APPENDIX A18

Gmail

Portmarnock Uncovered <catherineandbetty@gmail.com>

Coribb brief of evidence

Sabrina Joyce <sabrina.joyce@gmail.com> Thu, Sep 29, 2022 at 9:52 AM
To: Portmarnock Uncovered <catherineandbetty@gmail.com>

---------- Forwarded message ---------
From: **Sabrina Joyce** <sabrina.joyce@gmail.com>
Date: Mon, Sep 19, 2022 at 10:37 PM
Subject: Re: Coribb brief of evidence
To: Tim Jaguttis <t.jaguttis@delamotte-partner.de>

Hi Tim,
Thank you for letting me know and I agree that if this issue is raised that I will only produce the full email conversation and will advise you.
I was concerned as your BoE was produced after I raised concerns about existing faults and folds in the limestone that could contribute to bentonite breakout , on the route they has chosen under Baldoyle estuary. I didn't like the idea that an expert would be associated via a Brief of Evidence on a project he had never seen any information on. it is unfair to you.

My husband came to Ireland from [redacted] and he loved it so much that he never left. and In turn I have an affinity with Germany and now [redacted]. We live beside the coast (Portmarnock) on the opposite side from where you where when you visited. If you are ever in Dublin feel free to get in touch , we can show you the best beach on the East coast.
I appreciate you coming back to me so quickly.

All the best
Sabrina

On Mon, Sep 19, 2022 at 9:24 PM Tim Jaguttis <t.jaguttis@delamotte-partner.de> wrote:

> Hello Sabrina,
>
> Thank you so much for your explanations - please understand, that I'm a bit inquisitive as I've been through a 9 wks. hearing on the Corrib project, where I indeed presented the brief of evidence that you mention. Other than that, I'd like to ensure to you, that I've only found out about the GDD subsequent to your email. I've not been consulted in any way or by any party to introduce my BoE to this case and I'm not familiar with the ABP case no. you reference -- however, I'm not sure that this is really relevant, as my BoE seems to be in the public domain and any reference to this (as a citation) would solely depend on the expertise of a citing third party.
>
> Be it as it may, I leave up to the responsible person to judge upon this.
>
> From a personal point of view, I appreciate you contacting me, as I have fond memories of my time in Ireland and all the people I met there. Knowing many of them, please understand that if this conversation should be referenced or disclosed to third parties, I do only agree to this under the condition that the full unabridged email conversation is included. Under these circumstances, pls. feel free to revert to me.
>
> Success with your case!
>
> Best regards
>
> Tim Jaguttis
>
> -------- Original Message --------
> **Subject:** Re: Coribb brief of evidence
> **From:** Sabrina Joyce <sabrina.joyce@gmail.com>
> **To:** Tim Jaguttis <t.jaguttis@delamotte-partner.de>
> **Date:** 19.9.2022
>
> Good afternoon Tim,

Thank you for getting back so quickly and my apologies for not getting back to you before now. A family.member was unwell. I have replied in English as I suspect your English is better than my German, despite the fact that I have been married to a German for 11 years.

I am currently acting as a representative for a number of community's along the route of the development as a planning and environmental law consultant. On their behalf I took a judicial review of the original planning consent and the court overturned the development decision.

During the court case we became aware of the usual procedure for submitting a brief of evidence into an oral hearing was that the expert must read it into the record and answer any questions the inspector may have. We did not remember you listed on the oral hearing schedule, but your brief of evidence was produced and the inspector relied on the information in her report.

My only motivation is to ensure evidence rules were correctly followed and that you were aware that your evidence was used in this case to allow us fair procedure.
For your reference the An Bord Pleanála Case no was 301908.
Thank you for your time.

Best Regards
Sabrina Joyce-Kemper

On 14 Sep 2022, at 7:51 p.m., Tim Jaguttis <t.jaguttis@delamotte-partner.de> wrote:

Dear Sabrina,

Thanks so much for your mail. I see you're using a private email address. May I kindly ask you to share with me your role in this and what your motivations are in asking so. Thanks so much in advance.

Best regards

Tim Jaguttis

Am 2022-09-14 um 15:24 schrieb Sabrina Joyce:

Sehr geehrter Herr Dr. Jaguttis,

I entschuldige mich fuer diese Email aus dem Blauen heraus. I wuerde gerne herausfinden, ob Sie Irish Water die Erlaubnis erteilten, die an diese Email angehaengte Aussage als Beweis zu hinterlegen im Greater Dublin Drainage Project. Ihre Aussage wurde offiziell eingereicht am 28.03.2019 waerend einer Anhoerung von An Bord Pleanala im Gresham Hotel in Dublin.

Vielen Dank fuer Ihre Zeit und freundliche Gruesse,
Sabrina Joyce-Kemper
[redacted]

Good afternoon Dr. Jaguttis,
I apologise for contacting you out of the blue. I am just checking to see if you gave permission to Irish Water, for the attached brief of evidence to be submitted into evidence as part of the Greater Dublin Drainage Project Development. Your brief was officially submitted in or about the 28th Of March 2019 at an oral hearing held by An Bord Pleanála in the Gresham Hotel, Dublin.

Thank you and again forgive my intrusion.
Kind regards
Sabrina Joyce-Kemper

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<XSt0zxnbk3rQHhg7.gif>

Dr.-Ing. Tim Jaguttis

[redacted]

[redacted]

www.delamotte-partner.de • Geschäftsführung Dr. Tim Jaguttis, B. de la Motte • Amtsgericht Lübeck HRB 6789

--
"La Vida es la Aventura"
[Quoted text hidden]

Brief of evidence

Tunnelling construction

1 Personal Information and Qualification

My name is Dr. Tim Jaguttis. I am a mechanical engineer and carry a PhD in mechanical engineering. Since 2008 I'm a managing partner of the de la Motte & Partner GmbH.

We are an engineering company and our experience includes consulting companies with the focus on special pipeline and cable construction, which include crossings, landfalls, Horizontal Directional Drilling (HDD) and utility tunnels. Our national and international clients come from the private and public sector ranging from large oil and gas producers to community service providers.

Since 2006 I'm the deputy project manager and site representative for the Dutch N.V. Nederlandse Gasunie on the Emstunnel Project. A 4 km long 3 m internal diameter segment lining tunnel that has been constructed between Germany and the Netherlands for the installation of a 1.2 m (48") diameter, 80 bar high pressure transmission gas pipeline.

I have taken a leading role in this project from the feasibility phase until execution. The Ems tunnel project is has been completed in July 2010 and has been realized according to high standards and planning.

The Emstunnel project is an excellent reference to demonstrate the feasibility of a long-distance pipeline tunnel as it is under application for the Corrib Onshore Pipeline.

1.1 Knowledge of the Site and Related Activities

Shell E&P Ireland Ltd. consulted de la Motte & Partner in 2007 regarding alternative possibilities for routes crossing the Sruwaddacon Bay.

We were asked by SEPIL to examine trenchless and open cut construction methods that were examined and the pro and cons of each method were presented.

On the basis of this work and after consultation with SEPIL the finally proposed construction method was put forward.

We have already assisted SEPIL during preparation of the 2009 application and participated at the 2009 oral hearing.

1.2 Scope of Evidence

I visited Sruwaddacon Bay first on June 18th 2007, Since then regular trips have been undertaken.

Today, my evidence considers all tunnelling specific aspects, including:

- Tunnel route and alignment
- Segment lined tunnelling technique
- Tunnelling related constructions at the launch and receiving compounds
- Tunnelling fluid / bentonite system
- Spoil transport and separation
- Handling of obstructions
- Installation of the pipeline and services within the tunnel
- Grouting of the tunnel

2 General

The majority of the Corrib onshore pipeline route under consideration will be constructed by means of trenchless methods. Approximately 4.9 km of the pipeline will be installed inside a tunnel of 3.5 m internal and approximately 4.2 m external diameter between Aghoos and Glengad *(slide 1)* (Volume 1, chapter 1, figure 1.1 and drawing DG0401 of the EIS). The size of the tunnel has been selected to allow safe work inside during the construction process.

The Tunnel will be constructed using a mechanized tunnel building process, referred to as "Segmental Lining". During this process a tunnel boring machine (TBM) will be launched from the start shaft at the compound near Aghoos (drawing. DG0401 p.4) excavating the soil in a mechanized way. Within the TBM, the excavated void will subsequently be supported by a concrete lining which forms the tunnel.

This process of excavation and installation of tunnel lining will be carried out in a continuous cycle along the pipeline route from Aghoos to the compound near Glengad, where the TBM will be recovered from a shaft (receiving shaft)

After completion of the tunnel construction works, the pipeline and associated services (umbilicals, spares and ducts) will be installed into the tunnel and connected to the adjacent land sections prior to the final testing.

The remaining void space between the tunnel and the installed services will be filled up with a durable backfilling material as a last step of this construction process.

Finally, the compounds near Aghoos and Glengad will be reinstated.

3 Tunnel route and alignment

The horizontal tunnel route between Glengad and Aghoos is shown on dwg 0401, Appendix M1-A of the EIS *(slide 2)*. It is roughly oriented in East – Westerly direction and forms a gentle Double-S-curve with a minimum horizontal radius of 1000 m.

In order to optimize the route for the construction process and maintain the possibility to incorporate changes during detailed engineering, it is intended to route the pipeline within a maximum distance of 8 m from the current centre line.

The vertical alignment of the tunnel is given in drawing DG0401 as well. The alignment is chosen in a way to maintain a cover of minimum 1.3 times the machine OD (approx. 5.5 m) while at the same time minimizing the total amount of tunnelling distance through the lower bedrock.

Starting from Aghoos, the alignment continues with a downward gentle slope inside the rock formation. Approximately from tunnel chainage 4250 m (KP 88.13) to 4000 m (KP 87.88) the alignment transitions from the bedrock to the granular deposits above.

The alignment continues in the area of granular soil for approx. 3,850 m (KP 87.73) until tunnel chainage 400 m (KP84.28) *(slide 3)* from whereon a gentle incline will be realized in order to arrive at the receiving shaft near Glengad. The last 400 m of the alignment from tunnel chainage 400 m (KP 83.88) to the receiving shaft will be constructed inside the bedrock layer near Glengad.

Although tunnelling is possible likewise in rock as well as granular, cohesive or mixed ground conditions, it has been decided to select the current vertical tunnel alignment in such a way, that tunnelling through bedrock is avoided as far a possible, thus maximizing progress rates and reducing the project duration to a minimum. The alternative tunnelling routes and construction methods considered are discussed in greater detail by Mr. Ciaran Butler in his brief of evidence.

Within the tunnel, the pipeline and services will be installed on supports as shown in Volume 1, Chapter 5, Figure 5-5 of the EIS *(slide 4)*.

4 Tunnel construction

The construction process of the tunnel is outlined in Volume 1, Chapter 5 of the EIS *(slide 5)*.

It is industry practice that tunnel construction works are carried out 24 hour per day, seven days a week and this will be the basis for the Corrib Onshore Pipeline tunnel construction. A 24 hour operation is required to reduce the total duration of the very time consuming tunnelling works to a minimum and to reduce construction risks which are related to a repeated prolonged interruption of the works.

To construct the tunnel, a mechanized tunnel boring machine (TBM) equipped with a "cutter head" at its front face is used to excavate the soil, rotating at a speed of approx. 6 rpm. During this process the TBM is pushed forward by means of jacking cylinders installed inside the TBM pressing against the tunnel lining, which is installed in the rear part of the machine (the tail skin).

Subsequent to the excavation of a distance equal to the length of a tunnel ring (approx. 1.2 m) this process will be stopped and the next tunnel ring will be built inside the machine by assembling a number of concrete segments (typically 6) inside the tail skin.

Upon completion of the ring-building, the next excavation process will be started.

Due to this construction method, long tunnels can be constructed in almost all geologies.

The operation of the TBM, ring building and segment supply is carried out by a crew of typically 8 to 10 people inside the tunnel.

4.1 Construction compounds

For the construction of the tunnel and the installation of the pipeline and services two compounds will be erected: The start shaft compound near Aghoos (Volume 1, Chapter 5.5.2 of the EIS) and a receiving shaft compound near Glengad (Volume 1, Chapter 5.5.2.2 of the EIS, *slide* 6). Detailed information on the construction of the site compounds will be given by Mr. Eamon Kelly. Here, the key components of the compounds that are related to the construction of the tunnel will be addressed.

The pipeline and services installation will be carried out from the Aghoos site. The stringing area in Aghoos will be used to prepare the pipeline sections prior to installation into the tunnel.

4.1.1 Start shaft compound (Aghoos)

The start shaft compound will comprise all utilities and service installations to launch and supply the tunnel boring machine. All infrastructures to support the construction of the tunnel will be accommodated at the start shaft compound. The key facilities as given in Volume 1, Chapter 5 of the EIS are going to be:

- Tunnel start shaft and ramp
- Gantry crane to load equipment to the TBM / trains
- Storage area for segments
- Power generation plant for approx. 2.5 MW power supply
- Storage tanks for water, fresh bentonite slurry and used bentonite slurry
- Settlement pond for surface water run-off
- Separation unit for bentonite slurry handling
- Mortar / grout silos
- Bentonite silos for storage of raw bentonite

- A bunded storage area for tunnel arisings
- Mechanical workshop for on-site constructions and maintenance
- Site office and welfare facilities
- Lighting

The compound area at Aghoos does also include the stringing area, in which the pipeline and some of the services will be pre-fabricated in sections for the installation into the tunnel. The stringing area will comprise:

- Temporary storage area for pipes
- Pipe supports and rollers for assembly and transportation of pipe strings
- Driveways for movement of mobile equipment for welding, lifting and testing of the strings

4.1.2 Receiving shaft compound (Glengad)

In order to recover the tunnel boring machine after the arrival at Glengad, a second compound will be set up at the receiving area *(slide 7)*.

The compound measures approximately 65 m x 55 m and will accommodate the receiving shaft for the recovery of the TBM.

The receiving shaft will consist of a sheet piled excavation approximately 7.5 m wide and 15 m long with an adjacent sealing body.

The receiving shaft compound will be in place for approximately 12 months.

4.2 Soil excavation

The excavation of the soil at the machine face is carried out mechanically by means of a rotating cutter head *(slide 8)*. The cutter head is equipped with a number of specialized tools that have to be matched to the type of soil that is to be excavated.

Combinations of scrapers, reamers and cutter discs are used to loosen, break or chip the soil from the formation. Heterogeneous soils such as sand, gravel, clay rock and boulders can be excavated or crushed by these tools. Larger stone or cobbles that may pass through the openings in the cutter head to the excavation chamber will be further reduced in size by means of a hydraulic stone crusher.

In order to support the soil face and to transport the cuttings away from the face, the front of the machine is constantly fed by an adjustable flow of drilling fluid that is maintained at a pressure lightly above the ambient soil and water pressure.

The cuttings will remain in suspension inside the fluid and will be pumped from the bottom of the "Excavation chamber" through steel pipelines back through the tunnel and to the surface treatment facilities near the starting shaft compound.

4.3 Tunnel lining

To support the excavated tunnel from collapsing, a concrete lining is installed *(slide 9)*. The lining consists of reinforced concrete rings, dimensioned to cope with the external loads, resulting from the surrounding soil as well as traffic loads and water pressures.

Each concrete ring is transported in segments into the tunnel by means of trains. These segments will be assembled at the rear of the TBM to form the complete ring.

Between the circumferential and longitudinal joints of the segments, special seals are installed to prevent the inflow of water.

Since the lining will have to be assembled inside the tail skin of the TBM, it is of smaller diameter than the machine can itself (typically 10...15 cm). The excess space excavated by the TBM will form an annulus around the concrete lining, which is thoroughly injected with mortar, giving strength to the segment rings by embedding it into the formation and preventing settlement of the surrounding soils *(slide 10)*.

The mortar will be injected into the annulus at a predetermined pressure corresponding to the vertical tunnel alignment (range: 1 – 3 bar).

Volume and pressure of the injected mortar will be measured, monitored and recorded.

4.4 Soil transport and separation

The excavated soil will be mixed at the cutter head with the drilling fluid to form a slurry, which is hydraulically transported by means of pumps from the machine to the surface near the starting shaft compound.

Here the slurry is treated by a separation unit *(slide 11)*, which is used to "filter" or separate the cuttings from the slurry, which is in turn circulated back to the cutter head.

The cuttings from the separation plant will be stored temporarily on site. Fractions of the cuttings suitable for use in the construction process may be re-used. Surplus material will be transported off site. A detailed management plan for the tunnel arisings is given in Appendix S4 of the EIS.

The slurry that is used as a drilling fluid will be made up on site from fresh water at a ratio of approx. 35 kg of bentonite per m^3 of fresh water. Bentonite is a natural product comprised of very fine, inert clay, which is widely used in construction projects.

During the process of slurry circulation from the separation plant to the TBM and back, fractions of the slurry will be subject to losses and the slurry will over time be altered by the excavated soil of ground water effects at the soil face.

Therefore continuous monitoring of the slurry properties will be carried out and fresh slurry will be added to the system when required.

In total a conservative number of 1 m^3 slurry consumption per cubic meter excavated soil has been considered for the planning.

The losses of the slurry will typically distribute as follows. In addition to the slurry losses at the soil face or with the spoil, a certain amount of used slurry is taken from the circulation system and replaced by fresh bentonite slurry to maintain the required slurry parameters.

In total, the individual losses / replacement typically amount to:

	percentage	per day
Losses of slurry with the spoil	22%	33 m^3
Losses of slurry at the soil face	44%	66 m^3
Replacement of used slurry	33%	50 m^3
Total	100 %	150 m^3

At any given time the amount of slurry in the circulation system will depend on the tunnel length. As a maximum approx. 250 m^3 will be present in the system.

5 Specific tunnelling aspects

The tunnelling process will be carried out between the start and receiving shaft compounds without disturbance of the surface area in between.

The TBM will be equipped to ensure a safe and efficient construction of the tunnel mixed ground conditions.

The most important measures that have been taken are described below.

5.1 Handling of TBM obstructions, breakdown

During the tunnelling process a number of obstructions may be encountered that may affect the tunnelling operation. These items are also covered in the geotechnical risk register (Appendix M4 of the EIS). Obstructions that potentially affect the tunnelling operation are:

- Rock of abnormally high strength
- Highly fractured rock resulting in loss of slurry circulation
- Boulders of various sizes causing instability of the soil face
- Exceptionally weak soil layers causing loss of steering capabilities
- Artificial obstacles (man made)
- Wooden objects, trees or logs
- Machinery breakdown

High strength rock

Based on the geotechnical investigations in Sruwaddacon Bay rock strengths of up to 280 MPa (UCS) may be encountered in single locations and at greater depths.

Although the rock is of considerably lower strength along the current alignment, the TBM will be equipped with cutter head tools and a propulsion system to cope with these exceptional rock properties.

In the unlikely event that even higher strength rock is encountered, the machine will still be capable to cope with these conditions, but this would result in a reduced progress rate and would require increased maintenance efforts.

Highly fractured rock

Highly fractured rock will increase the losses of slurry suspension to the formation, thus affecting the removal of cuttings and impair the progress rate. In exceptional cases, the circulating slurry may be completely lost at the face.

To counteract circulation losses at the face, it is possible to adjust the properties of the slurry in such a way, that fractures in the rock are closed and slurry circulation can be restored. In addition to this, the machine will be equipped with special grouting ports, through which hardening grout can be injected around the full circumference of the TBM. In this manner, it is possible to close off large fractures.

Boulders

Boulders may impair the progress rate of the TBM in several manners:

Smaller boulders (roughly up to 40 cm in diameter) will be handled directly by the TBM as they are small enough to pass through the spokes of the cutter head. Behind the cutter head, the TBM is equipped with a stone crusher which is dimensioned to crush boulders of this size.

Larger boulders that may not pass through the cutter head will be split to smaller size by the tools on the cutter head. Once a boulder is split to a size that will be able to pass through the openings of the cutter head, it will be further crushed as outlined above. During this process, the progress rate of the TBM will be reduced.

In case boulders are encountered at the perimeter of the TBM, they may also be displaced by the machine into the surrounding formation.

In the unlikely event, that a boulder may neither be crushed nor displaced, it is possible to manually enter to excavation chamber of the TBM under compressed air and manipulate the boulder by drilling or with hydraulic splitting tools. For this purpose as well as for regular tool inspections / changes, the TBM is equipped with an air lock.

Weak soil layers

Exceptionally weak soil layers of large magnitude (several meters) may not provide sufficient bearing capacity to support the weight of the TBM. This would result in a reduction of steering capabilities.

Although the present geotechnical and geophysical investigations revealed small layers of peat (less than 1 m magnitude) under Sruwaddacon Bay, there is no indication of larger peat layers of low strength.

In the case that a weak layer should be encountered during the tunnelling operation, it is possible to improve the bearing capacity by injecting a hardening grout on the lower circumference of the TBM.

Artificial obstacles or tree trunks

Artificial obstacles or large tree trunks may be difficult to excavate by the TBM cutter head but can be handled manually under compressed air as described above.

However, investigations to date do not give any indication of artificial obstacles within Sruwaddacon Bay.

Machinery breakdown

The tunnel boring machine and cutter head tools will be maintained on a regular basis throughout the project and according to the maintenance schedule of the TBM manufacturer. Maintenance times have been included in the project schedule.

In the event of a machinery failure on the TBM, vital spare parts will be kept on site for immediate repair following the recommendation of the TBM manufacturer. In general, all machinery components, including the main drive and bearing can be accessed and/or replaced from inside the tunnel.

For this reason there is no realistic scenario that would require external intervention from the bay to the TBM.

However, it cannot be excluded that such an extremely unlikely intervention has to be accomplished. For this purpose, the procedure of constructing an intervention shaft is described in Chapter 5.5.1.3. of the EIS.

The largest shaft dimensions that can be anticipated would be 12 m x 15 m, which would suffice to create a safe access to or completely recover the TBM.

5.2 Controlling the bentonite flow

In order to prevent a break-out of circulating slurry or excessive settlements at the surface it is essential to control the pressure and flow of the bentonite slurry at the soil face in front of the TBM.

For this purpose, a slurry type TBM will be deployed, allowing an individual adjustment of slurry flow rate and pressure *(slide 12)*.

The pressure of the slurry at the soil face will be controlled by a compressed air cushion inside the TBM, which allows for rapid changes of the slurry volume in mixed ground conditions, while automatically maintaining a pre-set face support pressure (slide).

The pressure at the soil face will be continuously measured, monitored and alarmed when limit values are met. The maximum allowable and minimal required slurry pressures have been calculated at critical chainages. For the tunnelling operation, detailed slurry pressure calculations will be carried out for any position along the alignment.

The slurry volume inside the working chamber of the TBM will be continuously monitored and the flow will be shut down automatically in case a low or high level alarm is triggered.

In addition to monitoring the slurry pressures, feed and return lines of the slurry system will be equipped with flow meters, continuously measuring the flow of slurry to and from the excavation chamber.

Thus, in the unlikely event of a slurry break-out due to unforeseen ground conditions, only a limited amount of slurry suspension may be lost before the system is shut down and mitigation measures can be deployed.

5.3 Controlling the excavation process

The excavation process will be closely monitored at the central control post (slide 13) to ensure a controlled excavation of material and avoid possible surface settlements.

In addition to monitoring the slurry flow rate, both slurry feed and return lines on the TBM will be equipped with mass flow meters for an immediate control of the excavated soil mass.

As a second step, the amount of spoil from the separation plant will be monitored for each advance of the TBM.

Finally, the annulus between the TBM and the tunnel lining (overcut) will be thoroughly grouted to prevent settlements at the surface. During this process, the volumes and pressures at the grout outlets will be measured, monitored and recorded.

All TBM operating parameters will be continuously displayed to the operator at the central control post. They will be logged to a computer and monitored by the engineering staff on site.

The potential for settlement of the surface area directly above the tunnel have been assessed. There will be no tunnelling induced settlement in areas where the tunnel is located in rock. In sections of granular soil, the maximum tunnelling induced surface settlement have been calculated to be less than 7 cm in the directly above the tunnel; i.e. the tunnel axis plus approx 5 metres either side of the centreline.

This settlement will have no adverse effects on housing in the area or on the geomorphology of the bay. Since the settlement will occur transiently as the tunnel construction progresses, it is anticipated that these depressions will be infilled gradually by sediment transport in the bay. As a consequence, there will be no long-term effects.

5.4 TBM guidance

The TBM will be guided along the predetermined alignment by a laser guidance system. The position and direction of the machine with regard to the planned trajectory will be continuously displayed at the central control post.

After each advance cycle, the tunnel lining will be erected inside the TBM to match the drilled alignment.

Regular survey campaigns will be conducted to transfer the survey grid from fixed points above the surface into the tunnel in order to maintain the accuracy of the laser guidance system.

The actual position of the TBM underground can be determined to an accuracy of less than -/+ 5 cm through this process.

The potential for settlement of the tunnel during and after construction has been assessed. Since the weight of the tunnel boring machine is the largest load that will be applied to its underlying soil layers, it is during the construction of the tunnel that the maximum settlement will occur.

The potential settlement has been calculated to be less than 1 cm and will not affect the construction of the tunnel. In its final backfilled state the tunnel will be lighter in weight than the TBM - therefore no further settlements will occur.

6 Pipeline Installation

Upon completion of the tunnel construction, the pipeline and associated services will be installed into the tunnel.

As a first step the service lines will be transported into the tunnel by trains. They will be reeled out and attached to the tunnel walls.

Subsequently the pre-fabricated 20" gas pipeline will be conveyed into the tunnel in sections which are then connected.

Finally the complete pipestring will undergo hydro-testing inside the tunnel.

7 Grouting of the tunnel

Once the pipeline and services have successfully been installed and tested, the remaining tunnel void will be completely filled with a durable material. This process is referred to as grouting or backfilling of the tunnel.

The backfill material used for this grouting operation will be a fluid mix of water, cement and bentonite. It is fluid, pumpable and cures to a low strength of approx. 1 to 2 MPa.

After grouting of the tunnel and curing of the mix, it will provide sufficient bearing capacity to protect the pipeline and support the surrounding soil, thus rendering the function of the initial concrete lining of the tunnel obsolete.

In its final state, the tunnel will neither be accessible nor will it require any further maintenance.

The process of grouting has successfully been carried out in numerous projects. Most recently the 4 km long Ems pipeline tunnel between Germany and the Netherlands has been filled in a similar manner.

8 Reinstatement

Upon completion of the construction process, pipeline and service installation as well as grouting of the tunnel, the start and receiving shafts will be backfilled and both compounds will be fully reinstated to approx. 1 m below ground level.

It is not intended to remove deeper structures, such as the underwater concrete floor of the shafts or the lower shaft walls, since these operations would increase the environmental impact of the operation and bear the risk of adverse effects on the pipeline.

9 Conclusion

Based on my personal experience as well as that obtained by our company in recently completed projects and in over 30 years of professional experience I can confirm that the Corrib gas pipeline tunnel as described in the EIS can successfully be realized.

All tunnelling related risks have been identified and related mitigation measures and will be deployed. In the unlikely event of a severe obstruction or major machinery breakdown, it will be possible to access the soil face as well as repair or replace all essential machinery elements from within the tunnel.

Segmental lining in mixed ground conditions is a well proven construction method and the tunnel boring machine that will be used for this project will be newly built according to latest European standards.

It will be equipped to best practice and the tunnelling operation will be carried out and supervised by experienced staff.

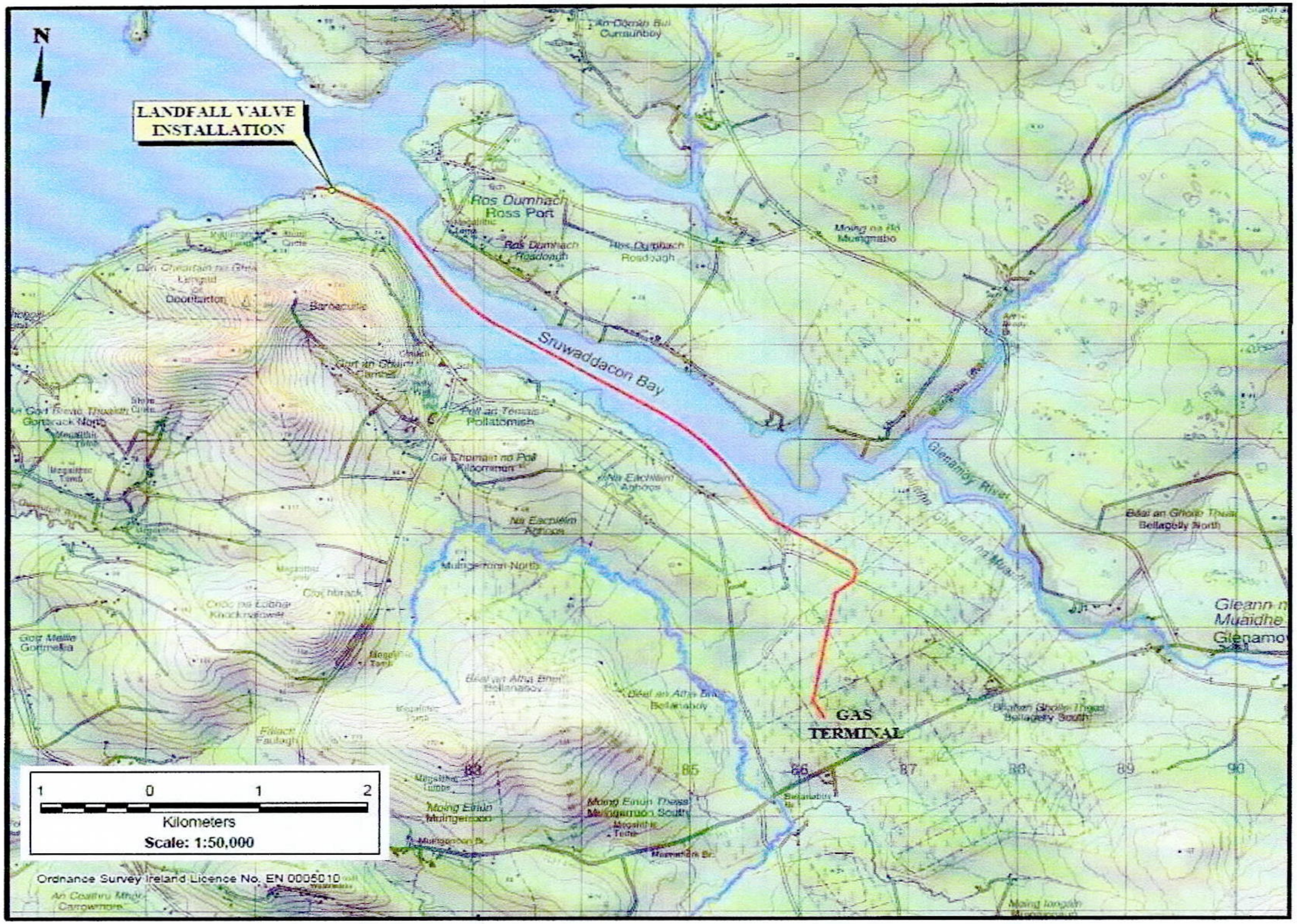
Corrib Onshore Pipeline

Tunnelling Construction

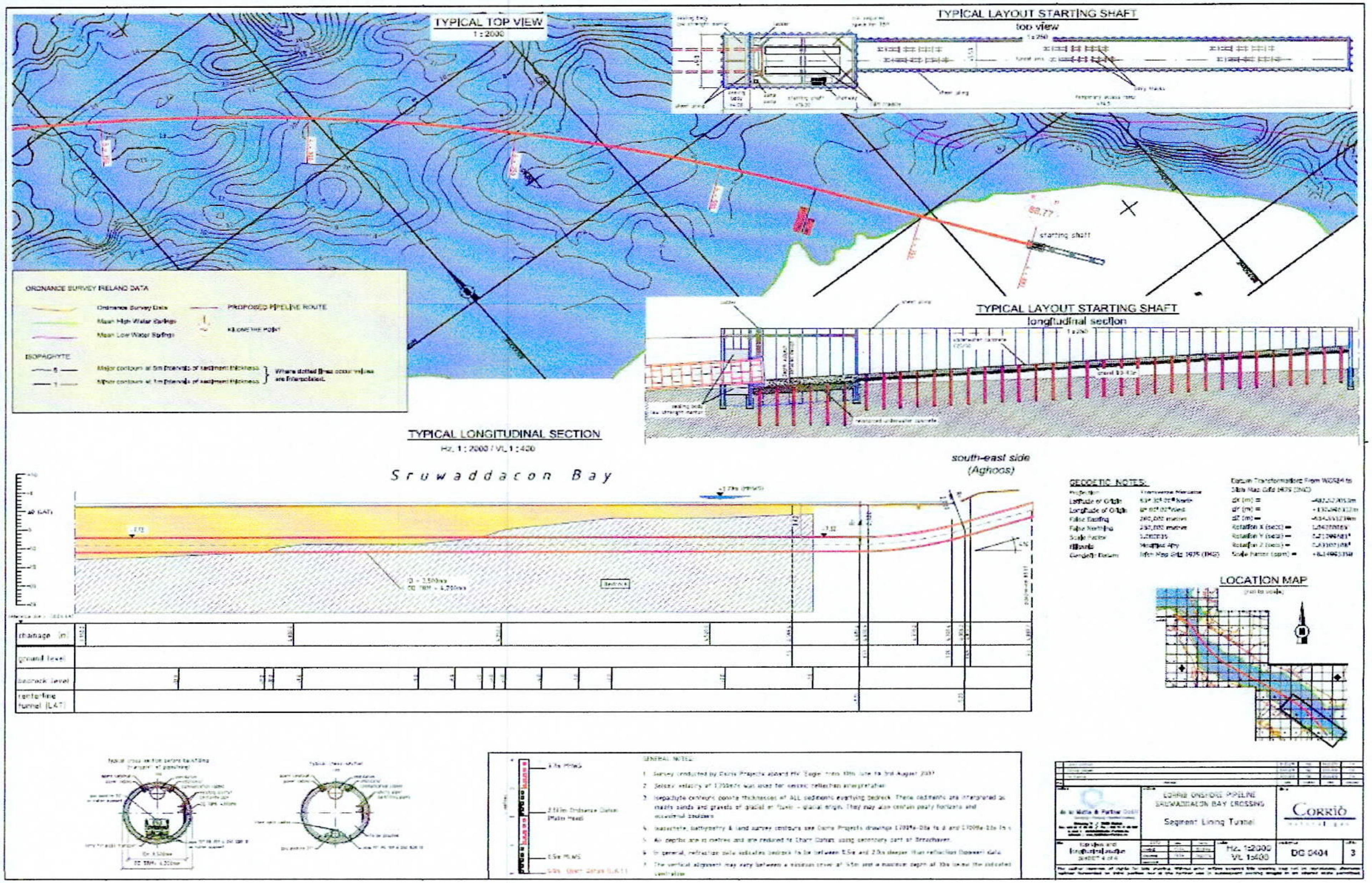
By Dr. Tim Jaguttis

(An Bord Pleanála Application Reference No.: 16.GA0004)

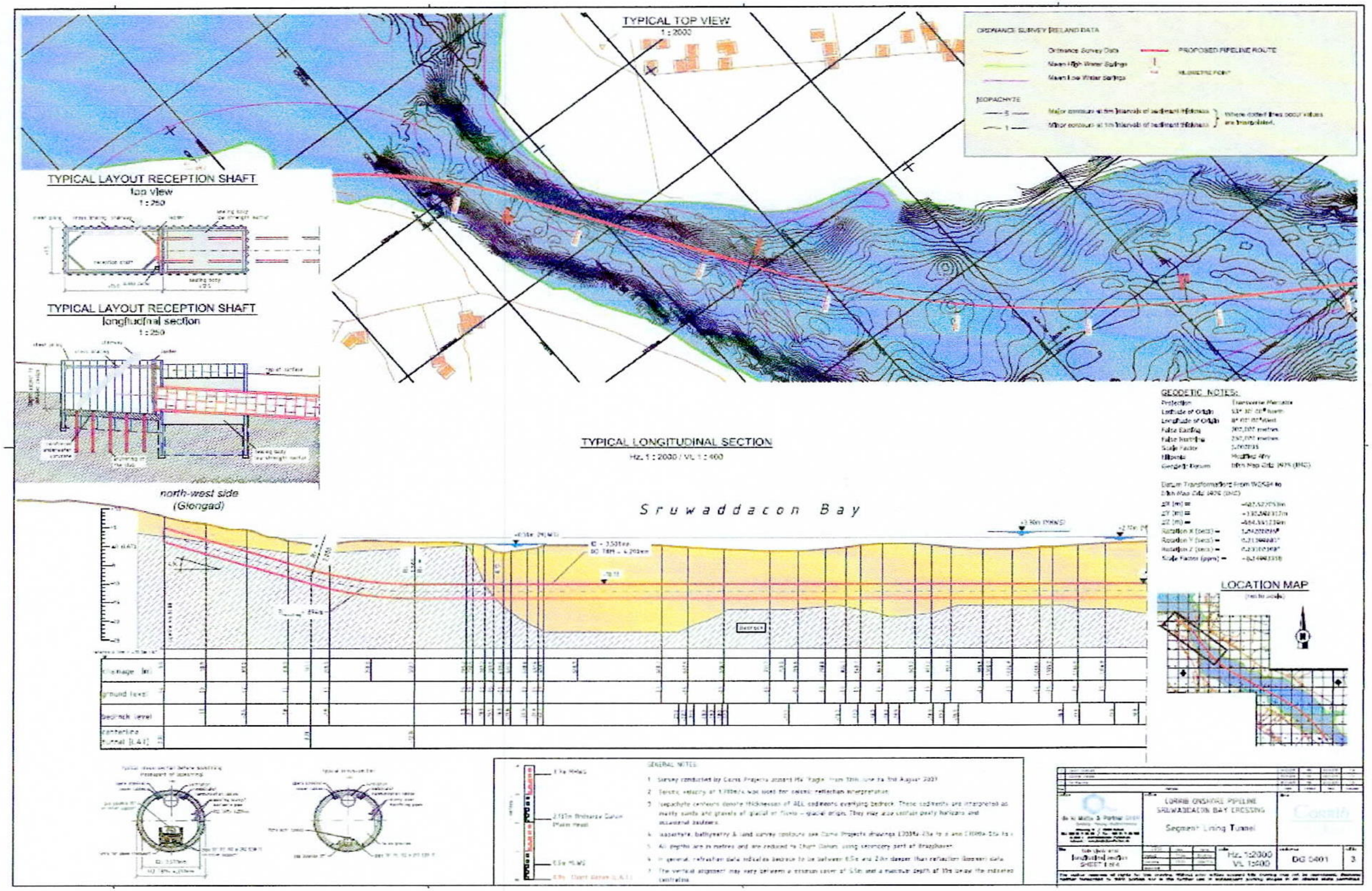
Corrib
natural gas



CORRIB natural gas



TYPICAL TOP VIEW
1 : 2000
TYPICAL LAYOUT STARTING SHAFT
top view
TYPICAL LAYOUT STARTING SHAFT
longitudinal section
starting shaft
ORDNANCE SURVEY IRELAND DATA
Ordnance Survey Data
Mean High Water Springs
Mean Low Water Springs
PROPOSED PIPELINE ROUTE
KILOMETRE POINT
ISOPACHYTE
Major contours at 5m intervals of sediment thickness
Minor contours at 1m intervals of sediment thickness
Where dotted lines occur values are interpolated.
TYPICAL LONGITUDINAL SECTION
Hz. 1 : 2000 / VL 1 : 400
Sruwaddacon Bay
south-east side
(Aghoos)
chainage (m)
ground level
bedrock level
centerline tunnel (LAT)
GEODETIC NOTES:
LOCATION MAP
GENERAL NOTES:
CORRIB ONSHORE PIPELINE
SRUWADDACON BAY CROSSING
Segment Lining Tunnel
Hz. 1:2000
VL 1:400
DG 0404
3



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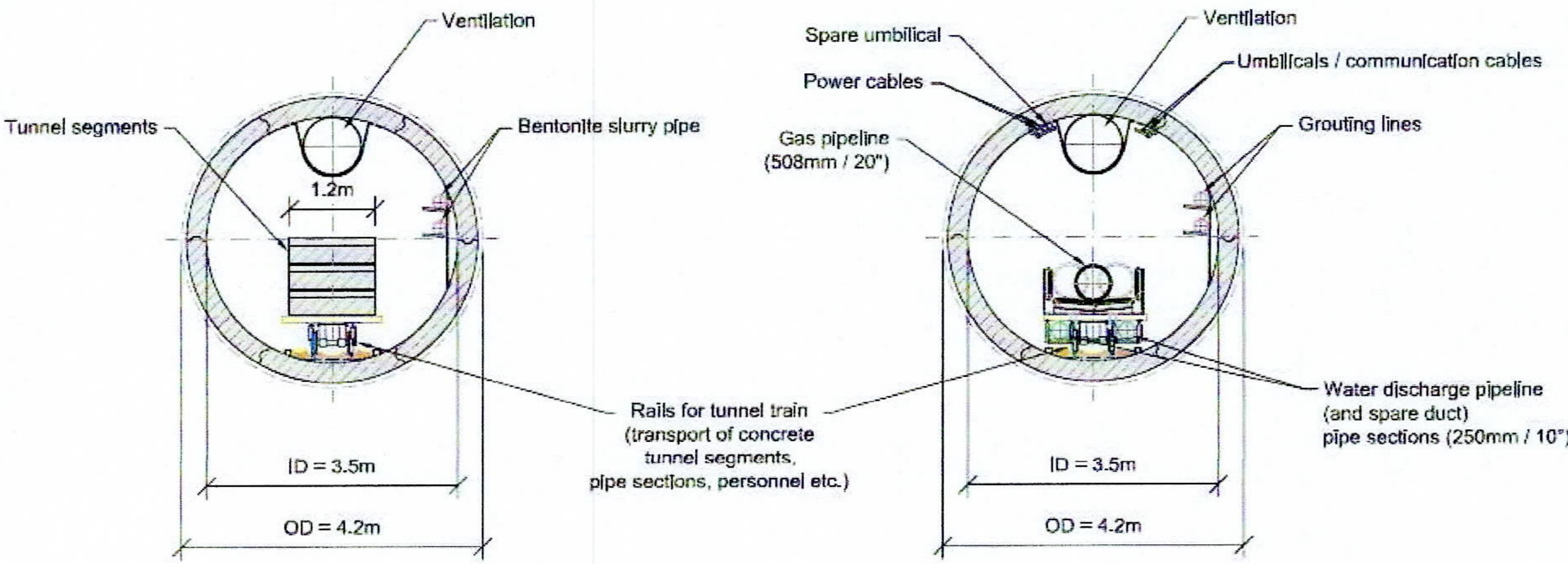
Tunnel cross-section during construction and pipeline installation



Transport of Tunnel Segments during Tunnel Construction

Installation of Pipeline and Associated Services after tunnel is completed

(EIS Vol. 1, Chapter 5, figure 5.5)

ID: Inner Diameter
OD: Outer Diamter

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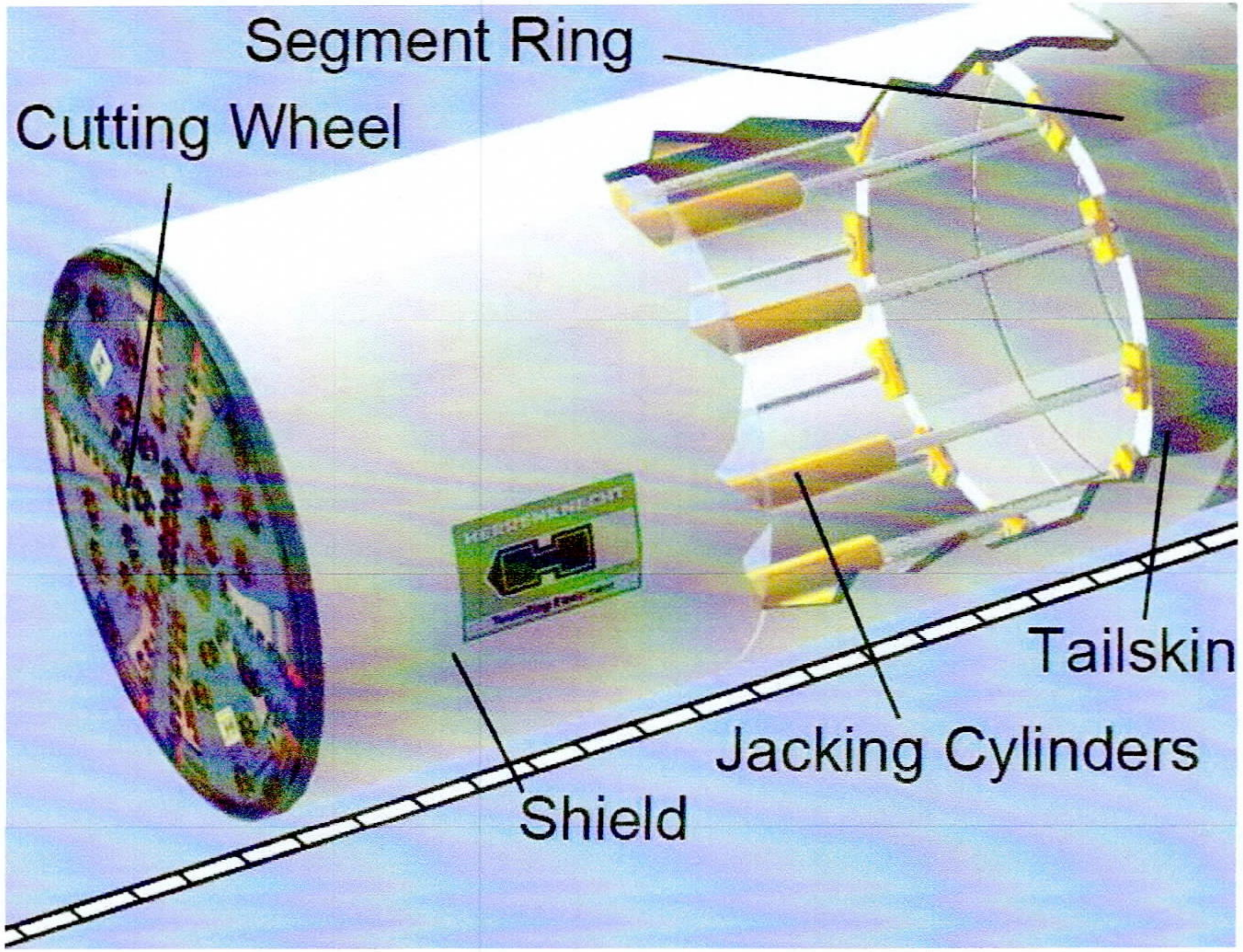
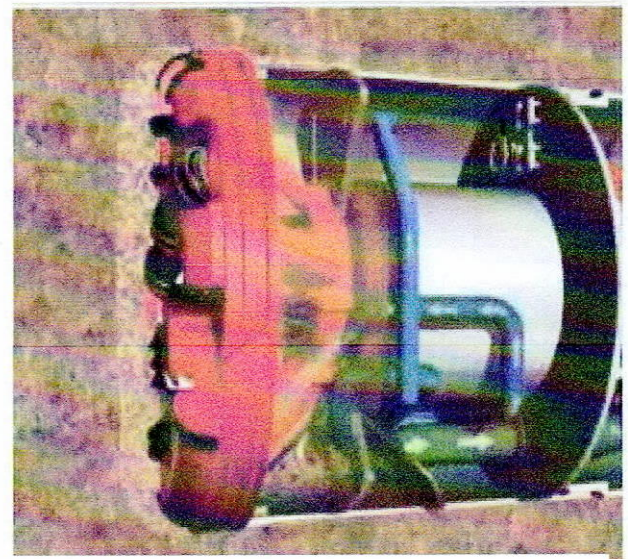


(EIS Vol. 1, Chapter 5, plate 5.9)

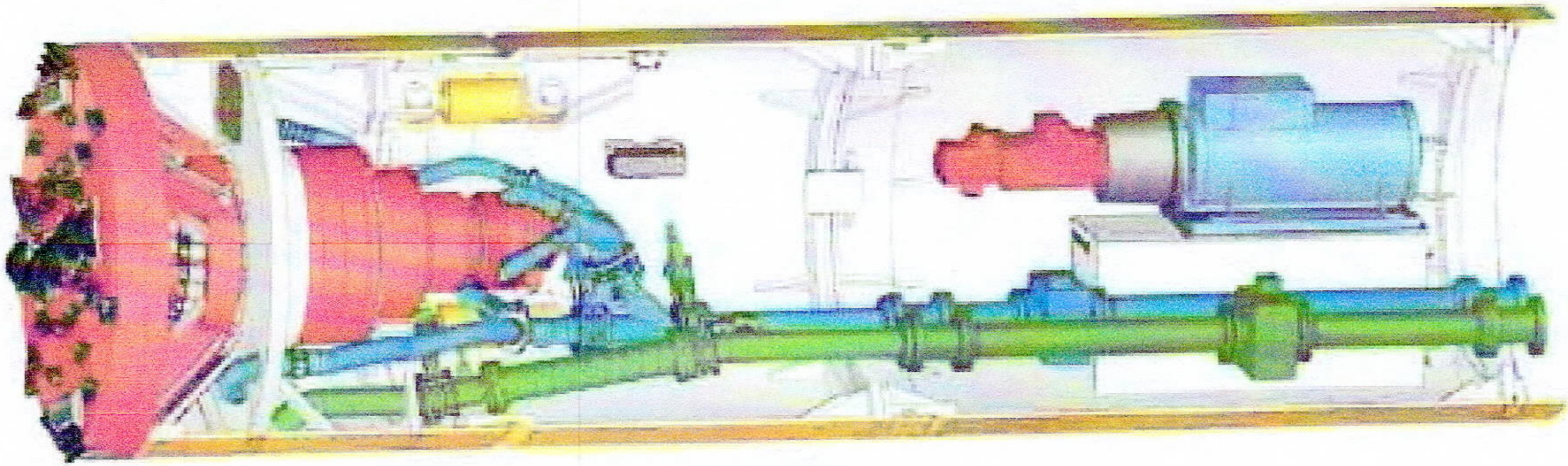
(EIS Vol. 1, Chapter 5, figure 5.7)

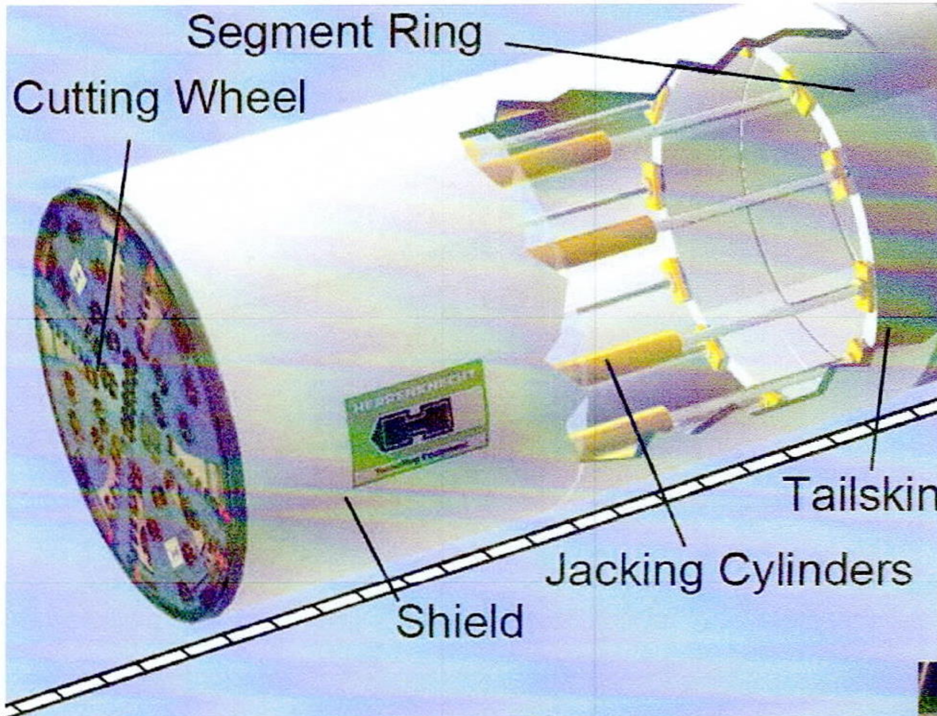
Location of Glengad site compound

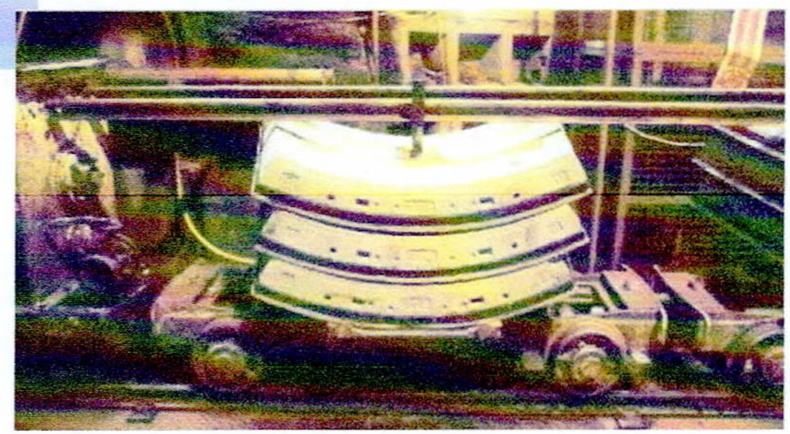
(EIS Vol. 2, Appendix A1, Figure 2.0)



(EIS Vol. 1, Chapter 5, plates 5.7 and 5.10)







(EIS Vol. 1, Chapter 5, plates 5.8 and 5.9)

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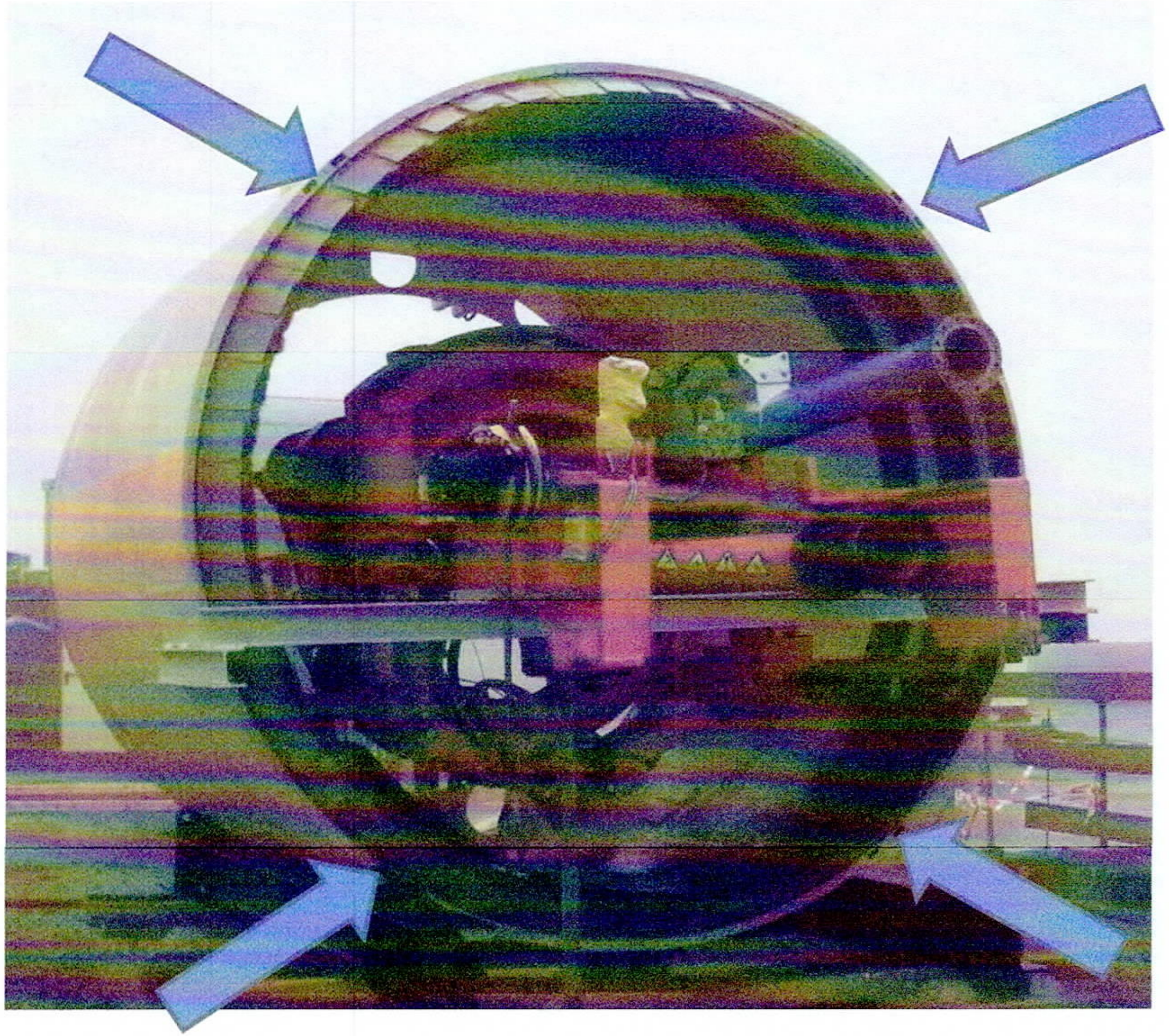

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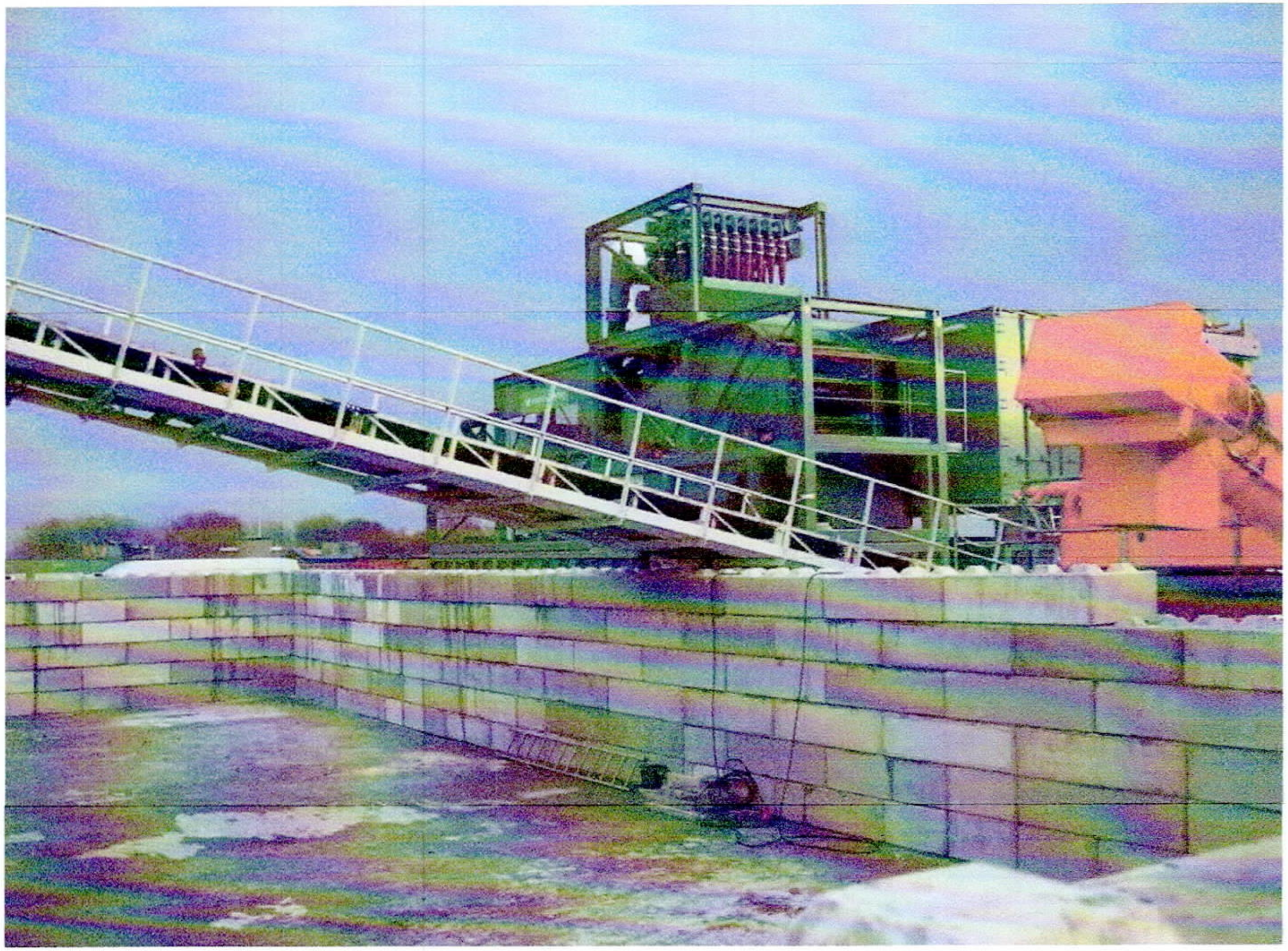
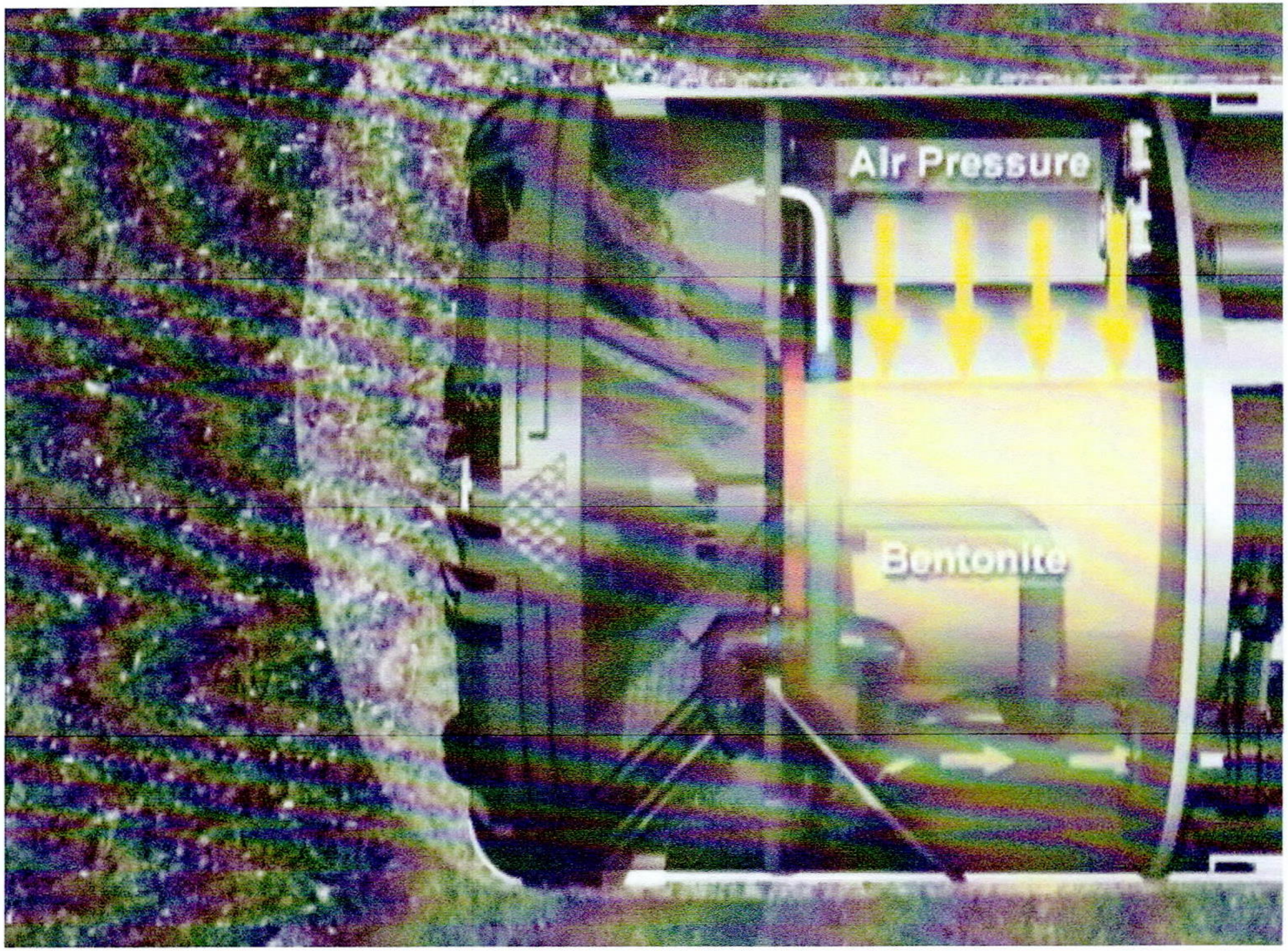
Typical Separation Plant and Spoil Disposal Area





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