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# 1. Introduction

Monopower Ltd, Killycarran, Emyvale, Co. Monaghan has made a Planning Application to Monaghan County Council for the construction of a Biomass Combined Heat & Power Plant (Planning Ref. 03/446). On 1/12/04 a request for further information was made by the council as follows;
*"The applicant is required to submit details on the adequacy of the proposed firewater retention structure and to outline whether or not a fire water reservoir is required. The physical dimensions of these structures should be shown on a drawing."*

The following assessment is used to determine the risk that will exist at Monopower Ltd for the release of contaminated firewater and the consequences of this release to the surface and groundwater bodies in the immediate and surrounding areas. Following on from this a risk management programme is outlined in order to control lire and runoff of contaminated fire water into the environment. The assessment has been carried out in line with the Environmental Protection Agency's 'Draft Guidance Note to Industry on the Requirements for Firewater Retention Facilities", 1995. Regard was also had to CIRIA Report 184, "Design of containment systems for the prevention of water pollution from industrial incidents', 1997.

The report has been carried out by Patricia Murtagh and Hugh Doherty of Q.E.D. Engineering Ltd and is based on a site survey and OR available information supplied by

1. Monopower Ltd, the developer
2. SWS Environmental Services, Cork, who compiled the Environmental Impact Statement for the development
3. Lars Bronden, Aalbork Energie Technik a/s (AET), Denmark, the designer and supplier of the Biomass CHP plant
4. Environmental Protection Agency
5. The Local Fire Fighting Unit.



The report gives a brief introduction to the proposed development and surface and groundwater features at the site. AH raw materials and products stored at the site are outlined along with safety and control measured and fire abatement information. A risk assessment of areas where contaminated fire water could be generated is then presented along with calculations on the volume of fire water to be generated for 90minute fire. The final sections of the report outline the firewater containment measures to be installed on the site and the fire water retention risk management programme.

## 2. Description of Activity

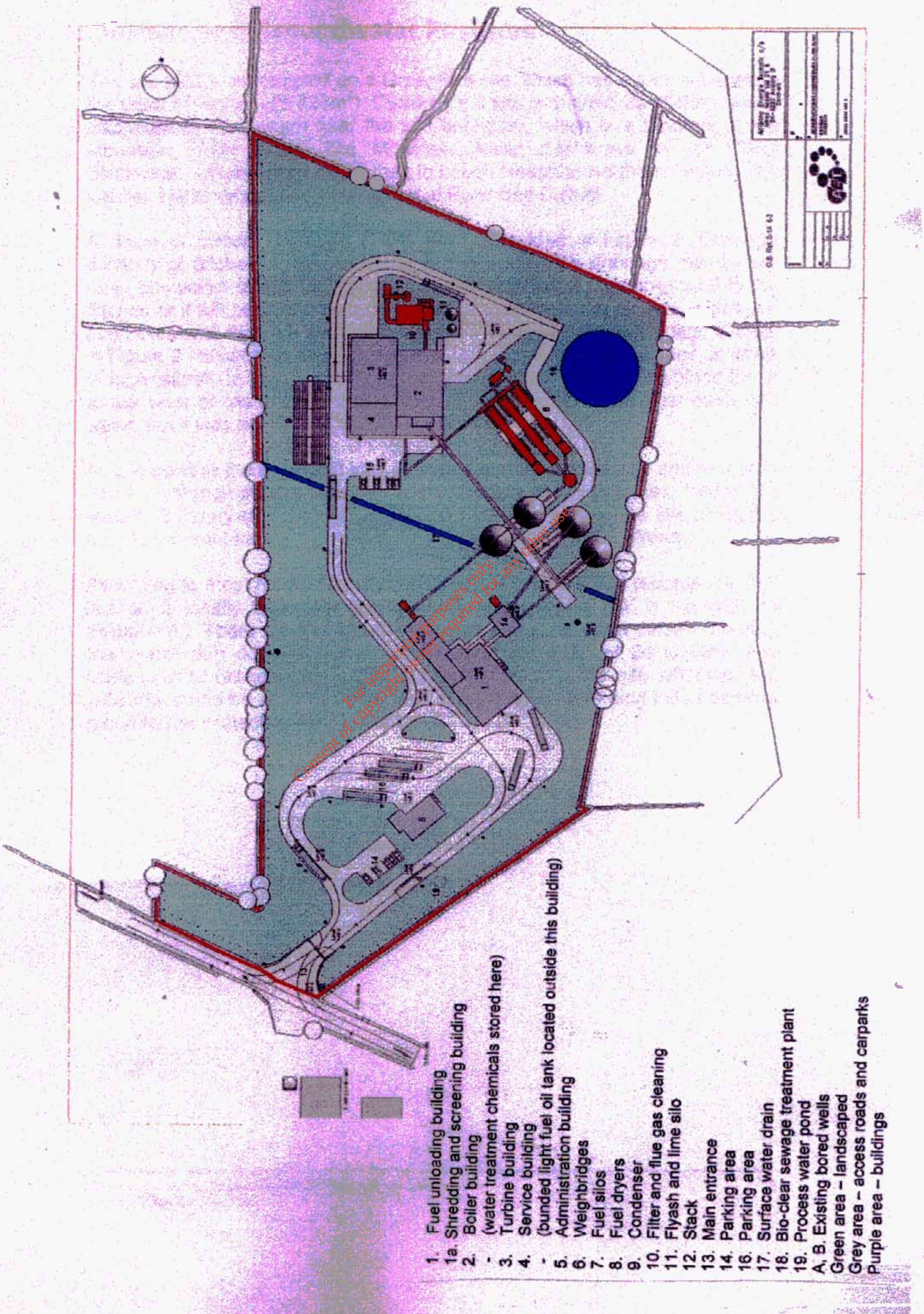
The proposed site is a Biomass Combined Heat & Power (CHP) plant. It will take in 3 raw materials; poultry litter (PL), spent mushroom compost (SMC) and wood chips (WC), which will be fed to a large steam boiler for combustion. The steam generated from this process will be converted via a steam turbine generator to electricity, which will be sold to the national grid. The capacity of the site will be 22.5MW of electricity per annum.

## 3. Description of Operation

A schematic of the site is provided in Figure 1. The site operation is summarised as follows;

1. Delivery of raw materials (fuel/biomass) to site via lorries i.e. poultry litter, spent mushroom compost and wood chips.
2. Disposal of raw materials in the unloading building (each raw material kept separate until combustion)
3. Feeding of raw materials via conveyors to a screening area to remove metal, plastic etc.
4. Storage of raw materials in silos; (2 x 1,250m$^3$ silos for SMC, 1 x 1,250m$^3$ silo for PL and 1 x 1,250m$^3$ silo for WC).
5. Drying of SMC from *70%* moisture to 75% moisture in 3 steam-heated fuel driers. PL and WC will not require drying.
6. Feeding of raw materials (SMC from the drying plant and PL and WC from the silos) to the combustion plant (boiler). Each raw material will have a separate fuel feeding system. A 4th fuel-feeding system will be in place from an oil burner. Oil is required for start-up of the plant.
7. Combustion of the raw materials in the boiler to produce steam/heat. By-products of this process are ash and combustion gases.
8. Steam produced in the boiler is passed to a steam turbine generator, where electricity is produced. This is the final end-product of the production process.
9. A condenser unit is also located on the site to condense steam prior to returning it to the boiler.
10. process ash generated on combustion of the fuel will be conveyed to and stored in a silo. This by-product will be transported off-site for use either as a fertilizer or in the cement industry.
11. Combustion gases from the boiler will pass through a flue-gas cleaning system, based on lime. Solids from this process will be conveyed to the fly-ash silo and gases will be emitted to atmosphere via a 50m stack.

**Figure 1. Monopower, Proposed Site Lay**



# 4. Surface and Groundwater Features

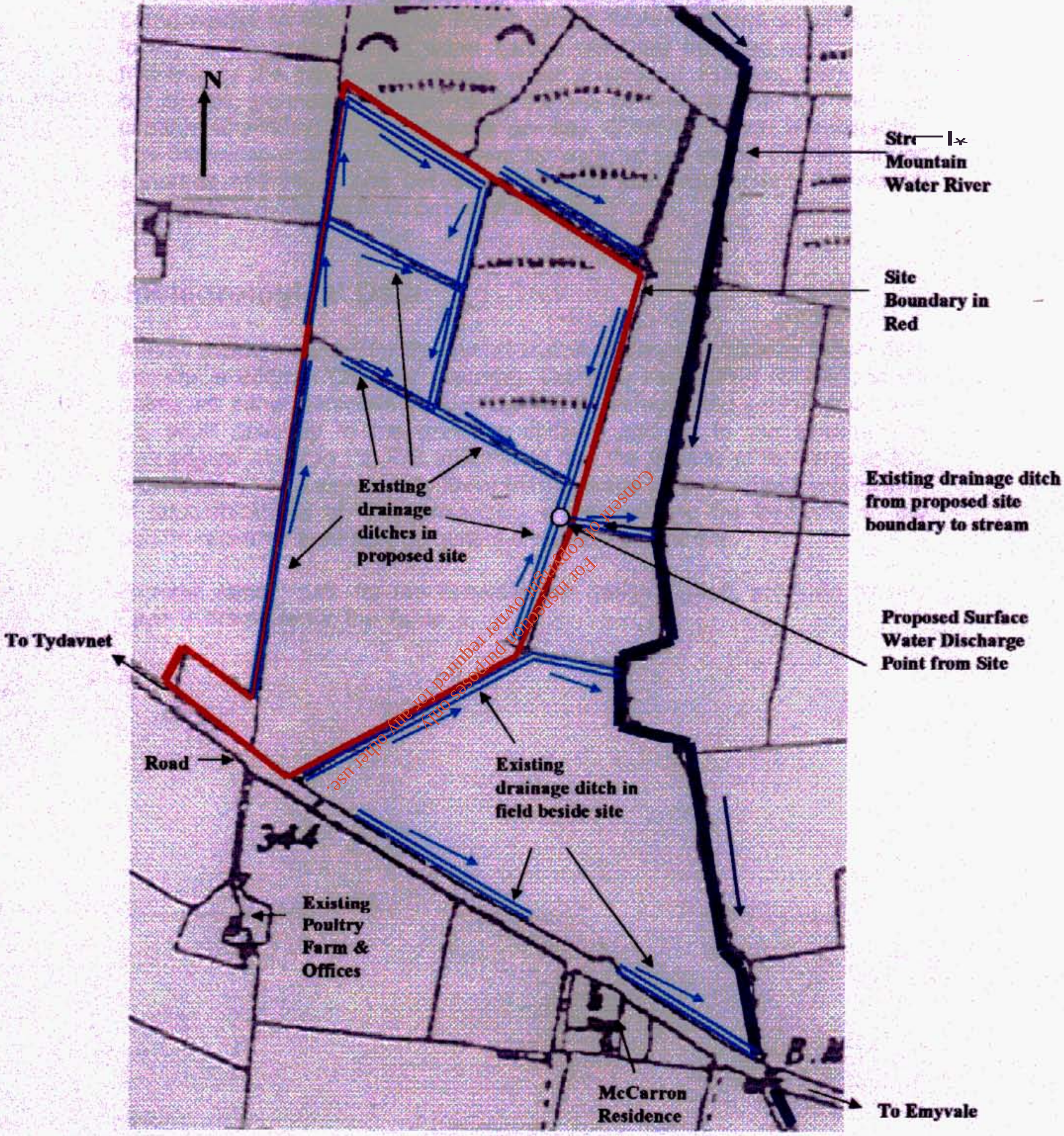
The *site* will be constructed on a Greenfield site, which has a total site area in the order of 7acres (28,328m$^2$). Currently the site is drained via ditches, which discharge to the stream near the site boundary, which is a tributary of the Mountain Water River. The Mountain Water discharges to the Ulster Blackwater, which in turn discharges to Lough Neagh in Northern Ireland. The site lies in the Neagh Bann International River Bed District.

A detail of current drainage *at* the *site* is provided in Figure 2. Drainage consists of ditches at the perimeter of the fields, The drainage ditches are open and water falling on the proposed site area wilf flow over-ground to the ditches or it will percolate through the soil and drain to the ditches, which are at a lower level than the fields themselves. The arrows along drainage ditches in Figure 2 indicate the likely direction of flow in the drainage ditches, in times of high rainfall. In March 2005 when all ditches were visually examined those to the west of the proposed site were dry and those to the east contained water, but it was not flowing.

*At* one point in the proposed site, surface water leaves the *site* and gradually flows a distance of 38m along an open drainage ditch in the next field to the stream (tributary of the Mountain Water). The field beside the *site* along the road to the front has its *own* separate ditches draining to the stream.

According to most recent Geological Survey of Ireland (GSI) records, the site lies on a locally important aquifer (Lm) which has a low vulnerability to pollution (L). There are two bored wells on the *site* and when these were dug, the overburden deposits were quite thick, in the order of 24 to 30m. Any contaminants falling within impermeable surfaces on the *site* will enter the subsurface and be absorbed into these clays, thereby affording the underlying groundwater protection from pollution.

## Figure 2.
## Existing Surface Water Drainage at the Proposed Development Site



## 5. Water Supply

The water supply to the site will be predominantly from groundwater, from the bored well(s) on the site. The Truagh Group Water Scheme supplies water locally to the area, so this water source will likely be used to supply fire hydrants on the site and for potable water, if required. Pumping tests carried out on the groundwater resource at the site determined that the well was capable of yielding 650m$^3$ of water per day, (27m$^3$/hr) which is substantial. The estimated maximum requirement for water at the site is 10m$^3$/hr (during abnormal operation) and the average water use requirement {for normal operation) is expected to be between 3-5m$^3$/hr.

## 6. Meteorological Data

Annual average rainfall for the rainfall station at Emyvale, located 3.5km from the *site* is 966mm (30 year average). Currently rain falling on the site (all grass) will either percolate through the soil to recharge the aquifer and some will drain naturally to the drainage ditches, and on to the stream. The hydrological study in the EIS determines that the volume of recharge in this area is likely to be significantly lower than average as a result of the presence of large thickness of low permeability days overlying the bedrock, so the aquifer-recharge area may be quite a distance from the site.

Extreme rainfall data for the Emyvale rain gauge station, provided by Met Èireann are shown in the Table 1.

# Table 1. Extreme Rainfall Return Periods

Location: Emyvale

**Average Annual Rainfall:** 966

Maximum rainfall (mm) of indicated duration expected in the indicated return period.

| Duration | 1/2 | 1 | 2 | 5 | 10 | 20 | 50 | 100 | Special (loglog) 30 |
|---|---|---|---|---|---|---|---|---|---|
| 1 min | | | | 1.9 | 2.2 | 2.6 | 3.2 | 3.6 | 2.8 |
| 2 min | | | | 3.2 | 3.7 | 4.4 | 5.5 | 8.3 | 4.9 |
| 5 min | | | | 5.8 | 6.7 | 8.0 | 10.0 | 11.5 | 8.8 |
| 10 min | | | | 8.3 | 9.7 | 11.6 | 14.7 | 17.0 | 12.9 |
| 15 min | 5.2 | 6.5 | 7.3 | 10.0 | 12.3 | 14.8 | 18.9 | 22 | 16.5 |
| 30 min | 6.9 | 8.6 | 9.6 | 13.1 | 16.0 | 19.1 | 24 | 20 | 21.3 |
| 60 min | 9.0 | 11.1 | 12.5 | 16.7 | 20.2 | 24 | 30 | 35 | 27 |
| 2 hour | 11.7 | 14.3 | 16.0 | 21.1 | 25 | 30 | 37 | 43 | 33 |
| 4 hour | 15.9 | 19.2 | 21.1 | 27 | 32 | 37 | 44 | 51 | 40 |
| 6 hour | 19.1 | 22.9 | 25 | 32 | 37 | 43 | 52 | 59 | 47 |
| 12 hour | 24.4 | 29 | 32 | 40 | 47 | 53 | 64 | 73 | 58 |
| 24 hour | 30 | 35 | 39 | 48 | 56 | 64 | 76 | 85 | 69 |
| 48 hour | 37 | 43 | 47 | 58 | 87 | 76 | 89 | 101 | 82 |
| 96 hour | | | | | | | | | |

Return Period (years)

Notes: Larger margins of error for 1, 2 ,5 and 10 minute values and for 100 year return periods

M560: 16.7 M52d: 55 M560/m52d: 0.30

# 7. Site Drainage

*An* outline of drainage routes from the proposed site, once constructed is provided in Figure 3. The existing drainage ditch flowing west-east across the centre of the site will be piped and will constitute the main drainage channel into which all surface water from the site will flow. This drain will link up with the ditch in the field beside the site, which will transport water to the stream, as is currently the case. Drainage from the site will be split in two so that water from the southern side of the main drainage channel will be kept separate from wafer from the northern side of the main drainage channel.

When the site is constructed it will comprise a number of buildings as shown in Figure 1 (administration, fuel/raw materials unloading, shredding, boiler, turbine and service building). The total site area of buildings is In the order of 2,160m$^2$ *(7.0% of* the total site area). Rainwater falling on roofs of these buildings will be collected via down pipes and discharge to the surface water drainage system outlined above.

Internal primary mads and hard standing areas wilf be paved with asphalt (6,900m ). Areas for handling of containers etc. will be paved with reinforced concrete (450m$^2$). Secondary roads for service access only will be paved with gravel (950m$^2$). The asphalt and concrete paving will be impermeable (7,350m$^2$) so surface water drains / gullies will be installed along roadways and car parks to catch rainwater falling on these areas. This rainwater wilt discharge to the surface water drainage system outlined above.



The remainder of the site will be impermeable, allying rainwater to percolate through the soil. This area will consist of 950m of gravel paving and the remainder will be grass/landscaped, comprising an area of approximately 17,868m$^2$. Kerbing will be placed along boundaries between impermeable and permeable areas so that surface water falling *on* impermeable areas is directed to the surface water drainage system.

A pond is to be located on the site which may accept process water, but its main function will be for fire water retention.

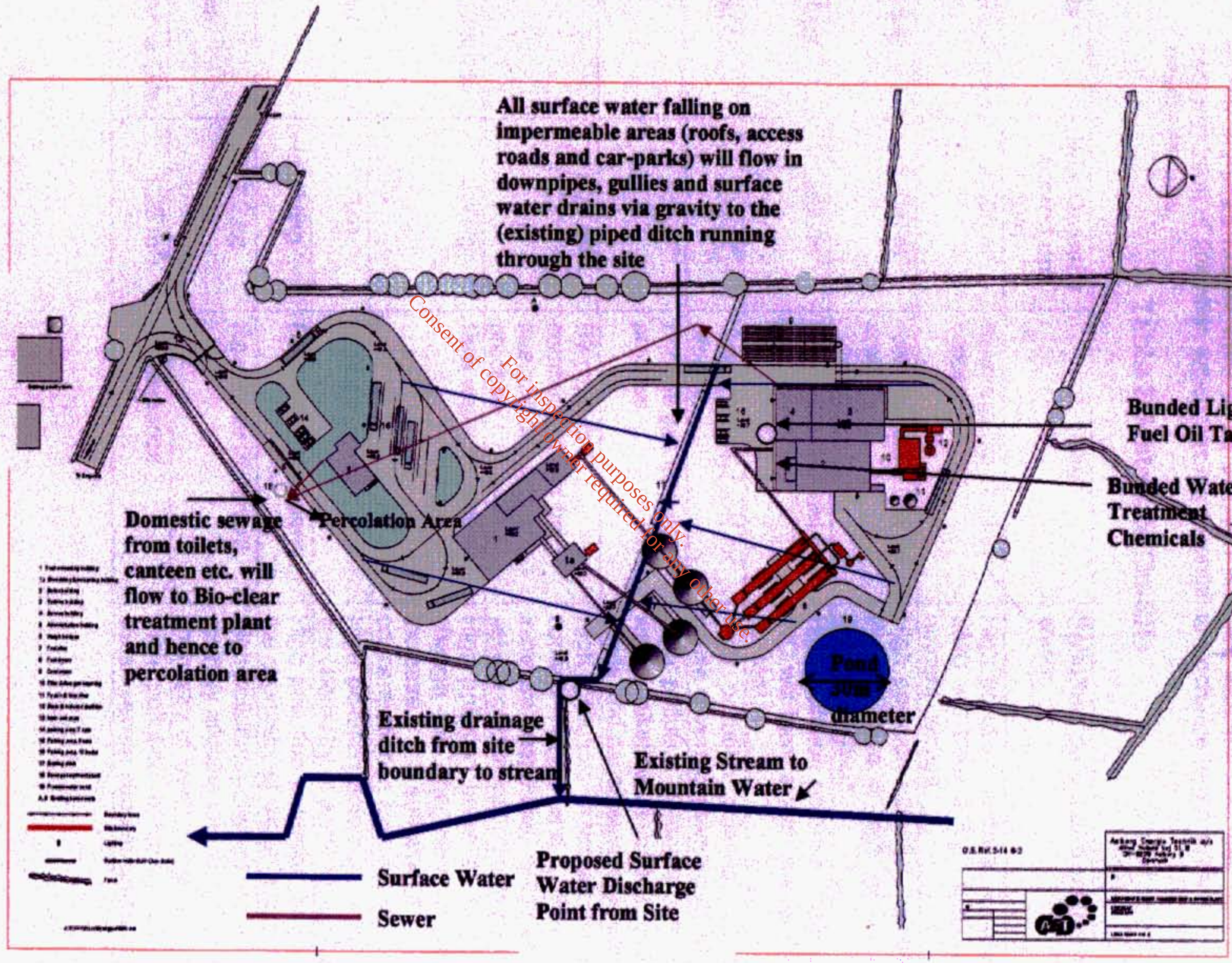
The site will be fitted with two oil interceptors, one at the oil tank loading area and one at the surface wabr discharge outlet from site at the eastern boundary.

Domestic effluent *on* the site, from toilets, sinks, showers and canteen areas will discharge to a dedicated treatment plant –a bio-clear treatment system. This system will be designed for a maximum of 25 staff (working 3 x 8hour shifts). Raw sewage from the administration and services building is discharged to an aerated tank, which fully treats the wastewater, prior to discharge to a percolation area. Within the percolation area, treated effluent is discharged via a network of pipes Into the underlying soil, where it undergoes further polishing and treatment, prior to discharge to groundwater.

The bio-clear treatment system is a fully enclosed plant, accepting only domestic-type wastewaters. No process water will be discharged to the bio-dear system.

In summary, all surface water runoff from the site will discharge via over-ground flow and via the surface water drainage system to the site outlet at the eastern site boundary and hence to the nearby sham. A large amount of surface water will also percolate through the soil to ground and groundwater, as approximately over half of the site area is permeable (i.e. grass/landscaped).

# Figure 3. Proposed Drainage Routes from New Site



# 8. Materials

The raw materials, intermediates and products used on the site are provided in the following table. The table also provides details on the pollution potential of the materials if they were to be involved in a fire incident and lead to contamination of firewater, which has the potential to discharge to the stream nearby the site.

## Table 2. Materials On-Site

| Materials | Max Quantity Stored en Site | Use | Pollution potential if mixed with fire water |
|---|---|---|---|
| Spent Mushroom Compost | 2,500 m³ | Raw material / fuel for Pro—— | High pollution potential, leachate from SMC will have a high BOD and high nutrient content |
| Poultry Litter | 1,250 m³ | Raw material / fuel for Pro—— | High pollution potential, leachate from PL will have a high BOD and high nutrient content |
| Wood Chips | 1,250 m³ | Raw material / fuel for P—— | High pollution potential, leachate from WC will have a high suspended solids content |
| Light Fuel Oil | 100 m³ | Raw material / fuel for process | High pollution potential, oil spill will cause severe contamination of waters |
| Lime | 100 m³ | For flue gas cleaning process | High pollution potential, lime will turn water alkaline, increase suspended solids and cause severe contamination |
| Fly Ash | 600 m³ | By-product of combustion and from flue gas cleaning process | High pollution potential, fly ash will contain lime and other metals, increase suspended solids and cause severe contamination of waters |
| Sodium Chloride | 250kg | Raw water treatment | High pollution potential, (salt) - would change the chemistry of water and increase suspended solids concentration In high doses |
| Citric Acid | 1kg | Raw water treatment | High pollution potential, would change the *chemistry* of water *in* high doses |
| EDTA | 0.6kg | Raw water treatment | High pollution potential, would change the chemistry of water in high doses |
| Sodium Hydroxide | 1.2 kg | Raw water treatment | High pollution potential, caustic soda is strongly alkaline and would change the chemistry of water in high doses |
| Maintenance Oils | 1.25 m³ | Maintenance | High pollution potential, oil spill will cause severe contamination of waters |

# 9. Site Safety and Control

The Biomass CHP plant will be automatically controlled in accordance with standard TRD 601(German standard for the control of steam boilers) and monitored by SCADA (Supervisory Control And Data Acquisition) system. The automation system will be built using standard PLC hardware (ex. Siemens) and PCs.

All interlocks and control loops for the boiler plant will be programmed in the PLCs and the plant will be monitored and operated through an interface on PCs. Alarms will be collected, recorded and printed on the alarm list with time indication. The alarms will be grouped according to their importance. The system can handle a power failure of maximum 24 hours without any loss of system and application programme documentation.

The safety equipment functions independently of the control system and will disconnect the boiler plant in *case* of failure, i.e. too low water level, too high steam pressure, too high steam temperature, power failure and control failure.

The *site* will be constructed and operated in line with local and national safety requirements. The entire plant will be fenced with a 2.1m galvanised chain link fence. A responsible trained operative will be on-site at all times to oversee operations.



# 10. Fire Abatement, Response, Training and Awareness.

A number of measures are proposed to ensure fire safety at the site. The site will comply with all fire regulations in terms of building structures, emergency provisions and fire fighting equipment, and all other stipulations set out by the local fire safety officers.

Fire safety systems and fire fighting equipment will be strategically located throughout the site. The systems and equipment provided will allow for the early extinction of a fire to ensure minimum risk to employees. This in turn prevents the generation of contaminated firewater.

*An* automatic fire detection system and break glass points will be installed all main processing buildings on the site;

- Fuel unloading building
- Boiler house
- Turbine hall
- Services building

The fire alarm will have both audio and visual alarms.

Alarm panels with 10 zones will be placed In the control room in the service building.

Fire extinguishing systems to be provided at the site indude;

- 4 external fire hydrants
- Hose reels & dry powder fuel unloading building, boiler and turbine building, service building and office/administration building.

Emergency telephone numbers of the local fire brigade, garda, doctors, 'ambulance and hospital will be posted in prominent locations throughout the site. Fire escape routes will be clearly identified and maintained available for use.

A safety statement will be devised for the site once constructed. This safely statement will indude the company and site information to be adhered to in an emergency event i.e. emergency response procedure. All staff on the site will be fully trained In the *safety* aspects of the operation.

The Local fire-fighting unit will be invited to the site to relay details on site processes, chemical storage arrangements, flammable materials, hydrants, site access etc. Any suggestions or improvement measures deemed necessary by the local fire fighting team will be taken on board by the company.

The Local Fire Fighting unit, based in Monaghan town have 2 main pumps and one Emergency Tender Rescue Unit. There are three full time officers in the local fire brigade, the Chief Fire Officer and two Assistant Chief Fire Officers. In addition to this there are 9 firemen. The backup services available to the local fire unit indude that from the outside towns. These include the Clones, Ballybay, Castleblaney and Carrickmacross Fire Units. The response time of the local fighting unit in the event of an emergency call to the site would be between 10-15mins.

# 11 Risk Assessment

On examining the proposed Monopower site a number of areas which pose a risk for the generation of contaminated firewater are evident (*see* Figure 1).

Table 3. Contaminated Firewater Risk Areas

| Ref. No | Details | Material posing risk of contaminating firewater |
|---|---|---|
| 1 | Fuel unloading building | Spent mushroom compost, poultry litter, wood chips |
| 1a | Shredding and screening building | Poultry litter and wood chips |
| 2 | Boiler building | Spent mushroom compost, poultry litter, wood chips |
| 4 | Services Building | Maintenance oils |
| 7 | Fuel storage silos | Spent mushroom compost, poultry litter, wood chips |
| 8 | Fuel dryers | Spent mushroom compost |
| 10 | Filter and flue gas cleaning | Lime |
| 11 | Fly ash and lime sibs | Fly ash and lime |
| | Oil tank | Oil |
| | Raw water treatment plant | Water treatment chemicals |



In all other areas of the site, other than those mentioned above, the likelihood for contaminated firewater generation does not exist or is considered minimal.

The likelihood of fire starting in any of the areas listed above is low, due the fact that *strict* controls and alarm systems will be in place. In addition, all the areas listed above are segregated from each other, so the likelihood of fire spreading between areas is small.

However the possibility of fire starting always exists, and as shown in Table 2, the consequences of contaminated fire water getting into *the* surface wafer system will cause a serious pollution incident.

Therefore systems for the containment of contaminated firewater will have to be installed by the company.

# 12. Fire Water Calculations

In any fire incident on the site, the site's employees would use extinguishers and hose reels initially to put it out. If the fire brigade were involved in extinguishing the fire they would utilise water from the fire hydrants coming from mains and from the well supply to the site. The following section provides details on the volume of firewater that could be utilised in a fire incident at the site, following EPA guidelines.

**Table 4. Calculation Assumptions**

| | Details | Comments on Data |
|---|---|---|
| 1 | Fire occurs in one area of the site only (as per Table 3) | Areas are segregated, so risk of fire spread is low |
| 2 | 4 fire hydrants are proposed for the sib, with an assumed capacity of 25 l/sec each (1.5 $m^3$/min). Given the size of the site, it is assumed that only the 2 closest hydrants to the fire will be used in a fire event. | Capacity of hydrants supplied by AET, the designer (water supply to the site has a minimum capacity of 7bar and a flow of minimum 25l/sec) |
| 3 | Fire tenders will be used to fight the fire 1,800 litres each (1.8$m^3$) | 2 fire tenders in Monaghan |
| 4 | Water from the on-site welt will be used to fight fire, with a capacity of 27$m^3$/hr (0.45$m^3$/min) | Capacity of well on site estimated in EIS |
| 5 | Duration of the fire is 90 minutes | Controls and safety features on plant deem that fire will be prevented and detected quickly, allowing fire to be brought under control within 90 mins. |
| 6 | Area of impermeable surface on the site Is 9,510$m^2$, but as drainage will be collected in two separate systems (i.e. site split in half) the impermeable surface area for any fire event therefore 4,755$m^2$. | From roofs and paved areas |
| 7 | 20 year, 24hour rainfall event is 64mm for Emyvale | Data provided from Met Éireann, as per Table 1. |
| 8 | No surface water is utilised for fire fighting purposes | No significant quantity available to the site |

**Table 5. Fire Water Calculation**

| | | |
|---|---|---|
| / | Fire water likely to be used for the site | $m^3$ |
| | Fire wter from 2 fire hydrants on the site; 2 x 1.5$m^3$/min x 90mins | 270.0 |
| | Fire water from well on site; 0.45 $m^3$/min x 90 mins | 40.5 |
| | Fire water from fire brigade; 2 x 1.8$m^3$ | 3.6 |
| | Total fire water likely to be used for the site | 314.1 |
| | | |
| 2 | Volume of contaminated water to be retained | |
| | In a fire in any of the high contaminant risk areas (Table 3), leachate from the products present wuld generate contamination. Therefore contaminants present will not increase the volume of contaminated fire water to be generated. | |
| | Therefore the required retention volume of contaminated fire water | 314.t |
| | | |
| 3 | Rainfall Allowance | |
| | Amount of rainfall that could occur during a fire; 0.064 m x 4,755 $m^2$ | 304.32 |
| | | |
| | Total required retention volume for contaminated fire water is | 610.42 |

# 13. Fire Water Containment

A pond is being constructed on the site, which may be used for storing process water. This pond was initially *sired* at 10m diameter and 1m deep, giving a volume of 78m$^3$. It is proposed increase the size of this pond, so that it can act as a firewater retention facility also.

The pond will be constructed to have a diameter of 30m and depth of 1m, as shown in Figure 3, which will provide a total retention area of 707m$^3$. This volume is estimated to have sufficient retention capacity for a 90 minute fire on the site, assuming an extreme rainfall event concurrently, as the calculated contaminated firewater volume for this event, as shown in the previous section is 618.42m$^3$. The pond will be constructed of a water-tight membrane and have sloping sides.

Along with the fire water retention pond, all storage tanks and areas on the site will be bunded to the required capacity. The EPA industry standard for bunding is; 110% the volume of the largest tank within the bunded area or 25% of the total volume to be contained in the bunded area, whichever is the greater. The site will comply with this standard.

For small fires, the company will have on site a supply of containment booms to contain the fire within small areas.



# 14. Fire Water Retention Risk Management Programme

- The site will be designed so that all chemical areas am adequately bunded.
- A fire water retention pond of 707m$^3$ capacity will be provided by the site.
- The drainage system will be set up so surface wafer drainage from the southern pert of the site will be kept separate from the surface water drainage from the northern side.
- The drainage system will be designed so that that the final discharge location from the site can be dosed and water can be diverted to the firewater containment pond.
- Water levels in the pond will be managed to ensure that there Is a sufficient volume available in a fire incident.
- Containment for small fires/spills will be done via spill kits on the site (containment booms).
- Once the site has been constructed, all required safety documents and emergency response procedures will be put in place to ensure formal management of emergency events.
- All required staff will be trained in safety and emergency procedures.
- Kerbing will be placed between impermeable roads and car parks and permeable grass areas, to direct excess surface water falling on the site to surface water drains.