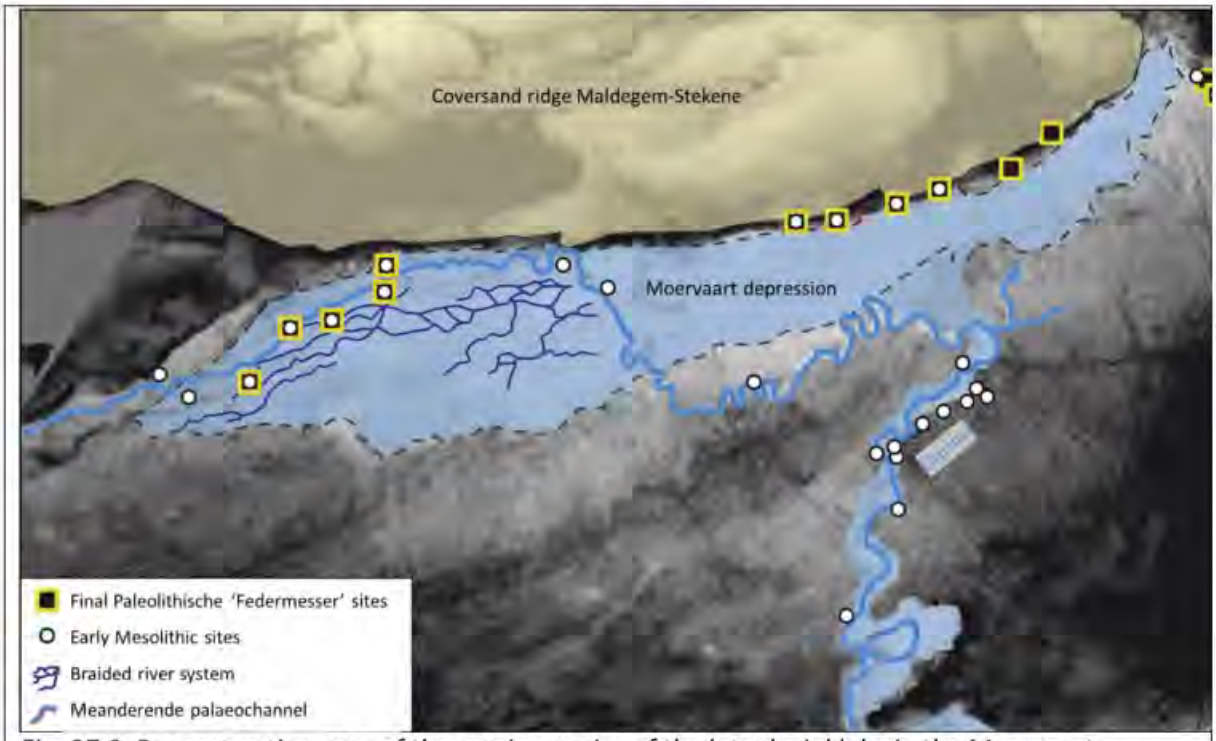


Fig. 37.9. Reconstruction map of the maximum size of the lateglacial lake in the Moervaart depression south of the Maldegem-Stekene coversand ridge, with indication of the initial braided and later meandering river systems and known archaeological sites from the final Palaeolithic and early Mesolithic. Adapted from Bos et al. 2017.

Documentation and resources

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Geosite n°38	**Steengelaag clay quarry** Relic of brick industry on the dipslope of the Waasland cuesta.
 Fig. 38.1. Map of Geopark Schelde Delta. Steengelaag clay quarry is number 38.	**Scientific importance and valuation of the geosite** As shown by the synthesis by Vandenberghe et al. (2014), the Boom Formation has been studied by geologists exceptionally long and extensively, both palaeontologically and lithologically. More recent research has been stimulated by the potential of the Boom Formation for the long-term disposal of radioactive waste in the deeper subsurface. The landscape of the Steengelaag has been protected since 1981, giving nature the opportunity to develop here. In addition to the three lakes, which are attractive for birds, there are moist swamp forest and valuable, flower-rich hay meadows. The clay dredger at the youngest clay pit forms an exceptional piece of industrial heritage, which keeps the link with the industrial past of the Steengelaag alive.
Municipality	Stekene
Province and country	Oost-Vlaanderen, Belgium
Protection status	The Steengelaag: protected cultura-historical landscape
Site management organizations	Natuurpunt vzw, municipality Stekene
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Routes that one can travel independently
Teaching equipment	Walking route with information panels.

Code	**Significance**
G-38	Provincial
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: The detailed internal lithostratigraphy typical for the Boom Clay, with alternating beds of tens of cm thick with variable silt, carbonate and organic material content which can be followed over large distances, is also present at this site.	
Geomorphology: Situated on the dip slope of the Waasland cuesta, this is a nice example of a former late 19th century quarry in the Oligocene Boom Clay which has not been flooded since clay production stopped in the 1970's and thus still displays the original depth and striking and irregular elevation differences within the pit.	

Sedimentology: The sedimentology of the Boom Formation which is exposed in this quarry has been studied exceptionally long and extensively by geologists, as shown by the synthesis by Vandenberghe et al. (2014).

DETAILED DESCRIPTION

1. Location

The plateau on which Stekene and Kemzeke are located belongs to the Waasland cuesta and forms an island, as it were, between lower elevated landscapes. Although the cuesta escarpment is not nearly as impressive as along the Durme and Rupel, we still see a striking elevation difference between the higher zone at Stekene and Kemzeke (about 10 m TAW) and the surrounding lowland (4 to 5 m TAW). The cuesta forms the north-eastern boundary of the Maldegem-Stekene coversand ridge and of the Moervaart depression at the foot of this ridge. The Stekene Canal, which drains into the Moervaart, is located in an elongated depression around the western edge of the cuesta. To the northeast, the area borders on the Waasland Scheldt Polders.

The Steengelaag is a very striking element on the elevation map, with a depth of more than 10 m relative to the surroundings (bottom at approx. -1 m TAW) and with a diameter of more than half a kilometre.

2. Landscape formation

Clay deposition in the Oligocene North Sea

Since the Steengelaag originated as a clay extraction pit, we have to go back to the period in which this clay was formed in order to understand the geological history of this area. The formation of the Waasland cuesta started about 32 million years ago, during the Early Oligocene. In this period, the continents were not quite arranged as they are today. South of the geopark, the Artois axis formed a land bridge between Great Britain and the Ardennes. The Netherlands and the north of Belgium were below sea level (Fig. 38.5).

Sediment originating from the erosion of the surrounding continents was deposited in the Oligocene North Sea. The coarser particles (sand) mainly ended up close to the coasts. Finer particles (silt and clay) drifted further and settled in the deeper parts of the basin. During periods of low relative sea level, the north of Belgium was close to the coast. This resulted, for instance, in the deposition of sand in the Ruisbroek Member (upper part of the Zelzate Formation, Fig. 38.6) between the Eocene and the beginning of the Oligocene (ca. 38-33 million years ago). Between about 32 million and 30 million years ago, there was a period in which the sea in northern Belgium and the Netherlands was 50 to 150 m deep and in which clay was deposited.

Water depths fluctuated frequently due to a combination of plate tectonics and climatic variations. This resulted in a varying supply of organic and mineral material from the land in the North Sea Basin. As a result, the deposit does not consist of a homogeneous layer of clay. It consists, however, of an approximately 100 m thick layer of alternating beds (tens of cm thick) with more or less silt, carbonate and organic material. The result is the Boom Formation: a clay layer about 100 m thick with a characteristic pattern of horizontal light and dark grey bands, the sequence of which can be read as a kind of bar code (Fig 38.6). In the calcareous layers, bread-shaped calcareous concretions of several decimeters in horizontal cross-section formed after burial: the so-called septaria of the Boom clay. Minerals such as pyrite crystallized in the cracks of these septaria.

Formation of a cuesta by tectonics and erosion

While sedimentation was taking place in the North Sea Basin, plate tectonics in southern Europe triggered important changes: the collision of the African and Eurasian plates caused the formation of several mountain ranges, such as the Pyrenees and the Alps. Due to the uplift of the land in the south, the crust in the north sank over millions of years and the deposits of, among others, the

Boom Formation, tilted from their original horizontal stratification into a north-easterly inclined position (Fig. 38.6).

In the Campine area and in the Netherlands, the clay was further covered by North Sea sediments during the Neogene (including the Kattendijk Formation) and the Boom Formation can now be found there in the (deep) subsoil. South of the current Durme, Scheldt and Rupel, the layer rose above sea level and was exposed to erosion. The firm clay of Boom Formation was more resistant to erosion than the underlying and overlying sand layers. As a result, the Flemish Valley – the Pleistocene predecessor of the rivers of the Scheldt basin – was able to incise faster into the sand of the Ruisbroek Member, than into the Boom clay. The result is a cuesta: an asymmetrical hill with a steep slope at the eastern border of the Flemish valley (the escarpment) and a gentle slope towards the northeast (Fig. 38.6). Near Stekene, the escarpment of the Boom Clay is located in the shallow subsoil, covered by several metres of sandy river and wind deposits from the Pleistocene (Fig. 38.6).

Brick industry

Because the clay in the area around Stekene is not very deeply buried, clay has been mined in the area for centuries. In the 16th century, more than 50 brickyards were active. The quarry in the Steengelaag was only started at the end of the 19th century. The Tuilerie Sainte-Marie brickyard was active there for almost a century: from 1880 to 1977 AD. The mining started manually, with wooden spades, in the 'Oldest clay pit'. From 1913 AD, the clay extraction was mechanized and the mining in the 'Youngest clay pit' was done by means of an electrically powered clay dredger, which is still standing at the clay pit today. These clay pits and the Grote Vijver (large pond), the former water reservoir of the brickworks, today form the three large pools in the Steengelaag.

Relation with other geosites

- In the Steengelaag, clay was extracted from the same layer as in the brickyards along the Durme, the Scheldt and the Rupel, where the southern cuesta front of the Waasland cuesta (geosite 35)
- And the Boom Cuesta (geosite 32) is located.

Fig. 38.2. Topographic map of the Steengelaag clay quarry. Source: OpenStreetMap & contributors. CC-BY-SA.

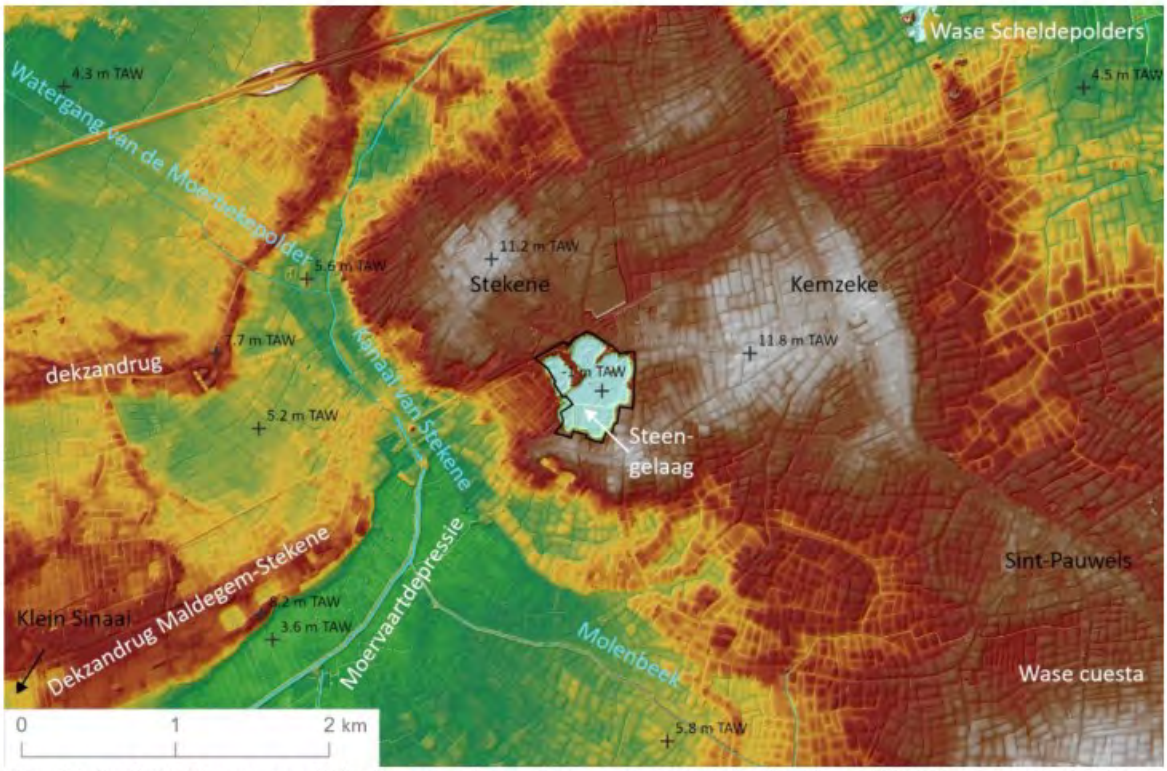

Fig. 38.3. Elevation map of the Steengelaag clay quarry, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency.

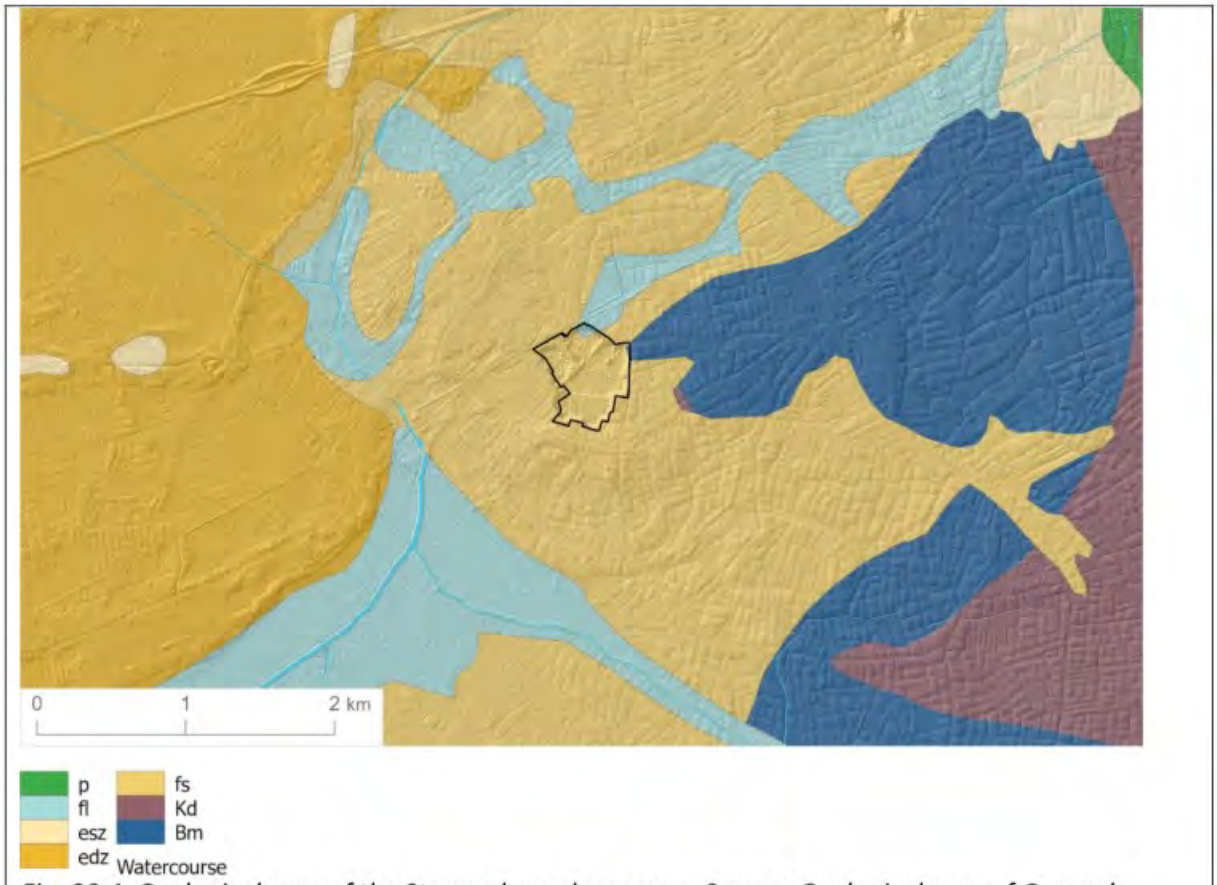

Fig. 38.4. Geological map of the Steengelaag clay quarry. Source: Geological map of Geopark Schelde Delta, TNO.

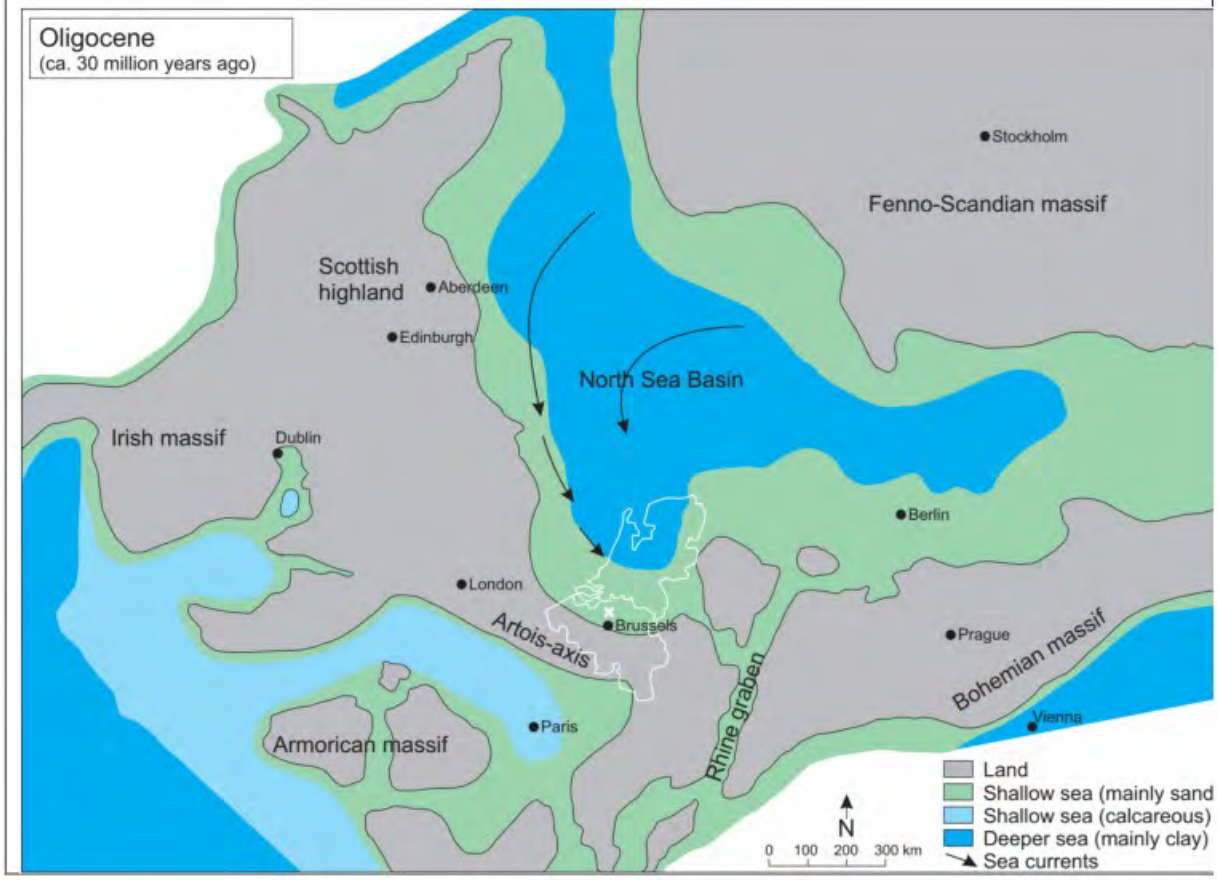

Fig. 38.5. Paleogeographic map of north-western Europe during the Oligocene. Adapted from Vandenberghe, De Craen & Wouters, 2014.

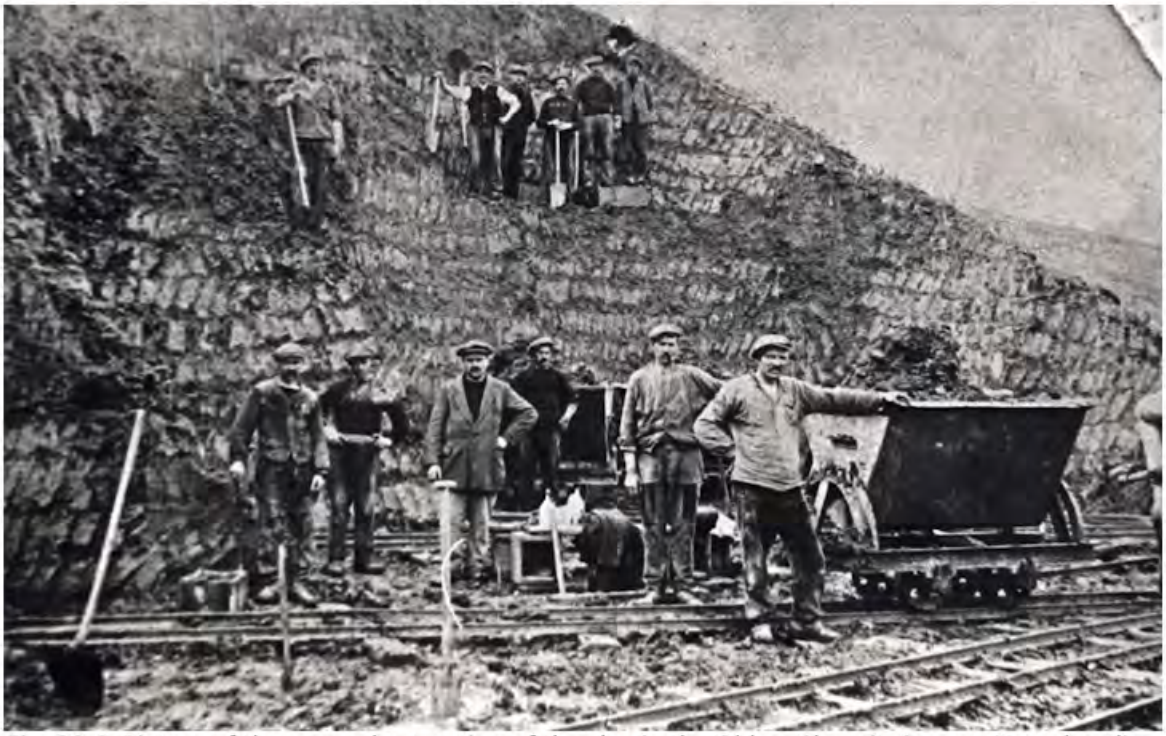

Fig. 38.6. Picture of the manual extraction of the clay in the Oldest Clay pit. Source: Heemkundige kring d'Euzie.

Fig. 38.7. Steep slope with clay dredger in the background. Once a week, the excavator rails had to be laid closer to the receding clay slope. Source: Heemkundige kring d'Euzie.

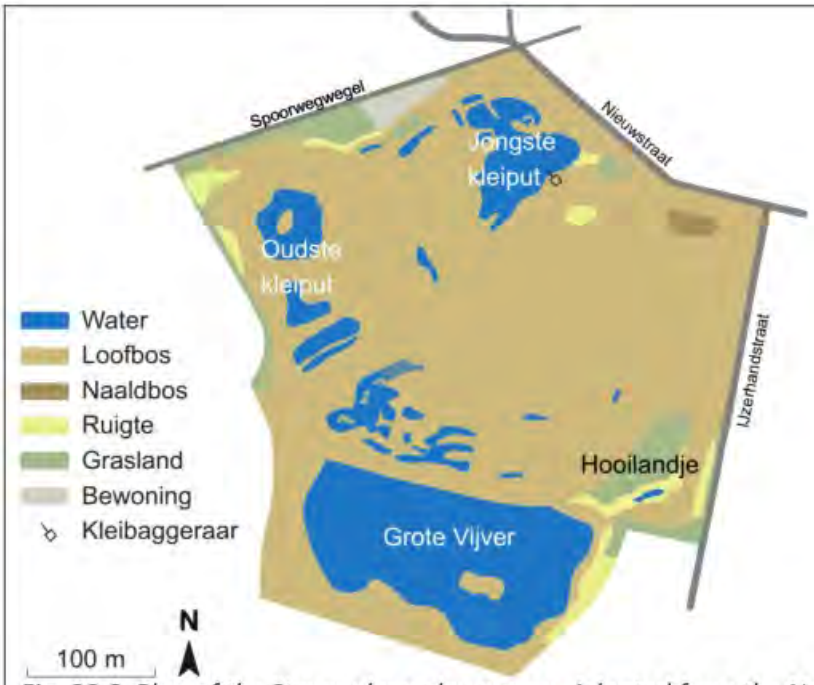

Fig. 38.8. Plan of the Steengelaag clay quarry. Adapted from the Natuurpunt walking brochure 'Het Steengelaag'.

Documentation and resources

- Agentschap Onroerend Erfgoed (2021) Het Steengelaag. In: Inventaris onroerend erfgoed. https://inventaris.onroerenderfgoed.be/erfgoedobjecten/301158
- Vandenberghe N, De Craen M, Wouters L (2014) The Boom Clay Geology from sedimentation to present-day occurrence - a review. Memoirs of the Geological Survey of Belgium 60:76.

Geosite n°39	**Paleovalley of the Oude Kale** Open and enclosed fields along the former upper reaches of the Durme.
 Fig. 39.1. Map of Geopark Schelde Delta. Paleovalley of the Oude Kale number 39.	**Scientific importance and valuation of the geosite** Due to the construction of canals, the original Durme catchment has been highly fragmented. The area south of Merendree and Vinderhoute is the only place where the meandering upper reaches of the Durme are still recognizable in the landscape. Since the valley is very wide here, several settlements with associated open fields (kouters) and enclosed fields (bulken) developed in the Middle Ages. This original landscape management, with the contrast between open and enclosed fields, is still intact in many places in the area.
Municipality	Lievegem
Province and country	Oost-Vlaanderen, Belgium
Protection status	Established landscape atlas relict; Windmill of Vlaanderensmolen and environment: protected town or village scape
Site management organizations	Natuurpunt vzw, Vlaamse Milieumaatschappij, Vlaamse Landmaatschappij, municipality Lievegem
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Excursions/guided tours - Routes that one can travel independently - Educational programme for children
Teaching equipment	Educational package for schools

Code	**Significance**
G-39	Provincial
Geological interest(s)	
Paleontology: not applicable.	
Stratigraphy: not applicable.	
Geomorphology: The landforms and microrelief at and near this site represent a fine example of fluvial-eolian interactions and river pattern change from braided to meandering in the environmentally highly dynamic transition period from the last ice age to the present Holocene, in which the Oude Kale formed the upper reach of the Durme river (site G-31) through the Moervaart depression (G-37), until cut off by man in the 16th century AD.	

Sedimentology: The Weichselian Lateglacial to Holocene fluvial deposits preserved in the deepest subsurface channel fills present at this site have been studied for their lithology and sedimentology as well as for paleoecological/paleoenvironmental purposes.

DETAILED DESCRIPTION

1. Location

The Paleovalley of the Oude Kale is located between Nevele and Vinderhoute. In Nevele, the Oude Kale is fed by the Poekebeek. Upstream from Merendree, the Schipdonk Canal runs parallel to the river, in a narrow valley between the Nevele ridge and the Vosselare ridge, which reach up to ca. 12 m TAW (Fig. 39.3). Then the Oude Kale meanders eastwards in a ca. 3 km wide plain between the coversand ridge Vinderhoute-Merendree and the ridge of Landegem. Within this 'Vinderhoute flat' we see a microrelief with depressions of ca. 6 m TAW and higher ridges up to about 8 m TAW. The hamlets of Dries, Slindonk and Luchteren are located on these ridges. At Vinderhoute, the Oude Kale crosses the coversand ridge and the river is cut off by the Ghent-Bruges Canal. The Nieuwe Kale flows parallel to the Ringvaart and forms the downstream continuation of the Oude Kale.

2. Landscape formation

Formation of the valley of the Oude Kale

During the Pleistocene (2.6 million to 11,700 years ago) the area was located on the western edge of the Flemish Valley. It was more or less at the point where the southern branch, within which the Lys and Oude Kale now run, connects to the broad main valley near Ghent. A braided river flowed within these valleys during the ice ages. At the transition from the Weichselian pleniglacial to the lateglacial (about 14,700 years ago), the rivers of the Scheldt Basin evolved into single-channel meandering systems. Although the Oude Kale is now a small river, the old wide meander bends (palaeomeanders) between Merendree and Vinderhoute testify to a past as a large river with an important discharge that incised into the Flemish Valley infill. The elongated ridges in the Vinderhoute flat are likely to be point bar ridges of this lateglacial meandering stream. These ridges formed due to sedimentation in the inner bends of the meanders as the river moved laterally towards the north. The 500 m wide valley of the current Oude Kale reflects the position at which the system stabilized thanks to the forest vegetation that developed during the warmer periods of the lateglacial and during the Holocene. Before canalization, the Oude Kale belonged to a much larger river: the Mandel and Poekebeek came together in the Oude Kale, which at Merendree ran together with the former Hoogkale (now Ghent-Bruges Canal) towards the Moervaart Depression. The lake in this depression drained again via the Durme into the Scheldt. That is why the term 'Kale-Durme' is used.

At the Vinderhoutse bossen, we see a circular depression on the elevation map. Here, at a depth of 40 cm, a 30 cm-thick layer of calcareous gyttja is present in the subsoil. This points to a shallow lake with stagnant water, which probably also dates from the lateglacial.

The point bar ridges in the valley formed dry zones in a wet area. Archaeological finds indicate that these sites, perhaps due to their proximity to fresh water, were a major attraction for humans during the lateglacial and Early Holocene.

An open and enclosed field landscape in the Middle Ages

During the Middle and Late Holocene, the Oude Kale was a much smaller river, within the valley that was formed by the large lateglacial river. The toponyms in the area show that until the Middle Ages the Hoogkale was known as 'Durme' and the Neerkale (Poekebeek and Oude Kale) as 'Poeke'. These rivers were connected to their lower reaches (present-day Zuidlede and Durme) until the Sassevaart (predecessor of the current Ghent-Terneuzen canal) was dug in the 16th century.

For a long time, habitation was mainly present in the higher parts of the landscape, but the valley was probably deserted. From the Middle Ages onward, the valley was systematically inhabited and cultivated. The habitation, in so-called dries hamlets, was located on the higher point bar ridges within the valley, such as Dries and Slindonk (Fig. 39.3).

In a first phase, possibly as early as the Early Middle Ages, only the higher, well-drained grounds around the settlement centers were cultivated. The three-field system was applied to these fields, also called kouters or 'open fields'. Livestock grazed here during the fallow year. The grounds were collectively managed by the village community, which contributed to the open character of the fields.

Due to the medieval population growth, the surrounding wetlands were also reclaimed from the 12th - 13th century onwards. Canals were dug to drain these meadows, creating a pattern of often narrow, small parcels. Hedgerows or rows of (pollarded) trees along the parcel boundaries enhanced drainage, kept grazing livestock inside and served as a source of wood. These plantations created the closed character of the so-called bulk landscape, which is characteristic of the wet soils in the region around Ghent. These bulk fields were not managed jointly, so the land use was more varied than on the open fields: depending on the humidity, they were worked as arable fields or hay meadows for winter fodder for livestock (hooimeersen). At the foot of the Landegem ridge, near Heiste and Wilde, these parcel patterns are still well-preserved in the landscape.

Interventions in the (early) modern era

During the 18th century, in the depression between Vinderhoute and Mariakerke, forests were planted for timber production. This was done in rabatten: elongated, parallel banks on which rows of trees are planted, with ditches in between for drainage. The Vinderhoutse bossen are a remnant of this production forest.

In the 19th century, the hay meadows largely fell into disuse and the grounds in the valley were mainly used as grazing meadows with plantations of pollarded willows and poplars. During the 20th century, the water management in the area was greatly disturbed by the construction of the Schipdonk Canal, the Ghent-Ostend Canal and the Ringvaart. Between Merendree and Vinderhoute, the Oude Kale largely retained its original course. Where the Oude Kale flows along the Ghent-Oostende canal in Vinderhoute, we find lakes in the nature reserves Molenmeers and Durmmeersen (Fig. 39.3). Contrary to what the names suggest, these are not natural depressions, but pits resulting from sand extraction from the 20th century.

Current management of the Valley of the Oude Kale

The area is part of the Kluizen surface water extraction area. In the context of the 'Lys and Scheldt land development project', of which the Oude Kale basin is a part, the area will become wetter. Agriculture continues to play a role in the area, but the wettest agricultural lands will be converted to nature, with a focus on landscape restoration and recreation.

Relation with other geosites

- The lateglacial and Early Holocene evolution of this area is very similar to the one in the Scheldt (geosite 30, 36), Rupel (geosite 33) and Durme (geosite 31) Valleys. However, unlike most other valley areas within the geopark, this site has no intertidal history. As a result, the medieval landscapes differ from those in the Scheldt and Durme Valleys.

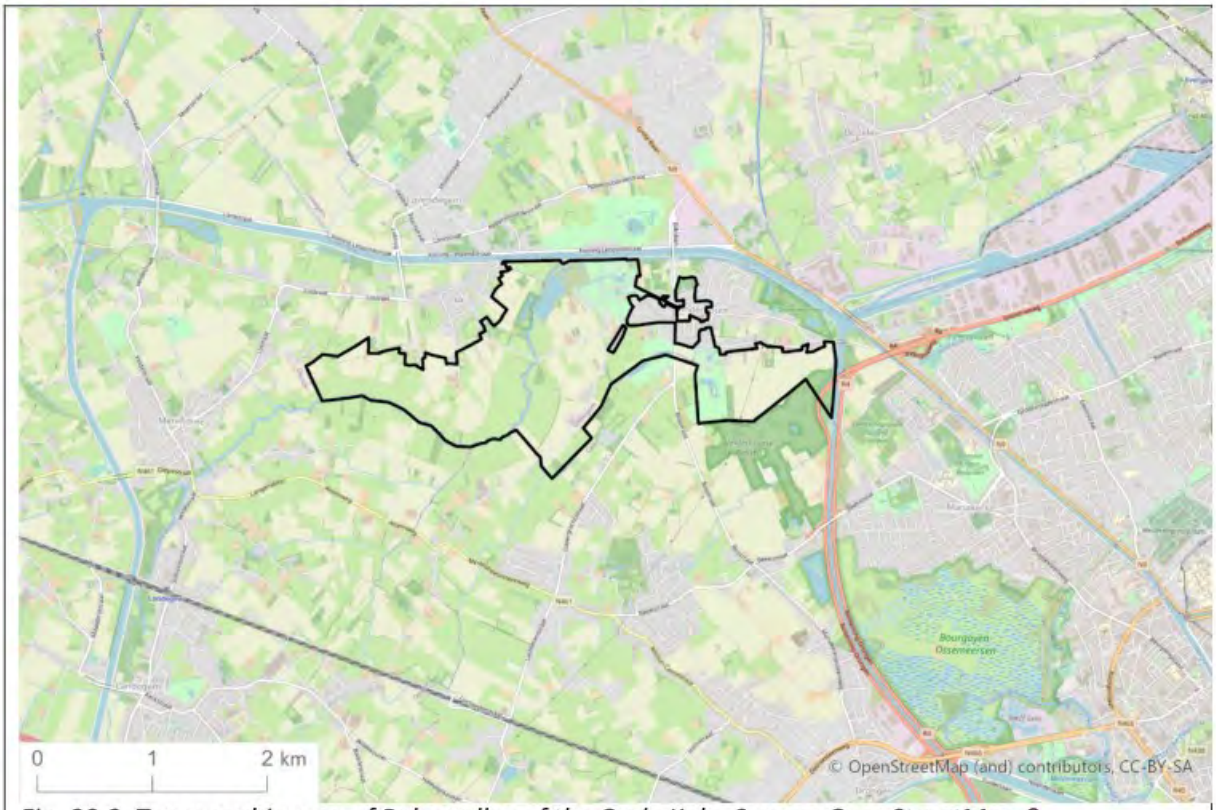

Fig. 39.2. Topographic map of Paleovalley of the Oude Kale. Source: OpenStreetMap & contributors. CC-BY-SA.

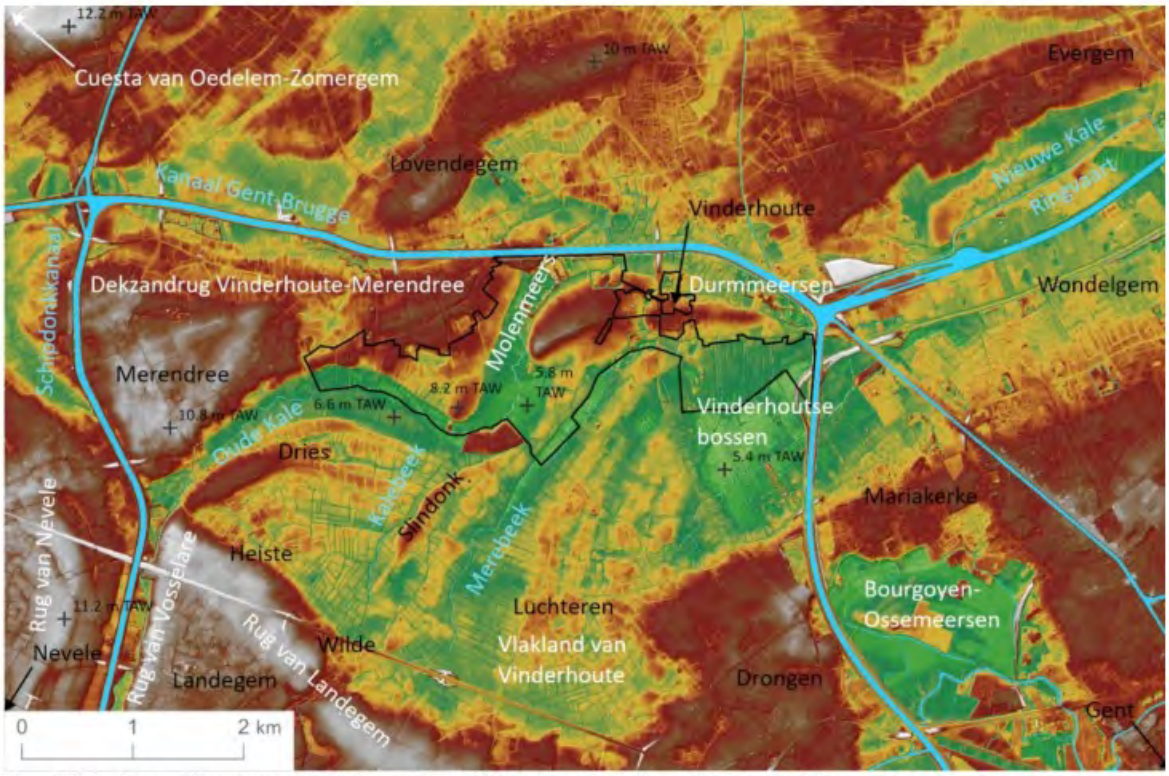

Fig. 39.3. Elevation map of Paleovalley of the Oude Kale, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency.

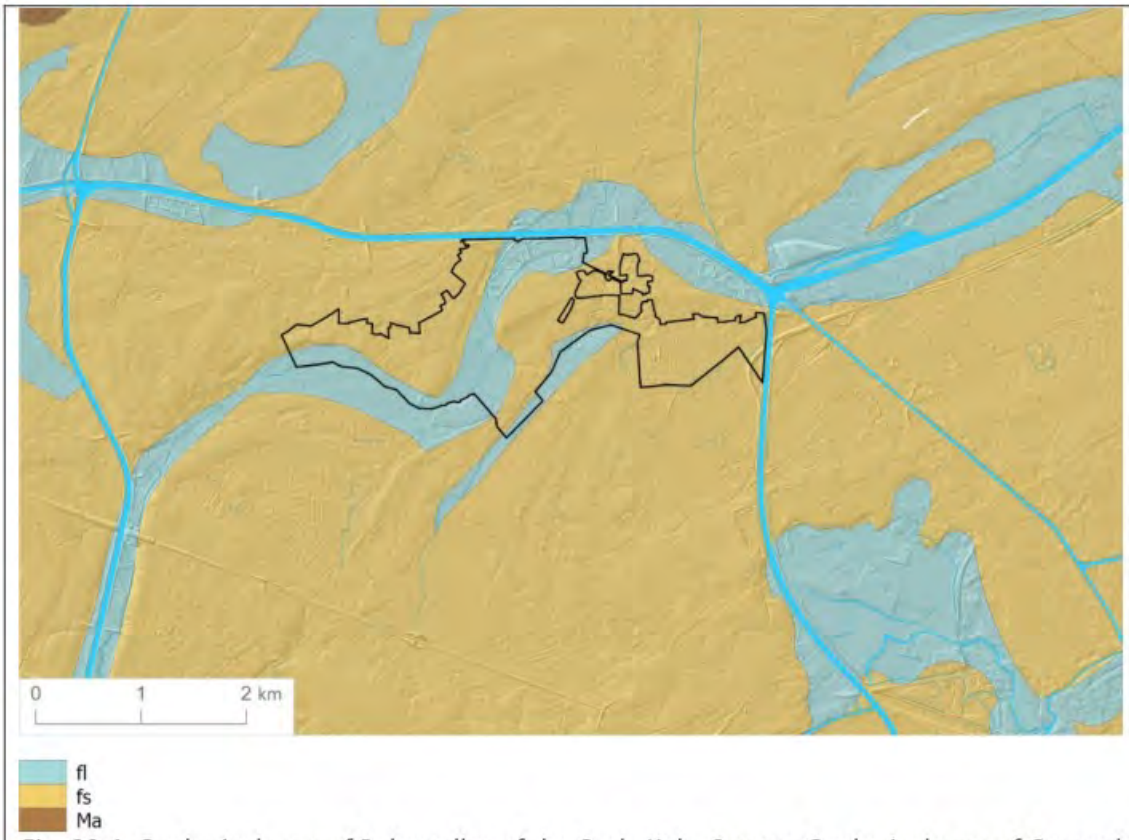

Fig. 39.4. Geological map of Paleovalley of the Oude Kale. Source: Geological map of Geopark Schelde Delta, TNO.

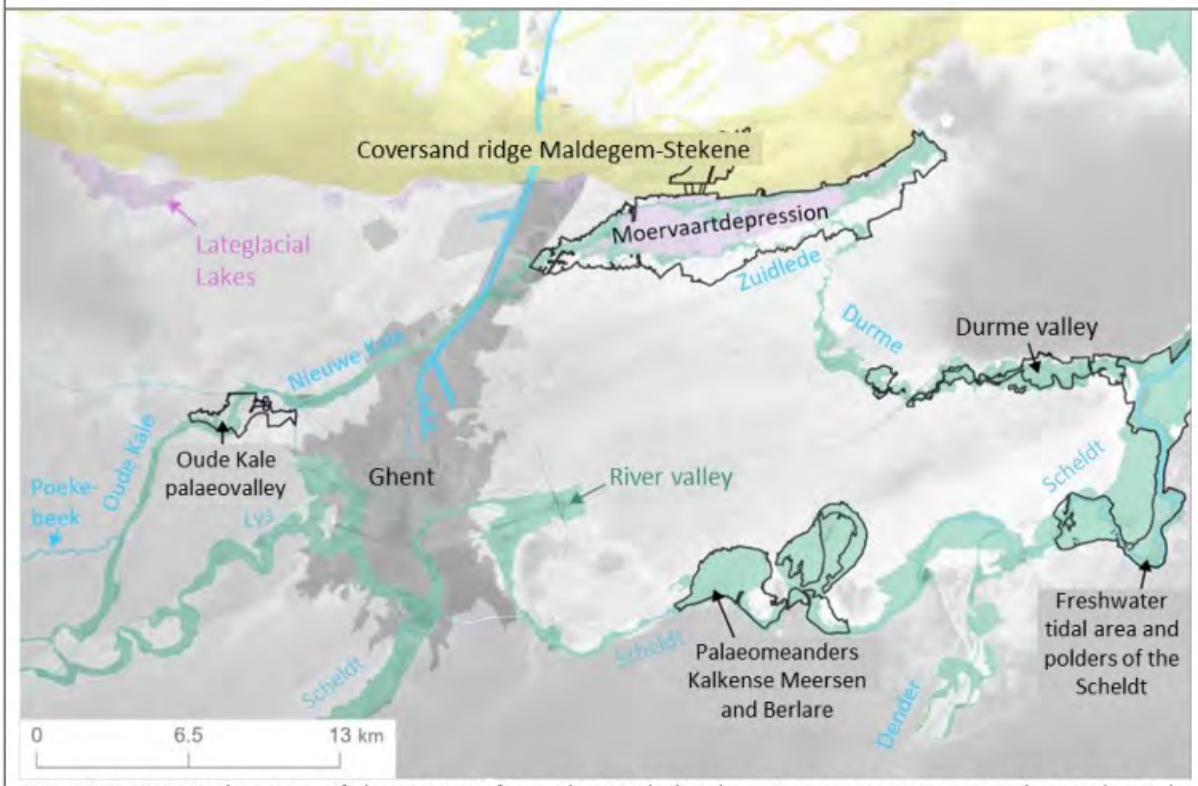

Fig. 39.5. Original course of the Durme: from the Poekebeek as its upper course, via the Oude and the Nieuwe Kale, through the Moervaart depression to the current Durme.

Documentation and resources

- Agentschap Onroerend Erfgoed (2021) Vallei van de Oude Kale, Vinderhoutse Bossen en Slindonk. In: Inventaris onroerend erfgoed. https://id.erfgoed.net/erfgoedobjecten/135387.
- De Moor G, Lootens M, van de Velde D, Meert L (1997) Toelichting bij de Quartairgeologische kaart - kaartblad 21 Tielt. Brussel
- De Vos A (1958) De middeleeuwse loop van de Durme en haar bijrivier de Poeke. Handelingen der Maatschappij voor Geschiedenis en Oudheidkunde te Gent 12:19–35.

Geosite n°40	**Oedelem-Zomergem cuesta** An asymmetric, clayey hill with a cyclic land use history. Seemingly barren but full of opportunities in times of pressure on the landscape.
 Fig. 40.1. Map of Geopark Schelde Delta. Oedelem-Zomergem cuesta is number 40.	**Scientific importance and valuation of the geosite** The Oedelem-Zomergem cuesta is of national geological importance as, together with the Dender-Zenne interfluve, it is the only location in Belgium with outcropping sediments of the Maldegem Formation from the Late Lutetian and Bartonian. These are important for the research of the Late Eocene. This also makes it the geosite with the oldest outcropping sediments in the geopark. As the largest contiguous forest area in the east of Flanders (Oost-Vlaanderen), it also has regional importance. The heritage value lies in the conservation of the landscape of the reclamation history of these marginal lands.
Municipality	Maldegem, Aalter (Knesselare), Lievegem
Province and country	Oost-Vlaanderen, Belgium
Protection status	Maldegemveld: established landscape atlas relict; Eastern and western part: Natura 2000; Drongengoed: established cultural-historical landscape
Site management organizations	Natuurpunt en Partners Meetjesland vzw, Agentschap voor Natuur en Bos, Province of Oost-Vlaanderen, Municipality Maldegem, Municipality Aalter (Knesselare), Municipality Lievegem
Accessibility	Site is accessible to the general public.
Relevance for tourism	- Visitor center - Excursions/guided tours - Routes that one can travel independently
Relevance for education	- Visitor center - Excursions/guided tours - Routes that one can travel independently
Teaching equipment	Guided and unguided walking tours. Visitor center Meetjesland at Ursel (Drongengoed Farm) and at Eeklo (Huysmans Farm).

Code	**Significance**
G-40	National

Geological interest(s)
Paleontology: The Paleogene deposits of the Maldegem and Aalter Formations outcropping at the site have been the subject of (micro) paleontological studies for paleoenvironmental and (bio) stratigraphical purposes (see below).
Stratigraphy: The sequence stratigraphic interpretation of this succession is discussed in Vandenberghe et al. (1998, 2004). On geological profiles through the area the top of the Maldegem Formation is the position of the Pyrenean unconformity, a widely recognized slightly angular unconformity in Western Europe (Deckers et al., 2015). The outcropping sediments at this site are the oldest in the Geopark.
Geomorphology: The hilly area just outside the Flemish Valley is a nice example of the geomorphological evolution of a stacked sequence of clay layers alternating with fine sands in the Eocene Formation of Maldegem, under the deep differential erosion of the land surface by rivers of the Scheldt basin during the Middle and Late Pleistocene.
Sedimentology: The Oedelem-Zomergem cuesta is one of only two regions in Belgium with outcropping sediments of the Maldegem Formation from the Late Lutetian and Bartonian, and thus important for the research of the Late Eocene.
DETAILED DESCRIPTION **1. Location** The Oedelem-Zomergem cuesta (Spanish for "slope") is a regionally remarkable, hilly area in the northwest of the Province of Oost-Vlaanderen. This geosite is located centrally at a distance of 15 km between Ghent and Bruges. The most important villages in and around the geosite are Kleit, Oostwinkel, Oedelem, Zomergem, Ursel, Knesselare and Oostveld. The geosite is intersected by the N44 and the airport of Ursel. The steeper cuesta escarpment in the south-west spans a significant elevation difference over fairly short distances, on average from 10 m TAW at the base to 25 m TAW at the top and peaks up to 29 m TAW. However, the dipslope of the cuesta is undulating and slopes less steeply to the northeast. The cuesta is mainly drained by the Ede. The top of the escarpment therefore forms a watershed, with streams on the escarpment draining southwards in the direction of the Beernem depression, while streams, such as the Ede and Flabbaertbeek, drain northwards from the cuesta ridge to the coastal plain. **2. Landscape formation** The Oedelem-Zomergem cuesta developed in three geological steps and determined the later emergence and evolution of this typical cultural landscape. <u>Formation of the cuesta</u> A cuesta is an asymmetric ridge and develops when geological layers tilt and then erode at different rates due to their different composition. The sloping layer that erodes less quickly, partly remains as an elevation in the landscape. Where the softer layer has eroded, a steep slope is created, transverse to the more resistant layer: the cuesta escarpment. Parallel to the sloping, erosion-resistant layer, a more gently sloping slope is created: the dipslope of the cuesta. <u>An alternating depositional environment in the Eocene North Sea</u> The deposition of the cuesta sediments started during the Eocene (56-33.9 million years ago), a period when the continents were not quite arranged as they are today. South of the geopark, the Artois axis then formed a land bridge between present-day Great Britain and the Ardennes. However, the Netherlands and northern Belgium were below sea level (Fig. 40.4) and sediment that eroded from the surrounding continents was deposited on the seabed. Coarse sediment particles (sand) mainly ended up close to the coasts. Finer particles (silt and clay) drifted further and settled in the deeper parts of the basin. However, climatic changes caused sea levels to fluctuate during these millions of years. During periods of low relative sea level, the region was located near the coast and mainly sandy layers were deposited (e.g. Tielt Formation, Gentbrugge

Formation, Aalter Formation and Lede Formation), while more clayey sediments (e.g. Kortrijk Formation and Maldegem Formation) were deposited when the geosite was in a deeper part of the sea. However, for the formation of the Oedelem-Zomergem cuesta, the formations of interest are the glauconitic, sandy Aalter Formation (ca. 48-47 million years old) and the glauconitic, clayey Maldegem Formation (ca. 42-38 million years old).

The core of the cuesta mainly consists of the sediments of the Maldegem Formation. This geological unit is up to 40-50 m thick and formed between 42 and 38 million years ago. The Maldegem formation consists of a number of thinner layers with sandier sediment (Wemmel Member, Onderdale Member and Buisputten Member) but mainly of clay layers (Asse Member, Ursel Member, Zomergem Member and Onderdijke Member), which gradually become coarser towards the top. These variations are caused by a stepwise, relative sea level rise, in which a sandy tidal plain continuously evolves into a more clayey, open coastal delta.

Tilting of the Eocene layers

While sedimentation took place in the North Sea Basin, plate tectonics caused important changes in southern Europe from 51 million years ago: the slow collision of the African and Eurasian plates formed several mountain ranges, such as the Pyrenees and the Alps. Due to this uplift in the south, the crust in the north sank and the deposits tilted to a north-easterly slope. As a result, the geosite evolved from marine to terrestrial environment at the end of the Eocene. To the (north) east of the geosite, later Oligocene marine clay layers have been deposited on top of these tilted Eocene sediments. These are at the surface in the geosites "Waasland cuesta" and "Boom Cuesta" but are no longer present on the Oedelem-Zomergem cuesta.

Inclusion and infill of river and brook valleys in the Eocene tilted strata

After the deposition and tilting of the cuesta sediments, a third important phase in the cuesta formation followed. During the Pleistocene ice ages, sea levels were much lower than today. As a result, rivers incised deep into the cuesta sediments, creating brook and river valleys. Loose sand was removed more easily than hard sandstone banks or clay layers. Erosion of the sandy Aalter Formation created the Beernem depression and formed the cuesta escarpment. The compact, clayey Formation of Maldegem, however, eroded more slowly and formed the dipslope. Smaller elevation changes were also present on the cuesta dipslope itself, as the more local erosion of the Maldegem Formation formed small stream valleys and harder gravel banks formed elevations.

The Beernem depression and the Flemish Valley were gradually filled and levelled during the Pleistocene due to the alternation of erosion during low sea level ice ages and sedimentation during high sea level interglacial periods. During the last interglacial period (Eemian), the geosite was like a headland, surrounded by the sea that had invaded the surrounding valleys. The oldest traces of human presence date from the last ice age (Weichselian) and were found in the depression of Beernem and along the north side of the cuesta. These Middle Palaeolithic artifacts were made by Neanderthals, who visited the flanks of these valleys as migratory hunter-gatherers. However, the dating of these finds (80,000 to 40,000 years ago) is too imprecise to suggest that these visits occurred during a colder stadial or warmer interstadial period within the ice age.

At the end of the Weichselian pleniglacial, loamy sand was blown from the north (west), over the dipslope of the cuesta. Sand wasn't blown that far and settled at the base of the dipslope. During the lateglacial period, this coversand was partly reworked into ridges, such as the coversand ridge Maldegem-Stekene. Final Palaeolithic hunter-gatherers then visited the large shallow pools such as at Burkel, where the water of the Ede and Flabbaertbeek collected between the cuesta dipslope and the coversand ridges. Mesolithic hunter-gatherers also visited these places during the Early and Middle Holocene.

Creation of a cultural landscape, determined by the cuesta

The dipslope of the cuesta was not very productive with old arable farming techniques due to its thin and acidic (clayey) sand soil, shallow clay layer and high groundwater table. As a result, the hill was mainly used extensively for grazing livestock or deforested for wood. This is also the origin of the "veld" grounds, such as the Maldegemveld. These grounds are the result of the reclamation of the landscape and created semi-open heathland landscapes with small groves or brushwood and fens. The latter wet depressions have formed where only little sand has accumulated by the wind and the underlying clay is close to the surface.

Since the cuesta was not very fertile but still offered opportunities, a certain cycle is recognizable in the history of its land use. In times of population pressure and stress on the landscape, the cuesta was used more intensively, possibly out of necessity, despite its apparent unattractiveness. When the pressure decreased, the intensity of land use also decreased.

Extensive reclamation from the Neolithic era

Neolithic axes testify to the first land reclamation by man about 6000 years ago. These were used to create small openings in the dense deciduous forest for agriculture or livestock. Human habitation traces increased from the Bronze Age (3500 years ago). It is possible that the cuesta soil was already a determining factor for the settlement structure even then. Despite the higher elevation, few Bronze Age funerary monuments (possibly near settlements) are known on the top of the escarpment, with the exception of a few sandy elevations. Visibility was important in the choice of location for these funerary structures. These appear to be more common on small ridges with a locally higher elevation at the foot of the cuesta front, possibly due to the proximity of settlements on the more fertile soils in the Beernem depression.

Roman reclamation: a possible first cycle

During Roman times, dozens of native, moated yards with wooden byre-house appeared on and around the cuesta. There are indications of large-scale deforestation, the introduction of crops, soil degradation and the appearance of heathlands. Cuesta clay was also a raw material for ceramic pots and roof tiles. During the late Iron Age and early Roman period, the yards were mainly located at the foot of the cuesta and in the Beernem depression. During the Middle Roman period, however, the pressure on the landscape was greatest due to tax pressure, favorable climatic and socio-political conditions, as well as some army camps in the area. As a result, settlements also appeared at less favorable, higher locations on the cuesta. However, the limited carrying capacity of this landscape was quickly surpassed. In the 2nd - 3rd century AD, habitation decreased and less favorable soils were avoided again.

Early Middle Ages: return of natural landscape and renewed extensive reclamation

From the late Roman period and the early Middle Ages (4th - 6th century AD), the Oedelem-Zomergem cuesta experienced strong forest recovery due to a lower population density and/or less intensive impact on the cuesta landscape. The few early medieval settlements (5th - 9th century AD) were at a significant distance from the cuesta. Gradually, however, more heathland appeared in the deciduous forests due to grazing sheep and pig herds.

High and Late Middle Ages: large-scale, intensive reclamation

The strong population growth from the first cities in the High Middle Ages strongly increased the need for agricultural land and land for cattle breeding, to the expense of the forests. Mainly large landowners, abbeys and nobility invested in these wastelands.

The first medieval reclamation phase (10th - 12th century AD) was undertaken from small farming communities and noble domains at the foot of the cuesta, such as Koningsgoed, Woestijnegoed and Prinsengoed. In the late 12th and 13th centuries AD, during the last major medieval reclamation

wave, under the impulse of abbeys, even the last, least fertile grounds of the cuesta were taken into use from three reclamation farms: the Papinglohoeve (Saint Bavo's Abbey, Ghent), the Drongengoed (Drongengoed Farm) and the Burkelgoed (Abbey Ter Doest, Lissewege later Abbey Ter Duinen, Koksijde). Despite the limitations of the landscape, it was still widely used for forestry and animal husbandry. Fish farming also took place in ponds created in the wet depressions. In the 12th century, cuesta clay again became a resource material for local, specialist potters, and from the 13th and 14th centuries, bricks were also made from local clay. The cuesta also had an important impact on the main medieval transport axes. For instance, the Oude Bruggeweg connected Ghent with Bruges via the top (the summer road) and the foot (the winter road) of the cuesta escarpment. The Lieve, a canal between Ghent and Damme, just avoided the cuesta and was excavated around the northern edge of the cuesta dipslope.

Late Middle Ages to Early Modern Era (ca. 1400-1750): failing exploitation

Due to the heavy, acidic clay soil, the reclamation of the area from the abbey farms did not proceed smoothly. For example, before 1750 barely one sixth of the heath had been successfully transformed into forest or arable land. The combination of decreased population pressure, a poorer climate, economic malaise and social conflicts (religious wars) led to a decline in the reclamation pressure. The Drongengoed Farm fell into decline and was eventually abandoned. The systematic development of the cuesta from the reclamation farms seemed to fail, in contrast to the lower sandy Flanders (Vlaanderen) around it. However, small-scale, intensive agriculture, instigated from the village centers, did lead to permanent land development on the cuesta slopes.

Early Modern Era (from 1740) to Modern Era: forestry instead of agriculture

It was not until the mid-18th century that the area that had been deforested in the Middle Ages and turned into grassland and heathland was reforested. Efforts to farm on the cuesta were abandoned. This time, however, the natural forest did not return, but the cuesta was adapted for systematic forestry thanks to innovative and enterprising abbeys. A second Drongengoed Farm was even built. From the 18th century onwards, modern agricultural techniques and agricultural industrialization allowed the marginal cuesta lands to become usable as well. Part of the forests were (again) converted into agricultural land. The eighteenth-century (woodland) lane pattern persisted until today. Only the least suitable areas remained in use for forestry, but the deciduous trees were replaced by conifers from 1850. With this modern landscape transformation, the centuries-old influence of the reclamation farms on the cuesta disappeared and external influences increased. Canals, roads and railways were built, linear settlement development increased and the forests were fragmented. In addition, the construction of airfields also gave the cuesta a military function in the first half of the 20th century.

Present-day

The contemporary landscape of the cuesta consists of large forest and nature complexes with lanes and both small-scale agricultural landscape and open agricultural area. Due to the occupation pressure in the surrounding sandy Flanders, the area is once again taking on a more important role. Since 2000, forest and agricultural land has been converted back to heathland to create valuable nature. In addition, the area also has an important social and recreational function. Moreover, the multi-layered geological and cultural-historical heritage landscape provides a typical regional identity, which has recently also been emphasized by the Drongengoed Landscape Park.

Relation with other geosites

- In the geopark, cuestas also occur in the 'Waasland Cuesta' (geosite 35) and 'Boom Cuesta' (geosite 32). These are younger (Oligocene) and are therefore stratigraphically higher on the southward sloping Paleogene layers.

- The Oedelem-Zomergem cuesta is surrounded by lower areas of the Flemish Valley landscape, such as the geosite 'Moervaart depression and coversand ridge' (geosite 37) in the north(east)
- And connects to the polders in the north (geosite 22 'creek and coversand area Sint-Margriete – Aardenburg')
- And northwest (geosite 21 'Zwin polders near Damme' and geosite 19 'Zwin').

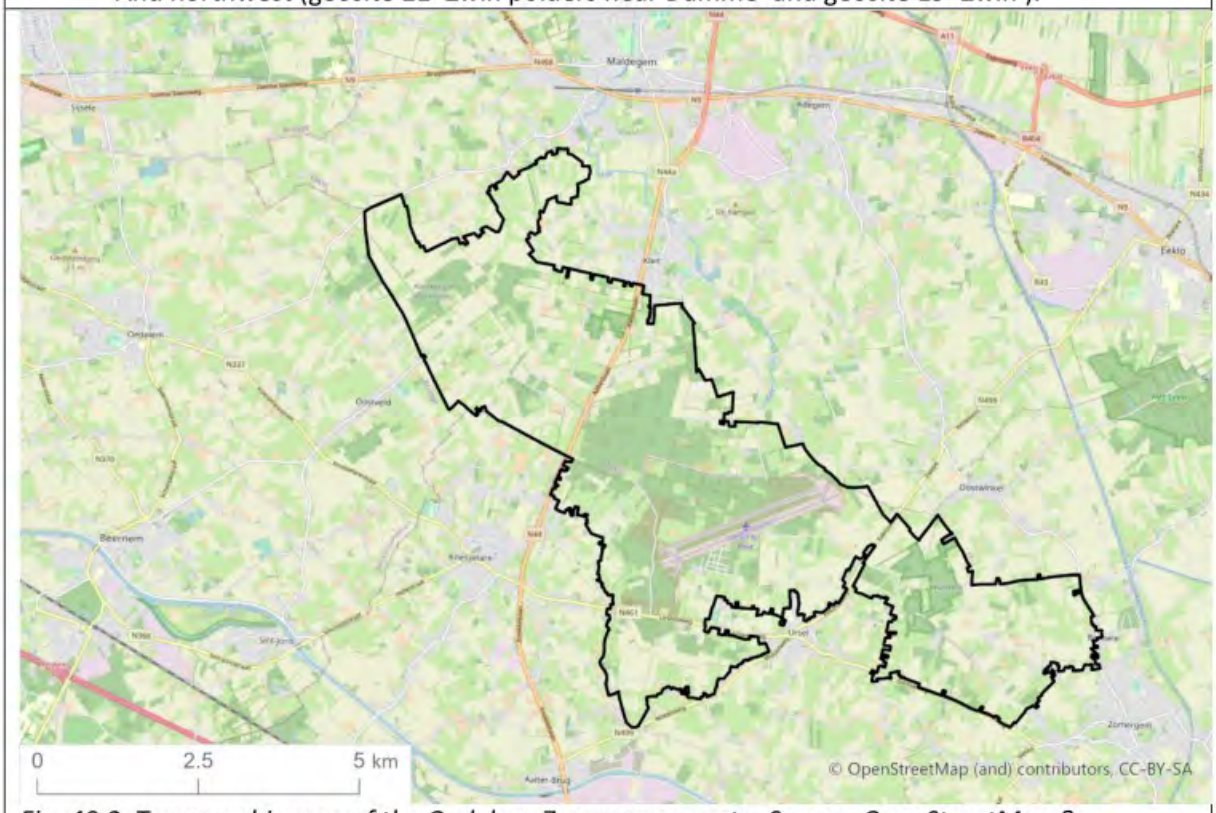

Fig. 40.2. Topographic map of the Oedelem-Zomergem cuesta. Source: OpenStreetMap & contributors. CC-BY-SA.

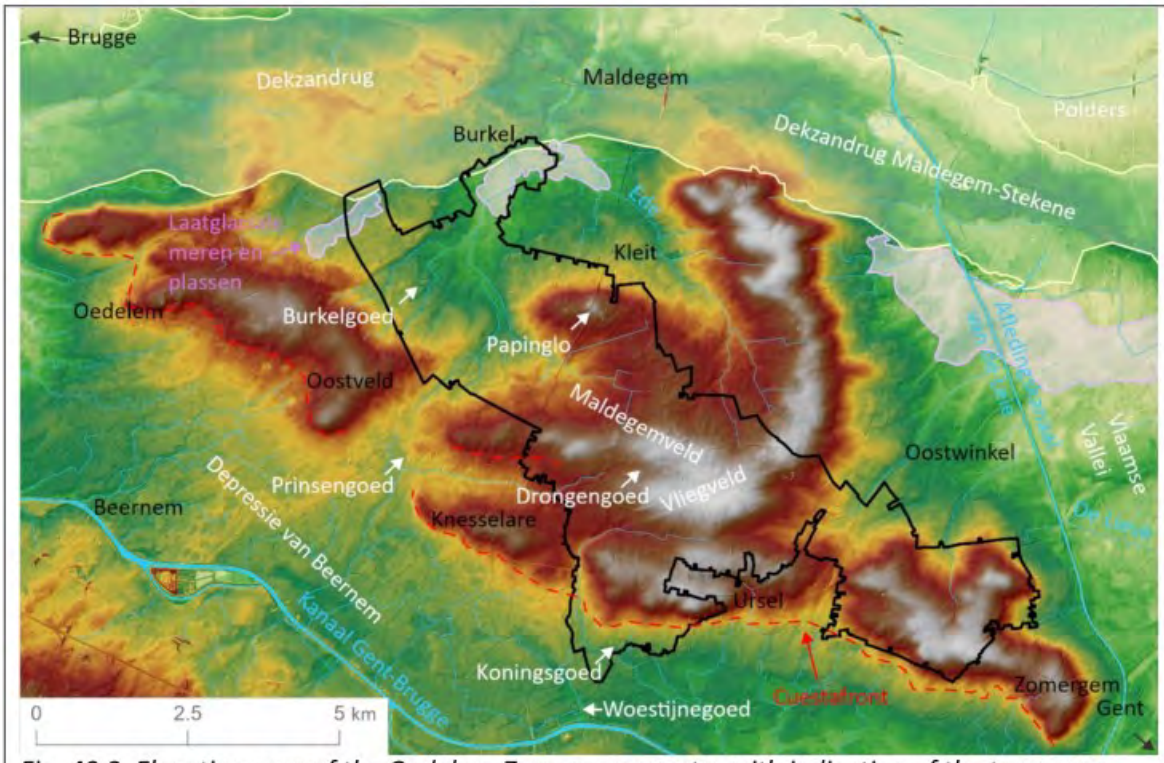

Fig. 40.3. Elevation map of the Oedelem-Zomergem cuesta, with indication of the toponyms, landscape units and hydrographic elements mentioned in the text. Source: DHMVII Flanders Information Agency.

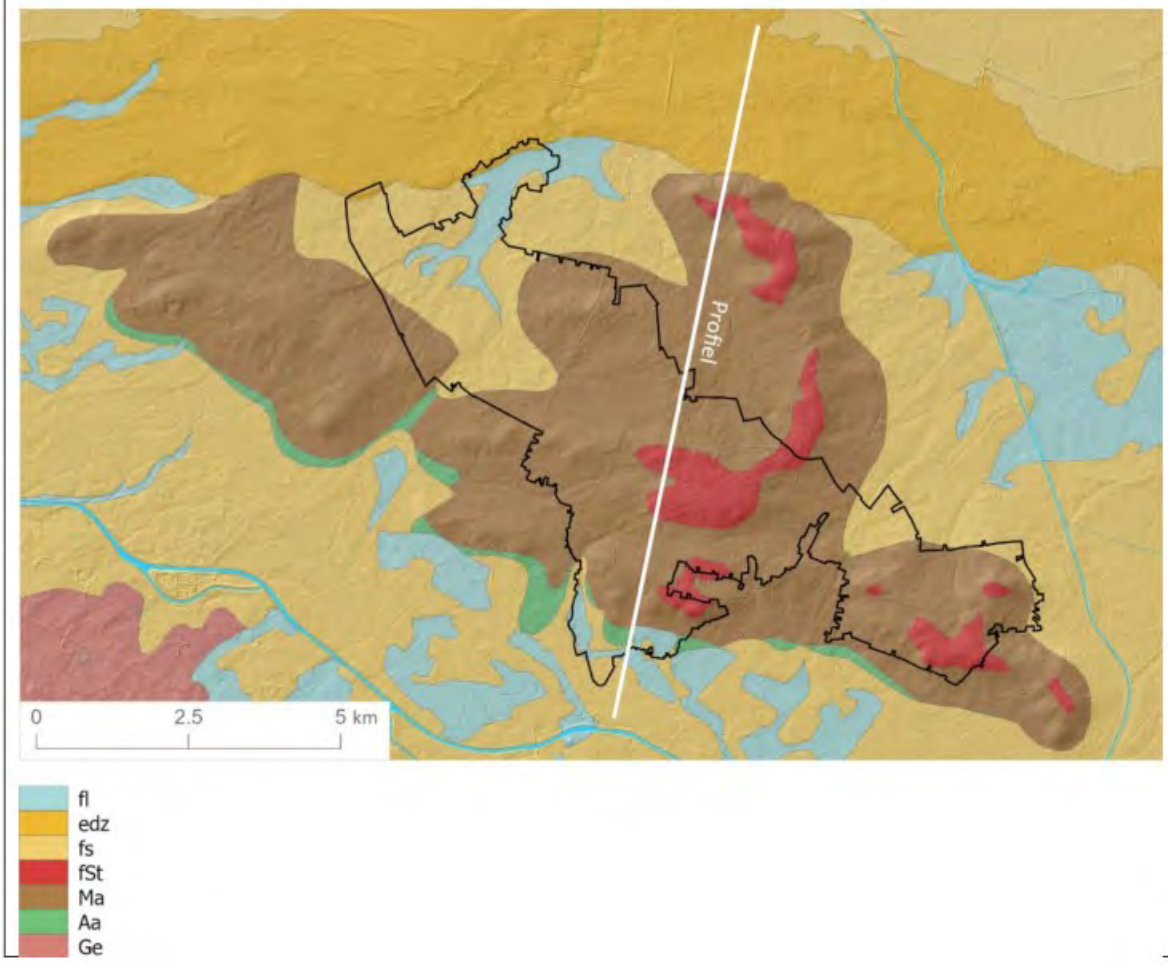

Fig. 40.4. Geological map of the Oedelem-Zomergem cuesta. Source: Geological map of Geopark Schelde Delta, TNO.

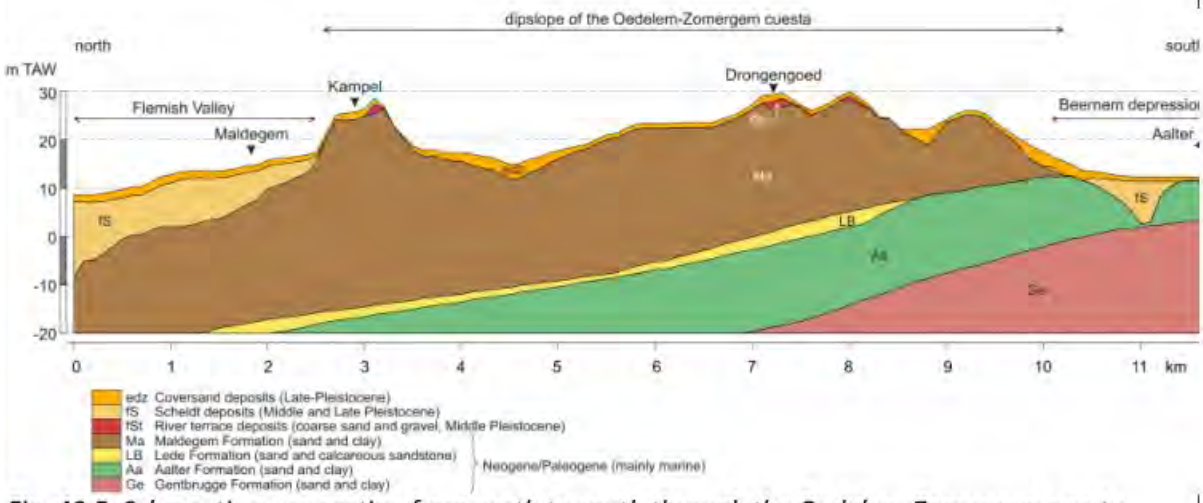

Fig. 40.5. Schematic cross-section from north to south through the Oedelem-Zomergem cuesta. Location: see geological map (Figure 40 3). Based on a virtual profile (dov.vlaanderen.be).

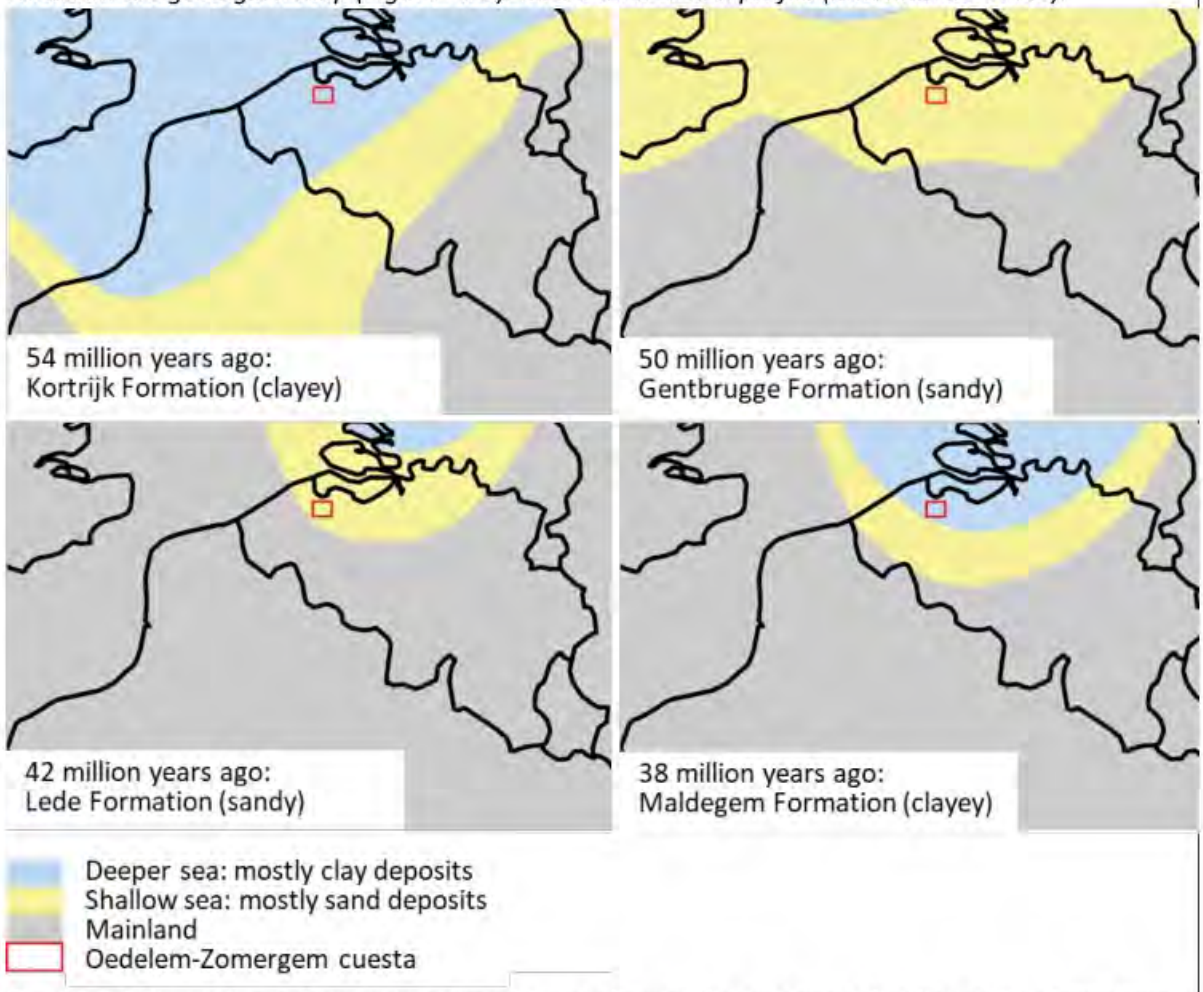

Fig. 40.6. Schematic map representation of the shallow and deep sea at the time of the deposition of the cuesta sediments. Adapted from: Exhibition "Het geheim van de cuesta", Drongengoed Landscape Park

Documentation and resources

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SCHELDE DELTA

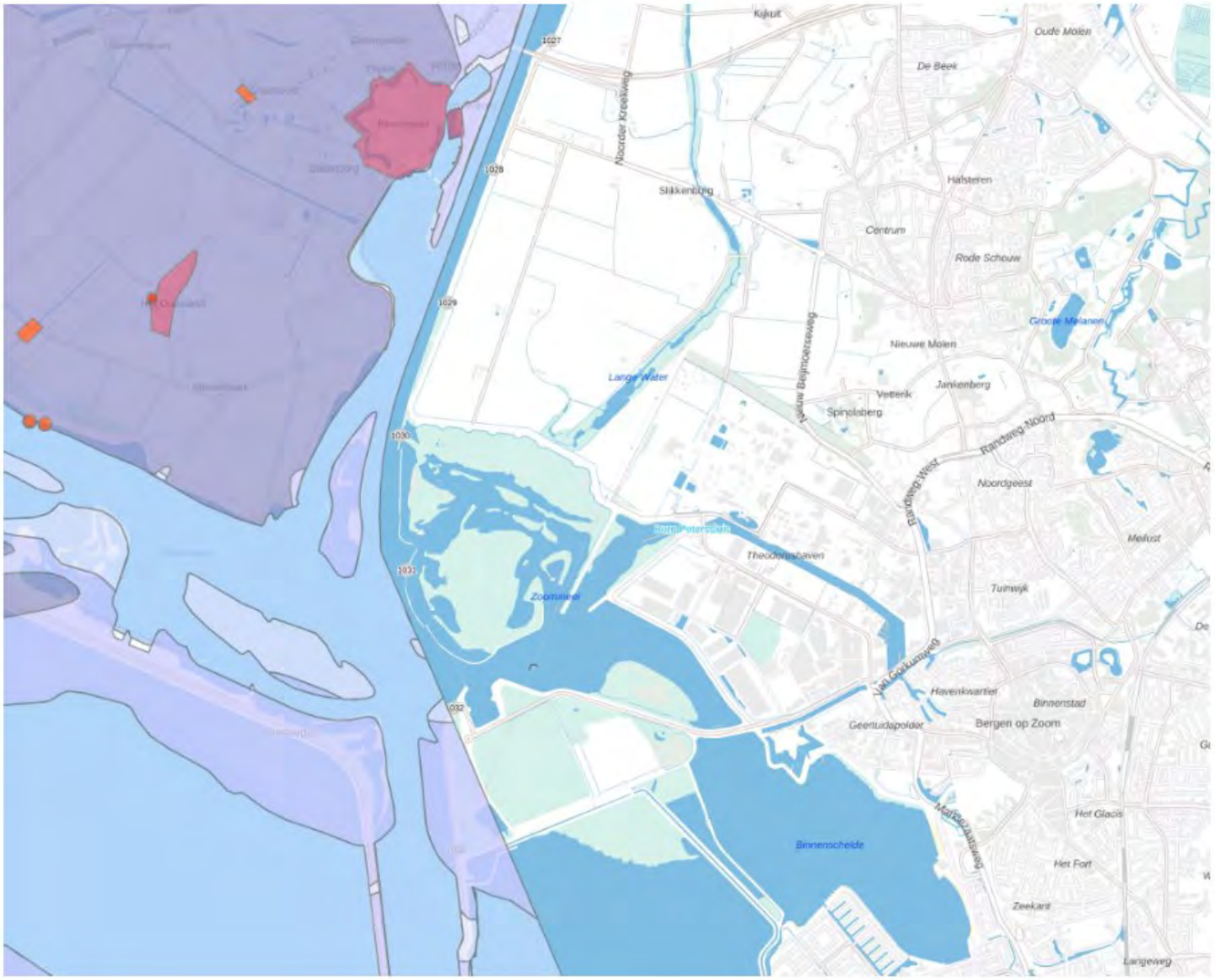
ASPIRING GLOBAL GEOPARK

November 2022

Toelichting grondslagen

In dit document kunt u secties terugvinden die onleesbaar zijn gemaakt. Deze informatie is achterwege gelaten op basis van artikel 5 van de Wet open overheid (Woo). De legenda verwijzing die hierbij is vermeld correspondeert met de bijbehorende grondslag in onderstaand overzicht.

Legenda verwijzing	Artikel verwijzing	Uitzonderingsgrond
		Artikel 5.1 lid 1 Woo – Absolute uitzonderingsgronden **De openbaarmaking van deze informatie:**
A	art. 5.1 lid 1 a	Kan de eenheid van de Kroon in gevaar brengen.
B	art. 5.1 lid 1 b	Kan de veiligheid van de Staat schaden.
C	art. 5.1 lid 1 c	Betreft bedrijfs- en fabricagegegevens die vertrouwelijk aan de overheid zijn meegedeeld.
D	art. 5.1 lid 1 d	Betreft persoonsgegevens als bedoeld in paragraaf 3.1 (bijzondere persoonsgegevens) of paragraaf 3.2 (persoonsgegevens van strafrechtelijke aard) van de UAVG.
E	art. 5.1 lid 1 e	Betreft nummers die dienen ter identificatie van personen die bij wet of algemene maatregel van bestuur zijn voorgeschreven als bedoeld in artikel 46 van de UAVG.
		Artikel 5.1 lid 2 Woo – Relatieve uitzonderingsgronden **Het belang van de openbaarmaking van deze informatie weegt niet op tegen:**
F	art. 5.1 lid 2 a	Het belang van de betrekkingen van Nederland met andere staten en met internationale organisaties.
G	art. 5.1 lid 2 b	Het belang van de economische of financiële belangen van de Staat, andere publiekrechtelijke lichamen of bestuursorganen.
H	art. 5.1 lid 2 c	Het belang van de opsporing en vervolging van strafbare feiten.
I	art. 5.1 lid 2 d	Het belang van de inspectie, controle en toezicht door bestuursorganen.
J	art. 5.1 lid 2 e	Het belang van de eerbiediging van de persoonlijke levenssfeer van betrokkenen.
K	art. 5.1 lid 2 f	Het belang van de bescherming van andere dan in art. 5.1 lid 1 sub c genoemde concurrentiegevoelige bedrijfs- en fabricagegegevens.
L	art. 5.1 lid 2 g	Het belang van de bescherming van het milieu waar deze informatie betrekking op heeft.
M	art. 5.1 lid 2 h	Het belang van de beveiliging van personen en bedrijven en het voorkomen van sabotage.
N	art. 5.1 lid 2 i	Het belang van het goed functioneren van de Staat, andere publiekrechtelijke lichamen of bestuursorganen.
O	art. 5.1 lid 4	Het belang dat de geadresseerde erbij heeft om als eerste kennis te kunnen nemen van de informatie (tijdelijke beperking).
P	art. 5.1 lid 5	Het belang van de onevenredige benadeling welke, in uitzonderlijke gevallen, wordt toegebracht aan een ander belang dan genoemd in art. 5.1 de leden 1 en 2, bij andere informatie dan milieu-informatie.
Q	art. 5.1 lid 6	Het belang genoemd in artikel 5.1 lid 1 sub c en het hier milieu-informatie betreft waardoor, bij openbaarmaking, ernstige schade wordt toegebracht aan het genoemde belang in artikel 5.1 lid 1 sub c.
		Artikel 5.2 lid 1 Woo – Persoonlijke beleidsopvattingen **De informatie uit documenten betreft:**
R	art. 5.2 lid 1	Persoonlijke beleidsopvattingen. Onder persoonlijke beleidsopvattingen worden verstaan ambtelijke adviezen, visies, standpunten en overwegingen ten behoeve van intern beraad, niet zijnde feiten, prognoses, beleidsalternatieven, de gevolgen van een bepaald beleidsalternatief of andere onderdelen met een overwegend objectief karakter.
S	Art. 5.2 lid 2	Tot personen te herleiden gegevens, met betrekking tot door het bestuursorgaan, met het oog op een goede en democratische bestuursvoering, verstrekte informatie die kwalificeert als persoonlijke beleidsopvattingen.
		Overig
T		De informatie valt buiten de reikwijdte van het verzoek.


Kijkuit
Oude Molen
De Beek
Noorder Kreekweg
Halsteren
Slikkenburg
Centrum
Rode Schouw
Groote Molenven
Nieuwe Molen
Langeweg
Jankenberg
Vetterik
Spinolsberg
Randweg-Noord
Randweg-West
Noordgeest
Melfust
Theodorushaven
Zoomvliet
Tuinwijk
Van Goltziusweg
Havenkwartier
Binnenstad
Geertruidapolder
Bergen op Zoom
Het Glacis
Binnenschelde
Het Fort
Zeekant
Langeweg

Toelichting grondslagen

In dit document kunt u secties terugvinden die onleesbaar zijn gemaakt. Deze informatie is achterwege gelaten op basis van de Wet open overheid (Woo). De letter die hierbij is vermeld correspondeert met de bijbehorende grondslag in onderstaand overzicht.

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D	art. 5.1 lid 1 d	Betreft persoonsgegevens als bedoeld in paragraaf 3.1 (bijzondere persoonsgegevens) of paragraaf 3.2 (persoonsgegevens van strafrechtelijke aard) van de Uitvoeringswet Algemene verordening gegevensbescherming, waarvoor geen toestemming is gegeven of door de betrokkene kennelijk zelf openbaar zijn gemaakt
E	art. 5.1 lid 1 e	Het betreft nummers die dienen ter identificatie van personen die bij wet of algemene maatregel van bestuur zijn voorgeschreven als bedoeld in artikel 46 van de Uitvoeringswet Algemene verordening gegevensbescherming, tenzij de verstrekking kennelijk geen inbreuk op de levenssfeer maakt
		Artikel 5.1 lid 2 Woo – Relatieve uitzonderingsgronden **Het belang van de openbaarmaking van deze informatie weegt niet op tegen:**
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K	art. 5.1 lid 2 f	Het belang van de bescherming van andere dan in art. 5.1 lid 1 sub c genoemde concurrentiegevoelige bedrijfs- en fabricagegegevens
L	art. 5.1 lid 2 g	Het belang van de bescherming van het milieu waar deze informatie betrekking op heeft
M	art. 5.1 lid 2 h	Het belang van de beveiliging van personen en bedrijven en het voorkomen van sabotage
N	art. 5.1 lid 2 i	Het belang van het goed functioneren van de Staat, andere publiekrechtelijke lichamen of bestuursorganen
O	art. 5.1 lid 4	Het belang dat de geadresseerde erbij heeft om als eerste kennis te kunnen nemen van de informatie (tijdelijke beperking)
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SCHELDE DELTA

ASPIRING GLOBAL GEOPARK

Legend

Geopark locations
- Entrance point
- EGTC, administrative headquarters Geopark
- Natura2000/Ramsar areas
- Geopark geosites (storyline 1)
- Geopark boundary

Information and experience infrastructure
- Visitor center
- Reception point
- Information point
- Large museum
- Medium sized museum
- Small museum
- Heritage site
- Castle
- Fortress
- Education center

Storyline 2: Living with the water
- Dike Westkapelle
- Drowned villages in Zeeland, Noord-Brabant and Vlaanderen
- Tidal mill Rupelmonde
- Delta Works
- Dike system Zuid-Beveland
- Inner diked wetlands north coast of Noord-Beveland and south coast of Schouwen

Storyline 3: Rich grounds to sustain
- Scheldt near Woensdrecht and polders
- Estate de Mattenburg
- Huysman Farm
- Villages van Tieringe
- Abbey Sint Bernardus, Hemiksem
- Bergse Moervaart
- District Nieverenen, with brickyards Fosteur en Lauwers
- Moervaart depression, prehistoric site
- Chateau grounds d'Ursel and polder of Hingene

Storyline 4: Gate to the world
- Shipyard Baasrode
- De Lieve
- The Lost Zwin Ports
- Historic city of Damme
- Damse Vaart

Storyline 5: Contested area
- Circular strongholds Viking age Burgh and Oost-Souburg
- Museum het Bolwerk
- Fortresses and fortifications near Bergen op Zoom and Steenbergen
- Fort Steendorp
- Atlantik Wall remnants WOII
- Spanish State Lines

Geopark Hosts of the Landscape
- Education
- Food and drinks
- lodging
- Tourism
- Recreation

Infrastructure
- Train station
- Bus station
- Marina
- Airport
- Railway
- Road
- Ferry

1:50.000

0 2.5 5 km

Toelichting grondslagen

In dit document kunt u secties terugvinden die onleesbaar zijn gemaakt. Deze informatie is achterwege gelaten op basis van de Wet open overheid (Woo). De letter die hierbij is vermeld correspondeert met de bijbehorende grondslag in onderstaand overzicht.

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Provinciale Staten

Provincie Zeeland

Vragen van het statenlid A. Geluk en M.A. van 't Westeinde (CDA) ingevolge artikel 44 reglement van orde

AANHANGSEL

tot de notulen van de provinciale staten van Zeeland 2018 **nummer 277.**

Vragen ingevolge artikel 44 van het reglement van orde inzake windmolens Auvergnepolder (ingekomen 1 november 2018)		**Antwoorden van gedeputeerde staten:**	
1.	Is het college bekend met het initiatief in de Auvergnepolder? Zo ja, hoe is het college hiervan op de hoogte gesteld?	1.	Ja. Via ambtelijk contact met de provincie Noord Brabant en de gemeente Tholen.
2.	Er is sprake van een initiatief in een andere provincie. Hoe werkt het vastgelegde beleid in het Omgevingsplan 2018 door in grensgebieden?	2.	Er is in het Omgevingsplan geen specifieke regeling voor projecten in grensgebieden opgenomen.
3.	Voor Zeeland geldt dat voor kleine initiatieven lokaal draagvlak via het gemeentebestuur van groot belang is. Hoe wordt hier mee omgegaan als net over de provinciegrens/landsgrens dergelijke initiatieven ontstaan?	3.	Het is aan de initiatiefnemer en het bevoegd gezag om voor afstemming met de omgeving (en dus ook met de buurgemeenten) te zorgen.
4.	Is het college bereid om interprovinciale afstemming te organiseren voor de grensgebieden? En dus ook de problematiek van de windmolens in de Auvergnepolder met de provincie Noord Brabant en betrokken gemeenten te bespreken?	4.	Wij zijn voornemens dit in het Omgevingsvisie traject vorm te geven. Het betreffende windenergieproject is onderdeel van de afspraken die de regio West Brabant rond de taakstelling windenergie 2020 met de provincie Noord Brabant heeft gemaakt. Wij zien daar voor ons geen rol. De gemeente Tholen maakt overigens onderdeel uit van dat regio overleg.

MIDDELBURG, 20 november 2018

Namens de fractie van CDA,

A. Geluk en M.A. van 't Westeinde

Gedeputeerde Staten,

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A.W. Smit

statenstukken

Toelichting grondslagen

In dit document kunt u secties terugvinden die onleesbaar zijn gemaakt. Deze informatie is achterwege gelaten op basis van de Wet open overheid (Woo). De letter die hierbij is vermeld correspondeert met de bijbehorende grondslag in onderstaand overzicht.

Legenda verwijzing	Artikel verwijzing	Uitzonderingsgrond
		Artikel 5.1 lid 1 Woo – Absolute uitzonderingsgronden **De openbaarmaking van deze informatie:**
A	art. 5.1 lid 1 a	Kan de eenheid van de Kroon in gevaar brengen
B	art. 5.1 lid 1 b	Kan de veiligheid van de Staat schaden
C	art. 5.1 lid 1 c	Betreft bedrijfs- en fabricagegegevens die vertrouwelijk aan de overheid zijn meegedeeld
D	art. 5.1 lid 1 d	Betreft persoonsgegevens als bedoeld in paragraaf 3.1 (bijzondere persoonsgegevens) of paragraaf 3.2 (persoonsgegevens van strafrechtelijke aard) van de Uitvoeringswet Algemene verordening gegevensbescherming, waarvoor geen toestemming is gegeven of door de betrokkene kennelijk zelf openbaar zijn gemaakt
E	art. 5.1 lid 1 e	Het betreft nummers die dienen ter identificatie van personen die bij wet of algemene maatregel van bestuur zijn voorgeschreven als bedoeld in artikel 46 van de Uitvoeringswet Algemene verordening gegevensbescherming, tenzij de verstrekking kennelijk geen inbreuk op de levenssfeer maakt
		Artikel 5.1 lid 2 Woo – Relatieve uitzonderingsgronden **Het belang van de openbaarmaking van deze informatie weegt niet op tegen:**
F	art. 5.1 lid 2 a	Het belang van de betrekkingen van Nederland met andere staten en met internationale organisaties
G	art. 5.1 lid 2 b	De economische of financiële belangen van de Staat, andere publiekrechtelijke lichamen of bestuursorganen
H	art. 5.1 lid 2 c	Het belang van de opsporing en vervolging van strafbare feiten
I	art. 5.1 lid 2 d	Het belang van de inspectie, controle en toezicht door bestuursorganen
J	art. 5.1 lid 2 e	Het belang van de eerbiediging van de persoonlijke levenssfeer van betrokkenen
K	art. 5.1 lid 2 f	Het belang van de bescherming van andere dan in art. 5.1 lid 1 sub c genoemde concurrentiegevoelige bedrijfs- en fabricagegegevens
L	art. 5.1 lid 2 g	Het belang van de bescherming van het milieu waar deze informatie betrekking op heeft
M	art. 5.1 lid 2 h	Het belang van de beveiliging van personen en bedrijven en het voorkomen van sabotage
N	art. 5.1 lid 2 i	Het belang van het goed functioneren van de Staat, andere publiekrechtelijke lichamen of bestuursorganen
O	art. 5.1 lid 4	Het belang dat de geadresseerde erbij heeft om als eerste kennis te kunnen nemen van de informatie (tijdelijke beperking)
P	art. 5.1 lid 5	De onevenredige benadeling welke, in uitzonderlijke gevallen, wordt toegebracht aan een ander belang dan genoemd in art. 5.1 de leden 1 en 2, bij andere informatie dan milieu-informatie.
Q	art. 5.1 lid 6	Het belang genoemd in artikel 5.1 lid 1 c, het hier milieu-informatie betreft waardoor, bij openbaarmaking, ernstige schade wordt toegebracht aan het genoemde belang in artikel 5.1 lid 1c
		Artikel 5.2 lid 1 Woo – Persoonlijke beleidsopvattingen **De informatie uit documenten betreft:**
R	art. 5.2 lid 1	Persoonlijke beleidsopvattingen. Onder persoonlijke beleidsopvattingen worden verstaan ambtelijke adviezen, visies, standpunten en overwegingen ten behoeve van intern beraad, niet zijnde feiten, prognoses, beleidsalternatieven, de gevolgen van een bepaald beleidsalternatief of andere onderdelen met een overwegend objectief karakter
S	Art. 5.2 lid 2	Tot personen te herleiden gegevens, met betrekking tot door het bestuursorgaan, met het oog op een goede en democratische bestuursvoering, verstrekte informatie die kwalificeert als persoonlijke beleidsopvattingen