

APPENDIX 4K

**DETAILED VENUE
ANALYSIS: STAMPEDE
CORRAL**

CALGARY BID EXPLORATION COMMITTEE

VENUE BRIEF:

Stampede Park – Stampede Corral:

PROPOSED Hockey 2 Venue

CALGARY, ALBERTA, CANADA

PREPARED FOR

CALGARY BID EXPLORATION COMMITTEE, Master Facilities Plan

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DATE

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INTRODUCTION

As part of an exploratory exercise to determine the feasibility of Calgary presenting a bid to host another Olympic and Paralympic Winter Games, a high level survey and study was conducted to review potential major competition and non-competition sites. One of the primary components of the exercise was to look at where there were synergies between venues and maximize existing infrastructure and transportation links/corridors.

The ability to cluster venues into precincts and parks provides substantial efficiencies in operational readiness, time, and costs. The Calgary Bid Exploration Committee (CBEC) focused their attention on Stampede Park and its venues for these existing efficiencies. The Stampede Corral located within the Stampede Park has been identified as the potential site for Ice Hockey 2, along with the Para Ice Hockey competition.

The information contained in this document is to provide the Calgary Bid Exploration Committee (CBEC), Facility Owners, and Planning Teams further information on venue use, spatial requirements, and any challenges that need to be explored regarding this venue.

PROPOSED SCOPE & WORKING ASSUMPTIONS

The Stampede Corral has been proposed as a competition venue, hosting the following events:

Sport:	Hockey
Discipline:	Ice Hockey 2 (Olympic) Para Ice Hockey (Paralympic)
Events:	Men's Tournament Women's Tournament

Throughout the exploratory discussions the following working assumptions have been applied:

- NHL ice surface dimensions will be provided;
- Transition to Para Ice Hockey is considered and provided for in all athlete areas, surfaces, and FOP equipment;
- Ice plant is fully operational and sized for Olympic Games operations and use;
- HVAC is fully operational and able to meet games requirements for temperature and humidity levels;
- Hockey 2 gross seating capacity minimum of 5,000 seats;
- Seating bowl is code compliant and meets best practice for accessible and amenity seating;
- Full venue is available for Olympic and Paralympic use including external compounds, parking, and all ancillary spaces. Shared or exclusive use periods to be determined during venue use agreement planning phase;
- Venue is located within Stampede Park, secure perimeters, vehicle and pedestrian screening, transport operations, and other amenities and services are provided for within the common domain or by the park;
- Lighting levels meet Olympic Games Broadcast requirements, see Appendix A;
- Roof structure has the capacity to hold additional loads for sport lighting, cameras, flags, look banners and/or dimensional rings, audio, video boards, and score boards;
- Toilets are code compliant and meet accessible guidelines and best practice;
- Concessions are in good working condition with all services operational, code

compliant, and accessible.

The material below is a non-exhaustive listing of the major areas and will act as a preliminary benchmarking tool when assessing the overall venues ability to operate as a Hockey 2 competition venue with Para Ice Hockey considerations. Using this material will provide the information needed to complete the next series of space studies to confirm flows, functional area space allocation, and develop further confirmation of required permanent works necessary.

As part of the Stampede Park, there needs to be further dialogue around the overall site access, egress, vehicular flows and Security Footprint, but as an initial phase of work the brief below will advise as to baseline requirements. There is minimal reference to the interior spatial requirements for the sport venues as most of the facilities have the primary requisites within their standard operating design, any gaps observed are noted at the end of the document for consideration. Further information on the Sport Federation and Media requirements will come later in the process.

HOCKEY 2 BASELINE REQUIREMENTS

1 | General Venue Use

The Organizing Committee Olympic Games (OCOG) will need to take possession of the venue and its surrounding site areas to allow sufficient time for build out and overlay works. Build out requirements are based on the number of compounds, cabling requirements, and overall build scale and complexity.

A typical build out duration for a Hockey venue is approximately 6-12 weeks prior to athlete training start, this includes venue lock down, technical rehearsals, and hand over to the games time operations team.

Coordination between venue owner and the OCOG is required to confirm non-exclusive use and exclusive use periods to allow for games build out, games operations, and remediation of the venue and site post games. Hockey is an Olympic and Paralympic sport, which requires transition between Olympic Ice Hockey to Paralympic Ice Hockey. This transition includes works to the FOP and athlete areas, along with other minor venue elements. Remediation works to commence at the end of competition of the Paralympic Games, in coordination and alignment with park operations for coordinated park remediation operations. As this venue is being proposed as a shared site with the IBC, during the next phase of detailed planning, build out and games operations need to be reviewed to confirm circulation, secure access, athlete operations, along with FOH and BOH operations.

Full use of the venue is required, including all exterior compounds, parking, ice maintenance areas, suites, food service areas, retail outlets, storage areas, home team locker rooms, offices, and facilities, and all operational spaces necessary to operate during the games.

2 | Front of House (FOH) Program Requirements

Front of House (FOH) areas are where spectator access, circulation, accommodations, and event viewing spaces are provided. FOH operations include spectator entry points, ticket scan, circulation concourses, concessions, ticket resolution, spectator services and information, retail outlets, toilets, water stations, spectator medical, and access to spectator

seating and competition viewing areas.

As part of Stampede Park, the Stampede Corral front of house operations are modified as the secure perimeter of the venue is provided by the park, where security screening for both vehicles and pedestrians will occur. A venue perimeter fence line will still be required at the venue, where spectator entry and exits gates will be located with access to the venue through ticket scan portals. The entry and exit points will be determined through crowd modeling exercises with the park to established ticket scan through put rates to ensure optimal spectator flows in the park and load-in/out of spectators to the Stampede Corral for competition.

General considerations for the front of house include providing spectator toilets and seating to meet best practices in accessibility, amenity seating, toilets, and concessions to ensure all spectators are able to enjoy the games without limitations. A thorough review of the venue's accommodations needs to be completed to determine where improvement works may be necessary to accommodate best practice and code compliance for an international sporting event. In addition to ensuring all seating is accessible and code compliant, all existing suites will need to be available for use in operations, sport production, international federation spaces, and additional spectator seating.

FOH areas optimally occur in existing spaces internally, however, there may be a requirement for additional spectator spaces to be provided to meet operations and games planning requirements. These spaces would be provided through temporary infrastructure in the spectator plaza's, entry spaces, and concourses. Internal space allocation and the requirements for external temporary spaces will be confirmed in the next phase of the venue confirmation and detailed planning.

a. FOH External Program Requirements

i. Venue Perimeter

A venue perimeter fence line is required for all venues within the park. This fence should be a minimum of 1.8m high, and ballasted to ensure stability in the event of heavy winds, creating a perimeter footprint of roughly 1-2m in depth. The fence will be covered in fence fabric with the look of the games applied, and entry and egress points. This enables the

flexibility for Stampede Park to allow access to the park without tickets to a competition venue, and controls access to the Stampede Corral to ticket holders and accredited pass holders only.

ii. Ticket Box Office (TBO)

A venue typically has a ticket box office located outside the venue perimeter, for ticket sales, will-call, or ticket related services. As part of Stampede Park, ticket box offices will be located centrally, no specific space is to be allocated for TBO at this venue.

iii. Ticket Scan

Ticket scan will occur in tent portals at the venue perimeter, the area and number of ticket scan portals will be determined based on the Stampede Park crowd modeling exercise, which will determine the spectator throughput rates into the venue, establishing the number of ticket scan portals required.

iv. Spectator Plaza

The spectator plaza occurs between the ticket scan and the venue, with direct access to the spectator concourses, where spectator amenities and services are provided, as well as access to seating and competition areas. The size of the spectator plaza will be determined through the crowd modeling exercise and spectator load-in/egress rates, based on venue spectator capacities and park crowd modeling. Also, due to multiple sessions, a venue spectator holding area is required with an area of approximately 3,500m².

v. Spectator Services – Plaza

Spectator services storage and staging areas are required for golf carts, wheel chairs, and stroller storage – this area should be no larger than 25m². In addition, an animal relief area, with direct access to potable water and drainage, is required. This area should be no larger than 10m².

vi. Exit or Blow Out Gates

Exit gates or blow out gates are located adjacent to the entry ticket scan portals. The number

of gates is determined based on the venue capacity and park crowd modeling, to accept the exiting spectators from the Stampede Corral into the park general population and circulation.

b. FOH Internal Program Requirements**i. Spectator Services – Information and Storage**

An area, existing or temporary, to be provided for spectator information, lost and found, and additional wheel chair and stroller storage. This space should be located centrally in the main spectator concourse area, and should be approximately 25m² in area with provisions for a counter to provide separation between event services staff and spectators. Use of the existing venues information office is preferred.

ii. Ticket Resolution

A ticket resolution office or area, existing or temporary, to be provided centrally in the main spectator concourse area. This area should be approximately 10m² in area, with provisions for a counter to provide separation between ticketing staff and spectators. Use of the existing venues TBO is preferred, if located within the venue perimeter.

iii. Concessions

Use of the existing concession areas to be provided, depending on the number of existing concession areas, additional temporary areas for concession sales may be required. Approximately 108 lm of concession counter space is required. A thorough review of the existing concessions conditions, operations, and services to be completed to determine if requirements for code compliance along with spectator accessibility best practice is provided.

iv. Retail Outlets

Use of the existing retail store outlet to be provided, depending on the size, additional temporary retail outlets may be required. Approximately 108 lm of retail outlet counter space is required.

v. Spectator Toilets

Use of all existing spectator toilets to be provided. A thorough review of the existing toilets to

be completed to determine if upgrades are required to ensure all toilets provide the required accessibility provisions to meet best practice and code compliance per the venue capacity.

vi. Spectator Medical

Use of the existing spectator medical area to be provided. If the existing spectator medical does not exist, a space of approximately 50m² is required. The space needs to have water and drainage, along with direct access to an accessible toilet.

vii. Water Stations

Water areas to be provided in the venue through existing drinking fountains or water fill stations. Water to be tested for drinking water use. Number of stations to be compliant with venue capacity and located throughout the spectator concourse areas.

c. Other Major FOH Program Requirements

i. Seating

The venues existing spectator seating gross capacity will net 15-20% less to accommodate for accredited seating and seat kills due to FOP build out, camera platforms, broadcast and press tribunes, and photo positions. Spectator services requirements and compliance to be aligned with this net capacity number.

3 | Back of House (BOH) Program Requirements

Back of House (BOH) areas are where sport, competition management and all venue operational spaces are located. Several spaces are required to be internal to the venue, with others in compounds outside the venue, with access to the venue for servicing and operations.

BOH operational areas include athlete areas, competition management, athlete medical, anti-doping, International Federation and Olympic Family areas, sport presentation, technology, food and beverage compound, cleaning and waste compound, workforce check-in and break areas, logistics compound, site compound, security, venue operations and management, broadcast compound, press operations (venue media center and press conference room),

and venue accreditation. In addition, there are services compounds, parking, venue access points, and emergency services vehicle points required in the BOH.

General considerations for the external BOH compound spaces include paved surfaces for high traffic use – vehicle and pedestrian, along with structures – tents, cabins, containers, and equipment. Connections to water and waste, along with fibre is a plus to minimize additional works that would be required for necessary service connections. Overall drainage of the BOH compounds is critical for proper surface water drainage. Considerations for internal BOH spaces include direct connections to the external BOH spaces for cabling and venue servicing.

a. BOH Internal Program Requirements

i. Athlete Areas

Space for all athlete areas should be provided inside the venue at the FOP level or with direct access to the FOP level.

The Hockey 2 venue requires 10 team locker rooms and no game day locker rooms. A typical hockey venue only has 2-4 existing locker rooms, this requires locker rooms to be provided through temporary infrastructure in cabin structures adjacent to the venue and integrated as a seamless connection to the BOH, FOP, and Athlete spaces. The space required for these additional locker rooms is roughly 3000m² in a compound space. If there is no space for the temporary locker rooms BOH, two game day locker rooms to be provided, with Sport to confirm location of team locker rooms at training venues.

Additional athlete areas include ten team storage areas, an apparel centre, skate sharpening, laundry services, athlete warm-up area and lounge, for an approximate area requirement of 700m².

Officials require a lounge, drying room, and locker room with an required area of approximately 150m².

All areas to be easily adapted to required IPC Para Ice Hockey accessible requirements in all athlete and officials areas, inclusive of toilets and shower facilities.

ii. Competition Management

The competition management space is where sport operations offices and work areas are located. The space should be located on the FOP level, or with direct access to the FOP level and athlete areas, with an area of approximately 300m².

iii. Athlete Medical

Athlete medical to be located on the FOP level with easy access to the ice and athlete areas, with a space allocation of approximately 150m², and connections to water and waste. In addition, all athlete medical areas are to be fully accessible, inclusive of toilet areas.

iv. Anti-Doping

If space is not available within the venue adjacent to the athlete locker and warm-up areas, anti-doping operations can be located outside the venue, with direct covered access to the athlete spaces within the venue. Anti-Doping space to be compliant with WADA space and processing guidelines, whether located within the venue or in a temporary cabin structure. The anti-doping space required is approximately 200m² and requires connections to water and waste. In addition, all anti-doping areas are to be fully accessible, inclusive of toilet areas.

v. International Federation

The International Federation (IF) for Ice Hockey is the International Ice Hockey Federation (IIHF) and the IF for Para Ice Hockey is the International Paralympic Committee (IPC), in coordination with the World Para Ice Hockey Technical Committee. There is a requirement for IF spaces within the venue for offices, meeting space, and an IIHF lounge. This space is approximately 500m² and should provide direct access to toilets.

vi. Olympic Family

The Olympic Family (OF)/Paralympic Family (PF) lounge and protocol offices to be located in existing lounge or club spaces or areas directly adjacent to the Olympic Family seating areas, with dedicated toilets. This space needs to be a minimum of 250m².

vii. Sport Presentation

Sport presentation includes spaces for ceremonies offices, presenter staging and dressing rooms, and mascot changing. There are no medals ceremonies for Olympic Hockey at this venue, they occur at the Hockey 1 venue, however Paralympic Ice Hockey will have medal ceremonies requirements at the Hockey 2 venue. These areas need to be located on the FOP level with easy access to the FOP, with an area of approximately 300m².

viii. Technology Operations

Dependent on readily available connections to fibre, there may be a requirement for compound spaces for technology and cellular structures, staging, along with containers for equipment and storage. This storage can be in the form of a tent or several containers. The compound space required is roughly 500m². Operational spaces for timing and scoring, work areas, and offices to be located on the production level with direct access to the FOP, this area is approximately 500m².

b. BOH External Program Requirements**i. Food and Beverage (FAB) Compound**

The food and beverage compound is the space for storage of both food and beverages, along with kitchen and food prep areas. Dependent on the venue, a temporary kitchen and additional storage is necessary to service all the additional lounges and food services outside concessions and standard venue operations. FAB sponsors, i.e. Coke, will also provide their own containers for storage on site and require a minimum of 1.5 days storage of products. This compound also requires offices, workforce areas, toilets, connections to water, waste, power, and easy truck access for daily off-hours food delivery. The compound space required is approximately 1000 – 1500m², depending on existing venue kitchen facilities.

ii. Cleaning and Waste (CNW) Compound

The cleaning and waste compound is an area for the staging of the large mobile collection bins, bin wash down area, compactors for the required waste streams, storage of CAW cleaning and paper products, along with offices. The compound space required is approximately 800m² with an additional area of 1000-2000m² for snow removal equipment

and snow storage.

iii. Workforce (WKF) Check-In and Break

An area to be provided for workforce check-in and break areas adjacent to the venue and workforce accredited entry to the venue. These spaces can be in a tent structure, with workforce check-in space allocation at approximately 225m² and workforce break at approximately 500m².

iv. Logistics (LOG) Compound

The logistics compound requires space for an office cabin, toilets, staging, and storage space. Additionally, this compound will provide containers for storage for other functional teams, dependent on in-venue storage, as well as parking for large equipment and vehicles. This compound is approximately 1000m², and must be secured due to the equipment and goods stored.

v. Site (VED) Management Compound

The site compound requires space for offices, toilets, staging, and storage areas for Site Management along with Energy, Look of the Games, and Signage and Wayfinding. Additionally, this compound requires parking for large equipment, vehicles, and spares with an overall compound space requirement of approximately 1000m², and must be secured due to the equipment and goods stored.

vi. Security (SEC) Operations

As a venue within the Stampede Park, a full PIDS system is not required, only a secure fence line and controlled entry points to separate and delineate the venue from other park venues and operations. These control points have accredited security check-points for operations and ticket scan entry areas and exits for spectators.

Accreditation access points are located BOH, with exception to one FOH accredited entry. Accredited entry points are provided for Staff, Olympic Family, Athletes, IF, and Media.

In addition, security operations require offices, control centre, briefing, and storage spaces –

these can be in the venue or in an external compound tent or cabin structure, with a compound size of approximately 300m². Dedicated power and direct fibre connections are required to support their secure independent servers and operations.

vii. Venue Management Operations

If space is not available within the venue, a venue operations centre (VOC) is required. This space will house the offices for venue management and miscellaneous functional areas, event services offices and storage, venue briefing area, venue communications centre, and storage as required. If located externally, these spaces can be in a tent or cabin structure, and is approximately 500m².

viii. Broadcast Compound

The Hockey 2 broadcast compound for the Olympic Broadcast Service (OBS) at the Winter Games, requires approximately 5000m² of clear open space immediately adjacent to the venue. The compound provides Rights Holder Broadcast (RHB) spaces and OBS technical operations, offices, and connections to the International Broadcast Centre (IBC) and in venue operations. With the location of the Corral next to the IBC, the space requirement would be reduced to fit only dedicated Hockey 2 Broadcast and required RHB operations, with a space requirement of approximately 2500m².

The compound will also require its own dedicated generator compound, dedicated to OBS operations in the compound and at the venue. This space is roughly an additional 500m² of required space, directly adjacent to the BRD compound.

In venue operations include camera positions and platforms, commentator positions, mixed zone, broadcast studio, commentator control room (CCR), and Broadcast Information Office (BIO). The studio space is approximately 30m², the CCR space is approximately 50m², with the BIO approximately 25m².

ix. Press Operations

Dependent on space available in the venue, a Media Centre may need to be located externally to the venue, with direct access for the media to travel between the tribunes, photo positions, mixed zone, and the media centre. The media centre can be housed in a tent, with

requirements for offices, lounge, lockers, and workroom. A media centre for Hockey 2 is approximately 600m², however, with the location next to the MPC, this space can be significantly reduced to only minor filing, storage, offices, and press operational spaces required specifically for the Hockey 2 venue.

In addition, there is a requirement for a Press Conference Room – if space is not available in the venue with connections to the media center and the tribunes, it can be located next to an external media center, adjacent to the venue with direct access for the press and athletes to and from the tribunes and mixed zone, and is approximately 150m² for Hockey 2.

x. Venue Accreditation

A central park accreditation office is provided, no specific venue accreditation office is required for this venue.

c. Other Major BOH Program Requirements

i. Services and Access

Access to water and waste, along with access to fibre connections is required for BOH compound spaces. In addition, there will be a Field of Play (FOP) and BOH energy requirement for prime generated power, along with redundancy generated power requirements. Energy compounds are broken into specific areas adjacent to the compounds and the venue with the most direct routes to reduce cable lengths. Roughly 4 compounds should be considered, outside the broadcast (BRD) compound, of approximately 500m² each.

ii. Parking and Vehicular Access

Each BOH compound will require parking within its compound for various operations. Additionally, Athlete's, officials, OBS and operational staff require parking – this can be as high as 150 parking stalls, with an area of approximately 4000m².

Further transportation planning with new and existing public and games transportation systems can reduce this number, along with park shuttle systems, but should not be less than 50 stalls for this venue.

BOH road access is dependent on available access routes in and out of the venue from the Park BOH transport and service roads within the park. A loop in and out of a venue is preferred, allowing for easy access of large trucks without backing up at any point of its entry into a venue. All security VSA's (Vehicle Screening Areas) will occur at park entries and not at this venue.

iii. Ambulance Staging

Emergency services vehicles will also require space within the venue BOH, dependent on the safety plans – fire trucks would be centrally located within the park, however, two ambulances would be required for the venue – one dedicated to Athlete's and the other for Spectators. These ambulances are located adjacent to the building, with direct access to both the FOP and spectator areas, and require connections to power.

4 | Field of Play (FOP) Space Requirements

The field of play (FOP) is the area where Hockey competition takes place, on the ice surface. In addition, to the FOP area, there are several areas that are directly adjacent to the FOP which are also considered as part of the FOP. These areas include the player's bench, penalty boxes, scorekeeper's bench, athlete on and off ice areas, broadcast platforms, photo positions, medical positions, ice crew staging, mixed zone, and off ice operations.

General considerations for the FOP include agreed ice surface dimensions, humidification requirements for the ice, along with on ice temperature requirements for the athletes. HVAC systems need to be reviewed to confirm compliance for games, as modifications may be required.

Further, lighting levels are required to meet Broadcast lighting requirements, See Appendix A. Lighting may require modification to meet the lighting levels and to cover the ice surfaces.

a. FOP Ice Program Requirements

i. Ice Surface

NHL size ice surface has been agreed to meet competition requirements for all Hockey venues.

ii. On-Ice Areas

Standard IIHF and IPC Para Ice Hockey adapted boards, and player's and penalty boxes are required. In addition, special flooring surfaces to be provide for circulation of athletes to and from the locker rooms and the FOP, using their sledges.

b. FOP Off-Ice Program Requirements

i. Off-Ice Areas

Ice maintenance operations is located directly off ice and requires a space of approximately 150m² for staging of equipment. Use of existing venue pits, staging, plant and other ice maintenance operational spaces to use utilized.

ii. Mixed Zone (MZ)

The mixed zone (MZ) is the location where media interview the athletes immediately post competition, and is the pathway back to the athlete areas from the FOP. There are three areas required in a mixed zone, the athlete lane, broadcast and press corrals, and the circulation corridor to feed the broadcast and press areas. The athlete lane needs to be 2m deep minimum, the full length of the mixed zone. Broadcast requires roughly 15 (1.8m x 1.8m) positions with the circulation corridor behind, approximately 2m deep. Press requires roughly 35m length by 3m deep as a minimum, with the circulation corridor, 2m deep. Back drops are required on the Athlete side that may take an additional .5m space required the full length of the mixed zone. Access to the mixed zone is directly adjacent to the athlete off-ice area.

c. Other Major FOP Program Requirements

i. Training

Training and competition occurs at the venues along with additional training venues, creating long operational periods and requirements for services.

ii. Roof Loads

The FOP roof structure requires the capacity to hold additional loads for lighting, cameras, flags, look banners and/or dimensional rings, audio, internet and mobile antennas, video boards, and score boards. An estimated load requirement is 25 tons to meet games requirements. The structure should be surveyed to confirm load capacity.

iii. FOP Lighting

Requirements for broadcast level lighting must be provided at each venue to meet the OBS technical specifications for broadcast lighting. See Appendix A for the OBS Broadcast Lighting Technical Specifications.

VENUE TRANSPORT SUMMARY

Refer to Appendix 4AA

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VENUE PROFILE SUMMARY

Venue: Stampede Corral

Location: Stampede Park

Key Contact: Paul Rosenberg

Owner/operator: Calgary Stampede

Current use: Miscellaneous events

	Yes/No	Comments:
FOP standards/IF approval:	no	Requires change rooms, dasher boards, modifications for Para Ice Hockey
Operational space	Yes	May need upgrades
External space – FOH	yes	Spectator seating needs renovating to upgrade seats and add accessibility. Also accessibility to washrooms.
External space – BOH	Yes	To be assessed with overall stampede park
Parking	yes	To be assessed with overall stampede park
Utilities services (gas/water):	yes	Existing may need upgrades due to age
Mechanical/electrical:	yes	May need upgrades.

Technology/BMS:	yes	
Fiber connectivity:	Yes	Connected to BMO
Access & Egress Transit:	yes	Accessibility need to be addressed.
Access & Egress Pedestrian:	yes	existing
Long term use contracts:	yes	Stampede park contracts
Capital improvement plan:	No	Slated for demolition when BMO phase 3 is constructed
Adjacent land (plans in use):	Yes	Stampede park
Lighting levels for broadcast use:	Yes	Will need to be enhanced
Sponsorship rights and agreements:	Yes	Stampede park sponsors

VENUE GAPS, CHALLENGES, AND CAPITAL WORKS PROJECTS

With the assumption that the Hockey 2 venue could potentially be located at the Stampede Corral, located within the Stampede Park, there are a number of items that need to be considered in order to ensure the existing venue meets Olympic Games requirements for competition and venue services.

i. Venue Gaps

There are a number of items that need to be considered with locating the Hockey 2 venue at the Stampede Corral, they are as follows:

- Currently the IBC at the BMO does not meet the space requirements for an IBC, the current plan utilizes the Stampede Corral for some required space, by taking this space for Hockey 2 only further reduces the space requirements for the IBC which will not meet Games requirements;
- The BOH space required for the potential Hockey 2 venue at the Stampede Corral is currently required space for the Broadcast Satellite Farm and Ops Compound. Moving this operation will further reduce IBC requirements that are currently not acceptable;
- This venue is currently being utilized for community hockey and does not meet the requirements for an elite sport venue, many capital works projects will be required to bring this facility up to Olympic standards and requirements, see capital works project listing below.
- Current seating does not meet Olympic standards, along with accessible and amenity seating code requirements.

ii. Venue Challenges

- Location identified in Stampede Park has challenges with BOH operational space and depending on the venues designs, may have impact to the overall shared operations within the Park;
- Flow of spectators to the Stampede Corral around the proposed hockey 1 venue, Saddledome and IBC;

- Other challenges are unknown at this time, pending venue design.

iii. Capital Works Projects

Capital works projects are pending designs of the venues, the following listing is of areas that need special consideration during the design process to ensure games requirements are considered.

HVAC

Confirm humidification and temperature levels to meet IIHF requirements.

Roof Loads

Confirm roof loads of 25 tons and height clearances for Games.

Lighting

Confirm FOP lighting meets broadcast lighting requirements as noted in Appendix A.

Toilets

Confirm all toilets meet code for accessibility and best practice for family and amenity toilets. This include athlete locker rooms and facilities BOH.

Seating and Accessibility Compliance

Confirm seating meets code for accessibility and amenity seating, with locations at all levels of the seating bowl to ensure ability to provide accessible and amenity seating at all price points. Review existing conditions for C-Value and sight lines and new seating, study optimization for new seating and potential expansion concepts.

Exterior Services Connections

Confirm connections are readily available for fibre, water, and waste in exterior compounds, along with connections to power.

FOP Ice Surface and Boards

Confirm ice plant and slab conditions meet Games requirements, along with location and condition of dasher boards, boxes, and timing and score boxes are compliant or need upgrading.

Building Shell

Confirm any upgrades required to the building shell or envelope.

Spectator Amenities

Confirm existing conditions for spectator amenities, against seating capacities for concessions and toilets to ensure quantities and conditions meet requirements.

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APPENDIX A: BROADCAST LIGHTING TECHNICAL SPECIFICATIONS



Esteem Projects & Consultancy

Date: 8th February 2017

Re: Olympic Broadcasting Service (OBS) summary of current Broadcast Lighting Technical Specifications.

Following is a summary of the OBS technical specification for broadcast lighting. The IOC and OBS would provide a comprehensive specification on confirmation of the Olympics Host City.

Below sets out the key areas for consideration when planning and design for games time lighting.

In addition to the completion area that require quality lighting are the non field of play areas such as

- Mix zones
- Press conference rooms
- Announcer positions
- Athlete holding areas
- Athlete pathways to FOP
- Spectator areas
- Warm up areas and Fields of play
- Medal and Flower Ceremony's
- Flags of Nations and Ceremony Flags

The technical specifications provide the detailed requirement for all venues. Sport specific requirements can vary between sports and venues. Consideration should be given to these specific requirements when formulating designs and equipment.

OBS Technical Specifications Summary Version February 2017

Light source (lamp)

The specified requirements apply to all light source (lamp) technologies e.g. HID (MHN, HQI, HSI, HIT, MSR, MSD etc.), LED, fluorescent etc.

Flicker

To support HFR production requirements and irrespective of the lamp technology e.g. HID, LED etc., the lighting shall be flicker free; the lamp driver/control gear shall be of the electronic type with an output frequency $\geq 1,000\text{Hz}$.

Low wattage lamps are preferred. The lamps shall be from the same manufacturer and from the same production batch.

Colour temperature:

The colour temperature, Tk, shall be 5600K (standard TV camera preset).

All lamps shall have the same colour temperature. That is, the colour temperature shall be nominally one value e.g. 5600K. Differences in colour temperature between different wattage lamps (at the FOP in question) are not acceptable.

It follows that if the competition of a sport is held at two (or more) venues, the FOP broadcast lighting of each shall have the same colour temperature.

Colour rendering10:

The CIE CRI Ra shall be ≥ 85 ;

and if no proven international standard installations of the lamp/luminaire system exist, a live field test with the intended light source/luminaire and a broadcast quality camera in cooperation with a national sports broadcaster shall be conducted and the results made available for review;

or

- Alternatively, TLCI11 Qa ≥ 85 ; or
- Alternatively, CRI Ra ≥ 85 and a R9 ≥ 45 ; or
- Alternatively, CRI Re(R1-R15) ≥ 85 .

If, for practical reasons (legacy, economics etc.), the lighting over the spectators has different lamp technology luminaires to the FOP, the colour temperature of these (spectators) luminaires shall not be higher than the FOP lamps.

Lighting equipment and operating conditions

The lighting equipment shall be suitable for the operating environmental conditions of the venue in question; and ensure that the lamps operate at the correct colour temperature and light output characteristics. The lighting equipment shall comply with the relevant host country's electrical safety standards. Luminaires shall comply with IEC 60598. The lamps shall comply with the relevant IEC lamp standards.

Winter Games outdoor venues, cold weather and lamp performance.

Extreme cold weather affects the proper functioning of all lamps (HID, HMI, fluorescent, LED). Apart from a lower light output, in particular the colour temperature may change significantly even between individual lamps and become unacceptable.

Lamps shall be operated on control equipment designed for very low temperatures so that the lamp operates to the stated nominal performance characteristics and meets the above requirements; and be utilised in luminaires designed for cold temperatures.

Anticipated light output losses due to low temperatures shall be factored into the lighting design.

The projected Games time temperatures shall be established well in advance.

Secondary warming (heating) the localised ambient temperature and air space control to ensure compliance should be considered. If necessary tests should be carried out to ensure the equipment would operate at the Games time predicted operating temperatures.

Calculation and measurement grids

Calculation grid intervals shall nominally be 2m (varies per sport – see specific sport requirements).

Illuminance towards a camera - known as camera illuminance, E_c , shall be on a plane nominally at 1.5m above the FOP surface.

Vertical illuminance, E_v , towards a nominated side of the FOP shall be on a plane nominally at 1.5m above the FOP surface.

Horizontal illuminance, E_h , shall be calculated/measured on the FOP surface.

Compliance illuminance measurement grid intervals shall nominally be 4m.

Note: the calculation plane shall match the gradient/slope of the FOP; e.g. cycling track, alpine skiing slalom; and/or the athlete's principal competition 'line' through the space above the FOP which may be a vertical plane e.g. skiing freestyle aerials, diving and ski jumping.

Camera locations

The camera positions modelled in a lighting design shall be as specified by OBS. Nominal camera plans are provided as production teams can survey the venues and formulate related plans.

HD, 4k and HDR

The on-going evolution from standard definition to high definition and beyond raises the question of

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illuminance levels. The reality is that with most professional broadcast camera system cameras, the sensitivity remains the same. In other words, the illuminance criteria herein remain the same for HD and 4K.

Similarly, high dynamic range (HDR) provides no additional restriction. At the time of publication 8K is in the early stages but it likely that the same requirement will prevail. The reader should check with OBS for currency.

Minimum illuminance

The minimum vertical illuminance at any point of the FOP shall be $E_c \geq 1,600$ lux towards the main cameras.

Note: the minimum average illuminance and the average horizontal illuminance are determined by the uniformity ratios. For HDTV/4K it is imperative the uniformities are met or exceeded. The minimum vertical illuminance at any point of the FOP towards the orthogonal directions of the FOP, where camera #1 is central to a side, or 45° to the 4 sides of the FOP where camera #1 is not central to a side shall not be less than 70% of the minimum illuminance towards any main camera.

Uniformities for FOP

Vertical illuminance uniformity for each relevant main camera.

The minimum to maximum camera illuminance ratio, $E_{c \min}/E_{c \max}$, shall be ≥ 0.7 for the FOP; and ≥ 0.4 for the FOP-surround.

The minimum to average ratio, $E_{c \min}/E_{c \text{ ave}}$, shall be ≥ 0.8 for the FOP; and ≥ 0.6 for the FOP-surround.

Horizontal illuminance uniformity

The minimum to maximum ratio $E_{h \min}/E_{h \max}$, shall be ≥ 0.7 for the FOP; and ≥ 0.4 for the FOP-surround and/or run-off

The minimum to average ratio, $E_{h \min}/E_{h \text{ ave}}$, shall be ≥ 0.8 for the FOP; and ≥ 0.6 for the FOP-surround and/or run-off

The ratio of vertical illuminances at any point on the FOP between the orthogonal planes (at either 90° or 45°; i.e. four calculation planes only) facing the four sides of the FOP shall be ≥ 0.75 and ≤ 0.9 .

The average vertical illuminance on the FOP towards camera #1, or the designated principal camera, shall be greater than the average vertical illuminance towards the other 3 orthogonal directions.

The uniformity gradient UG , for both horizontal (UG_h) and vertical illuminance to main cameras (UG_c) shall nominally be $\leq 10\%$ on a 2m calculation grid (varies per sport by interpolating the appropriate calculation grid).

The UG_v of the vertical illuminance towards the backlight side or sides where there are no fixed cameras shall nominally be $\leq 20\%$ at 4m grid intervals (varies per sport and interpolation).

The ratio of the average horizontal illuminance of the FOP surround to the average horizontal illuminance of the FOP shall be ≥ 0.6 and ≤ 0.8 , target 0.7.

Slow motion replay zone (SRZ): some sports will have a defined SRZ. In the absence of a specific SRZ requirement, the $E_{c \max}$ towards the main camera, shall be at the FOP centre.

Coefficient of variation (CV): the CV shall be ≤ 0.13 .

Maximum illuminance

Whilst firstly complying with the six basic specified uniformity criteria i.e. $E_{c \min}/E_{c \max}$, $E_{c \min}/E_{c \text{ ave}}$, $E_{h \min}/E_{h \max}$, $E_{h \min}/E_{h \text{ ave}}$, UG_c and UG_h , the maximum illuminance towards the main cameras, $E_{c \max}$, $\geq 2,000$ lux.

Luminaires and aiming logic

The luminaire-aiming angle shall be $\leq 65^\circ$. Light should reach any point within the total FOP from at least three directions where the third directional component should form a 'backlight' to one or both of the other two directions, with respect to the main cameras.

No luminaire shall be aimed directly at a camera, and not within a 50° cone centred on the camera lens. If the aiming point potentially coincides with a (hard/main) camera, the azimuth aiming angle shall be outside a cone of 50°.

A luminaire within the field-of-view (FOV) of the main cameras and aimed generally in a direction towards the cameras shall be constructed, or fitted with a glare-controlling device. The control shall be such that the light emitting area of the lamp is shielded from the camera's FOV or fitted with barn-doors, louvres or similarly acceptable devices.

Fit-for-purpose louvres, shields, hoods, barn-doors etc. may also be required to minimise the effects of glare, spill light and reflected (skip) light.

Equipment type and position shall be chosen to meet the specified glare limits.

Where the sport includes athlete action above the FOP surface (e.g. gymnastics, ski-jumping, diving etc.), there shall be light projected through the space above the FOP. The athlete's performance space in effect becomes the 'field of play' with respect to broadcast.

The total amount of light (luminous flux) projected from the camera #1 side shall not be less than the total luminous flux from the opposite side. Lighting equipment (luminaires, truss, cable looms, and chain motors etc.) located between the main cameras and the far side of the FOP shall be outside the cameras' field of view (FOV) when shooting the competition.

Noise – lamp control gear or drivers shall be silent (no ballast "hum"). Apart from aerial sports, in principle the luminaires should be designed, installed and aimed such that there is no light projected above the horizontal.

Multiple venues for one sport

Some sports take place at two or more venues accommodating preliminary rounds and the finals. The BRD LX quality of the two (or more) venues shall be the same, or as close as possible – a difference of not more than 5% of both the average horizontal and the average vertical illuminance (to camera 1). The colour temperature shall be the same or not more than a 5% differential.

The baseline lighting quality shall be set by the venue that stages the finals.

End of Technical Specifications

Report Author:

Steven Allen
Esteem Projects & Consultancy LTD. London UK

Broadcast Lighting Consultants to PyeongChang 2018 & Tokyo 2020
Previous Olympics: - Rio 2016, Sochi 2014, London 2012, Vancouver 2010

End of Report

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DRAFT

APPENDIX C: STAMPEDE CORRAL – SCOPE OF WORK

The Corral is being considered as a possible 5000 seat ice venue for the games. This use of the Corral is likely to require significant capital upgrades to bring the venue up to an adequate level for olympic use. Below is a summary of the items that would need to be considered, do not hesitate to let us know if anything key is missing.

For this exercise start at a high level - what envelope upgrades are required? Will the existing rakers work? If these seem surmountable then start digging into the mechanical, electrical and other items. Set up a meeting with CBEC within a week to update on your progress.

Deliverables:

- Text document describing the anticipated capital improvements; include text on the building engineering including roof load capacity, mechanical HVAC description, plumbing and electrical upgrades.
- Simple sketch outlining the proposed seating strategy both in plan and section addressing building code and accessibility issues. Simple sketch outlining any proposed additions (for locker rooms etc).
- *Deliverables as required to complete a Level 5 costing exercise.*

Format of Deliverables:

- 11x17 pdf document summarizing your findings.
- The CBEC team will ensure that credit is given to all work completed by architectural and engineering professionals; however, information needs to be provided to CBEC in a 'raw' form as it will be included within an overall report that will require a consistent look.
- Text documents should be provided in WORD.
- Drawings - provide pdf drawings, as well as AutoCAD plans. AutoCAD plans are required by CBEC to complete an overlay analysis. Also provide your logo for inclusion in the CBEC title block for the overlay drawings.

Below is a summary of the key requirements and areas to be assessed:

Field of play:

- NHL Ice surface
- Comment on the current state of the ice plant and will it be in good shape in another 9 years for the olympics? Will this need replacement?
- Dasher boards? Assumed these need replacement.

Existing Building Shell:

- Investigate any existing envelope upgrades that would be required.

- Review the roofing and outline any upgrades that would be required.

Roof Structure:

- Roof to be able to support and additional 25 tons of hanging loads (this includes a 'jumbotron')
- Identify what the height is over the existing ice surface.

Spectator Seating:

- Ideally 5000 seats, the Corral currently has 6400 seats. It is anticipated that the seating bowl does not meet code... especially with respect to accessibility.
- Investigate the rakers - is the rise and run appropriate for new seating to be installed.
- Accessibility - accessible and amenity seating in multiple locations to serve 1% of the seating.
- Is there the possibility adding an upper level - possibly at the BMO upper level? That could have elevator access for spectator seating up top - even if it means blowing out a few rows in a certain area? We would need an elevator within the corral - unless there is one in the Boyce theatre that we could tie into - we would need to be separate from the BMO.
- Also look at how to get accessible seating down low in a certain area within the seating - can this tie into the elevator discussed above - or can we add rating on the concourse?

Spectator Amenities:

- Outline washroom upgrades that may be required, include the addition of family washrooms to serve people with disabilities.
- Concessions - what level of concession upgrades would be required? What is the extent?

Athlete & Support Amenities:

- For the permanent build it is assumed new change rooms will be required. These may or may not fit under the seating as they are now - maybe this is storage and concessions? Would it make sense to push change rooms out and have an addition under the +15 bridge to allow for new change rooms - this would require the athletes to cross the concourse; however, this can be accommodated.

Electrical & Lighting:

- Lighting levels to meet Olympic Games Broadcast requirements of 2000 lux with zero flicker tolerances. What would the anticipated permanent build lighting be? How much will we need to supplement?

Mechanical/Civil:

- It is assumed that the HVAC system will need to be replaced - review and provide a summary of HVAC upgrades that will be required.
- Will the existing services (water and sanitary) be able to handle the increased loads?

FULL VENUE REPORT:

Stampede Corral

Architectural (Lead): Gibbs Gage Architects

Structural: Read Jones Christoffersen Ltd.

Mechanical: Remedy Engineering

Electrical: SMP Engineering

Refrigeration: Thermocarb

Cost Consultants: BTY

GIBBS GAGE ARCHITECTS

CORRAL CENTRE

FACILITY ASSESSMENT FOR ICE HOCKEY AND SLEDGE HOCKEY OR
CURLING AND WHEELCHAIR CURLING

CBEC

APRIL 7TH, 2017 | 17013



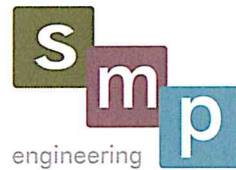


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TERMS OF REFERENCE

The Corral Centre is a 6500 seat ice hockey venue originally built in 1950 and renovated in 1980 as a venue for the Calgary Flames until a new arena, the Saddledome, was built in 1983. The scope of work for this report was to do a non destructive evaluation of the major building components in the building with the expectation of what significant improvements would be required to have the facility ready to host Ice Hockey and Sledge Hockey or Curling and Wheelchair Curling during the 2026 Olympics and Paralympics. Specifically we were asked to look at the following:

- Field of Play –ice plant condition, dasher board condition
- Existing Building Shell – envelop issues and roof condition
- Roof Structure – Ability to support “jumbo-tron” score clock and identify the height over the existing ice surface
- Spectator capacity- code requirements with respect to rake, accessibility, upper level seating bowl, elevator access to upper level
- Spectator Amenities- washroom count and accessible washrooms, as well as the number and type of concession
- Athlete and Support Amenities- location for new change rooms
- Electrical and Lighting- 2000 lux broadcast lighting levels
- Mech/Civil – HVAC upgrades, plumbing loads

The Calgary Bid Exploration Committee requested we engage the following consultants to assist in the preparation of the report and their sections are noted independently in this report:

Structural – Reid Jones Christofersen (RJC)

Mechanical – Remedy Engineering

Electrical – SMP Engineering

Refrigeration – Thermocarb

A site investigation was held on February 24th, with members of the consultant team and representatives from the Calgary Stampede. Drawings have since been provided by the Stampede and are listed below.

Beyond the above noted items, we were requested to review the building for potential code non-compliance and other issues that may have cost implications to the renovation to make suitable for the Olympic Games. In most of these conditions the current non-compliance can likely be grand-fathered pending the scale and scope of alterations to the building.

Additional consideration for cost implications were requested by the CBEC committee that looked at the following 3 criteria:

- **Capital Maintenance/Life-Cycle:** Costs that are required to extend the useful life of a facility in its current configuration to a period which includes, at minimum, the expected time frame of the 2026 OPWG. Such cost forecasts do not necessarily enhance the facility’s functional use or change physical attributes in a substantial or enhanced nature. These are costs that will need to be incurred by venue operators prior to the 2026 OPWG to keep the facility operating in its usual manner whether or not Calgary bids for the Olympics.
- **Olympic Requirements :** Costs which are required to modify or otherwise make ready a facility to meet the Olympic requirement from either a field of play perspective or from an operational/ancillary space perspective and would only be incurred by venue operators if the Olympics were being staged at the venue. These costs could result in a significant legacy to the facility, sport and/or the community. The costs in this category that result in a significant legacy will be highlighted in the report.
- **Additional Long-Term Legacy Enhancements:** Improvements to the venue that reasonably enhance the facility from its present state/configuration and as a result, provide incremental and long term benefit to sport, venue operators, recreational users and/or the community at large - locally, provincially and nationally, and from a social, sport or economic perspective. This cost category may be undertaken in conjunction with one or both of the other two categories (i.e. Capital Maintenance/Life Cycle and/or Olympic Requirements) and possibly result in lower costs than would otherwise be the case if such Long-Term Enhancements were undertaken on a “stand-alone” basis. These “additional investments” are

not required to host the Games and should be considered whether or not the Games are hosted.

Separate Prices

In addition to the above noted categorization of the costs associated with developing the Corral, 2 separate price analysis/study was developed as part of this scope of work to evaluate the comparable cost of New Construction of 5000 seat Ice Hockey venue

Drawings provided:

- Corral floor plan
- Corral Bleachers (layout)
- S1 - (structural building section)
- S2 - (structural building section)
- Corral Roof Loads.pdf
- Corral-1 10058100 M-1 1.pdf (mech)
- Corral-1 10058100 M-1 2 (mech)
- Corral-1 10058100 M-1 3 (mech)

EXECUTIVE SUMMARY

The overall facility has been very well maintained for a building of 67 years and shows no obvious signs of significant replacement of major systems required to be a suitable venue for International Hockey during a potential 2026 Olympic and Paralympic Games. Cost considerations for Capital Maintenance/Life Cycle were considered to be the same regardless of whether the venue was deemed suitable for Curling or Ice Hockey. The costs for Additional Long Term Legacy Enhancements was considered to be only applicable if the Stampede saw value in keeping the Corral beyond the 2026 which was deemed more likely in the scenario of using the Corral for Hockey. If the venue is tailored for Curling for the Olympics, it is assumed that there would be no legacy as a future curling or hockey venue.

OLYMPIC REQUIREMENTS ICE HOCKEY/SLEDGE HOCKEY

Overview

The Corral, in its current state, has several non-compliant field of play issues and will need upgrades to some of the specific performance requirements during the Olympic Games and Paralympic Games. The following is a high level summary of the items that would absolutely need to be revised to accommodate the use of the Corral as a hockey venue:

Field of Play

The current benches and performance of the dasher boards does not meet the requirements for High performance Hockey. A section of the first 6' of the concrete bleachers would need to be removed and rebuilt to suit the appropriate arena layout with player benches. New dasher boards and glazing with new netting for fan protection required. New dasher boards would need removable curbs and panels that could be replaced with clear panels for Sledge Hockey. Benches would need to be designed to be removable to function for both Olympic and Paralympic requirements.

Barrier Free requirements

An elevator and additional seating for people with disabilities will be required. A total of 7 barrier free washrooms will need to be added as either stand alone family type, temporary facilities or as part of improvements to the East washrooms

Bleachers

New bleachers will need to be added to replace the existing wood two seater bleachers in the corners of the rink. The access to the bleachers from the lower level will need to be altered to suit removal of the 2' high concrete at the dasher boards for player safety.

Broadcasting Requirements

Additional camera locations will likely need to be added to meet media requirements

Spectator Enhancements

Structural improvements are required for supporting a Jumbo-tron score clock.

Athlete amenities

The current locker rooms are insufficient in size. New locker rooms located underneath the +15 walkway to the Saddledome could be either permanent or temporary facilities. Access to the player benches from the North side proposed dressing rooms would require alterations to the spectator seating.

Lighting

New LED lighting with addressable dimming will be required for Broadcasting lighting levels

Power

New 4-400A, 2-200A, and 2-100A 208V 3 phase disconnects would be proposed for broadcast and event power

COSTS

The summary of hard construction costs for the items noted above are \$4,549,000. Further breakdown and information is provided under the cost summary section of this report

OLYMPIC REQUIREMENTS CURLING/WHEELCHAIR CURLING

Overview

The Corral, in its current state, would be well suited to facilitate both Curling and Wheelchair curling for the Olympics and Paralympics in 2026. Most of the upgrades to the facility would be focused on

improvements to spectator experience, barrier free upgrades and temporary ice conditions.

Field of Play

No major modifications would be necessary to accommodate the 4 sheet layout required for Curling however, an allowance for bumpers and removal of the dasher boards should be allowed. In place of the dasher boards, guard rails would need to be added.

Barrier Free requirements

Similar to the scenario for hockey an elevator and additional seating for people with disabilities will be required. A total of 7 barrier free washrooms will need to be added as either stand alone family type, temporary facilities or as part of improvements to the East washrooms

Bleachers

New bleachers will need to be added to replace the existing wood two seater bleachers in the corners of the rink. The access to the bleachers from the lower level will need to be altered to suit removal of the 2' high concrete at the dasher boards for player safety.

Broadcasting Requirements

No major modifications would be required to accommodate broadcasting requirements for Curling however allowances have been made to support additional minor structural modifications

Athlete amenities

The current Ice Hockey locker rooms would need to be refurbished to suit the requirements for use as Curling Locker Rooms and additional temporary facilities would need to be created to meet the requirements for Olympic Curling. These would logically require barrier free access for Wheelchair Curling use.

Lighting

New LED lighting with addressable dimming will be required for Broadcasting lighting levels

Power

New 4-400A, 2-200A, and 2-100A 208V 3 phase disconnects would be proposed for broadcast and event power

COSTS

The summary of hard construction costs for the items noted above range from \$7,197,000 to \$7,723,000.

Further breakdown and information is provided under the cost summary section of this report

CAPITAL MAINTENANCE LIFE CYCLE

Renewal of the Corral for a 25-30 year horizon would focus improving the functionality and performance for Hockey Events as the current primary purpose of the facility

Field of Play

The arena slab is beyond its current life cycle and would need to be replaced as part of the maintenance program to meet even a 10 year outlook. Any replacement of the slab would suit Hockey and Curling in the future

Washrooms

The current East washrooms are dated and will likely need to be replaced to improve the functionality and extend the life of the structure another decade.

Ice Resurfacer Room

A new Ice resurfacer room with proper melt pit, drive aisle and storage will improve the functionality of the rink and support its use as an arena beyond the 10 year window

Ice Plant

The current condenser and controls are expected not to last to 2026 and the current layout requires ammonia detection and a vestibule to be added.

Life Safety

The fire alarm will likely be at the end of its life cycle and need to be replaced. All exit signs should be upgraded to running man type

COSTS

The summary of hard construction costs for the items noted above range from \$13,803,000 to \$14,294,000. Further breakdown and information is provided under the cost summary section of this report

LEGACY CONSIDERATION

Given the use of the facility by the Stampede as concert venue and event facility as well as a hockey facility, the assumed enhancements would be in support of providing more functionality to those uses.

Bleachers

Adding compliant stairs with more access points would be an important consideration in making the facility more functional for hosting a wider array of events and would address current non-compliance issues

Green Room

Given the larger variety of functions, additional support spaces and staging areas for performers and entourage would allow the Corral to be a more prominent multi-purpose venue. The previous locker space would be ideal to function as this space.

Athlete amenities

The current locker rooms noted as insufficient to host the Games would be ideally rebuilt in the concourse as a permanent dressing room bank aligned with centre ice. This would require expanding concourse space potentially to the south around the current washroom bank. A separate cost has been provided for the creation of 4 new dressing rooms and 1 referee room

Arrival/gathering/ticketing and concourse

The entrance to the Corral is tied into the entrance for the BMO facility and the Corral could benefit from a better user experience and pre-function/ticketing entrance. Additionally a larger concession offering would create a venue appropriate to host mid size concerts and events.

Exterior Envelope

The current facility has a very poor performing envelope and would benefit from a refreshed look and better performing envelope. An allowance for recladding and generally improving the facility should be considered for the enhancement.

COSTS

The summary of hard construction costs for the items noted above range from \$531,000 to \$11,496,000. Further breakdown and information is provided under the cost summary section of this report

ARCHITECTURAL REVIEW

EXTERIOR

Building envelope

The existing facility is largely clad in concrete block and concrete and on visual inspection shows no noticeable deterioration. The building abuts the BMO Convention Centre on the West side and The Boyce Theatre on the North side. No building sections were available currently. The Calgary Stampede has not noted any concerns or ongoing maintenance with the building envelop. The flashing and gutters are metal and generally in good condition with no noted leaks or comments from the Calgary Stampede. Fascias on the lofted portion of the roof are wood and may need to be replaced by 2026.

Exterior - Roof

The roof was snow covered on inspection and was unable to be reviewed. The Calgary Stampede indicated that there were no ongoing concerns with the roof or issues with leakage. Further review of roofing reports would indicate the expected lifespan of the current system. Drainage from the larger barrel vault shows that gutters and roof drains will likely need to be replaced within 10 years. The parapet connection to the adjacent roof is metal and appears to be in good condition.

INTERIOR

General

The interior of the facility was in generally good condition and entirely suitable to host Ice Hockey during the Olympic Games. Improved concourse and arena lighting are noted in the Electrical portion of the report. The condition of finishes was generally in good condition, however, new painting and replacement of concession millwork would be required to refresh the facility for the 10 year time frame of the 2026 Olympics.

Field of Play - Ice Surface

The current rink surface is noted further in the report by Thermocarb but it currently does not meet the dimension for NHL requirements for arena surfaces. The corner radii are too small currently at approximately 13 feet. The overall length and width are sufficient. Increasing

the radii would not have a significant additional impact as the dasher board system and the arena slab would need to be replaced. The report on the slab suggests that a slab replacement should be undertaken to make the rink suitable in 2026 for Hockey

Field of Play - Dasher Boards

The current dasher boards are a steel frame system and abut the concrete bleachers at the mid way mark of the dasher system. The glass system on the dasher boards is inadequate in height around the entire playing surface and in poor condition. There are 4 large gates for player access in each corner of the rink. There is a guillotine style ice resurface gate on the East end of the rink. The construction and type of boards are not adequate for international competition and would require the lower 2M minimum of poured in place concrete bleachers to be removed and reconfigured with a new aluminum dasher board and glass system. It is recommended that with new dressing rooms that the corner access points be abandoned for better performance of the boards during games.

As a sledge hockey venue, the dasher boards require no curbs at the gates and transparent panels at the player benches. Removable benches would be suitable for Sledge Hockey and Ice Hockey.

Dasher boards are not required for Curling and would likely be replace by glass guardrails since the bleachers are raised above the ice surface.

Field of Play - Player benches

The current location of the players benches are across the ice surface from each other and inadequately sized. IIHF requires 2, 10M minimum benches on one side of the rink with a 2M offset from the centre line. As noted above, the lower 2M of bleachers will need to be removed to allow for required players benches, time keepers box and penalty boxes.

For use as a sledge hockey venue, additional spatial considerations are required for the depth of benches and a level access from the dressing rooms on a portable synthetic skate surface is required with removable benches noted above.

For Curling, no player benches would be required and the area could be made available for additional barrier free seating.

Athlete Amenities - Dressing Rooms

The current dressing rooms are woefully undersized and insufficient to host a World class event like the Olympics. These dressing rooms should be decommissioned and re-purposed as noted later in the report if the venue is to be used for Hockey.

To suit Hockey, new dressing rooms would be ideally suited on the south side of the arena between the two stair towers. These dressing rooms should have sufficient space for a full hockey team, shower facilities and dedicated washrooms as well as coach's areas and a large referee room. The assumed area per dressing room is 160 SM and would include barrier free washrooms and showers. The Referee Room assumed area would be 80 SM with accessible showers and washrooms. Access to the ice surface should be into the back of the new player benches and would coincide with a re-configuration of the south washroom bank. Access across the concourse could be either temporary as needed for players or made permanent by reconfiguring the concourse slightly.

The dressing rooms, either temporary or permanent should be completely barrier free and large enough to accommodate the sledge through doorways and corridors. Showers and washrooms should exceed code requirements.

With respect to Curling, the existing locker rooms underneath the bleachers could be refurbished, with minimal cost, to a level that would serve their use during the Olympics and Paralympics. This would accommodate approximately half of the 20 required player dressing rooms. Another 10 dressing rooms would be required at an area of 25 SM each. These, like the proposed Hockey dressing rooms above would ideally be located to the South of arena adjacent to the +1.5 walkway to the Saddledome. In locating these facilities, attention will be required to maintain exiting from the arena.

Spectator Amenities - Bleachers

Many of the existing wooden bleachers have been replaced with new plastic bleachers that appear to meet the clearances for unobstructed passage. The exact quantity of these has not been calculated at this time. As previously noted the lower 6 feet of the concrete raking will need to be rebuilt to suit replacement of the metal dasher boards with aluminum boards and proper clearances. This would result in the loss of approx. 175 seats.

In the corners of the arena the original two-seater wood

seats remain and would need to be replaced with individual seats. More problematic is the cross slope of the bleacher and raked concrete in the corners of the rink. The stairs serving the corner sections exceed the 1 to 50 cross slope allowable on stairs. This may be able to be grand-fathered as existing non-compliant condition. This will require further investigation to confirm but it is recommended to be remediated for legacy considerations by re-pouring these stairs and providing alternative aisles.

The current bleacher system also exceeds the allowable number of seats to an exit aisle in the corner sections. Additional stairs built to code and re-configuration of the improper cross sloped stairs would address this concern.

Corner access points to the seating bowl also currently feature combustible construction elements in the ceiling which would need to be replaced with non combustible materials.

Spectator Amenities - Concessions

The Corral does have concession services but would benefit from the addition of more concession locations and with the relocation of the dressing rooms to the South side of the arena, these locations could easily increase and improve the spectator amenities. Alternatively these facilities could be temporary or external

Spectator Amenities - Green Rooms

The Corral has a few green rooms and show offices but also utilizes the dressing rooms for larger events. There is no direct separation between performers, staff and spectators that is not created as a temporary solution for events. Utilizing, the current locker rooms and enhancing those spaces could provide more functionality to the venue for multi-purpose events

Spectator Amenities - Scoreboard

There is currently no centre ice jumbo-tron. Refer to structural for roof loading. The clear height to the underside of the truss is 12.8M. A lower profile scoreboard would need to be considered to not compromise the performance of the ice surface.

Barrier Free Upgrades – Access

To provide barrier free access to the bleachers an elevator will need to be provided and would be ideally suited outside the Corral footprint. The most

suitable location would be in the lobby of the Boyce theatre and could serve access to the upper level of the Theatre as well.

Barrier Free Upgrades - Seating

There are 10 wheelchair seats provided in the bowl. These would need to be modified and relocated as they are located in the 6' area adjacent to the dasher boards. Barrier free access will need to be provided to the upper concourse and wheelchair stalls can be easily accommodate with this provision to the number required. The understanding for the requirements of barrier free seating for Olympic and Paralympic Events is to provide multiple tiers of seating at multiple cost points for barrier free seating throughout the facility. To accommodate this the existing location would need to be reconfigured based on the requirements for replacing the dasher boards and bleacher interface. This may result in the loss of some seating to accommodate this. Additional, the potential alternative location would be at the upper concourse level accessed via an elevator. This will require the removal of the upper standing room on the North side and can suit as many spots as required. Another potential location for barrier free seating could be in the corners of the rink which currently have access to the bleacher system and to the ice from the existing dressing room. Either temporary or permanent ramps could be located in this zones to provide barrier free seating stalls with the relocation of the dressing rooms mentioned above.

A total of 18 barrier free stalls are required for a 5000 seat capacity venue. This is a code minimum and it is assumed that the Paralympics may have a higher requirement for seating than the current Alberta Building Code requires.

Support Spaces - Washrooms

The North bank of washrooms has recently been upgraded by the Stampede. The South washrooms are original. The total washrooms provided are sufficient for the 6500 spectator seating capacity. However, neither Washroom bank has fixtures that meet barrier free requirements. Improvements to the South washrooms could address this deficit and enhance the spectator experience. 7 barrier free stalls are required in the facility based on a total of 70 stalls provided in the concourse area. These could be stand alone family type universal washrooms or integrated as part of an upgrade to the South washroom bank

Support Spaces – Ice Plant

As noted in the Refrigeration summary, the Ice Plant is missing a vestibule and would need upgrades to meet the current code requirements for life safety.

Support Spaces – Ice Re-surfacer Room

The current Ice re-surfacer room is in poor shape with some cracking and chipping floor with an insufficient drain location. There is no melt pit and snow is dumped and melted manually by hosing it down. The current facility does not under perform during events but a proper melt pit may improve user experience and operations for the event. At this point minor improvements to patch and repair the slab are recommended to serve the Games and replacement is recommended for legacy considerations.

No modifications to the Ice Re-surfacer Room would be required for Curling

Broadcast requirements – Camera Locations

Renovations to the bleachers would need to consider ideal location of the cameras to cover hockey and will likely result in the level of some areas of the stands to create a suitable camera position.

The broadcast booth is currently used as "box" suites for events and in consideration of legacy improvements could be enhanced with better finishes.

STRUCTURAL REVIEW

BACKGROUND

The Stampede Corral roof structure consists of a series of nine (9) 5000mm deep steel trusses clear spanning approximately 42 metres over the ice surface and bleachers. In addition to lighting, broadcast booths are hung from both ends of the central five (5) roof trusses. The remaining structure consists of cast-in-place concrete bleachers/rakers and concrete slab on grade concourse level. We have been asked to comment on the feasibility of the Stampede Corral structure to accommodate the following upgrades:

- Support an additional 25 tons (50,000 lbs) of hanging loads, which includes a large screen display 'Jumbo Tron'.
- The possibility to introduce an elevator from the main concourse level to the upper concourse level.
- Demolish the entire seating bowl to provide an open flat floor to house the international broadcast centre.

RJC met with maintenance staff on February 24th to visually review the facility. The structure appears to be in good condition with no obvious signs of deterioration. In addition to our site visit, we have assessed the Corral's ability to support the additional 25 tons, using existing rigging drawings supplied by the Calgary Stampede. The drawings were prepared by BEI Engineering Inc. and dated September 2005. Please note, we have conducted our assessment at a conceptual level only. Further detailed engineering analysis will be required if the project proceeds beyond the feasibility stage.

Item 1 – Support Additional 25 Tons (50,000 lbs)

The nine roof trusses are broken into the following three categories; two 'end' trusses, four 'middle' trusses and three 'centre' trusses. The roof structure can support an additional 25 tons (50,000 lbs) of additional rigging load with the following restrictions:

- End Trusses - The two (2) end trusses can support no additional rigging loads
- Middle Trusses - Each of the four (4) middle trusses can support an approximate additional 8 tons (16,000lbs), at support points as located on the rigging drawings.

- Centre Trusses - Each of the three (3) centre trusses can support an additional approximate 2 tons (4,000 lbs), at support points as located on the rigging drawings.

As noted above, there is a significant reduction in rigging capacity of the centre three trusses, which would most-likely be the location of a new 'Jumbo Tron'. The weight of a new 'Jumbo Tron' would need to be established to determine if there is sufficient rigging capacity in the existing structure. Two options to remove the rigging restrictions noted above are; stiffen the existing trusses or add steel trusses that span the length of the ice, which are located between existing roof trusses.

Item 2 – New Elevator to Upper Concourse

Structurally it is feasible to introduce a new elevator from the main concourse level to the upper concourse level. The location and details of the renovation would need to be developed to better understand the impact to structure.

Item 3 – Demolish Entire Seating Bowl

The seating bowl is constructed from cast-in-place concrete slabs supported on rakers spanning from the upper to lower concourse. No structural drawings of the seating bowl have been provided; however, it is our understanding the rakers provide lateral support to the upper concourse level and steel roof columns. With the understanding the upper concourse is to remain, it is feasible to demolish the existing seating and rakers to create an open flat event floor. The following structural modifications are required to demolish the seating area:

- Introduce a new lateral diaphragm at the upper concourse level. This could be achieved by either a new 3.5m wide by 200mm deep reinforced concrete slab cast on top of the existing concourse level or a 4 meter deep horizontal steel truss supported from the upper concourse level. Either options, the 200mm concrete slab or the horizontal steel truss would in-circle the existing upper concourse level. Based on the assumption of a 4m deep truss, the assumed weight of the new horizontal steel truss would be approximately 335kg per linear meter of upper concourse level.

- Introduce vertical steel brace elements between the upper and lower concourse level, at an approximate spacing of 24m on centre. The assumed width of the new vertical steel brace is 4 meters. Based on this assumption, the assumed weight for each vertical steel brace is approximately 6000 kg. It is feasible to make use of the existing concrete columns as part of the new brace element, however, further investigation would be required.
- Install a new foundation system to support the design loads from the new brace elements. This would most likely be a micro-piles system; however, further investigation with guidance from a geotechnical engineer is required.

MECHANICAL REVIEW

GENERAL

Introduction

The Calgary Corral is a multipurpose venue located at 10 Corral Tr. S.E., Calgary, Alberta. The facility includes a hockey rink, seating for 6,500, change rooms and support areas. The facility was built in 1950 making it 67 years old.

A site review was conducted on February 24, 2017. The development of the opinions of the mechanical components and systems comprising this facility is based on a walkthrough and visual review of mechanical components and feedback from operational and maintenance (O&M) personnel. There were no mechanical drawings available. The report is based on the conditions present and viewed during the review to obtain a representative impression of the facility.

The review occurred during mild winter conditions and did not test the capabilities of the seasonally operated equipment during climatic extremes. Destructive testing or exposure of building materials (such as removal of finishes) to expose concealed spaces, disassembly of equipment, or local excavation, was not undertaken.

Mechanical Systems Overview/Executive Summary

During the life of the building, a lot of the systems or system components, have been upgraded or replaced. In general, the mechanical systems are in acceptable condition and have been well maintained.

Site Services: Since the underground water, gas, sanitary and storm services could not be inspected directly, they have been assessed in comparison to similar installations of similar age, assuming a normal life cycle associated with the system. The O&M personnel did not report any problems but a video survey of the underground sanitary and storm services would be worthwhile to ensure there are no sags, separations or blockages.

Plumbing: Plumbing systems are generally in reasonable condition. There were no visible or reported leaks on any of the sanitary, storm or water piping and O&M personnel are repairing them as they arise. Plumbing fixtures are generally in poor condition, especially in the change rooms. Some of the washroom spaces have been upgraded, but the change rooms have not.

The main domestic hot water (DHW) plant is located in the main boiler room. There are 2 systems in place; building DHW and rink flood DHW.

Fire Protection: The facility is sprinklered. Fire extinguishers are in place throughout in accordance with NFPA 10.

HVAC: Primarily the systems consist of roof mounted packaged gas heating/DX cooling units operating in conjunction with a hot water heating system. Some the units have been replaced in 2013 as part of a facility renewal program. The units are constant volume single zone units. Hot water unit heaters and cabinet unit heaters are supplied in the concourse area.

Controls: There is a direct digital automation control system in place that services the major mechanical systems and rooftop units.

SITE SERVICES

The facility is serviced with water, sanitary, storm and gas. Utility sizes and locations were not confirmed on site. Operation and maintenance staff did not report any problems or issues.

PLUMBING

Domestic Water

Domestic hot, cold and recirculation water piping is generally fed throughout the facility via a copper pipe distribution system. There are no visible leaks or reported problems.

Domestic Hot Water

There are two (2) domestic hot water systems located in the facility.

Arena Flood Water: this system consists of a Plate and Frames heat exchanger tied into the hot water heating system. There is a water softener in place for the rink flood water to remove any calcium and magnesium from the water.

Public Areas and Dressing Rooms: a standalone domestic hot water boiler and storage tank feed the facilities domestic hot water load. Additional hot water storage would be added if new locker rooms required plumbing.

Plumbing Fixtures

There is a variety of plumbing fixtures and trim throughout the facility. Over the life of the facility, some the fixtures and trim have been upgraded, but generally fixtures appear to be in poor condition throughout.

- Water Closets: Vitreous china floor mounted bowls with manually operated flush valves
- Urinals: Vitreous china wall mounted urinals with manually operated flush valves
- Lavatories: Drop in type stainless steel bowls with 2 handle
- Shower: Single temperature metering faucet (manual) with wall mounted commercial shower heads in change rooms
- Drinking Fountains: Wall mounted stainless steel drinking fountain

SANITARY SYSTEM

A conventional gravity buried piping system connects all plumbing fixtures, floor drains, equipment drains and specialty drains to the building sewer. Generally, all above grade piping consists of cast iron and copper. Given the age, all below grade piping is believed to consist of asbestos or cast iron pipe. We would recommend conducting a video survey of the existing system to ensure its integrity.

STORM SYSTEM

Roof drains throughout the buildings are connected together and are internally piped and discharged out to the municipal storm system thru rainwater leaders. Above grade piping consists of cast iron piping. Given the age of the building, below grade piping is believed to consist of asbestos or cast iron pipe. We would recommend conducting a video survey of the existing below grade system to ensure its integrity.

NATURAL GAS

Natural gas is distributed from the meter room location throughout the building thru a steel pipe distribution system. Most of the gas distribution is exposed in the mechanical room and on the roof running on sleepers.

FIRE PROTECTION

Fire Extinguishers

Fire extinguishers are provided throughout in

accordance with NFPA 10. Extinguishers in occupied areas are located in wall mounted cabinets.

Fire Protection

The building is fully sprinklered in accordance with NFPA 13. Fire extinguishers are in place in accordance with NFPA 10.

HVAC

Arena Bowl:

The arena space temperature and humidity is controlled via 2 rooftop units which feeds an overhead duct distribution loop and utilizes indirect fired gas heating to dehumidify the space and DX cooling for summer operation. The units are in good shape and appear to be well maintained. The bowl also has 4 wall mounted high volume exhaust fans for smoke and fume extraction. They are manually controlled.

Refrigeration Room:

On an alarm call for ammonia detection, a roof mounted exhaust fan and make up air unit provide a high level of exhaust and makeup air for the space. The room does not have a functioning vestibule into the space with alarm and controls. There is no distribution duct work on the exhaust and make up air.

Dressing Room/Washrooms/Concourse:

Change rooms and concourse areas are fed from 4 roof top indirect gas fired heating/DX cooling units and numerous roof top dome type exhaust fans.

Overall the facility HVAC is in fair condition with newer roof top installed over the past 5 years.

CONTROLS

The facility has an energy management control system (EMCS) in place. The EMCS controls and monitors the major mechanical systems.

REFRIGERATED SLAB

The existing refrigerated slab was installed in 1981 making it approximately 36 years old. Operation and maintenance personnel have had a few leaks that have had to be repaired over the years. They have also reported some cracks in the slab. Given the slabs age and condition, replacement is recommended.

ELECTRICAL REVIEW

INTRODUCTION

Electrical systems for complexes of this nature tend to be categorized into two major classifications; Power and Distribution Systems and Auxiliary Systems.

Power and Distribution systems generally comprise the following:

- Utility Service
- Distribution Panelboards
- Branch Panelboards
- Motor Control Centres
- Transformers
- Convenience Power
- Lighting Systems
- Emergency Power Systems
- Special Power Systems for ancillary equipment

Auxiliary Systems usually comprise the communication systems within the complex, they include:

- Telephone/Data Systems
- Paging, Intercom, and Sound Systems
- Fire Alarm Systems

This report provides an overview of the Electrical systems for this complex identifying key issues to foster discussion on user requirements and preliminary cost analysis. The recommendations proposed are intended to provide costing required to utilize this facility to host Olympic hockey in 2026.

GENERAL – LIGHTING

Existing lighting

- .1 Over the stands is wrap 2-T8 347V fluorescent type fixtures
- .2 The concourse level consists of wrap 347V 2-T8 fluorescent type fixtures
- .3 Over the rink is 400W 347V metal halide type fixtures with multilevel switching.
- .4 There are also TV lights on the sides of the rink that are 1000W 347V metal halide type fixtures.

.5 When all lighting is on it is expected the light levels would be above 1000 lux vertical and horizontal

.6 The TV lights do not have shutters for blackout purposes

.7 Existing lighting control is low voltage. Low voltage control is located in the broadcast booth.

.8 There are four spot lights at the four corners of the arena bowl. There are multiple theatrical style fixtures mounted on the trusses.

Proposed lighting

.1 Replace all existing fluorescent and HID fixtures to new LED fixtures (approximately 1250lux)

.2 Provide provision for additional temporary LED fixtures to get to 2000lux

.3 Approximately 50% of the light fixtures in the bowl will be backed up on emergency power

.4 Replace existing lighting control with new addressable dimming system

.5 All new lighting to be shifted to the sides of the rink and supplied by a sports lighting manufacturer such as Musco or Ephesus

.6 By 2026 all fluorescent lighting in the facility will be due for replacement and should be upgraded to LED.

.7 Provide an allowance for additional spot lights and theatrical type fixtures and associated power and DMX control.

GENERAL – POWER & DISTRIBUTION SYSTEMS

Existing power distribution

- .1 The existing service in the building is a main-tie-main of a 2000A 347/600V service on a ring main fed through Stampede Park
- .2 The distribution equipment was upgraded in 1999 and appears to be in good working condition.
- .3 Motor control centres are located throughout the facility in mechanical rooms and look to be in good condition. The MCCs have space to add additional motor starters if required for the Olympic event.

.4 Multiple 50A 208V event power receptacles are located in the concourse level.

.5 Most branch circuit panelboards appear to have been replaced as a part of the distribution upgrade in 1999. The panels have approximately 20-30% spare breaker spaces/capacity.

Proposed power distribution

.1 New 4-400A, 2-200A, and 2-100A 208V 3phase disconnects would be proposed for broadcast and event power.

.2 The existing power distribution will be within its expected life span and is not proposed to be upgraded for this event.

.3 New power will need to be provided at all TV platform stations.

.4 New power/communications will need to be provided to a new jumbo-tron.

.5 An allowance should be made for electronic message displays and signage power/communications.

.6 Temporary power should be provided for temporary concessions, change rooms, and washroom facilities.

.7 Provide an allowance for additional miscellaneous power around the rink.

.8 Additional power at the entrances to the facility will be added for additional site and feature lighting. Power will also be needed for possible event booths, concessions, or beer gardens outside.

GENERAL – AUXILIARY SYSTEMS

Existing Communication Systems

.1 Single mode fibre is run to multiple locations in the facility as a part of a network in Stampede Park

.2 Wireless network devices are located throughout the facility.

.3 The rink has one scoreboard at either end of the rink however it does not have a jumbo-Tron in the centre of the ice.

.4 Paging speakers are distributed throughout the facility and tied into a Stampede Park network system.

.5 The various fibre locations around the facility are expected to be sufficient for the needs of a hockey venue during an Olympic event.

Existing Sound Systems

.1 The sound system in the hockey rink is a distributed type system using speakers hanging from the existing trusses.

.2 Controls for the sound system exist at both the broadcast booth and at ice level.

.3 The sound systems are in good working condition and satisfy the needs of the facility.

.4 Additional wireless access points will be added throughout the facility.

Proposed Sound Systems

.1 New temporary sound systems will be required to enhance sound quality and intelligibility.

.2 Sound systems should be allowed for outside of the facility for beer gardens, bands, etc.

GENERAL – LIFE SAFETY SYSTEMS

Fire Alarm System

.1 The existing fire alarm system is a single stage addressable system. The system was upgraded around 2010 and is tested annually. The signaling devices are combination horn/strobes.

.2 The system is in good working condition but will be coming towards the end of its projected life by 2026. An allowance should be made to upgrade the system prior to an Olympic event. Consideration should be given to changing the system to a two-stage system with speaker/strobes as signaling devices.

Exit Signs

.1 The existing exit signs are a combination of new Running man type and old EXIT type incandescent/LED fixtures. They appear to be replacing the old EXIT type signs over time as a part of a maintenance routine.

.2 All exit signs should be replaced with new Running man type LED signs as a part of any facility upgrades.

Existing Emergency Power and Lighting

.1 Emergency power for this facility is provided with a combination of a diesel emergency generator and emergency remote heads and battery packs.

.2 The diesel generator is 35kW 120/208V 3phase 4wire generator. This generator feeds some emergency lighting and a few miscellaneous loads in

the refrigeration room.

.3 All exit signs, emergency lighting, identified mechanical and other loads will be connected onto the emergency distribution system.

Proposed Emergency Power and Lighting

.1 A temporary 2MVA generator would be provided to backup critical loads such as lighting and broadcast power. This would be tied into the existing main distribution.

.2 An allowance should be made for UPS power for the data infrastructure.

REFRIGERATION REVIEW

OVERVIEW

This report outlines the refrigeration implication associated with operating the Stampede Corral (Corral) as an ice hockey venue for the 2026 Winter Olympic and Para Olympic Games. The system has the required capacity and if regularly maintained, will require minimal upgrades specific to hosting the 2026 games.

Refrigeration System

An ammonia refrigeration system with an estimated capacity of 170 TR provides the cooling for the refrigerated slab. The system uses ammonia as the primary refrigerant to chill a secondary cooling fluid of calcium chloride which is circulated through circuits in the concrete slab. The system has sufficient capacity to provide the required refrigeration to insure a high quality playing surface. The system has been upgraded over the years however there are pieces of equipment that will require life cycle replacement prior to the 2026 games.

- The refrigeration room is not B52 code compliant. It lacks a vestibule and proper fire sealing, no ammonia detection was visible, the ventilation system does not meet code, and there is a natural gas powered generator installed in the room.
- The control system is outdated and should be upgraded prior to 2026.
- The compressors are in good shape. If properly serviced and overhauled they should not need to be replaced prior to 2026.
- The condenser is located on the roof above the refrigeration room and was installed in 2008. The expected life of the condenser should reach beyond 2026, however there are signs of many leaks and the unit will likely require replacement prior to 2026.
- The chiller was built in 2007 and appears to be in good condition. As long as the brine is well maintained it is expected the chiller will be suitable for service in 2026.
- The pumps appear to be in good condition and with regular maintenance should not require replacement prior to 2026.

The current refrigeration system is suitable to be used

as an ice hockey venue for the 2026 Winter Olympic and Para Olympic Games, however as noted above the facility will require some life cycle upgrades between now and 2026 to maintain operation.

Budget estimate life cycle upgrades required prior to 2026: \$300,000 (Not including architectural and mechanical code requirement upgrades)

Refrigerated Slab

The refrigerated slab is from 1981. It is suspected that there is at least one leak within the floor piping. The slab is approaching the end of its life cycle and will need to be replaced prior to the 2026 Olympics. All of the brine piping should be upgraded with the floor replacement.

Budget estimate for refrigeration piping component of slab: \$300,000 (Not including concrete or accessories)

COST REVIEW HOCKEY

1.0 INTRODUCTION

The estimate presented in this report provides an assessment of the direct and indirect construction costs for the Corral Centre located in Calgary, AB.

The estimated costs contained in this report are based on schematic design drawings, schedules and reports prepared by Gibbs Gage Architects and their consulting engineers. The estimate is based on the information listed in section 10 "Documentation". The documents provided are not sufficiently detailed to allow the project to proceed for a fixed-price tender call. The estimate provides a reasonable cost envelope within which the project design can be developed. Further estimates based on more detailed design information may, however, vary from this baseline.

The estimate is for the hard construction cost and the projects "soft" costs. The soft costs on a project typically includes; professional fees/disbursements, planning, administrative, financing costs, project commissioning, development cost levies, permits, testing, field analysis, site services connection fees, project management fee, owner's planning/administration cost, project insurance, furnishings, fittings & equipment, food services equipment, payable GST and soft cost contingency. A general rule of thumb is soft cost are 25% of the hard cost.

Detailed specifications are not completed at the conceptual design stage and therefore, cost assumptions for the anticipated final design products had to be made. As well, final design decisions will be made during the design process and preparation of tender documents. The order of magnitude estimate (Class D) estimate reflects those drawings and information made available at the time the estimate was prepared and may not totally reflect the final tender package.

A complete description of the work, including the associated cost, is summarized under the "Cost Plan" appendix in this report. The purpose of the cost plan is to identify to The City of Calgary, Gibbs gage Architects and their consulting engineers; the components, items, renovated spaces, new construction quantity of materials and methods of construction utilized to produce the order of magnitude estimate (Class D). In simplicity, the cost plan is a large shopping list of construction items, materials, and methods. If items in the order of magnitude estimate are not required or desired, the items may be removed from the estimate/design and the cost will be reduced. If additional items are required or desired, which are currently not included in the estimate, then either additional funds will be required, or savings must be incorporated elsewhere in the design to offset the cost increase.

The estimate is not representative of the low bid that will be received at the time of tendering. An indication of the range of bids expected can only be estimated at the time of the tender based on the final contract documents, specific market conditions at the time of tender, including number of other projects out to tender at the same time, interest in project and availability of specified materials in local market. The current estimate represents a fair and reasonable value for what is currently shown on the conceptual drawings, design reports and those requirements as discussed with Gibbs Gage Architects and their consulting engineers: assuming adequate coverage from both the General Contractors and associated sub

In order to maintain the budget parameters established in this report, BTY strongly recommends that further cost estimates be prepared at major design stage milestones to track and monitor the cost of the proposed design.

Should you have any queries regarding the content of this report, please do not hesitate to contact:

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2.0 PROJECT DESCRIPTION

The scope of work, as extracted from Gibbs Gage Architects report, can be summarized as follows:

"The Corral Centre is a 6500 seat ice hockey venue originally built in 1950 and renovated in 1980 as a venue for the Calgary Flames until a new arena, the Saddledome, was built in 1983. The scope of work was to do a non destructive evaluation of the major building components in the building with the expectation of what significant improvements would be required to have the facility ready to host Ice Hockey during the 2026 Olympics.. Specifically we were asked to look at the following:"

- *Field of Play –ice plant condition, dasher board condition*
- *Existing Building Shell – envelop issues and roof condition*
- *Roof Structure – Ability to support "Jumbotron" score clock and identify the height over the existing ice surface*
- *Spectator capacity- code requirements with respect to rake, accessibility, upper level seating bowl,*
- *Spectator Amenities- washroom count and accessible washrooms, as well as the number and type of concession*
- *Athlete and Support Amenities- location for new change rooms*
- *Electrical and Lighting- 2000 lux broadcast lighting levels*
- *Mech/Civil – HVAC upgrades, plumbing loads*

A site investigation was held on February 24th, with members of the consultant team and representatives from the Calgary Stampede. Drawings have since been provided by the Stampede and are listed in the Appendix. Beyond the above noted items, we were requested to review the building for potential code non-compliance and other issues that may have cost implications to the renovation to make suitable for the Olympic Games. In most of these conditions the current non-compliance can likely be grandfathered pending the scale and scope of alterations to the building.

Additional consideration for cost implications were requested by the CBEC committee that looked at the following cost categories:

1. Capital Maintenance/Life-Cycle

"Costs that are required to extend the useful life of a facility in its current configuration to a period which includes, at minimum, the expected timeframe of the 2026 OPWG. Such cost forecasts do not necessarily enhance the facility's functional use or change physical attributes in a substantial or enhanced nature. These are costs that will need to be incurred by venue operators prior to the 2026 OPWG to keep the facility operating in its usual manner whether or not Calgary bids for the Olympics."

2. Olympic Requirements

"Costs which are required to modify or otherwise make ready a facility to meet the Olympic requirement from either a field of play perspective or from an operational/ancillary space perspective and would only be incurred by venue operators if the Olympics were being staged at the venue. These costs could result in a significant legacy to the facility, sport and/or the community. The costs in this

3. Additional Long-Term Legacy Enhancements

"Improvements to the venue that reasonably enhance the facility from its present state/configuration and as a result, provide incremental and long term benefit to sport, venue operators, recreational users and/or the community at large - locally, provincially and nationally, and from a social, sport or economic perspective. This cost category may be undertaken in conjunction with one or both of the other two categories (i.e. Capital Maintenance/Life Cycle and/or Olympic Requirements) and possibly result in lower costs than would otherwise be the case if such Long-Term Enhancements were undertaken on a "stand-alone" basis. These "additional investments" are not required to host the Games and should be considered whether or not the Games are hosted."

3.0 DEFINITIONS

The estimate for the project has been prepared and summarized in the following categories. Items A and D to I are considered "soft cost" and are specifically excluded from the current "hard" construction cost. The scope of work covered within each category is as follows:

A. Land Cost:

These costs include the acquisition of the site and associated fees, service obligations and property purchase tax.

B. Construction:

This category encompasses all direct and indirect construction costs including building(s), associated site development work and general contractor's general requirements and fee.

C. Allowances

Allowances for cost increases as the design is developed and/or the work is performed on site.

D. Professional Fees:

Within this section professional fees have been estimated for the primary design team consultants including: the architect, structural, mechanical & electrical engineers, and the cost consultant. Other specialist consultants and an allowance for disbursements are also included. Where available, all consultant fees have been calculated based on the current schedule of recommended charges published by professional associations.

E. Municipal & Connection Fees:

This section includes an estimate for all project related fees and charges required as part of the development by the city and other authorities having jurisdiction. These costs include Development Cost Charges (DCC's), Building Permits, levies and associated legal and survey fees. These costs are based on current city formulas and schedules.

F. Management & Overhead:

The project management fee is charged by a company or individual providing project management services. The Owner's Planning and Administrative cost covers the owner's project-related management costs. Provisions are also included for project insurance, commissioning the facility prior to handover and move-in costs.

G. Project Contingency:

This allowance is provided as an owner's contingency to cover changes to non-construction items.

H. Furnishings, Fittings & Equipment:

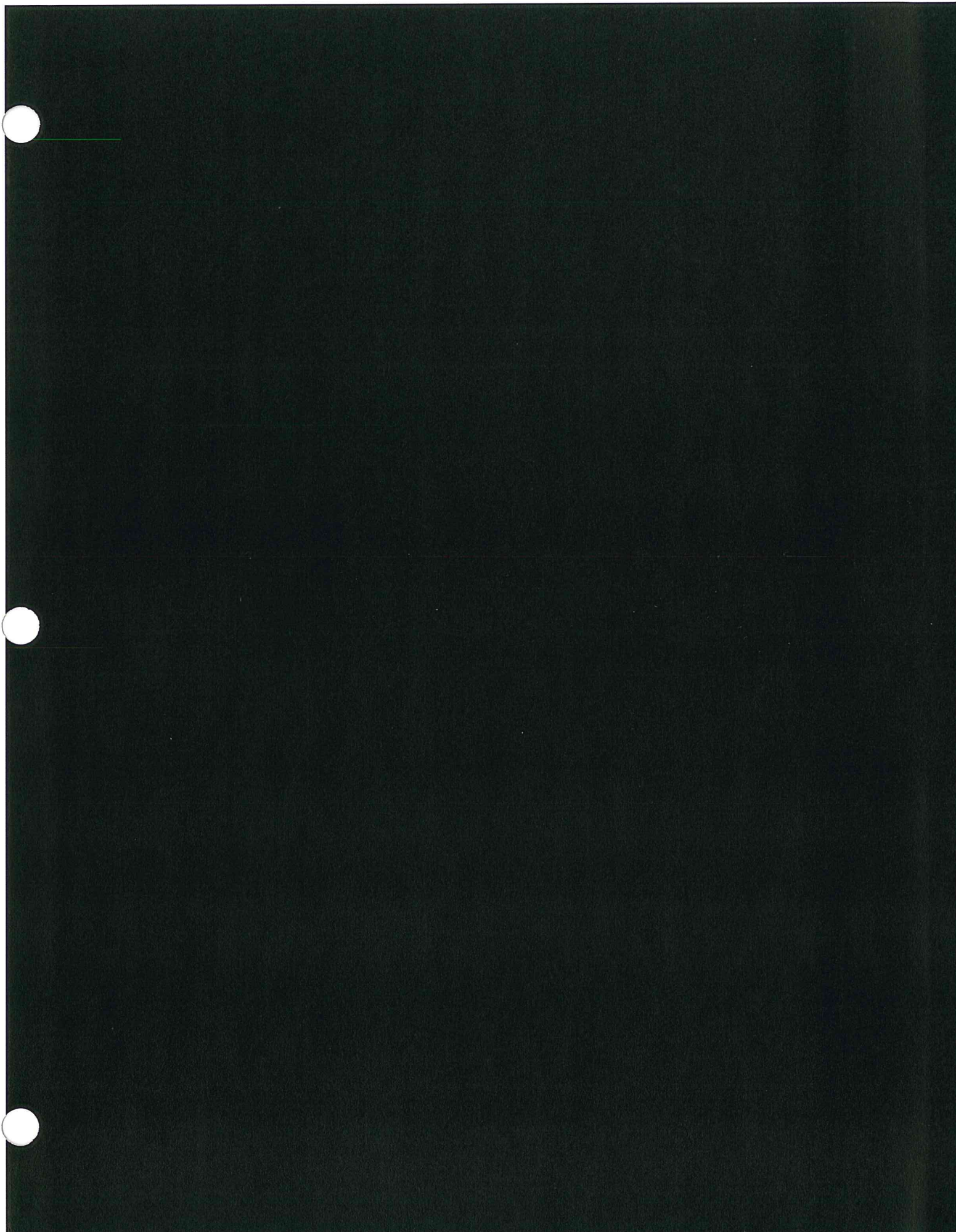
The Furnishings, Fittings & Equipment estimate for the project has been compiled using a combination of BTY Group's own historical cost data and information specific to this project. The percentage of construction costs, ranges from 3% to 4% (depending on the building usage)

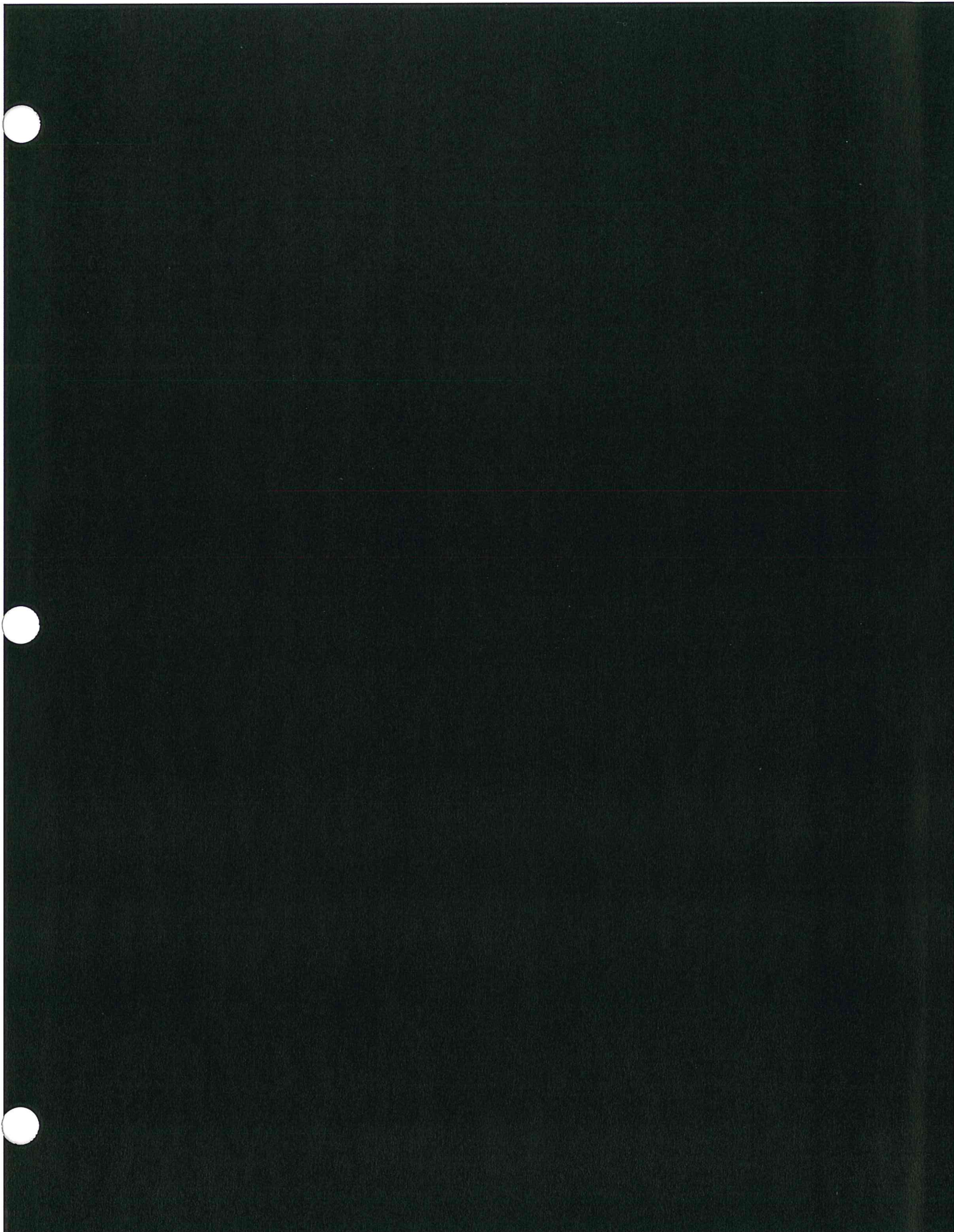
I. Taxes

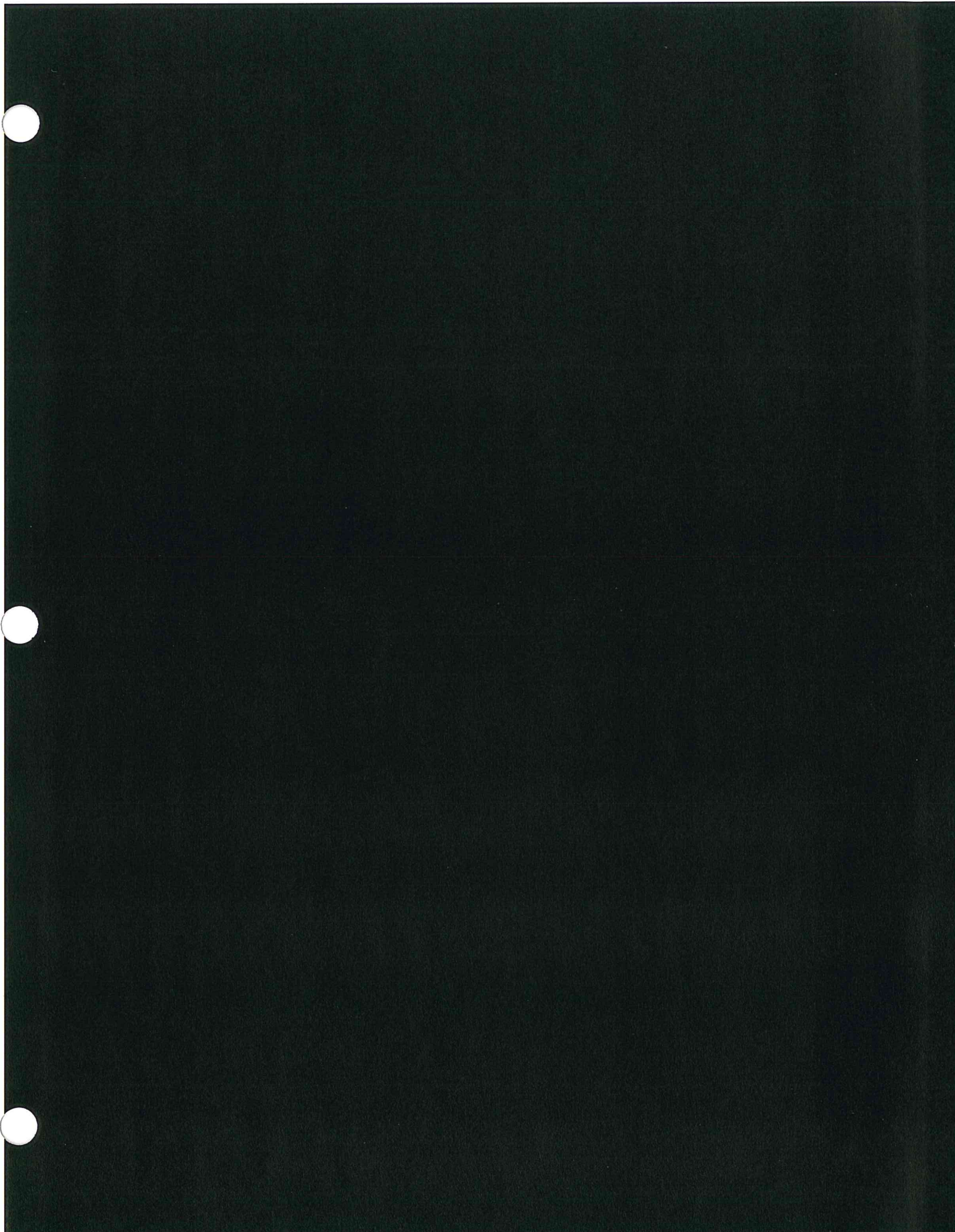
The amount is adjusted to reflect rebates available to certain types of project.

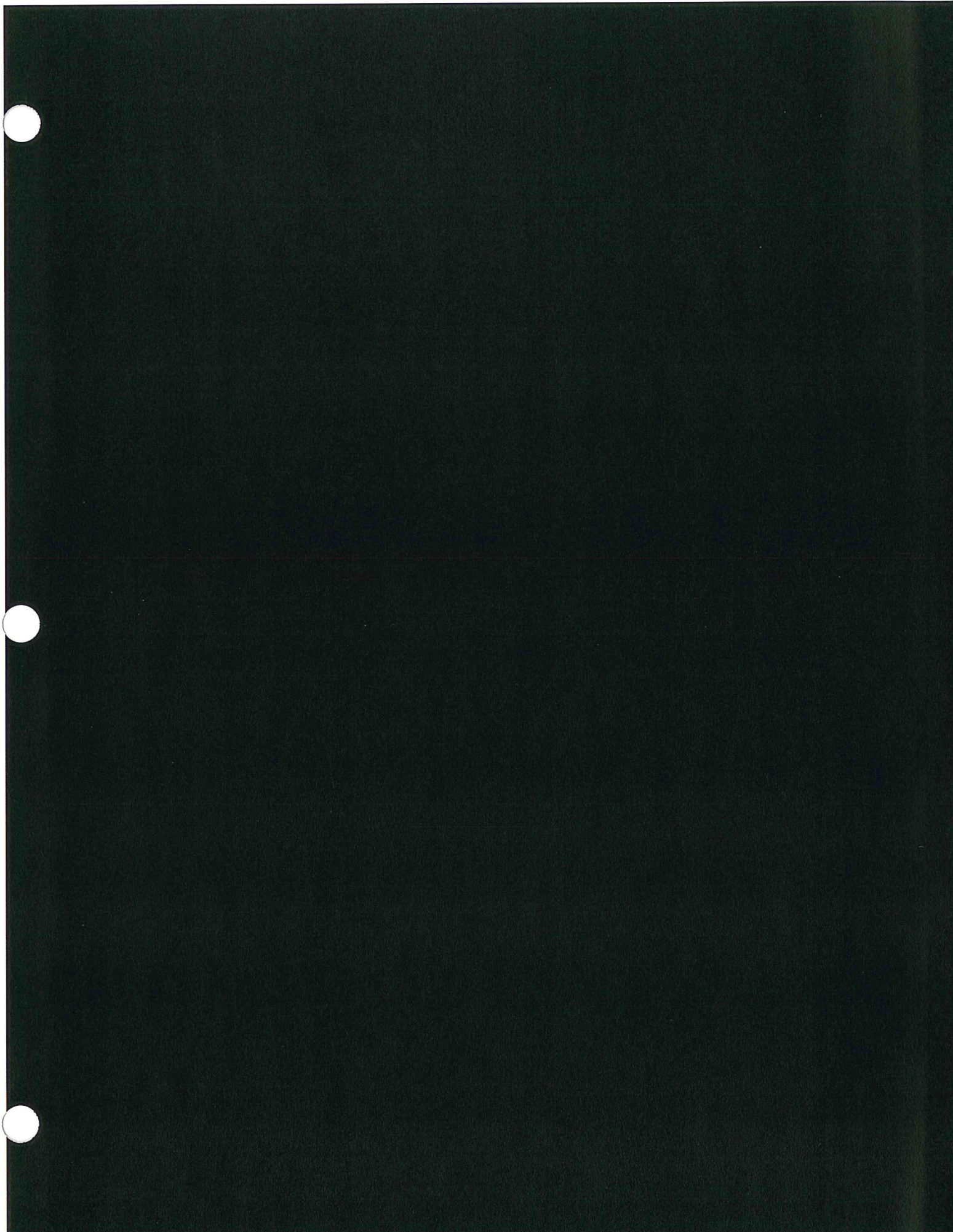
J. Escalation

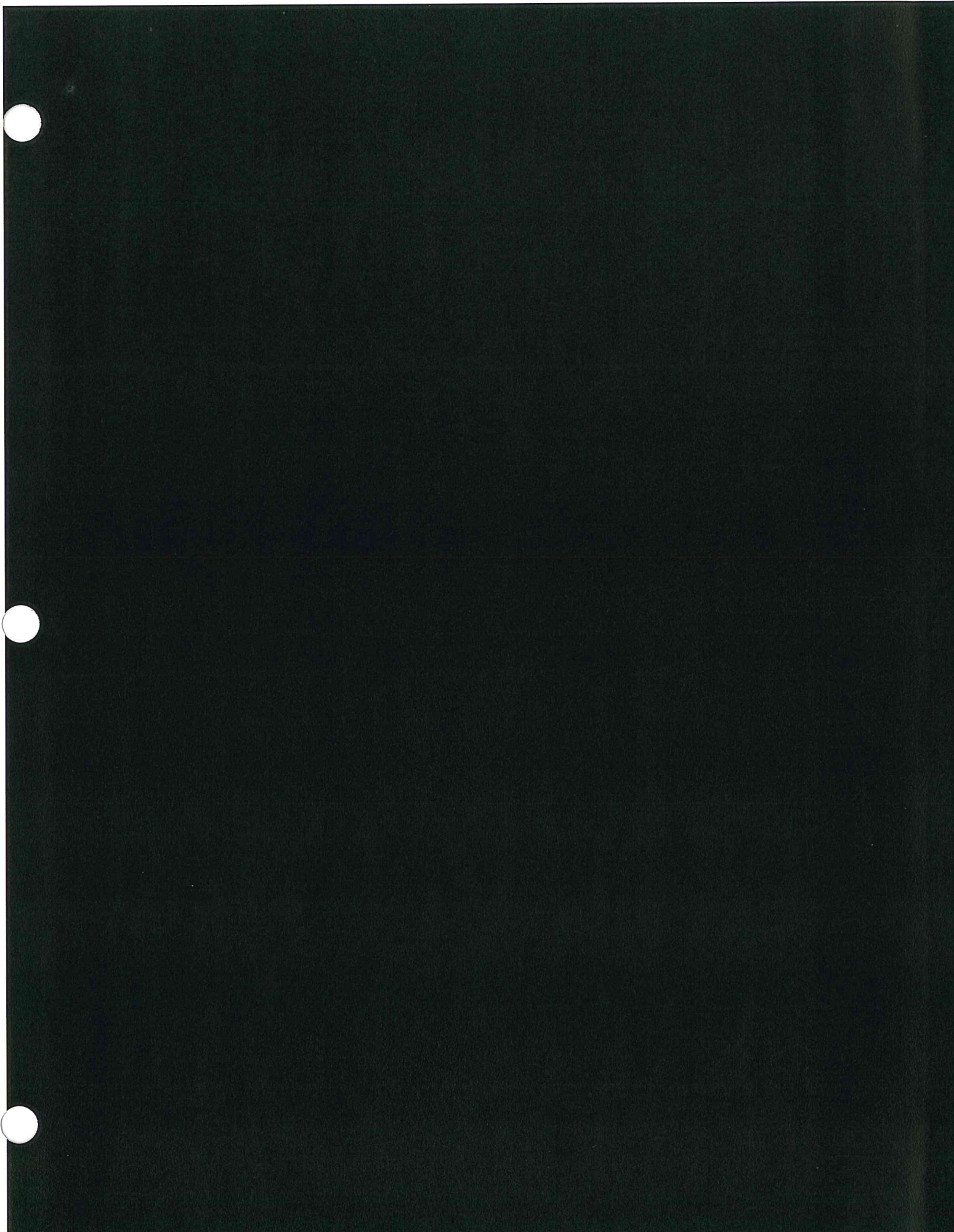
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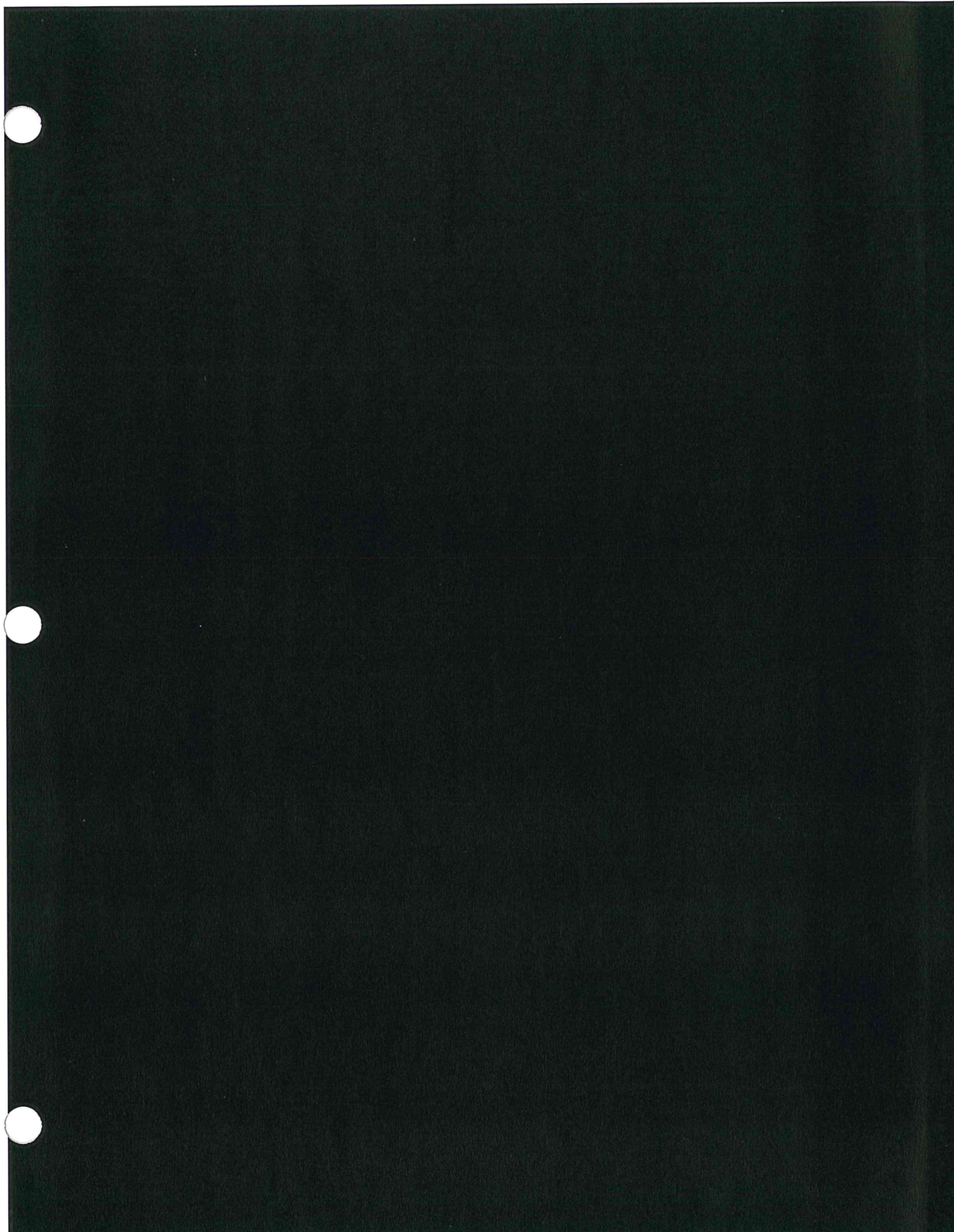


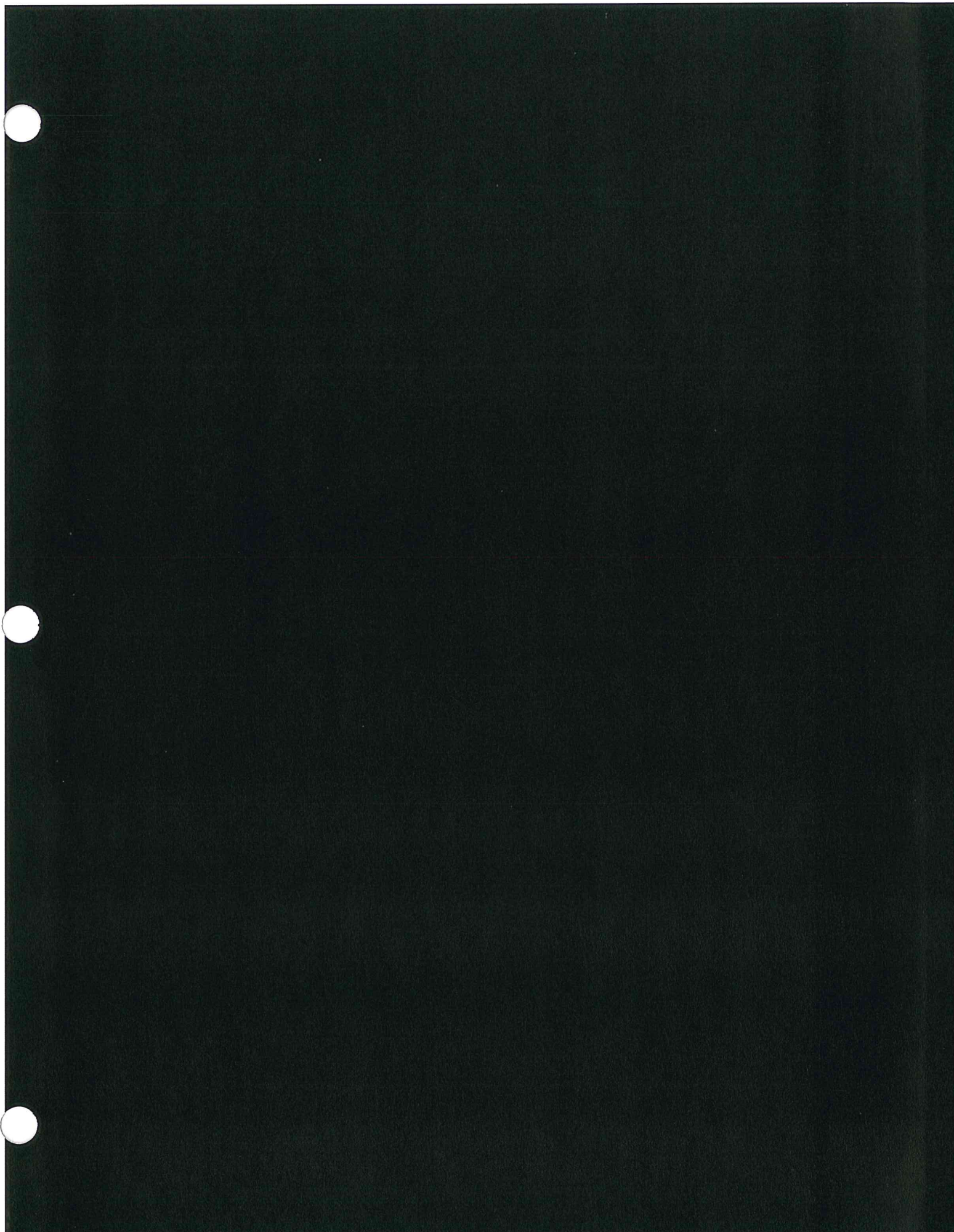


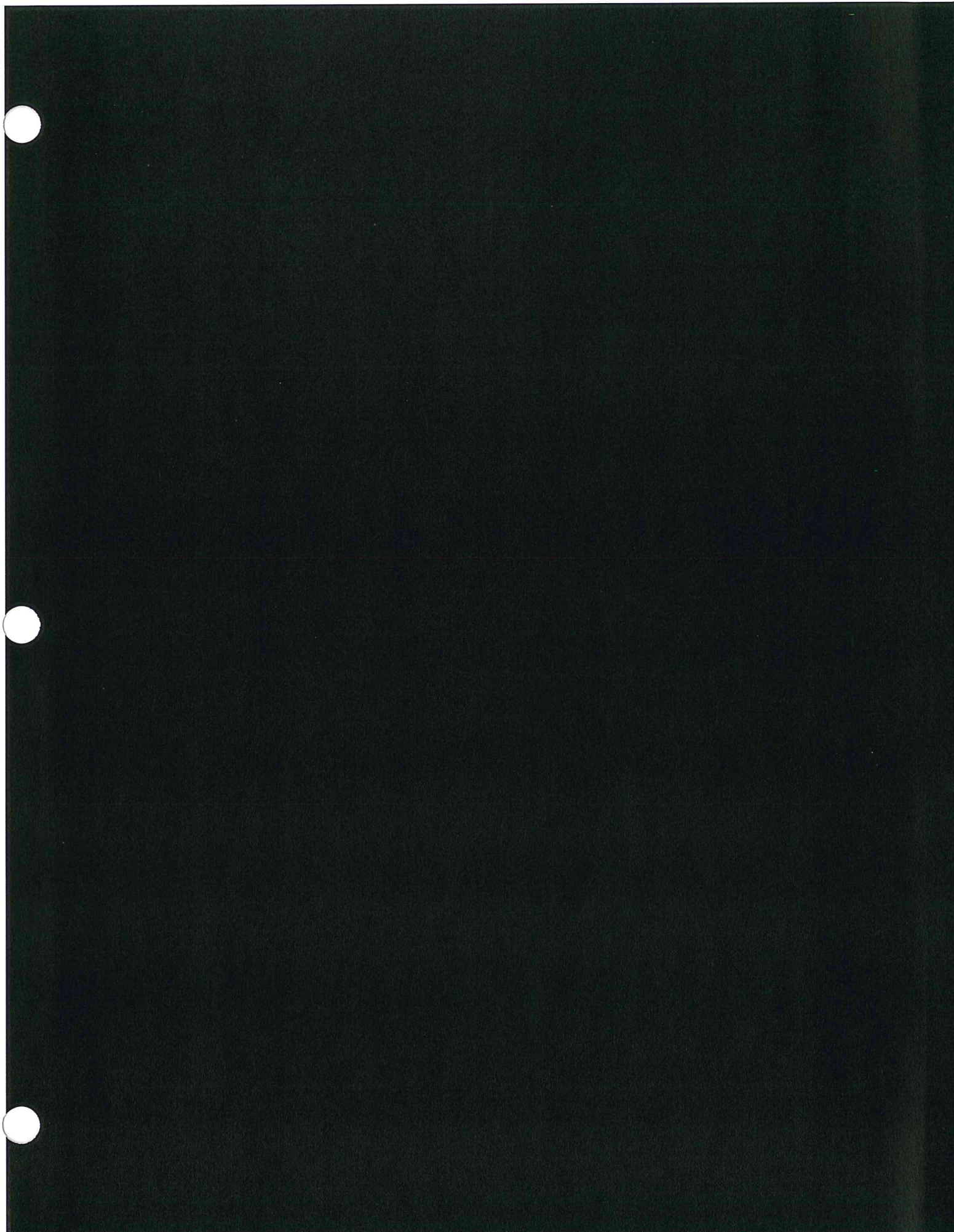


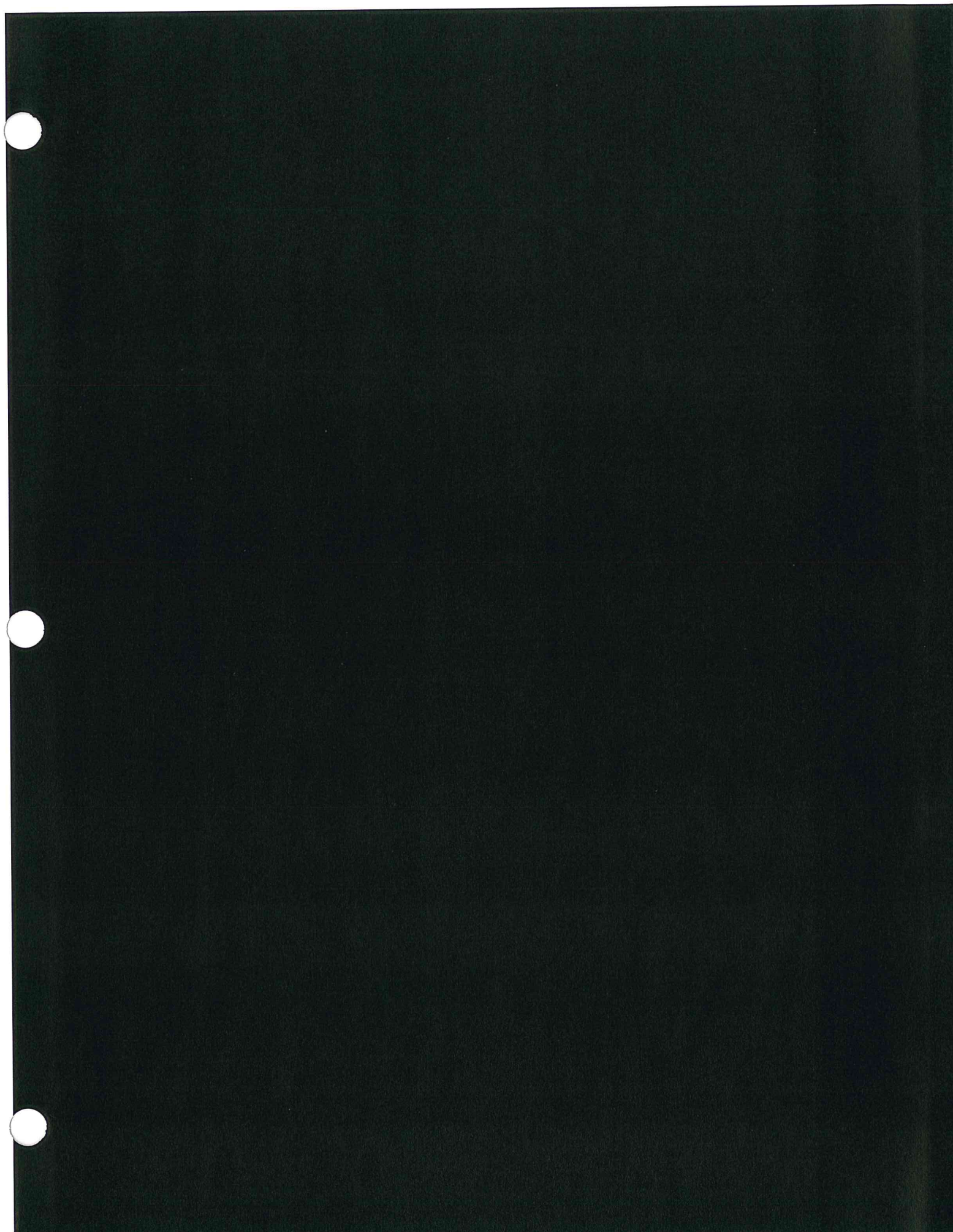


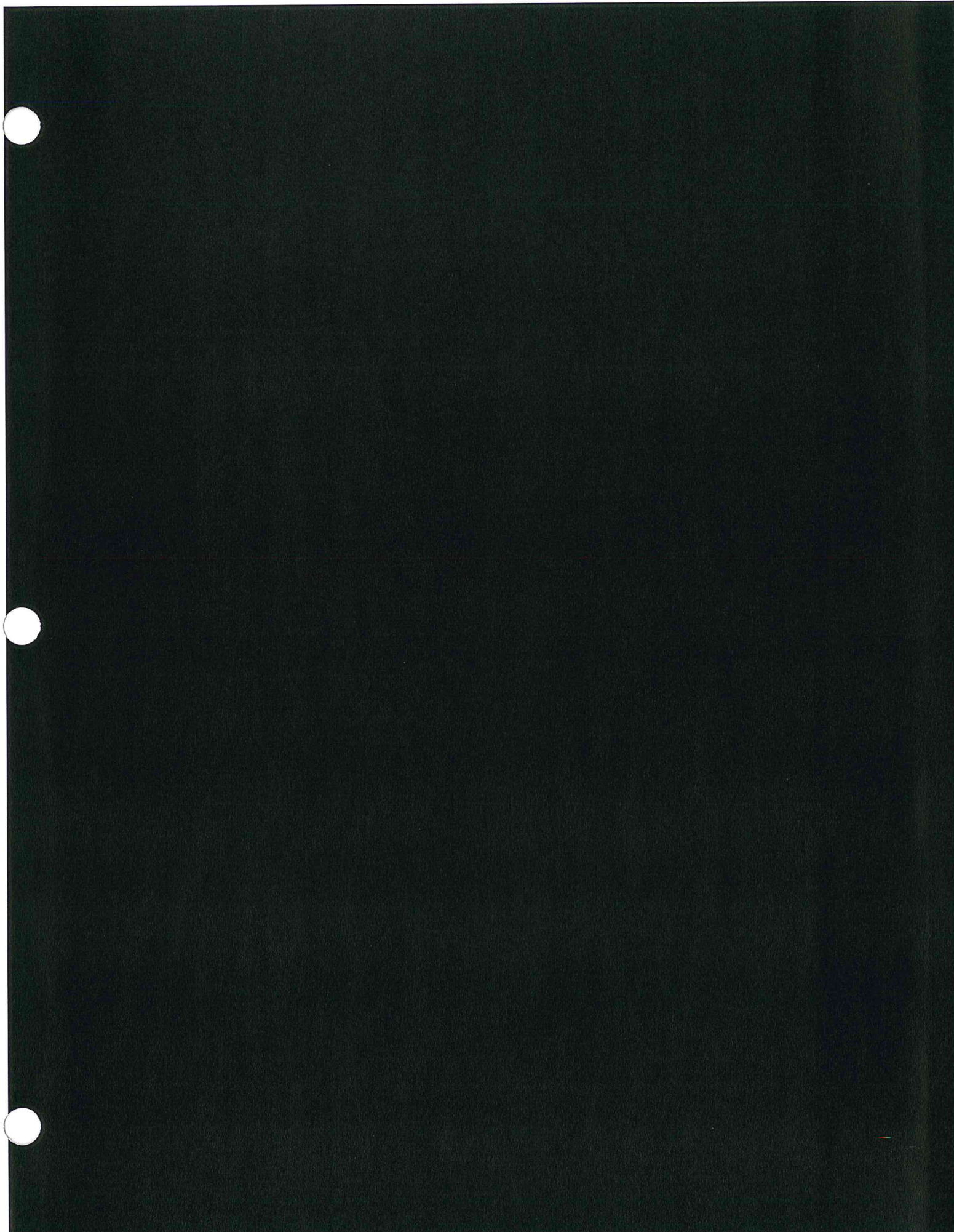


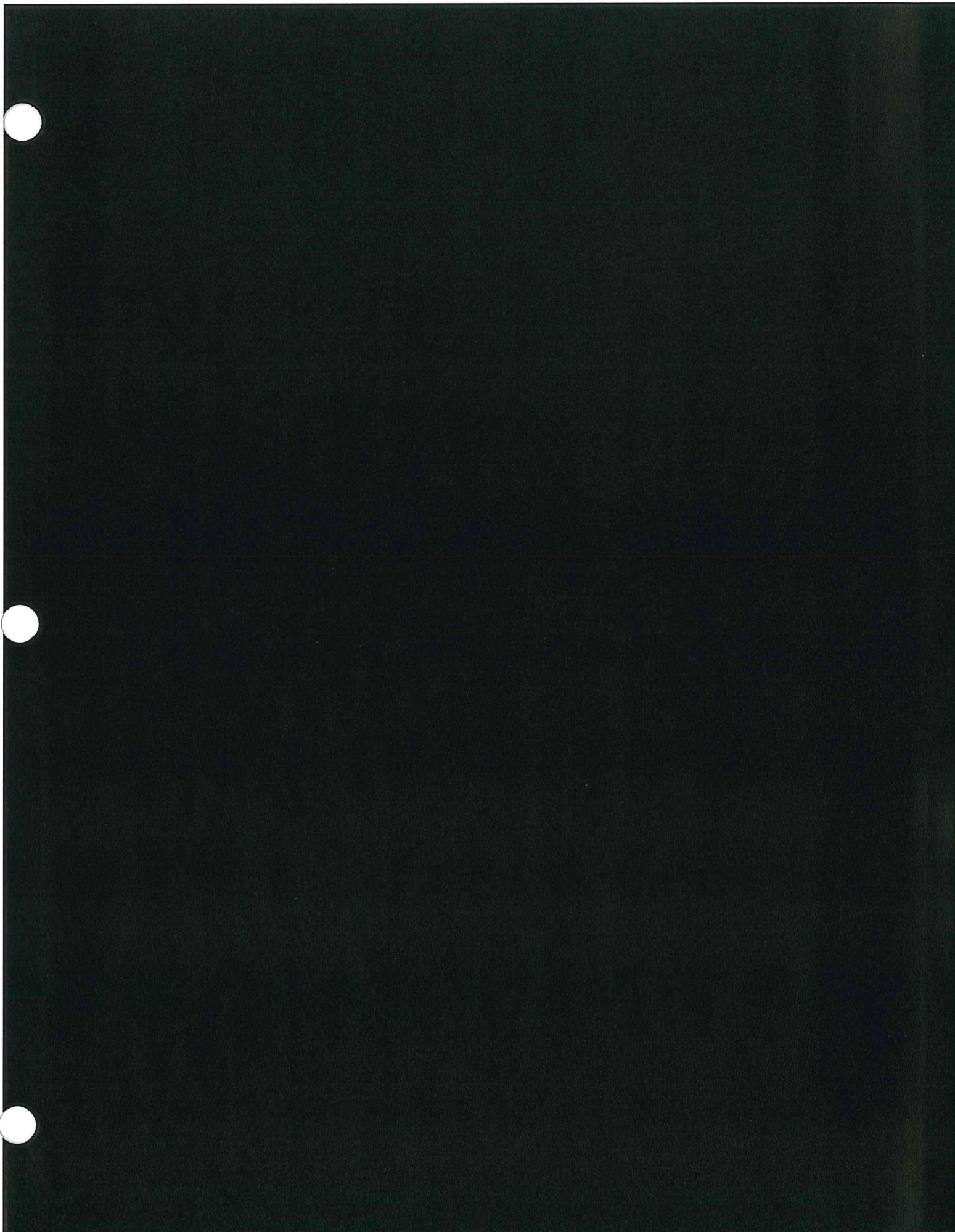


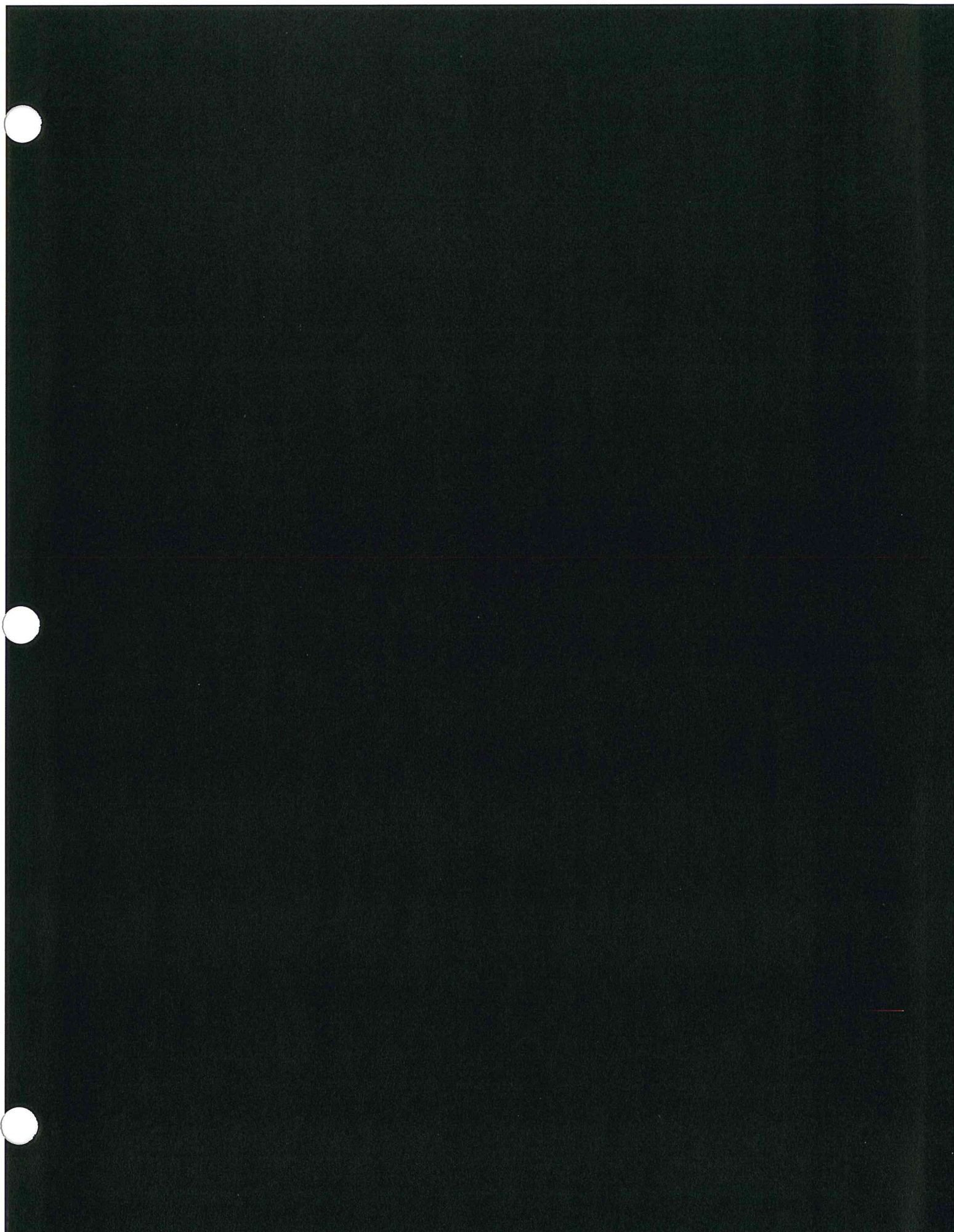


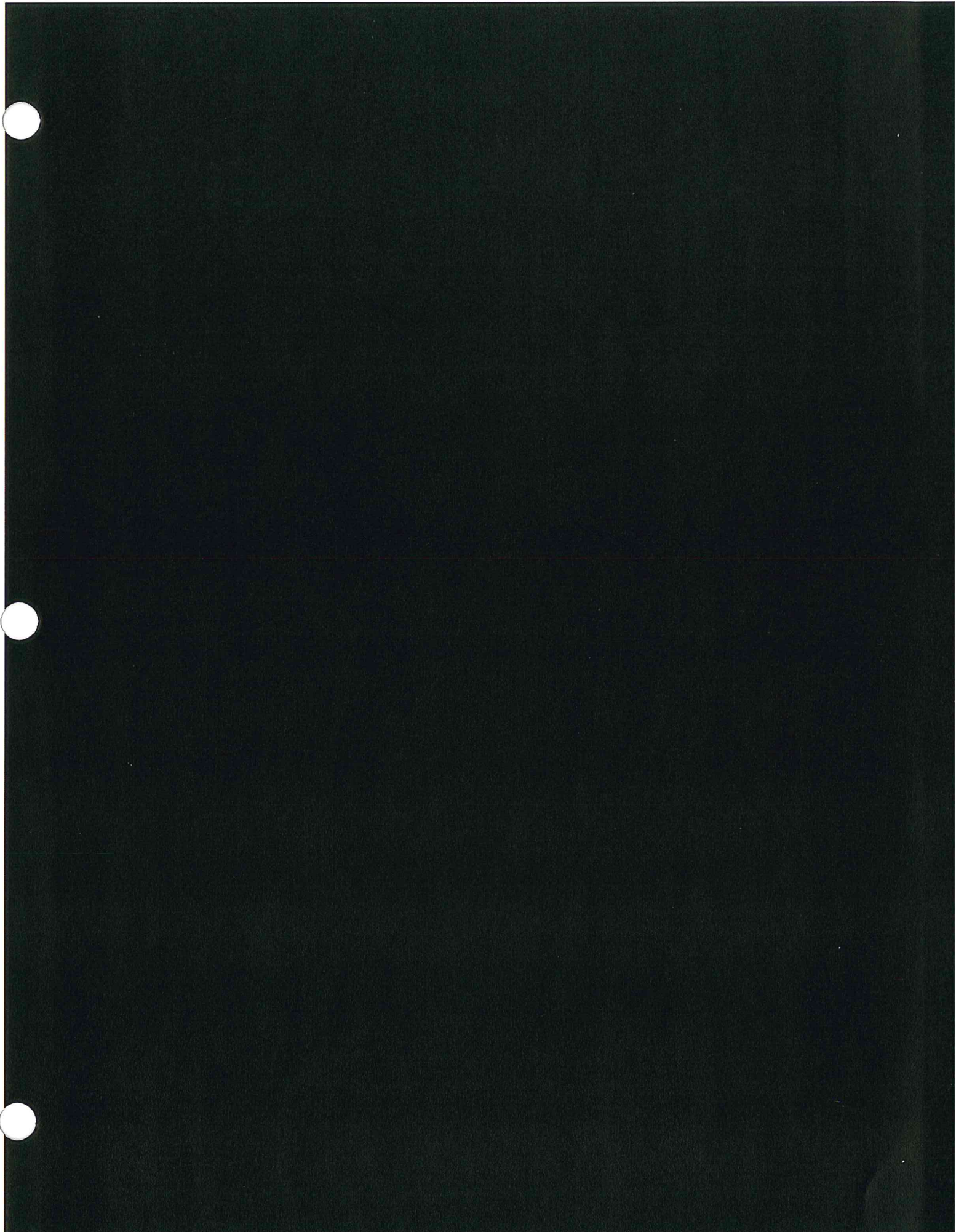


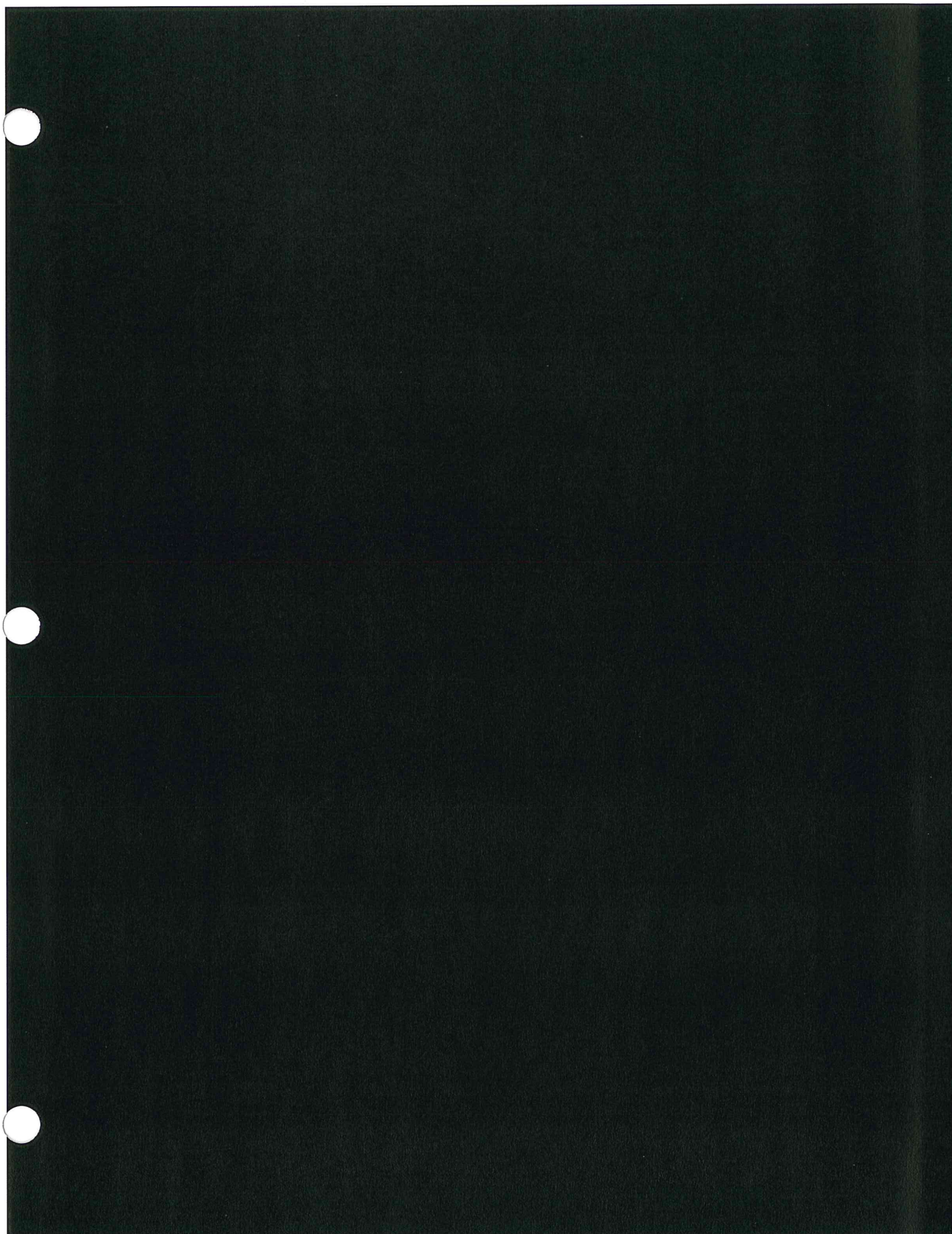


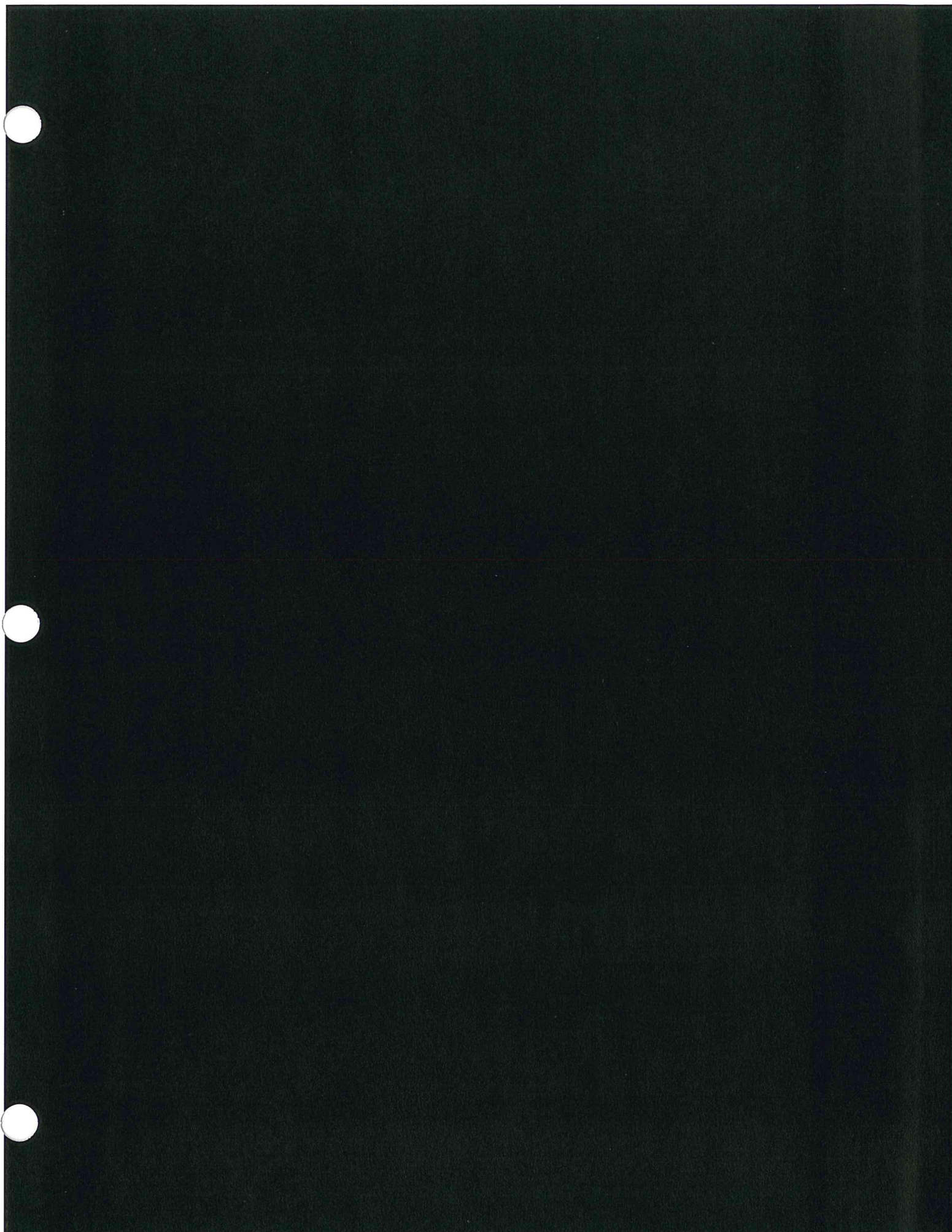












COST REVIEW CURLING

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MarkRavelle@bty.com

Tel: 403.269.5155

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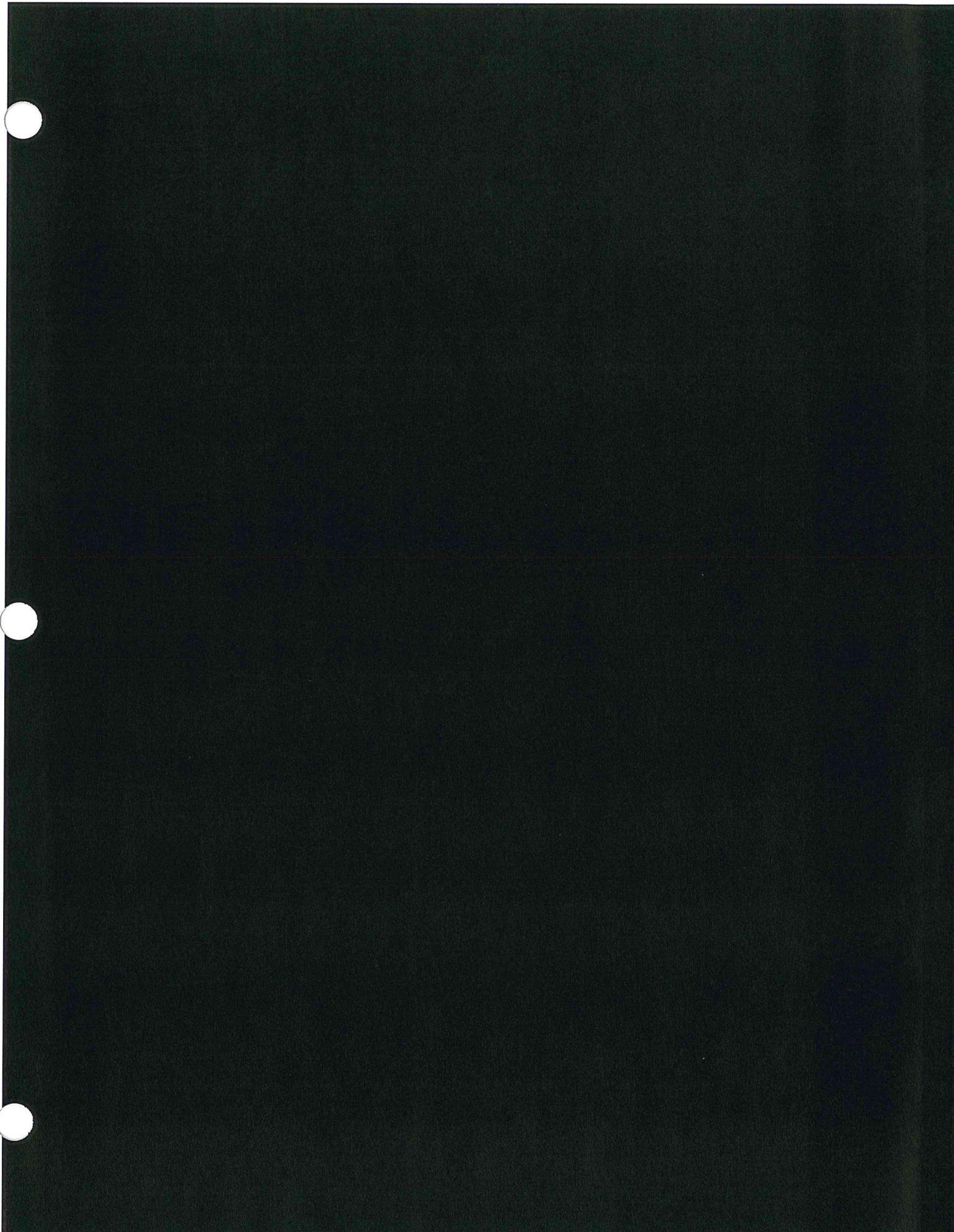
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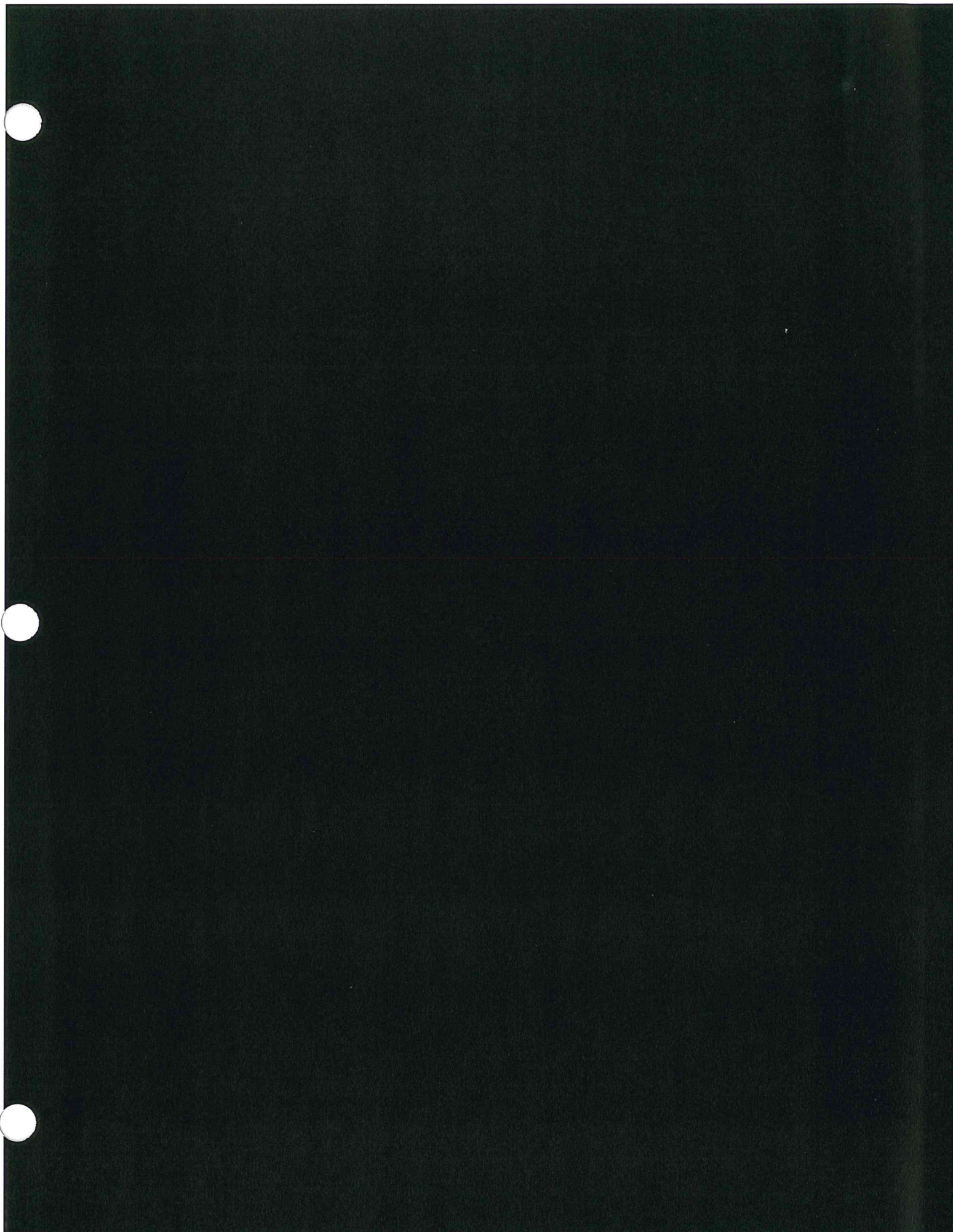
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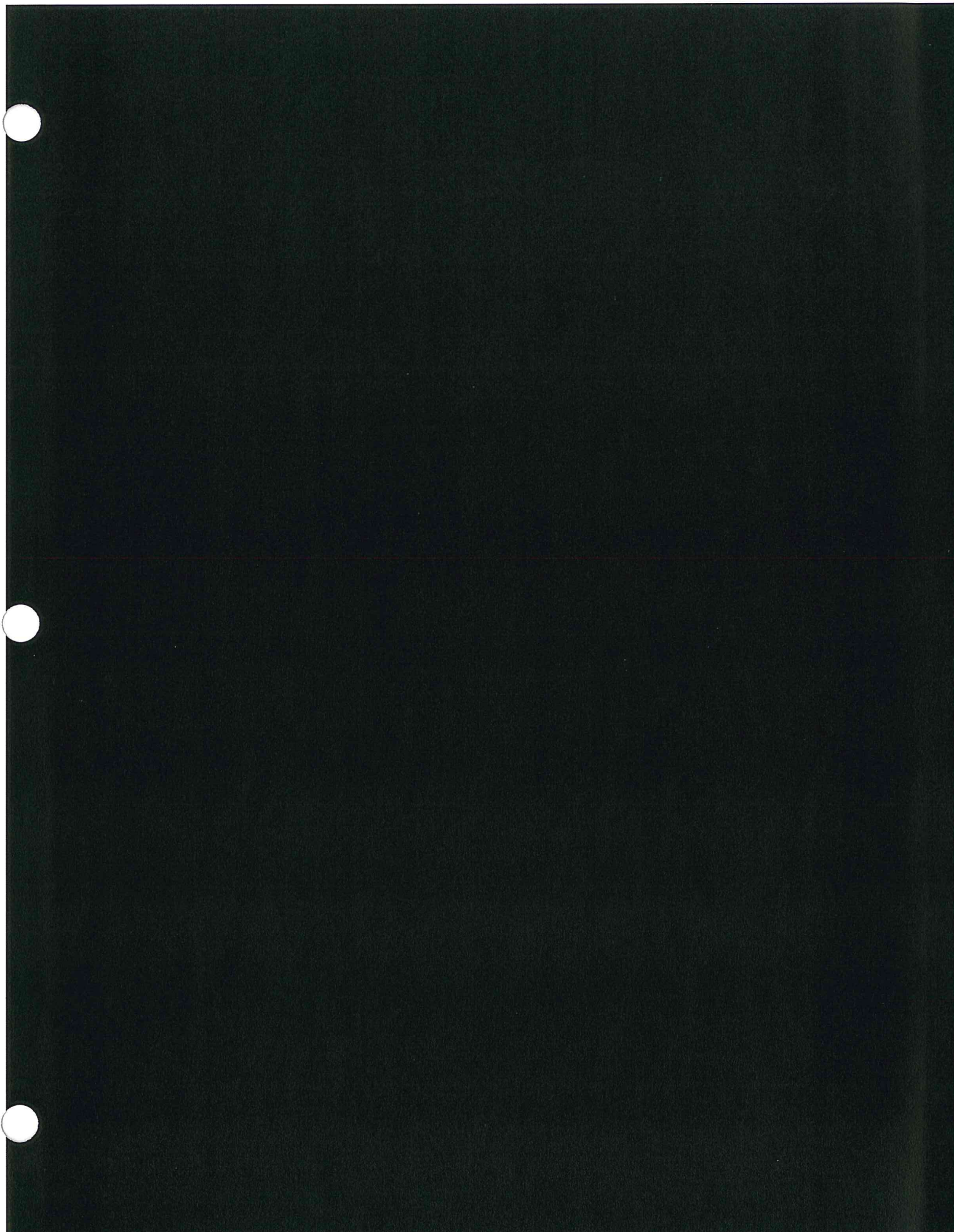
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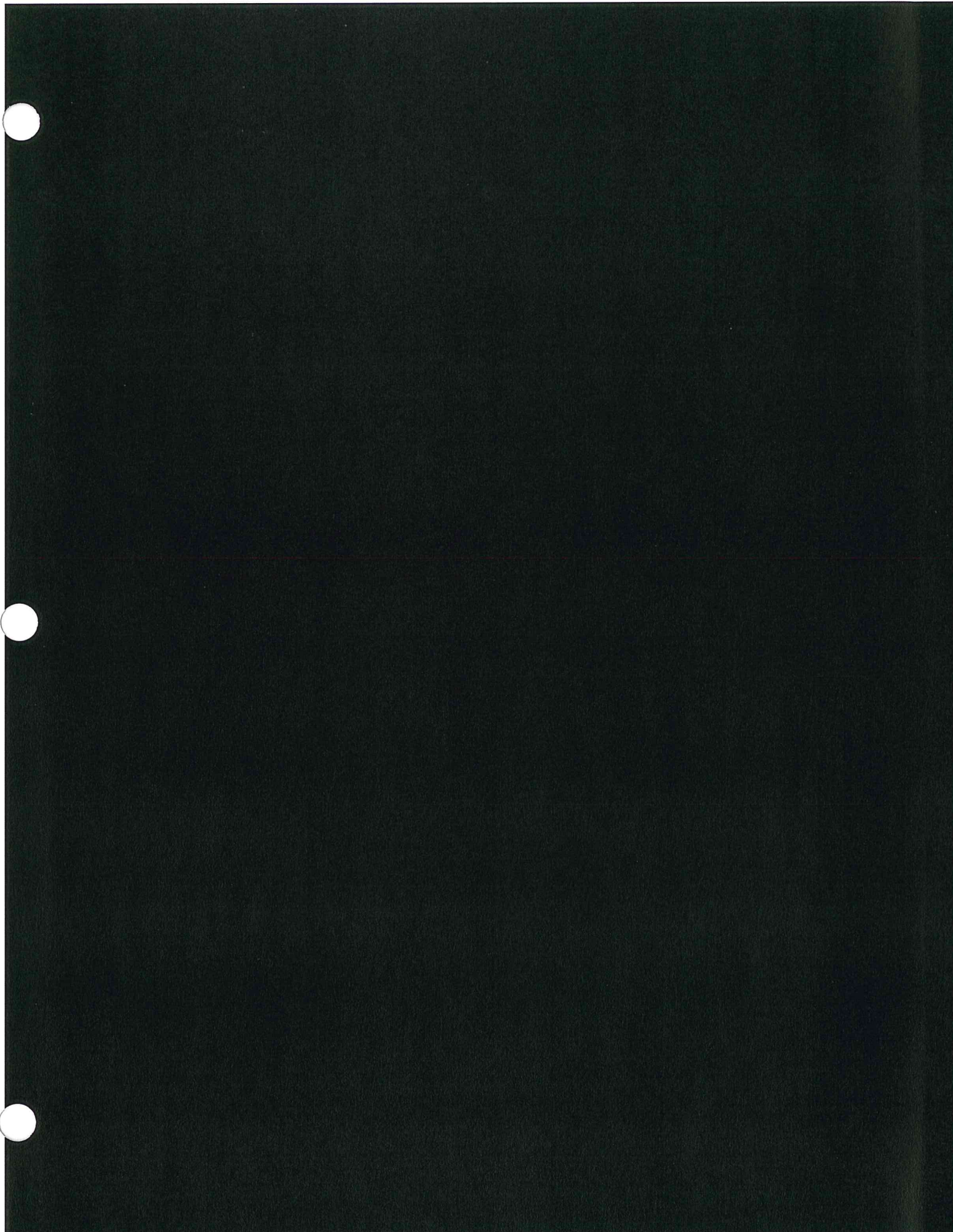
J. Escalation

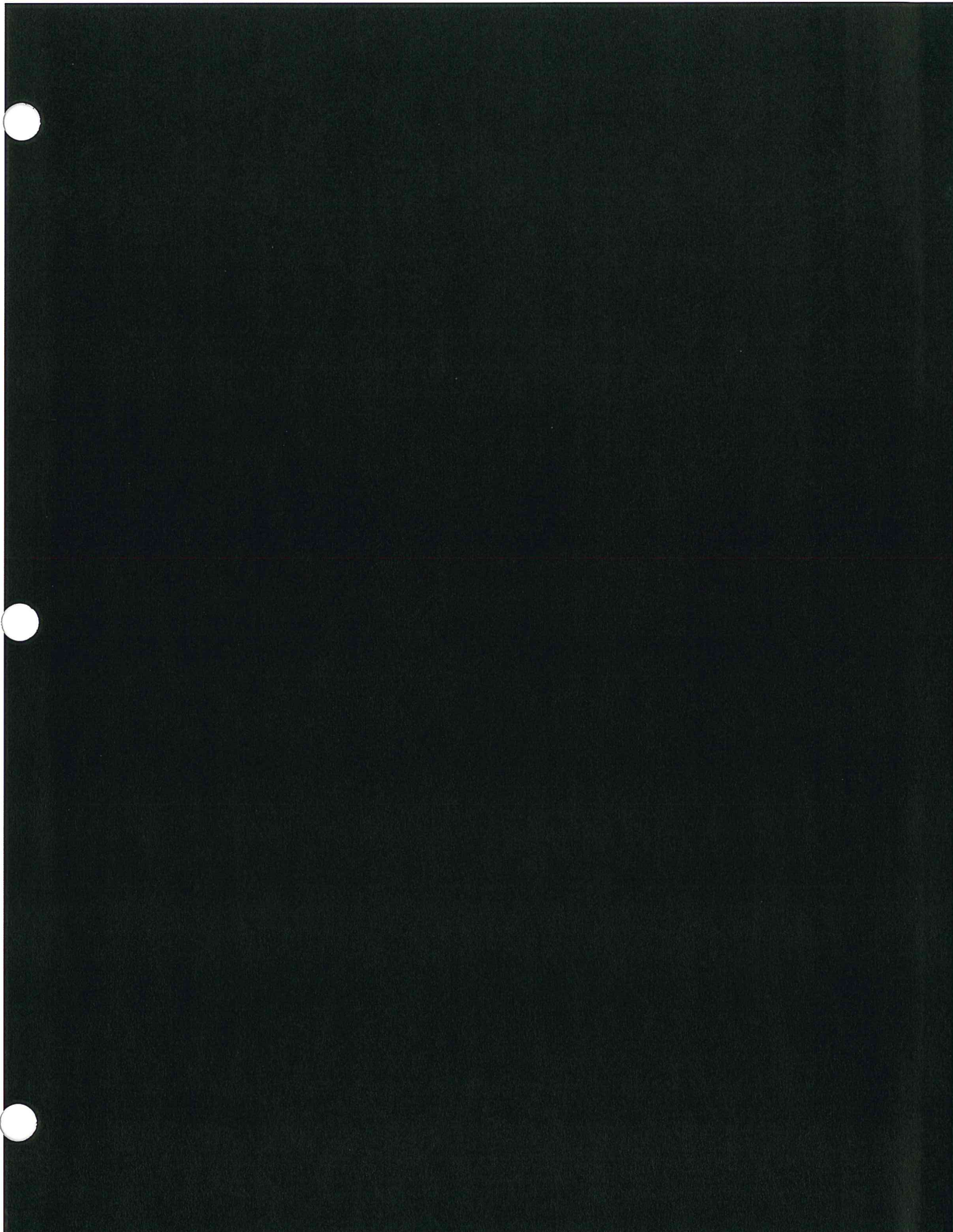
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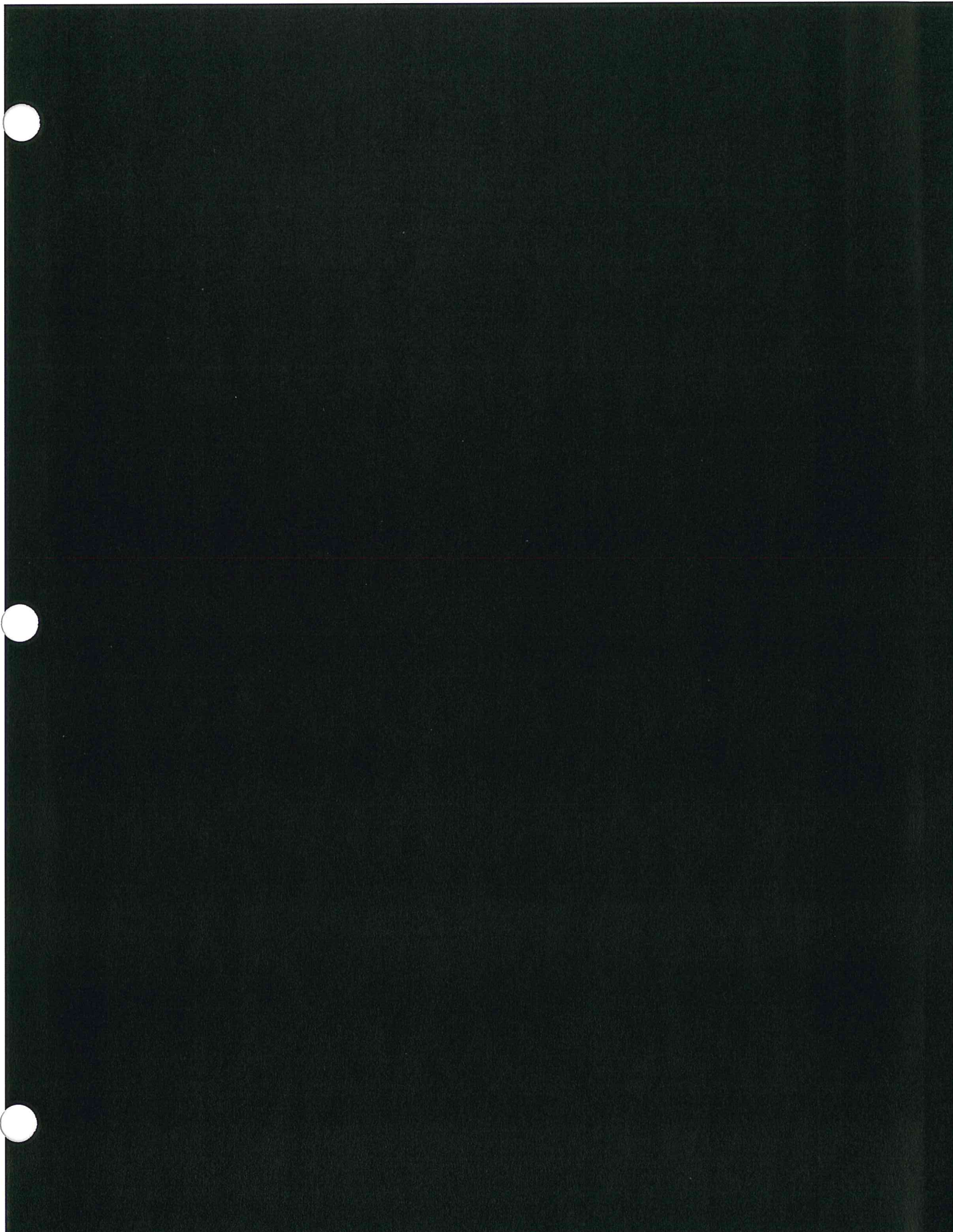


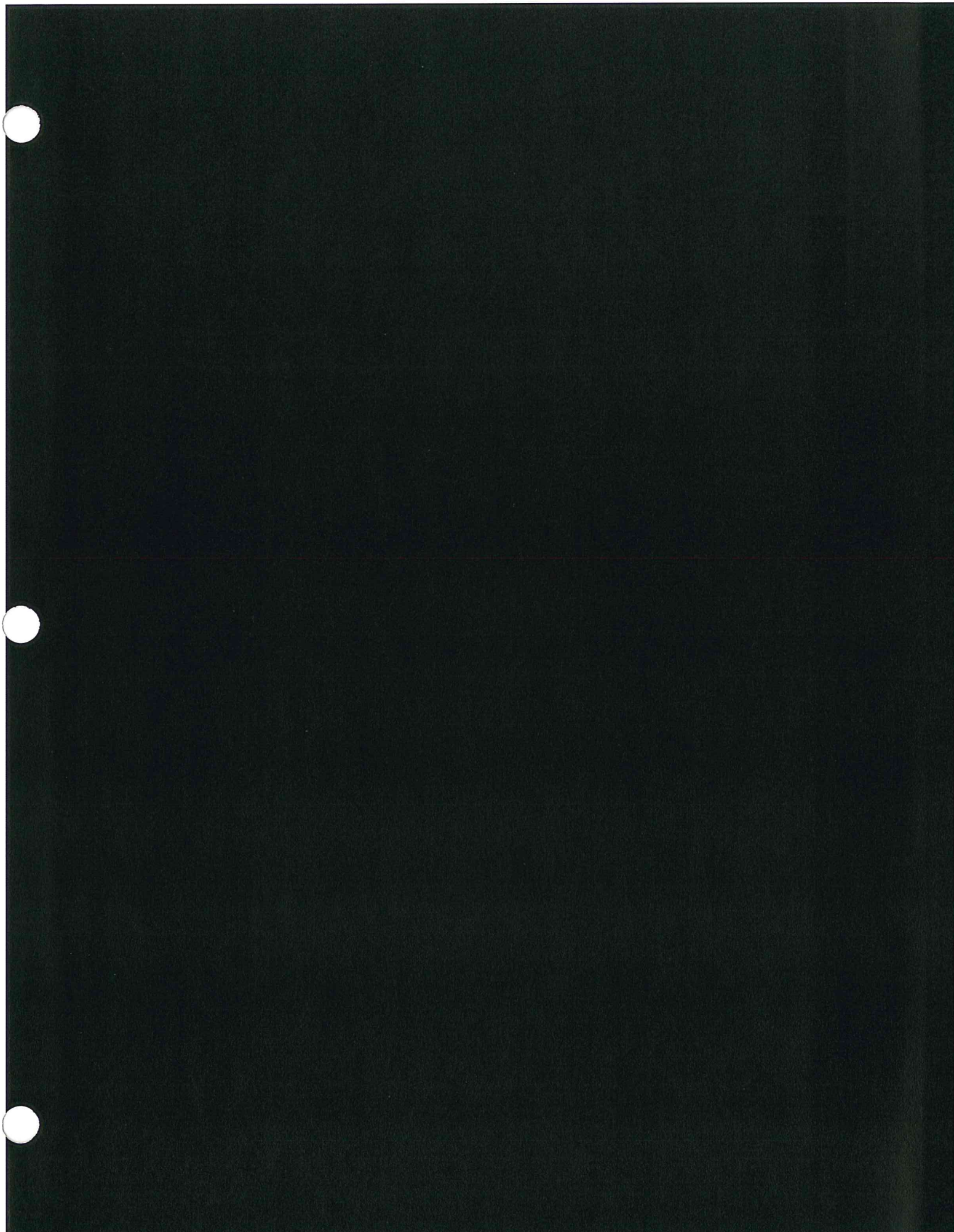


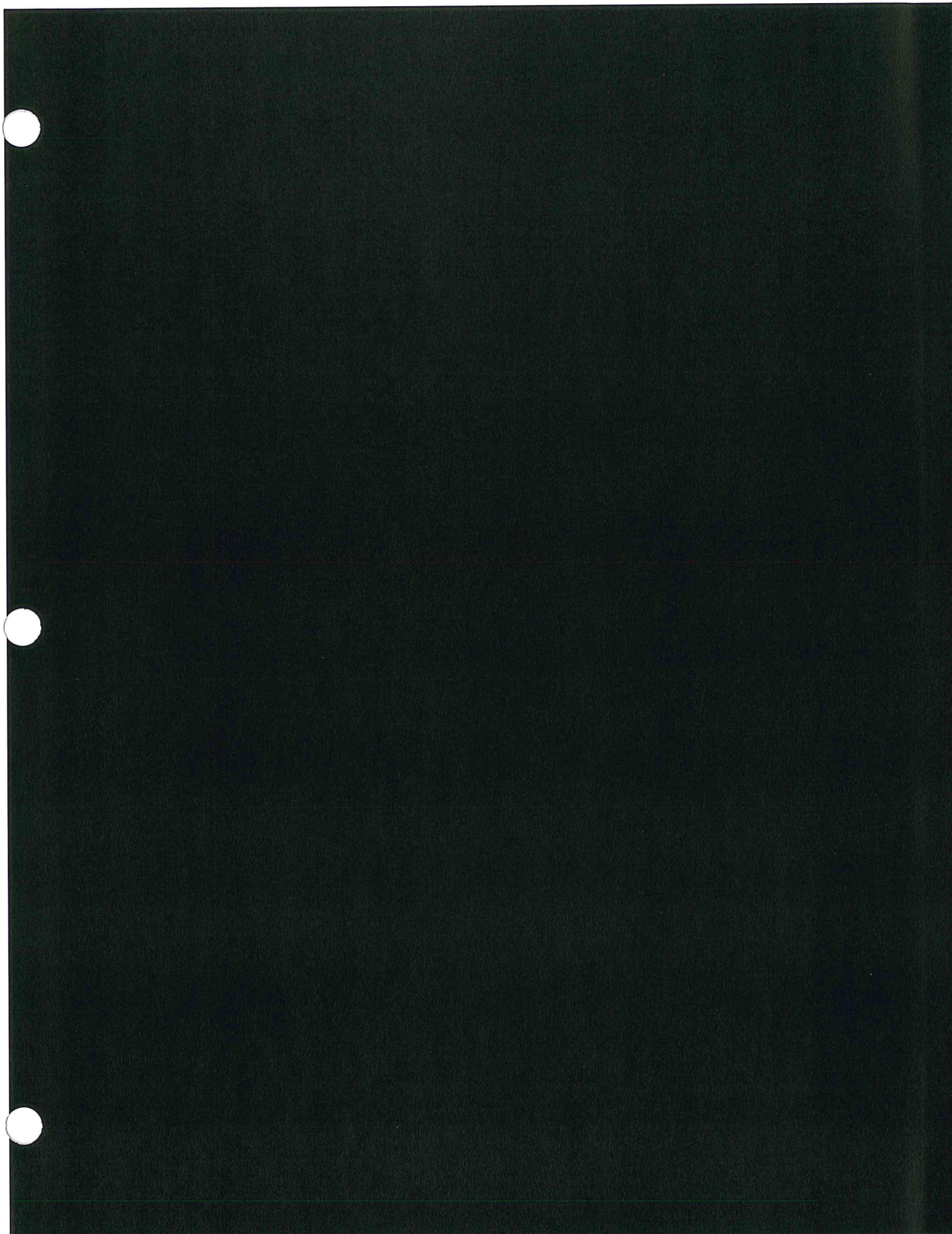


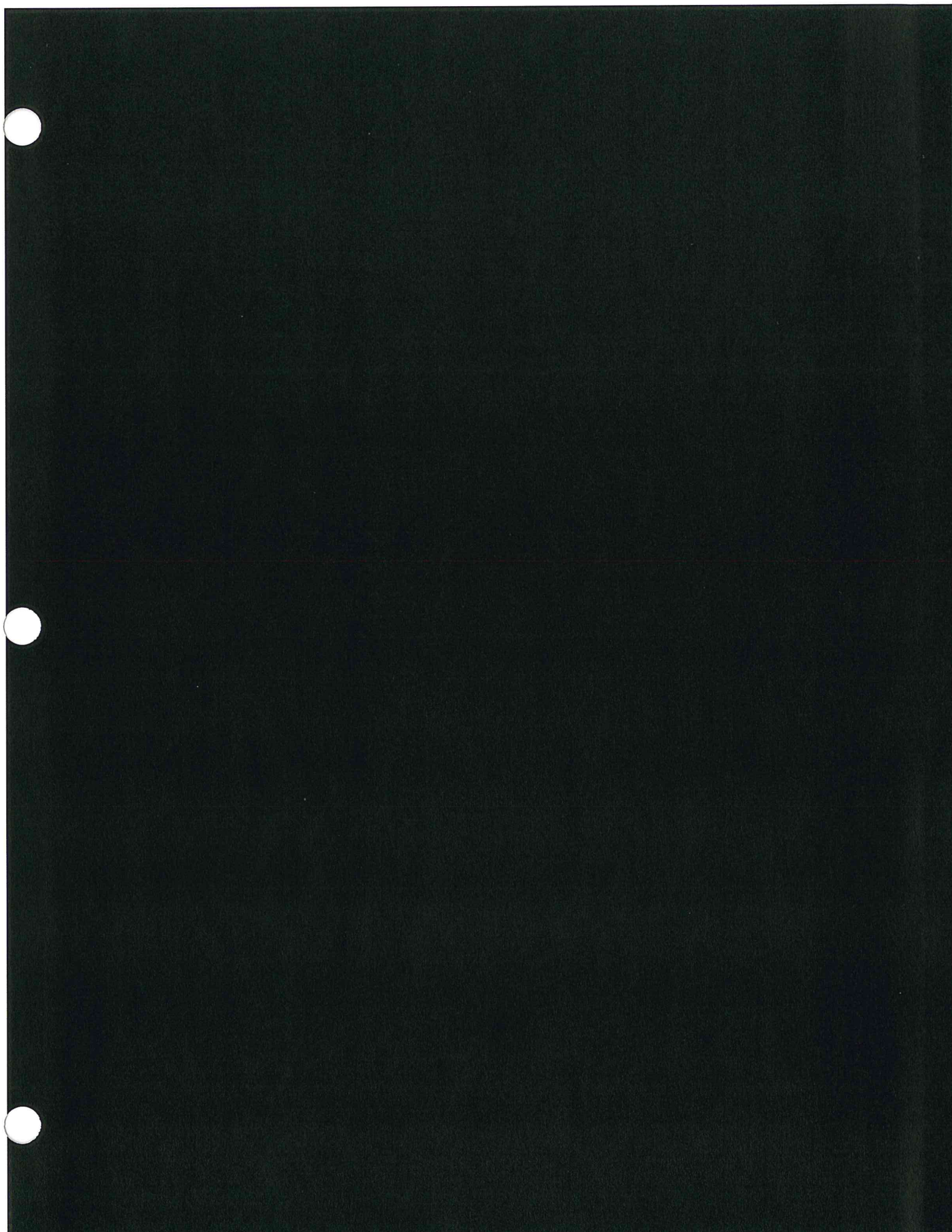


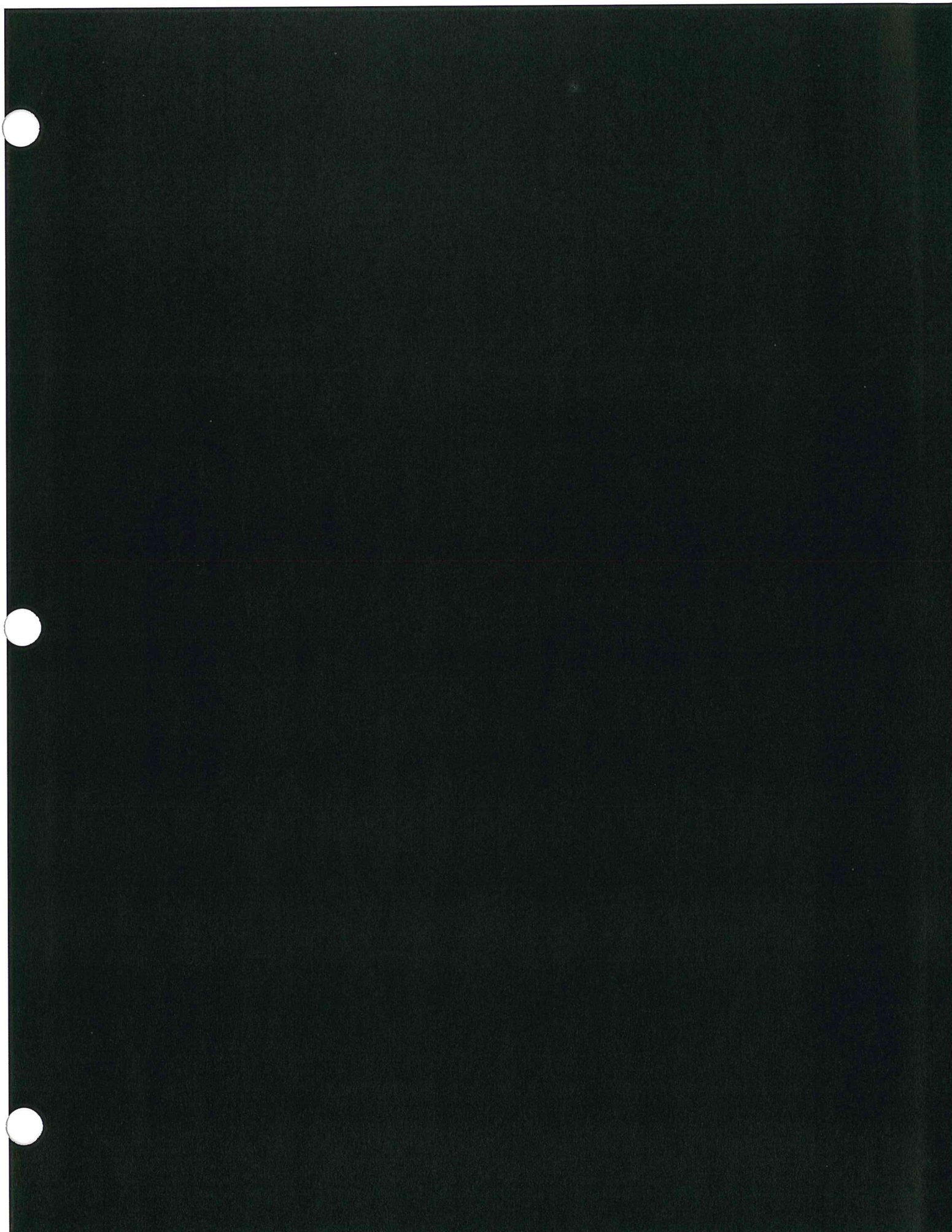


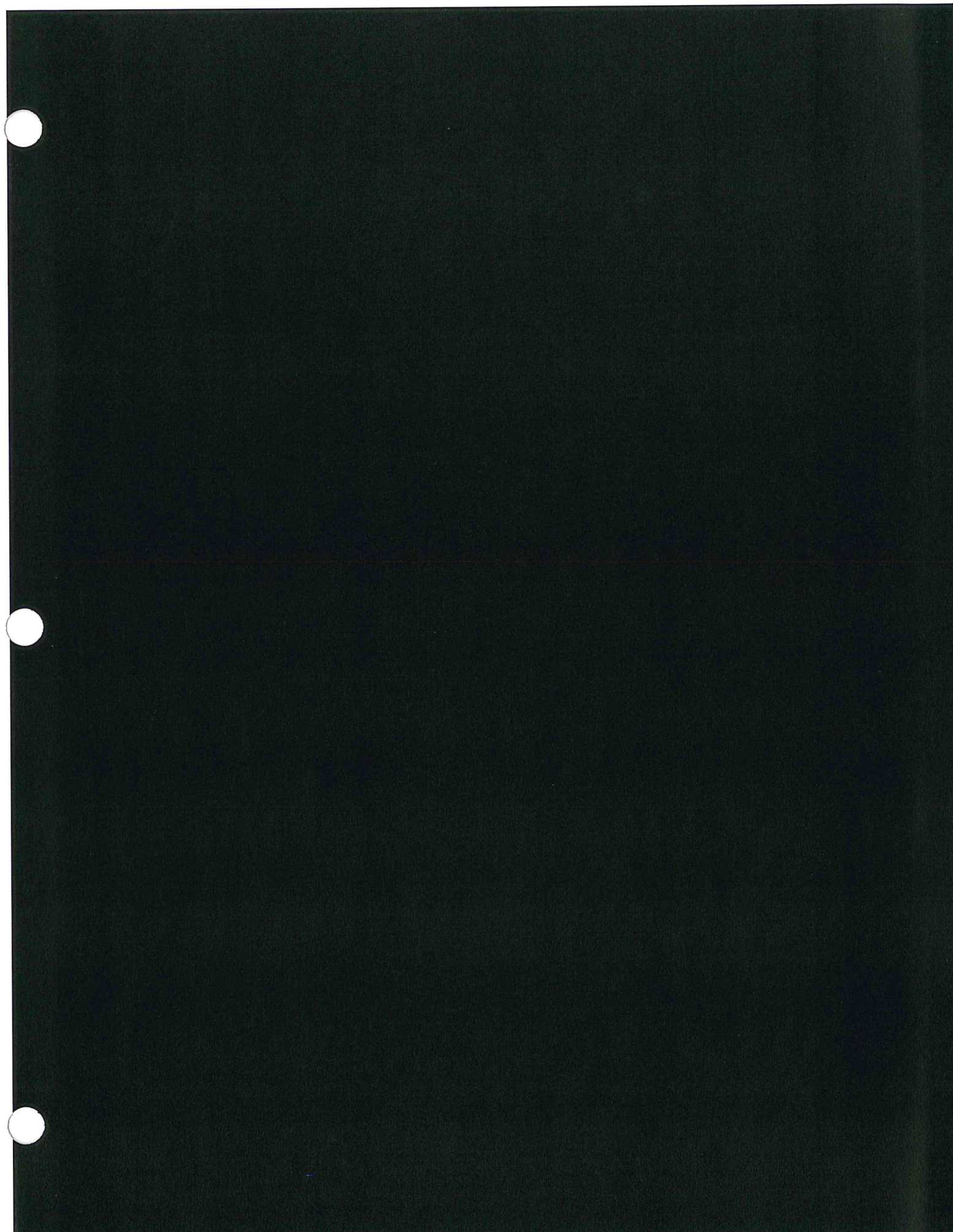


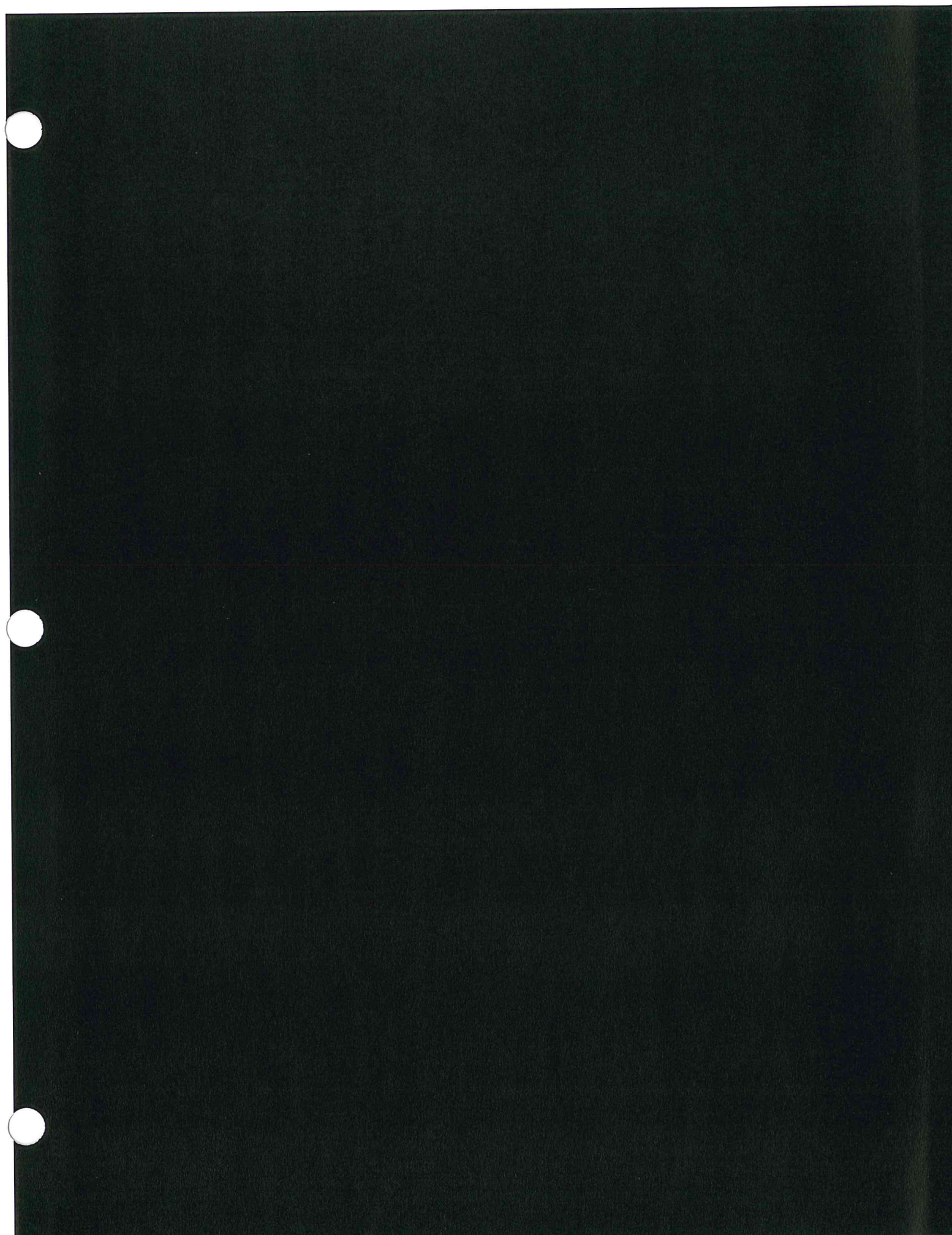


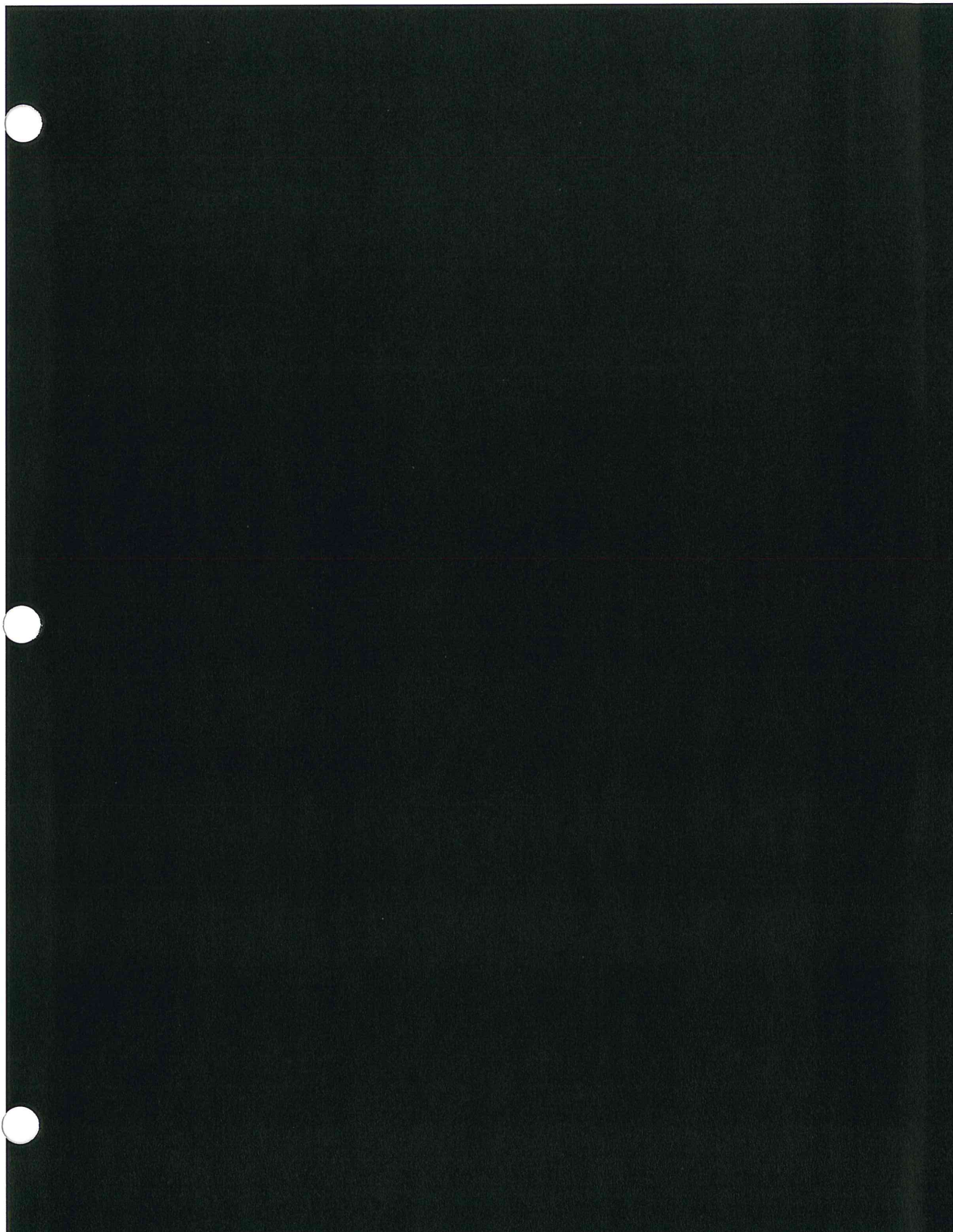






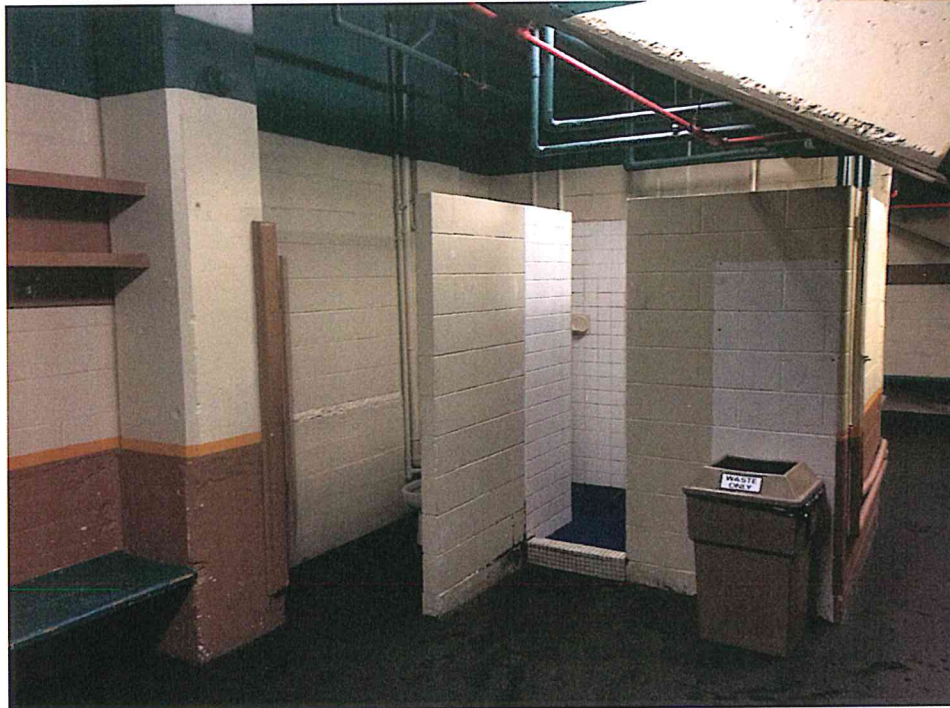








APPENDIX A - SITE PHOTOS



EXISTING DRESSING ROOMS AND SHOWERS UNDERNEATH BLEACHERS



CONCOURSE



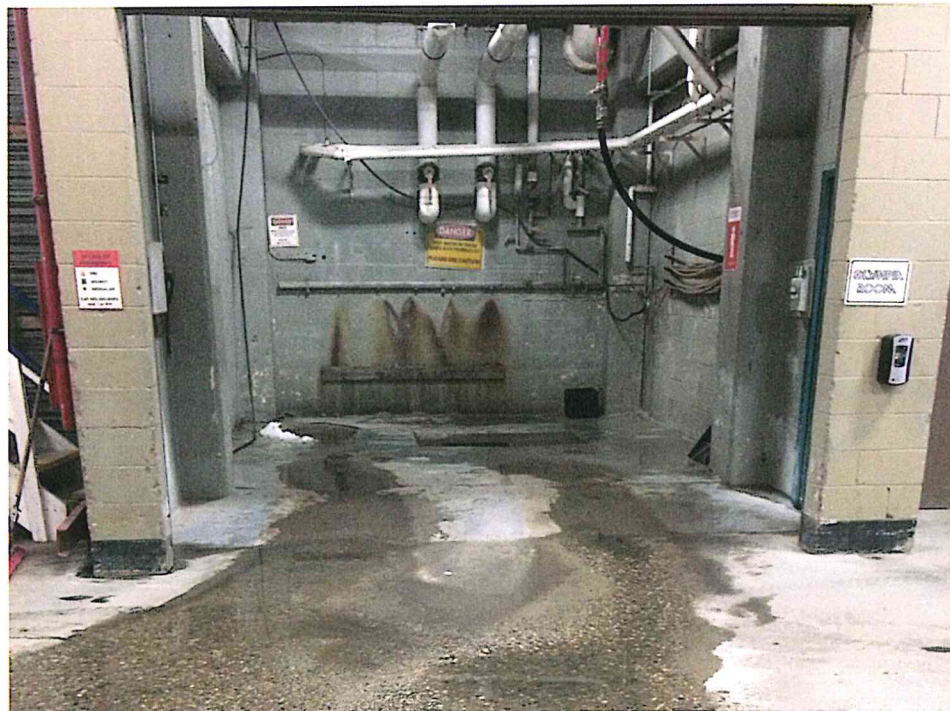
CONCRETE BLEACHERS AT STEEL DASHER BOARDS



BARRIER FREE SEATING AREA



RENOVATED WASHROOMS



ICE RE-SURFACER ROOM



CROSS SLOPED STAIRS AND BLEACHER CONDITION



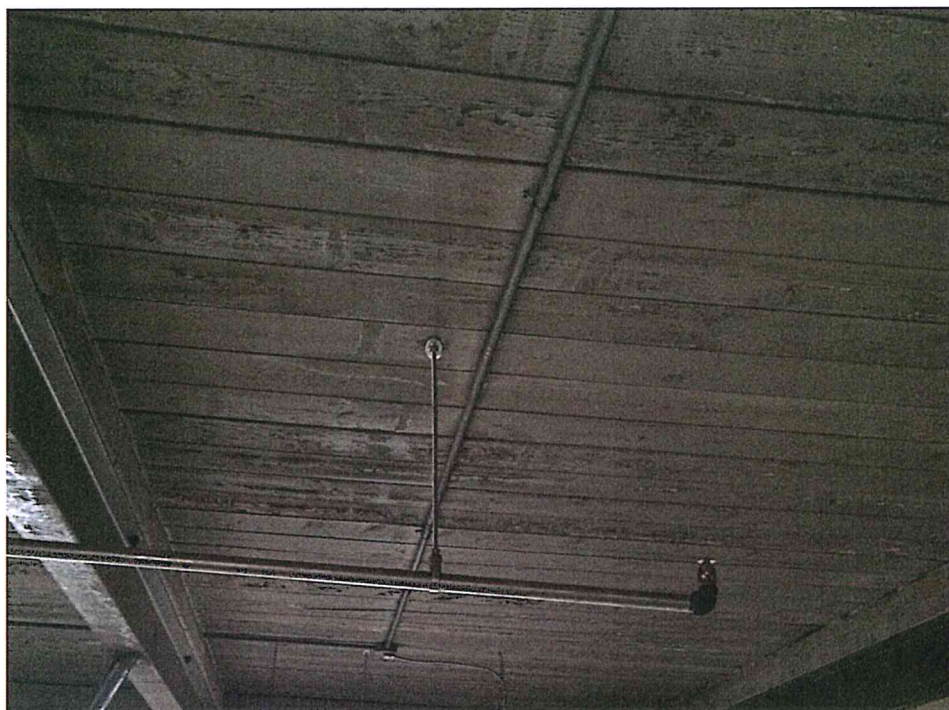
WOOD "TWO" SEATER BLEACHERS SEATS



FASCIA AND GUTTERS OF UPPER ROOF



ACCESS CATWALK TO PRESS BOX



SPRINKLERS



UPPER CONCOURSE RAILING AND NEWER BLEACHERS



CORRAL CENTRE: CURLING VENUE

Calgary, AB

April 3, 2017

Order of Magnitude Estimate # 5

**404 6th Avenue SW
Suite 645
Calgary, AB
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+T: 403.269.5155**

BTY.COM



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Low Case (must do)	
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Olympic Costs	3 pages
Mid Case (should do)	
Capital Maintenance	2 pages
Legacy Costs	1 page
Legacy Costs	1 page
High Case (would be nice to do)	
Legacy Costs	1 page
APPENDIX II : Drawings	8 pages



draft

Corral Centre: Curling Venue
Order of Magnitude Estimate # 5
April 3, 2017

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Corral Centre: Curling Venue
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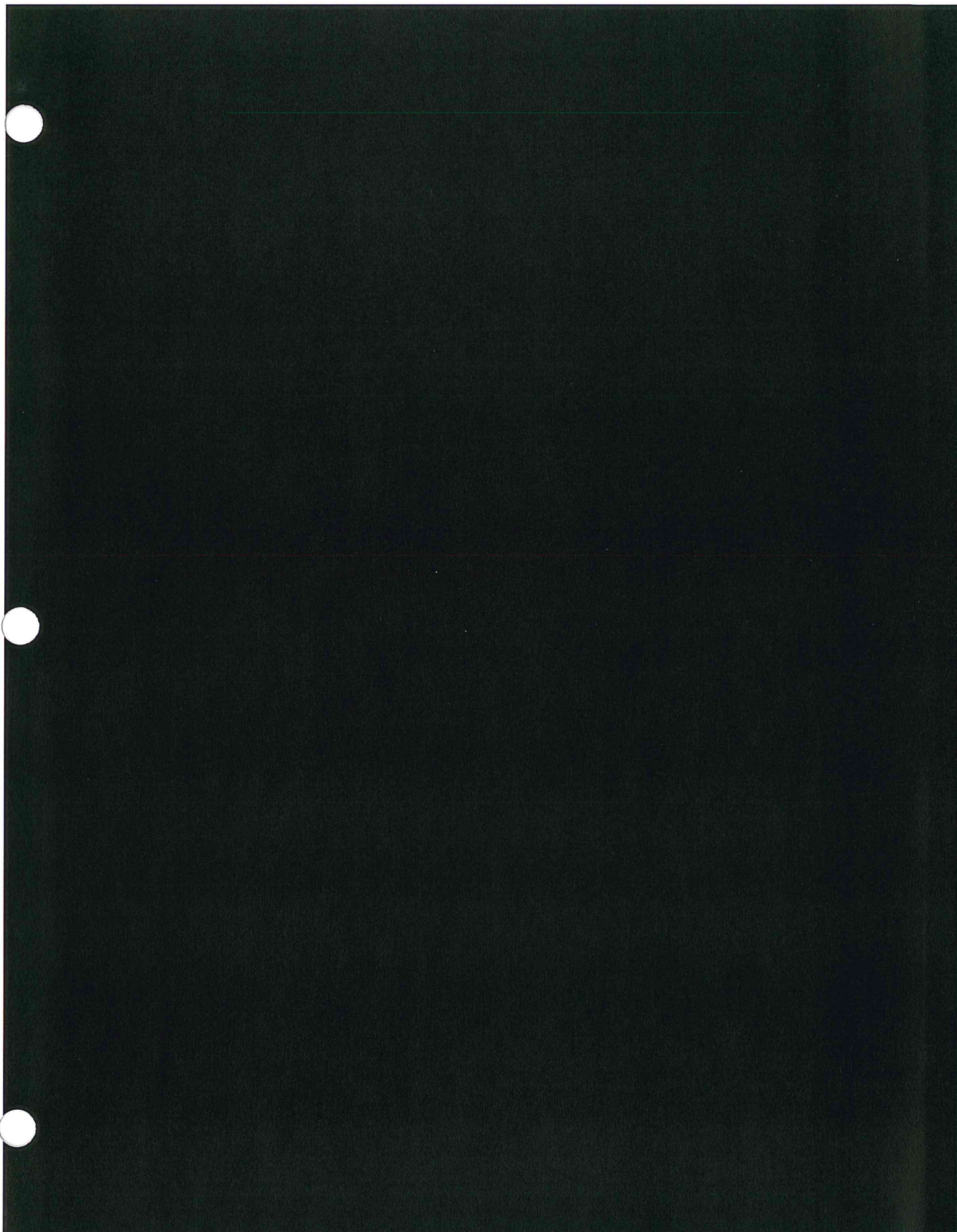
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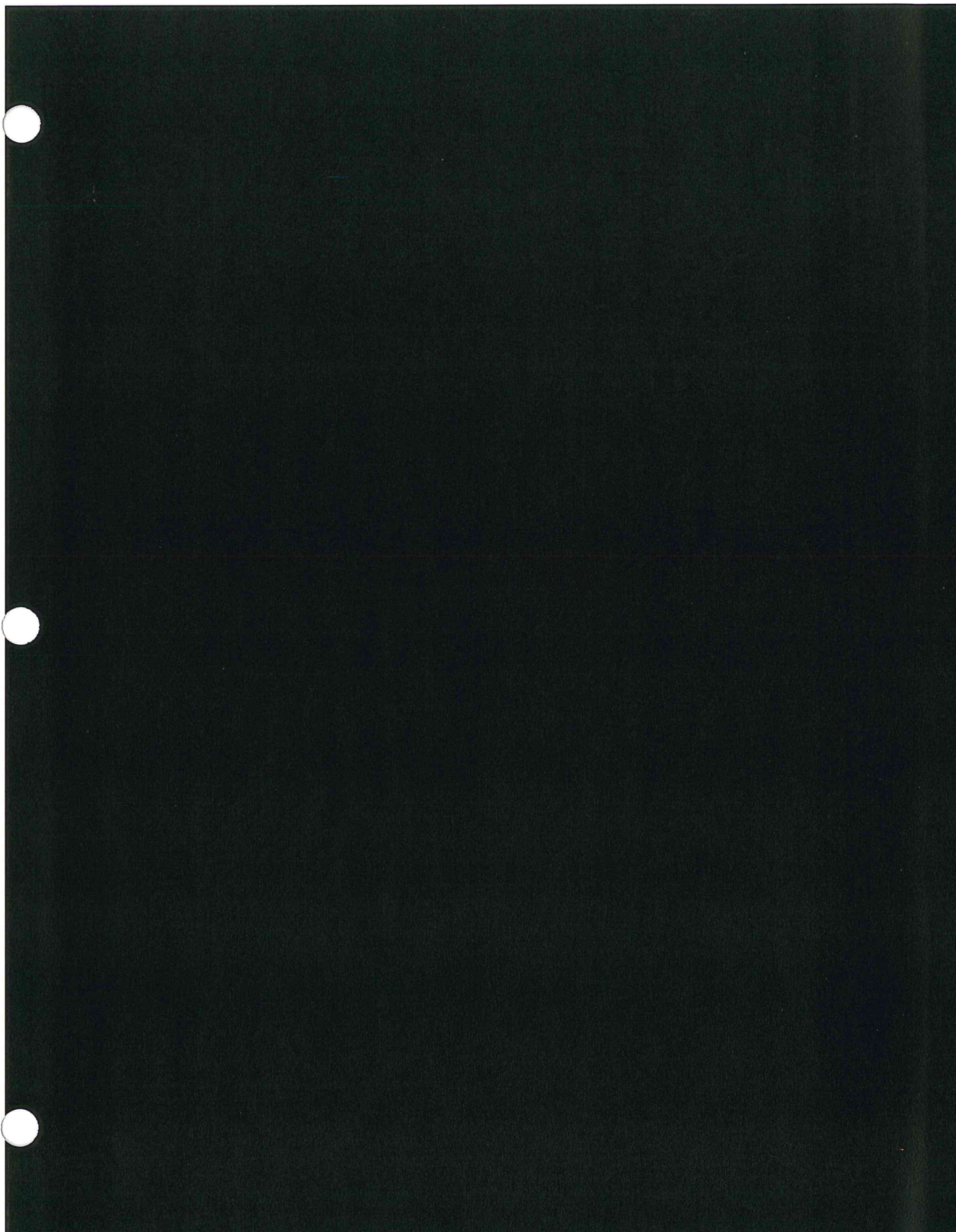
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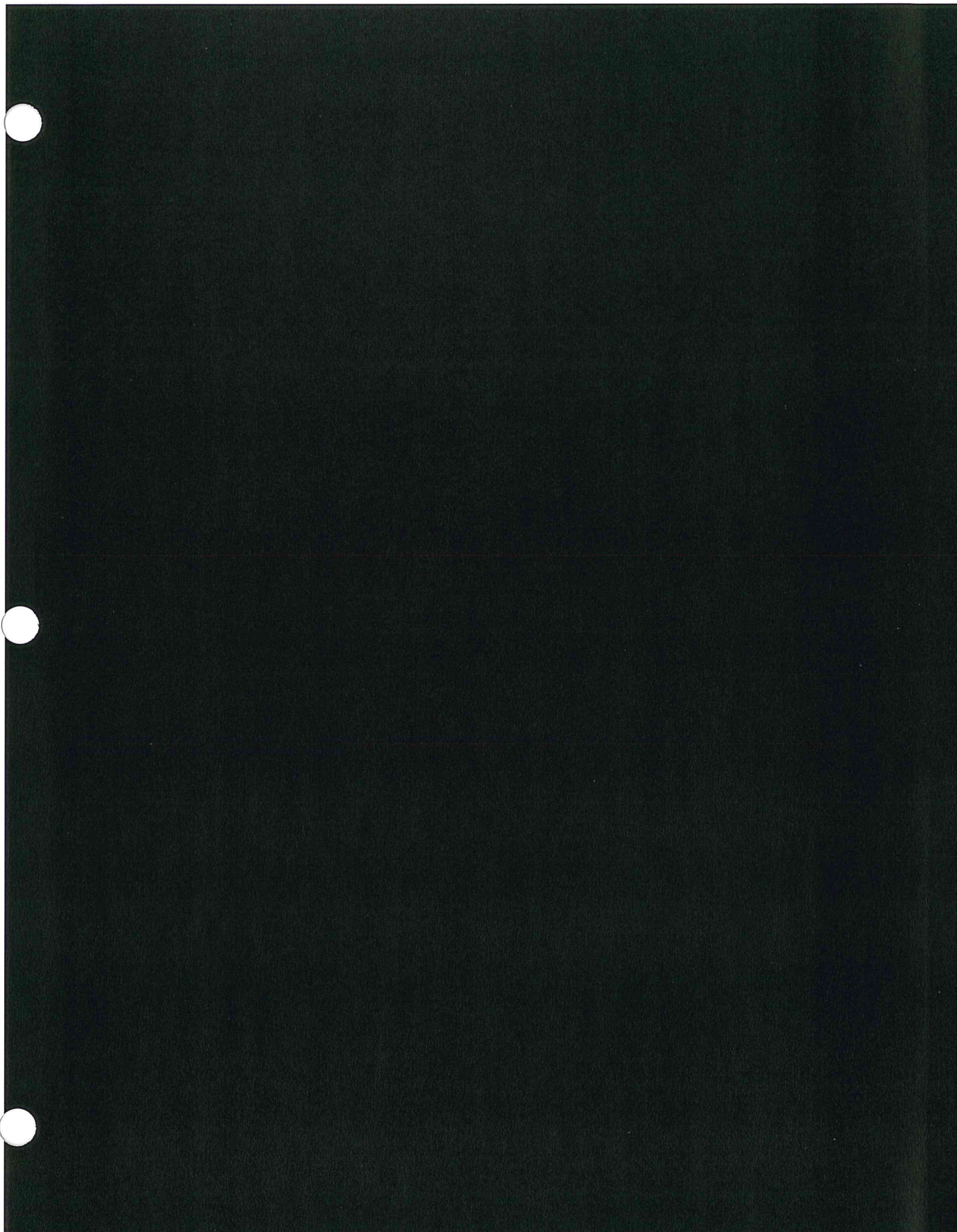
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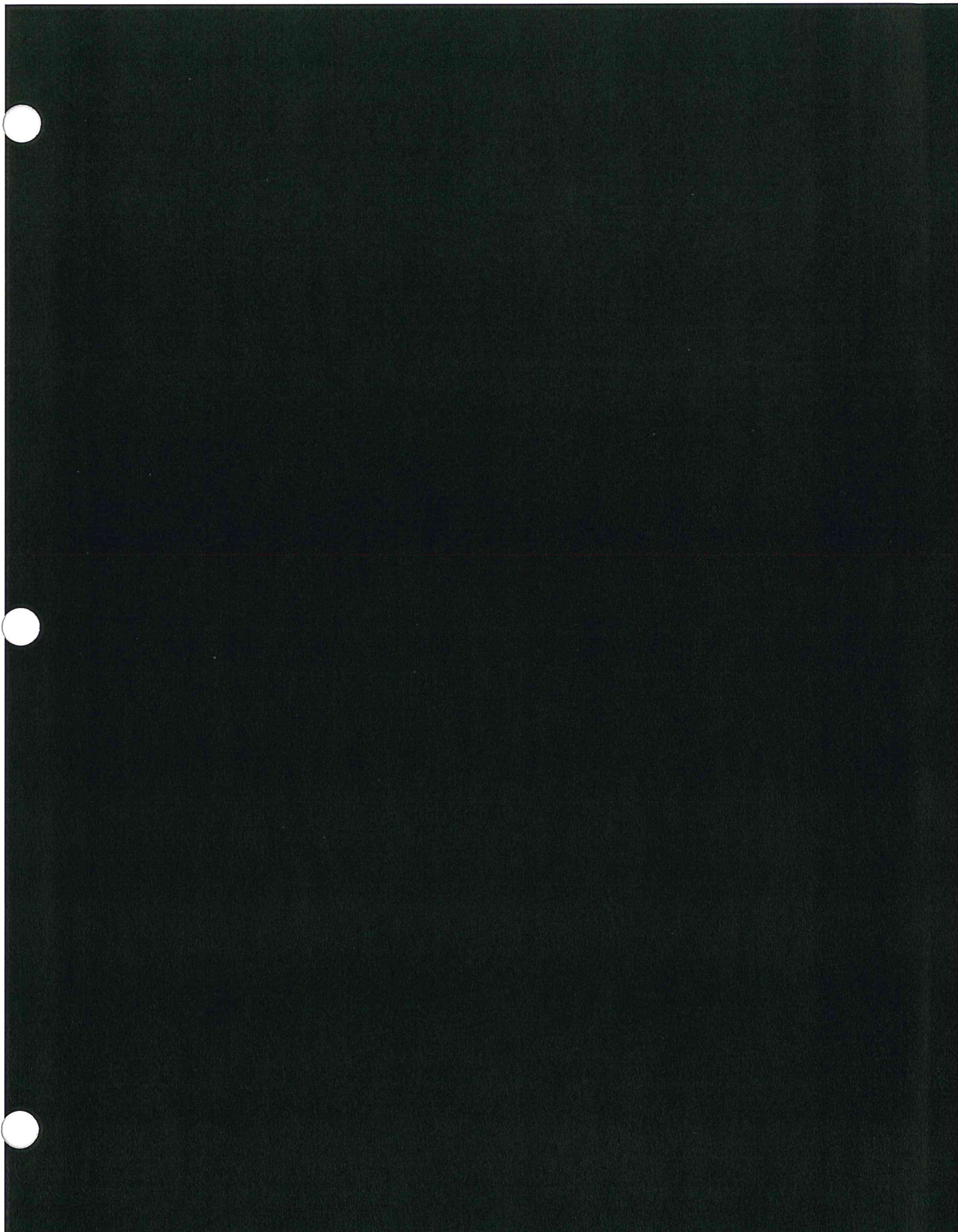
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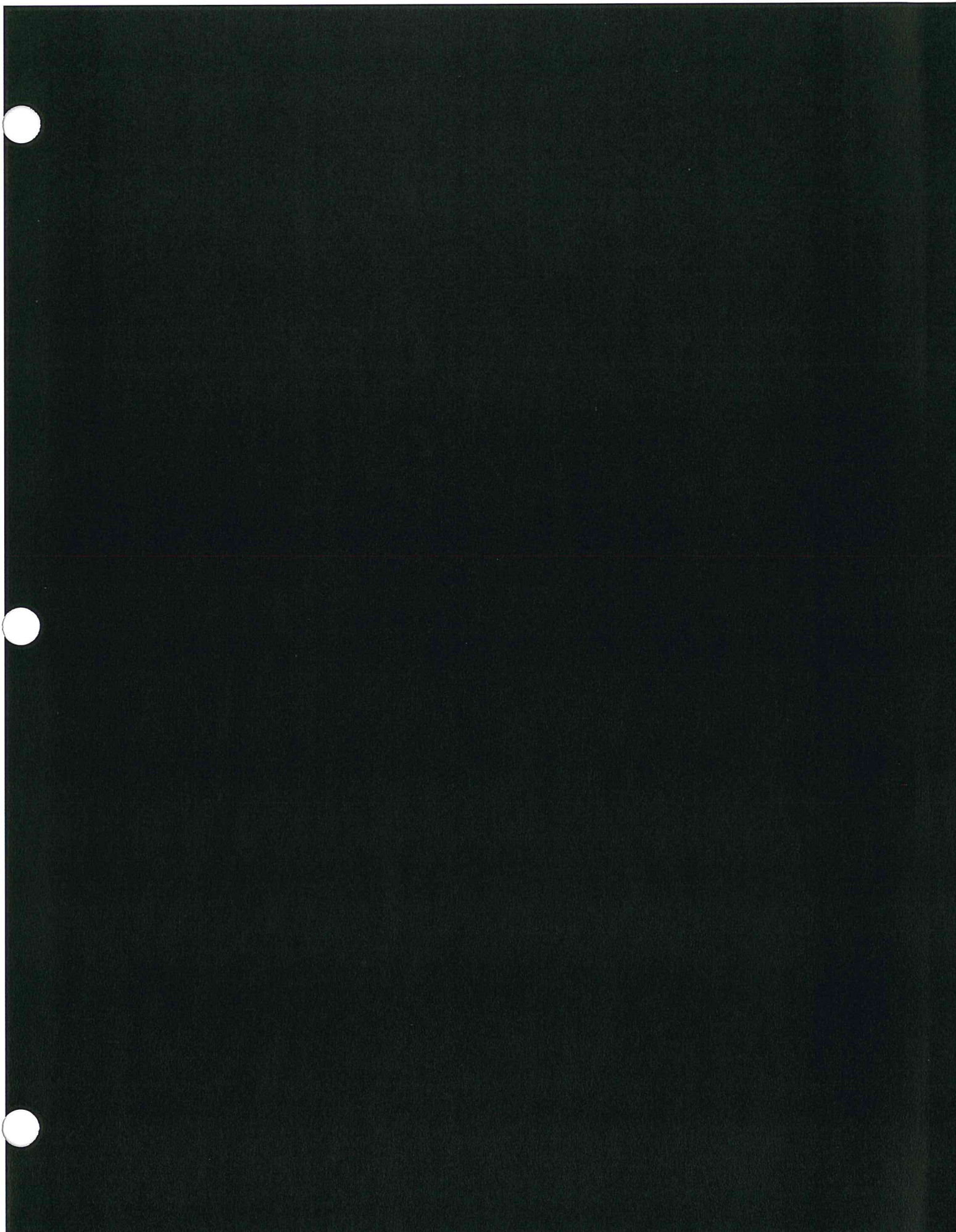
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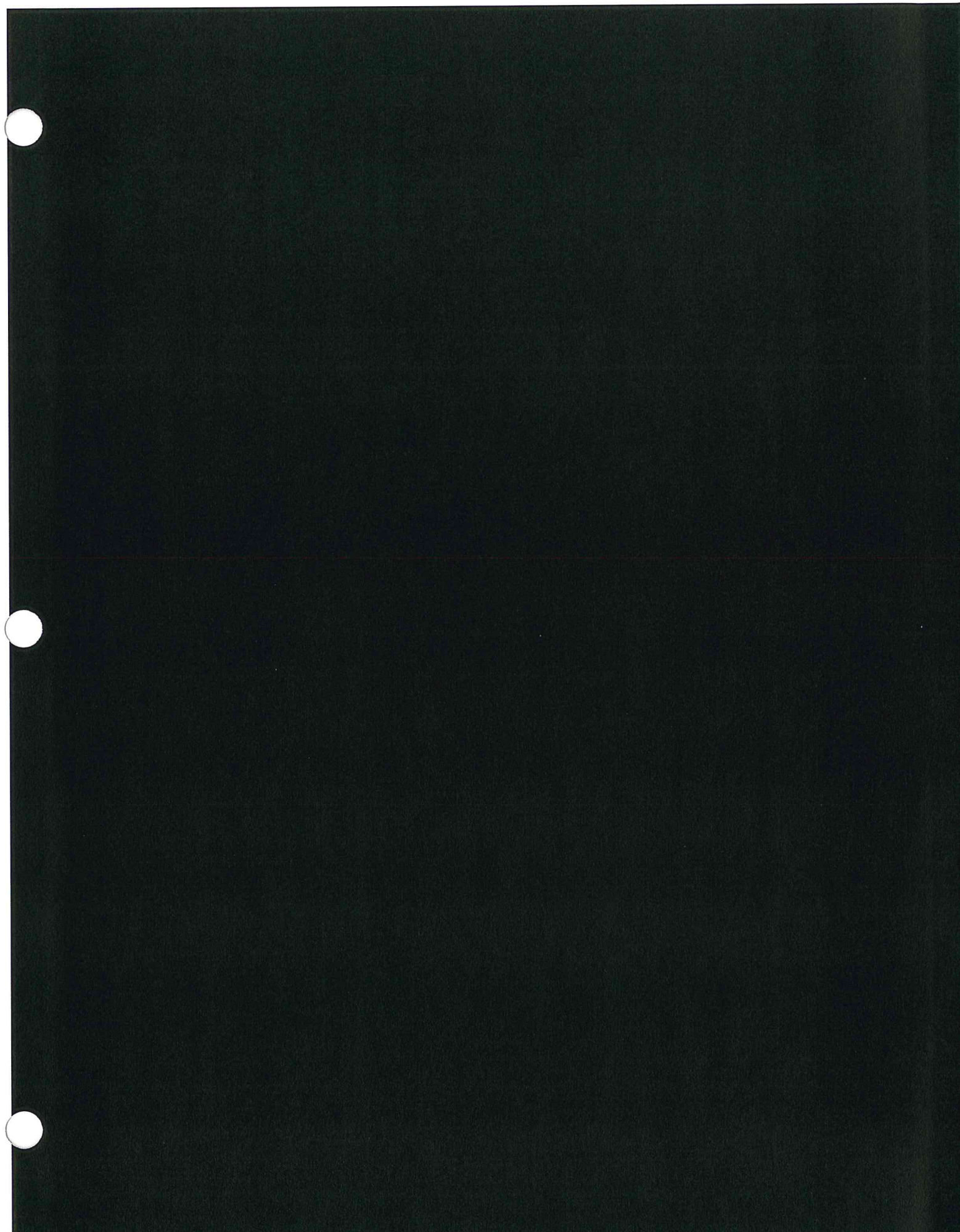


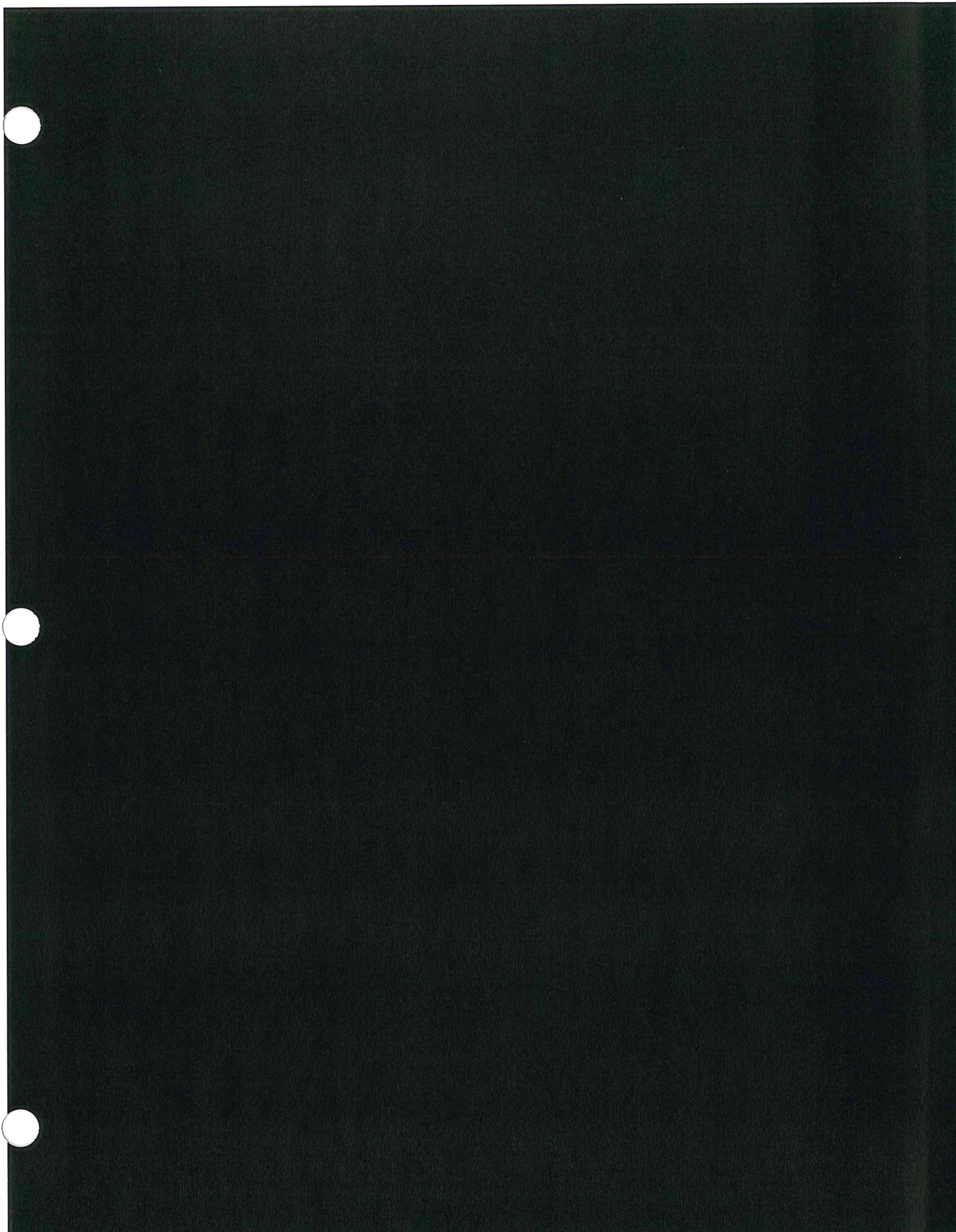


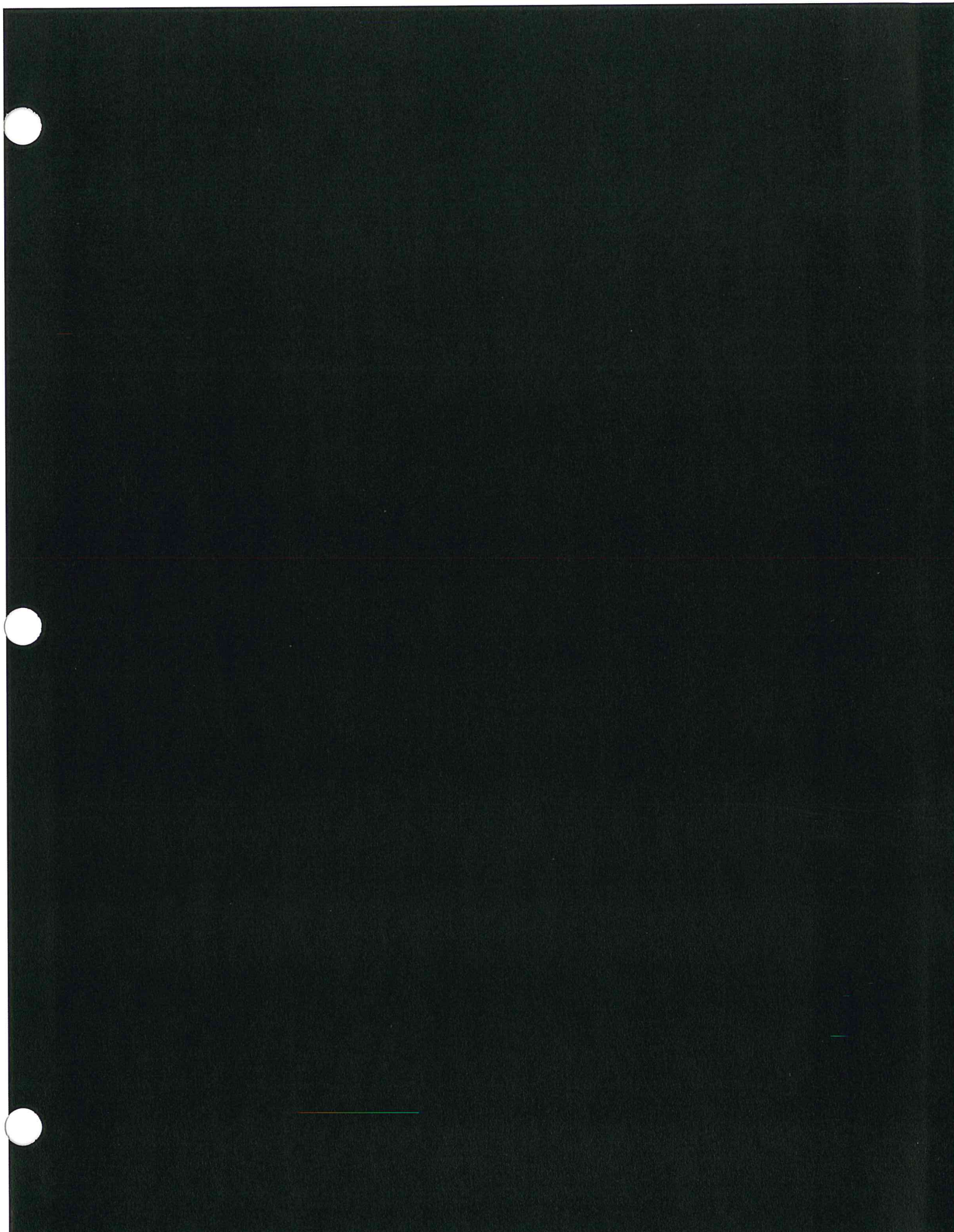




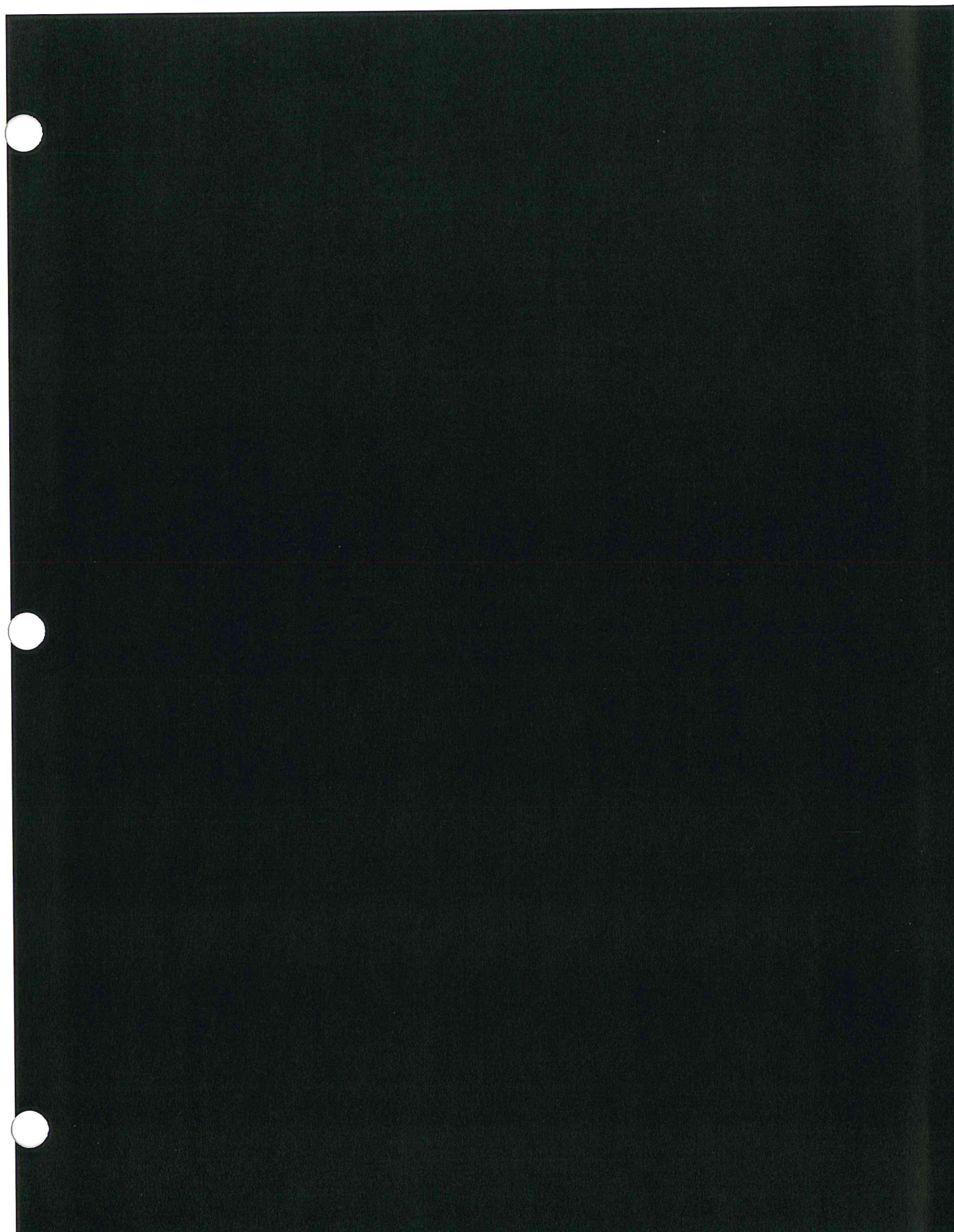


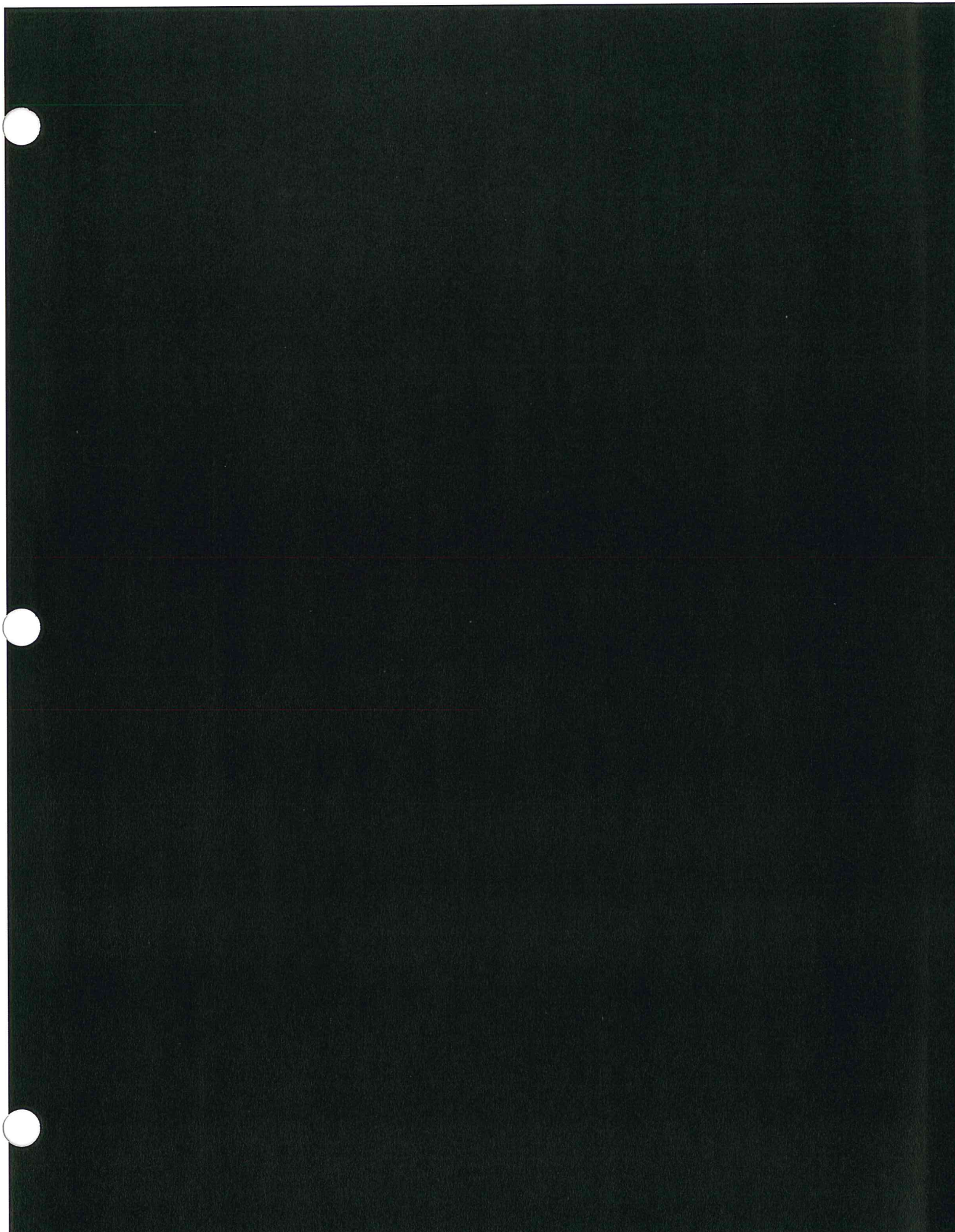


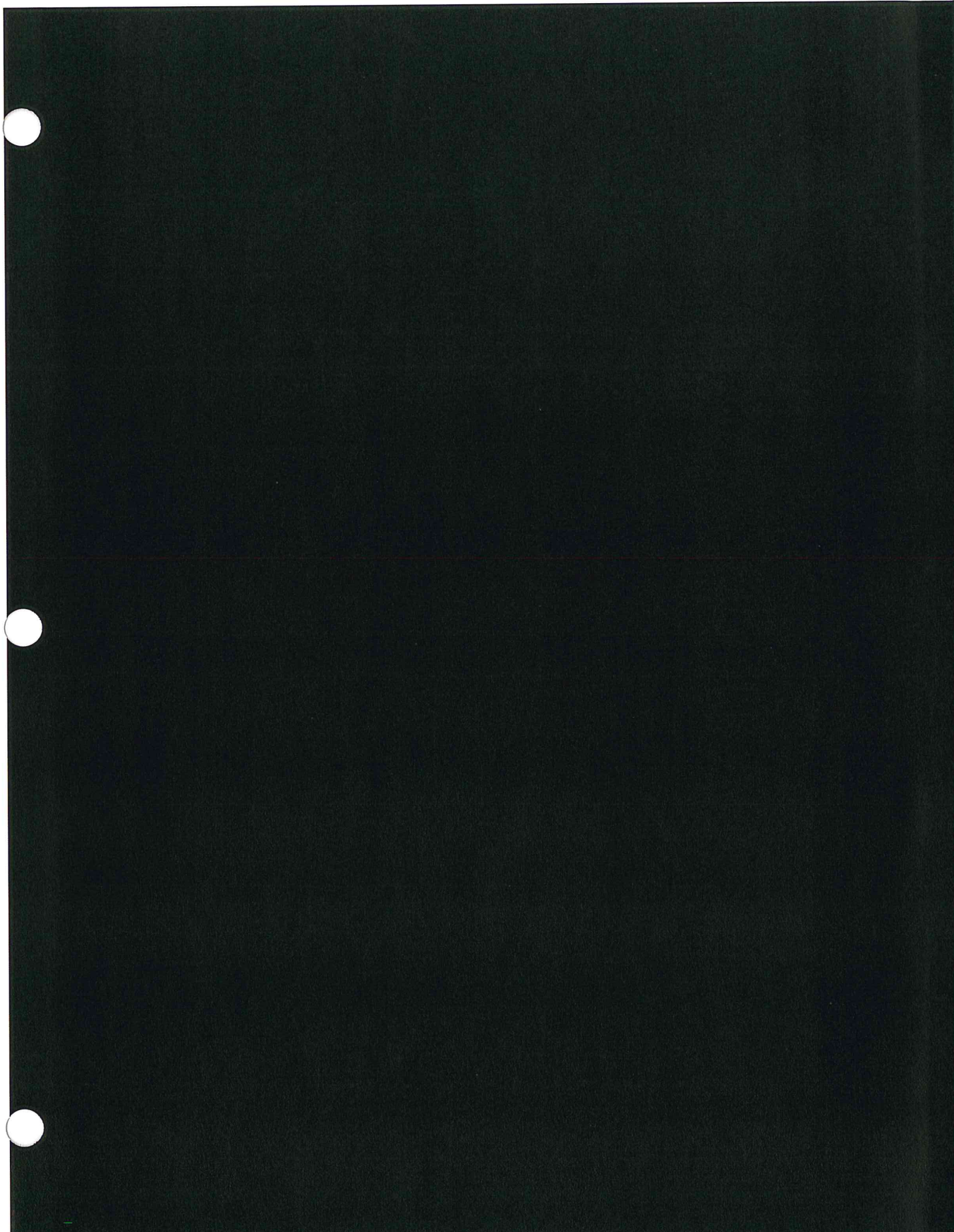


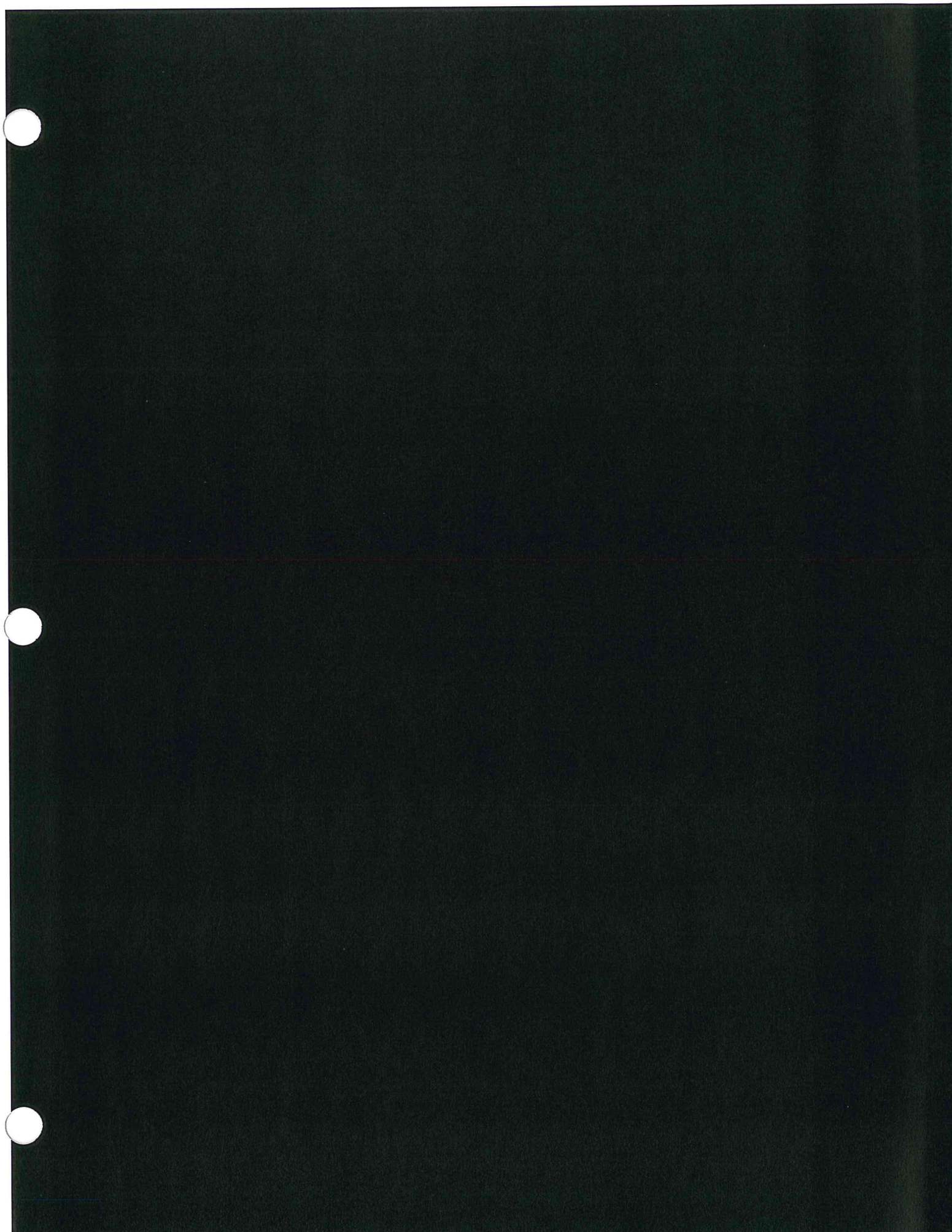


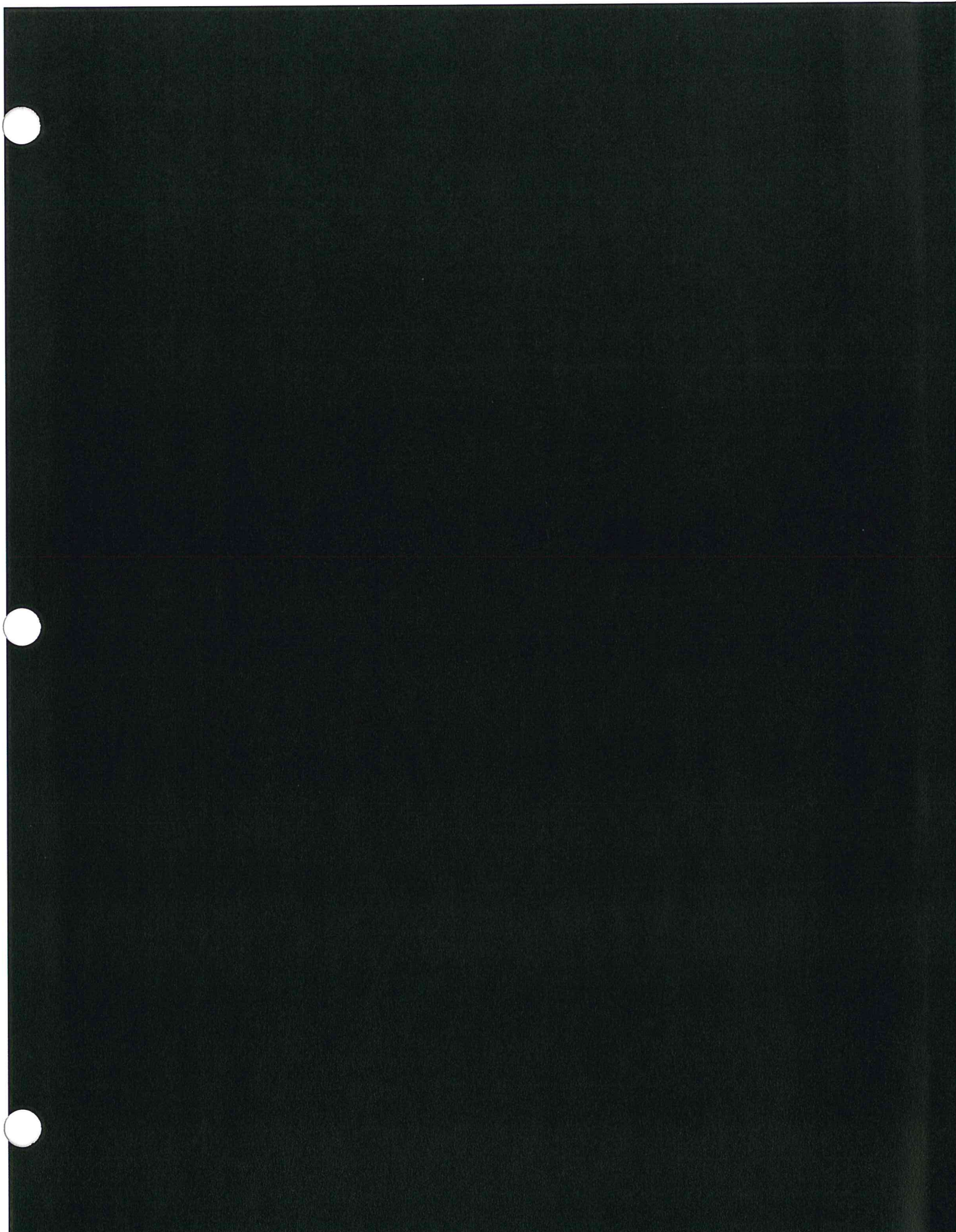


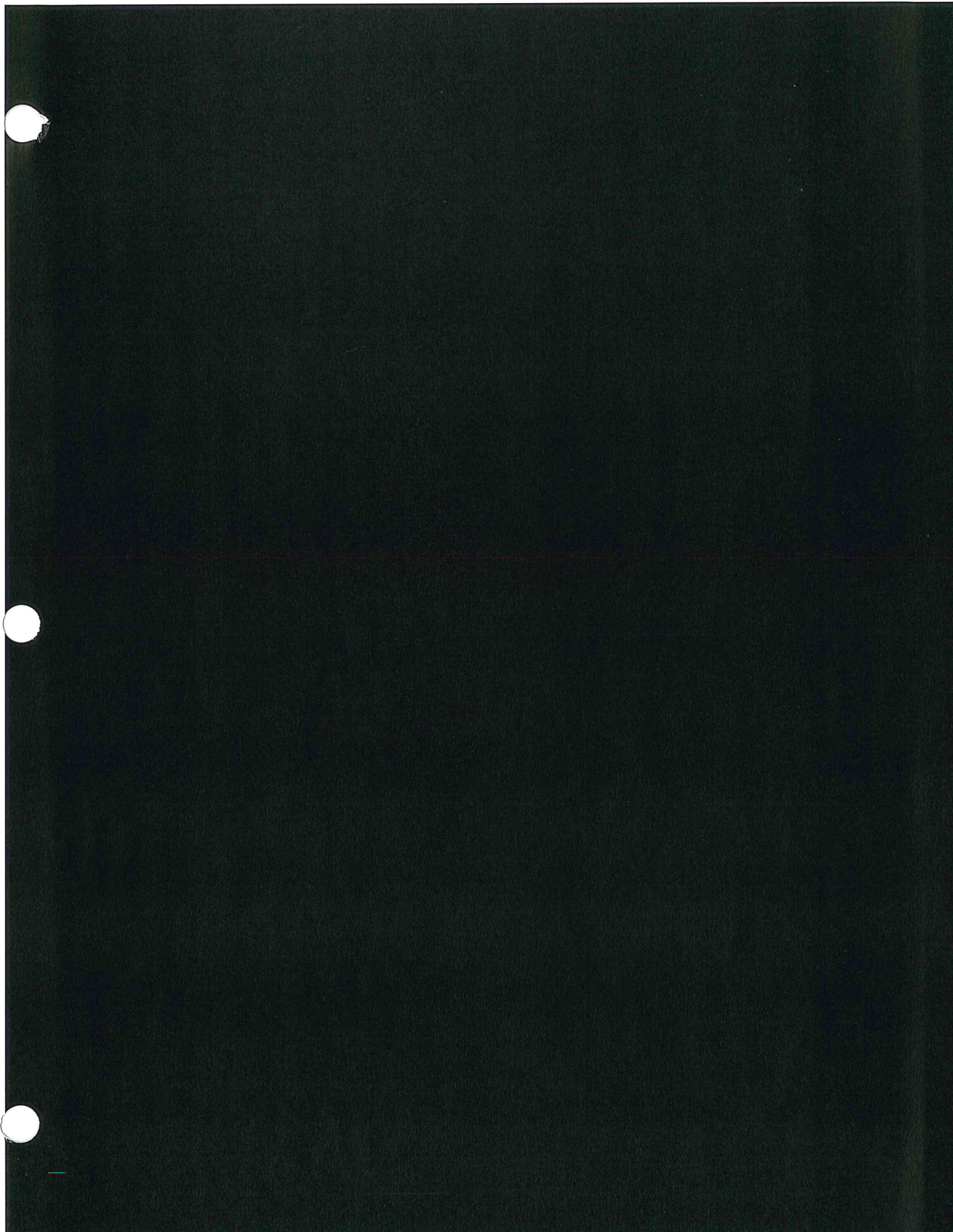








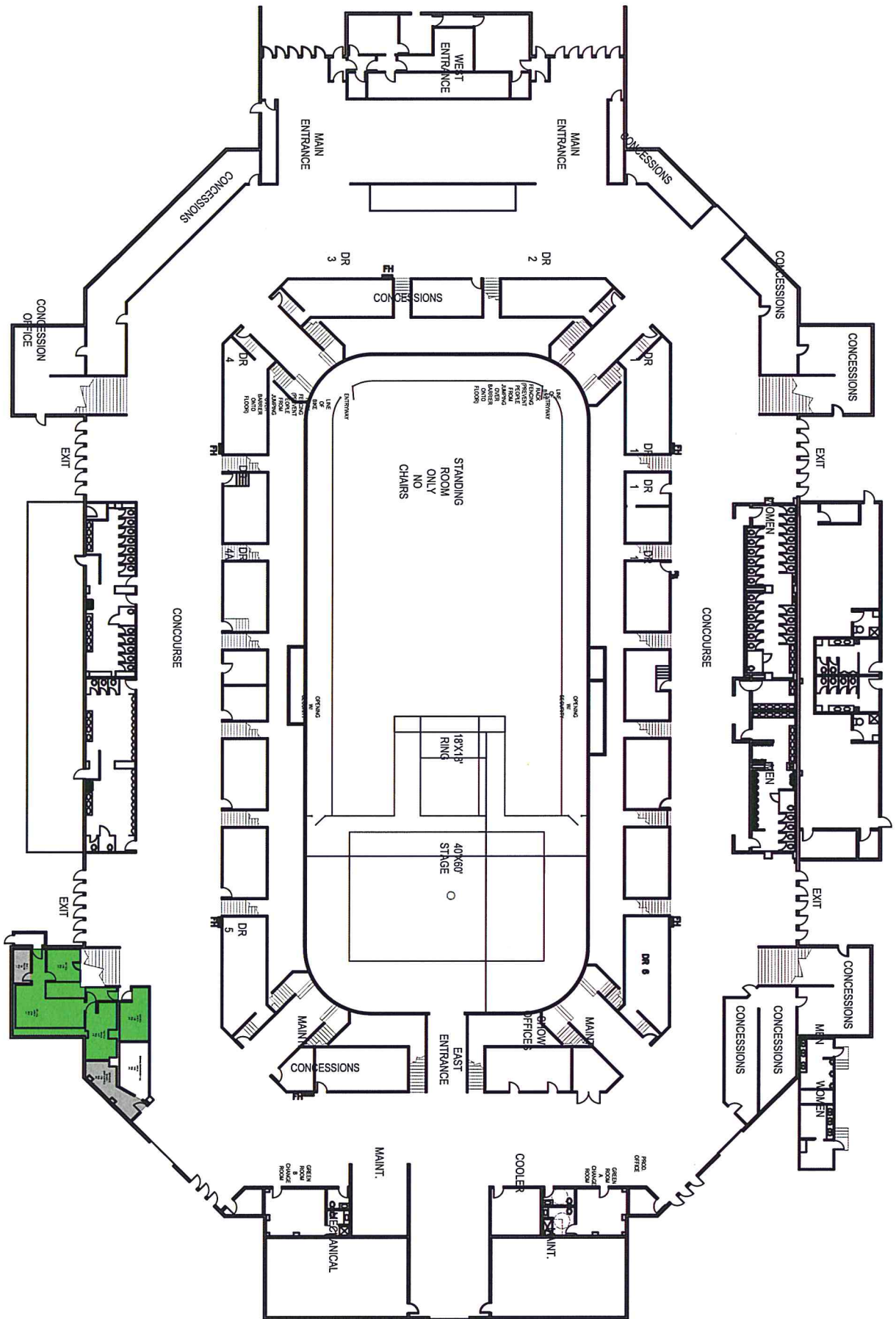


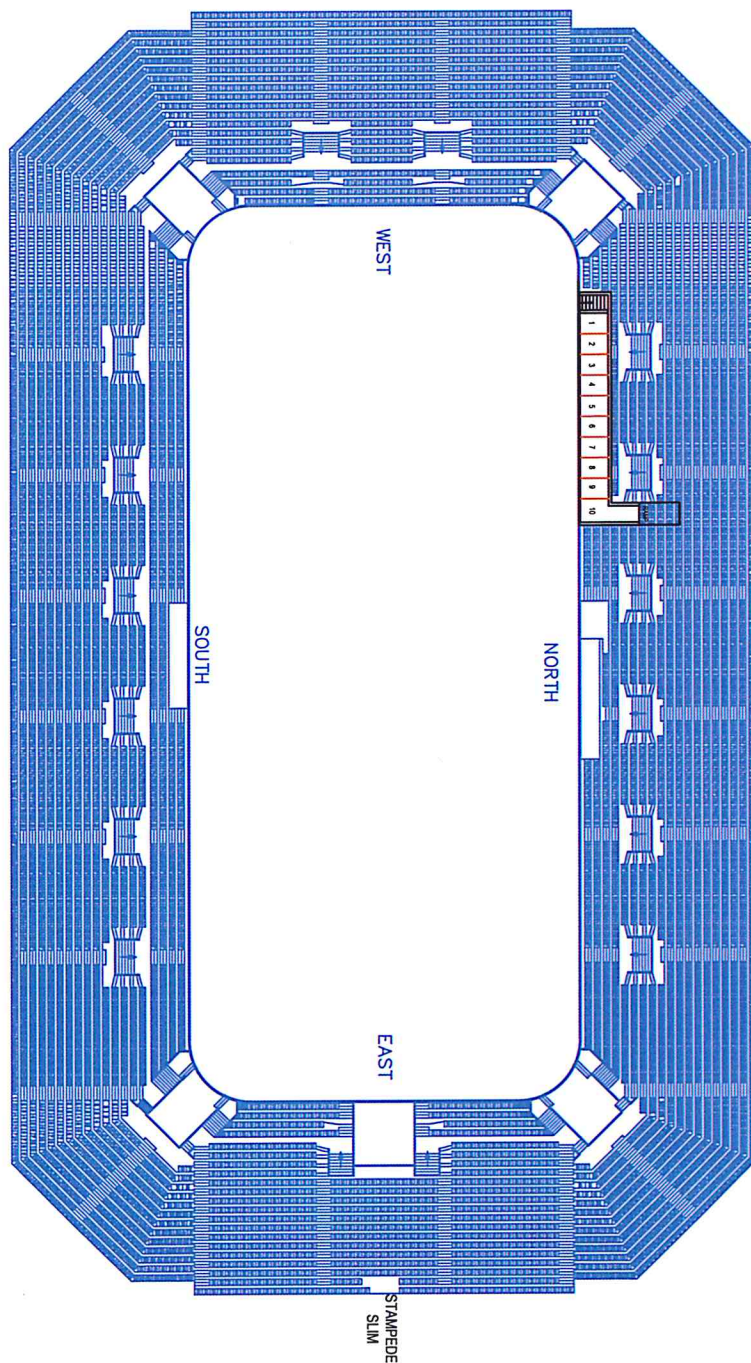


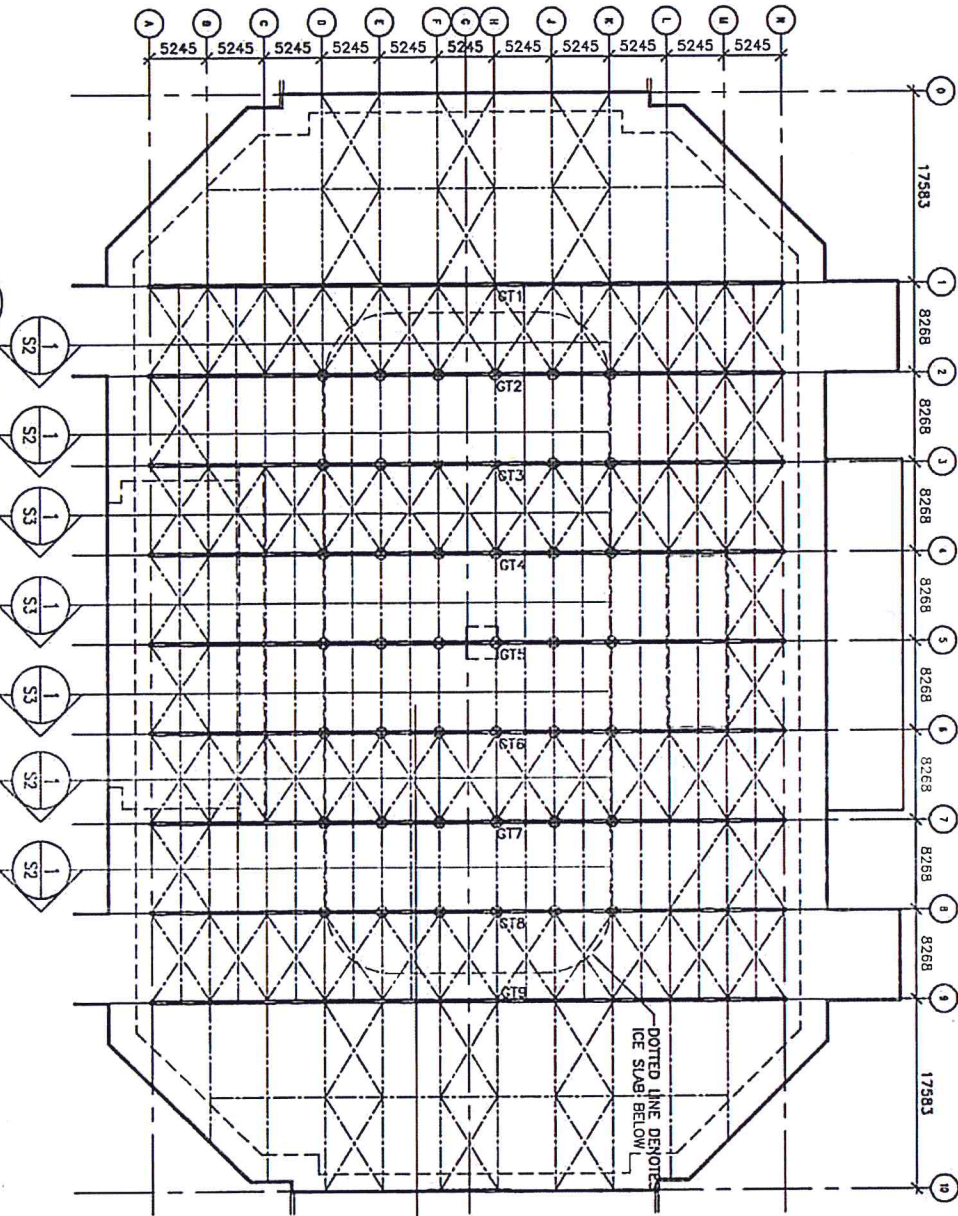


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APPENDIX II : Drawings





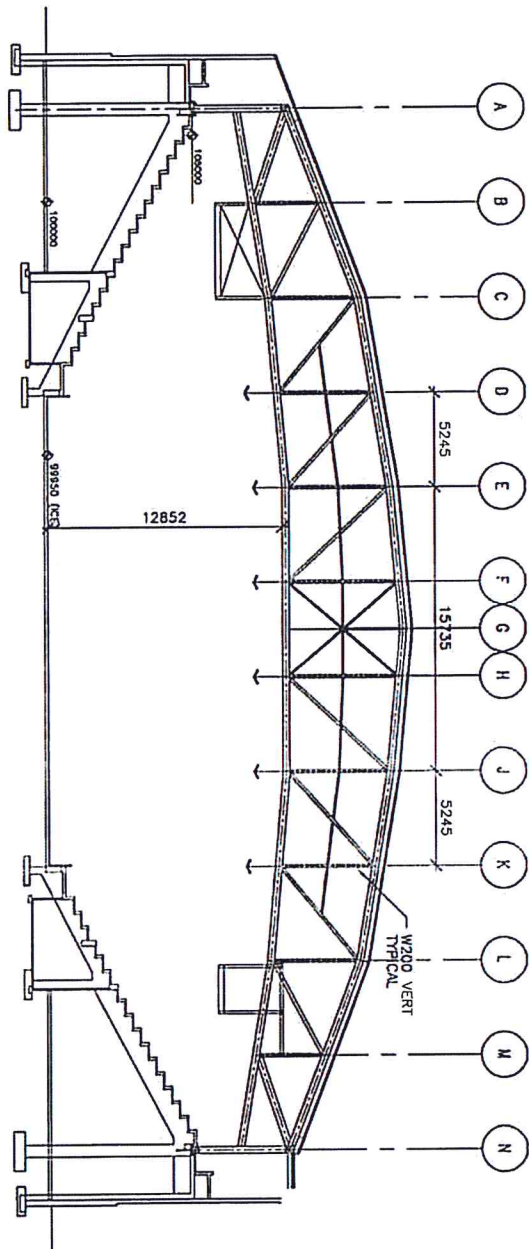


PLACEMENT OF ANY LOAD EXCEEDING THE LOADS
 SPECIFIED ON DRAWINGS S2 & S3 EXISTING STRUCTURAL MEMBERS
 WILL REQUIRE STRENGTHENING OF EXISTING STRUCTURAL MEMBERS
 LOADS TO BE SUSPENDED AT SPECIFIED GRIDS ONLY
 AT BOTTOM CHORD PANEL POINTS
 LOADS MAY BE HANGED OFF GIRDER CENTER ALONG
 BOTTOM ANGLE TIES OR PURLINS AS SHOWN ON 2/S2 & 2/S3
 NO ALLOWANCE FOR DYNAMIC EFFECT IS INCLUDED



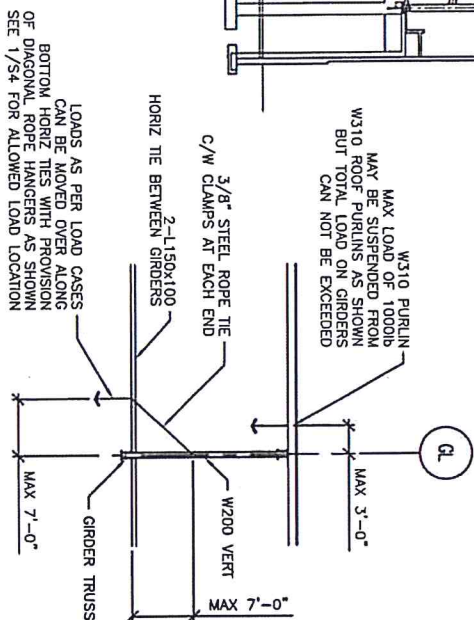
1
 ROOF PLAN
 SCALE
 NTS

BEI ENGINEERING INC.
 CONSULTING ENGINEERS TEL: 229-4237
 CE&S CORRAL BUILDING
 ROOF PLAN
 ALLOWABLE LOADS
 S1
 SEPT 1, 03

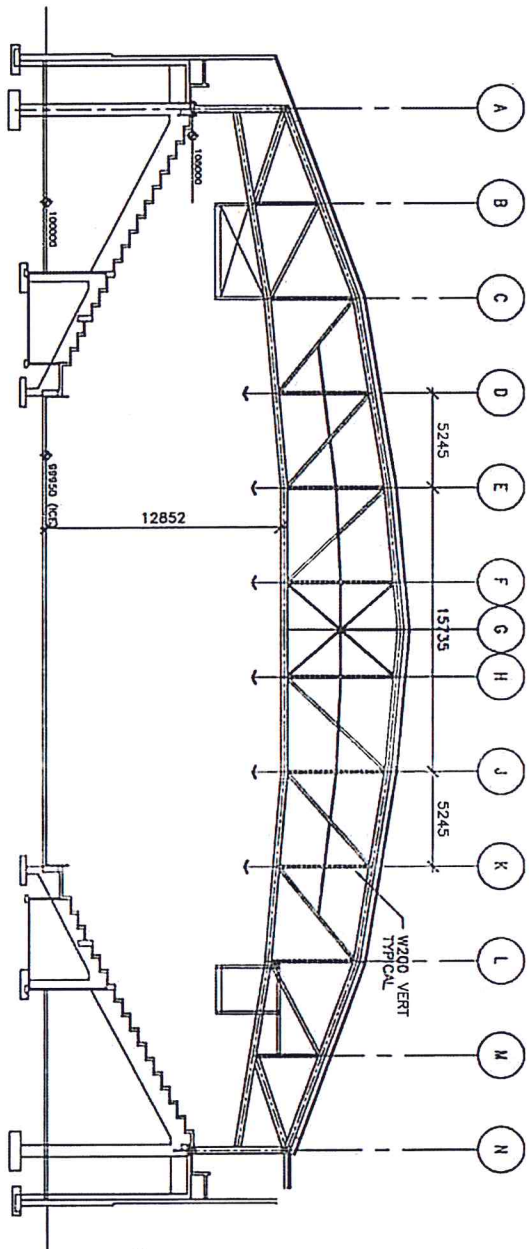


1 ELEVATION
SCALE 1 = 300

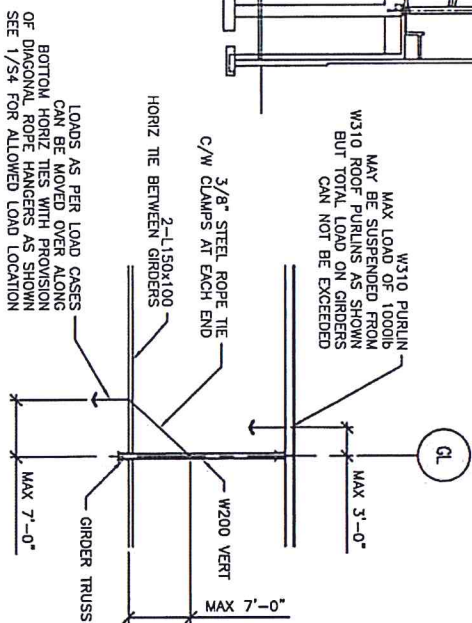
MAXIMUM ALLOWABLE ADDITIONAL LOADS
ON GIRDERS GT2, GT3, GT7 & GT8:
LOAD CASE 1: 4000 lb / GRIDS D, E, J & K
LOADS CAN BE APPLIED SIMULTANEOUSLY
OR
LOAD CASE 2: 4000 lb / GRIDS D & K PLUS 1500 lb / GRIDS E, F, H & J
LOADS CAN BE APPLIED SIMULTANEOUSLY
NO ADDITIONAL LOADS ALLOWED ON GIRDERS GT1 & GT9



2 SECTION
SCALE 1 = 200



1 ELEVATION
SCALE 1 = 300

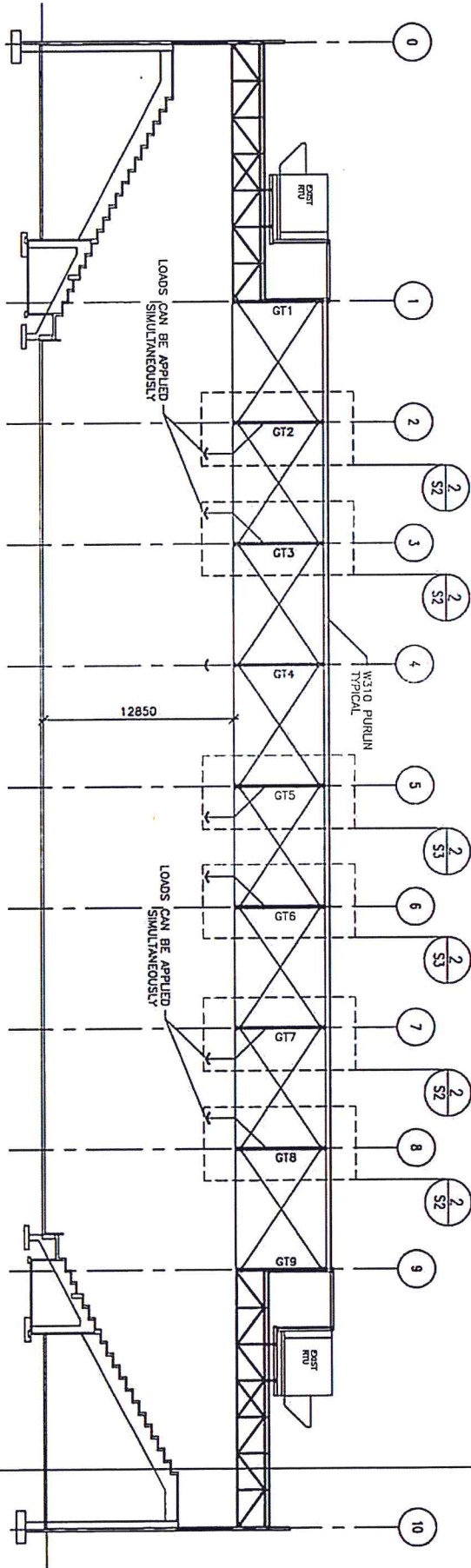


2 SECTION
SCALE 1 = 200

MAXIMUM ALLOWABLE ADDITIONAL LOADS
ON GIRDERS GT4, GT5 & GT6:
LOAD CASE 1: 1000 lb / GRIDS D, E, J & K
LOADS CAN BE APPLIED SIMULTANEOUSLY
OR
LOAD CASE 2: 1000 lb / GRIDS D & K PLUS 500 lb / GRIDS E, F, H & J
LOADS CAN BE APPLIED SIMULTANEOUSLY
NO ADDITIONAL LOADS ALLOWED ON GIRDERS GT1 & GT9

BEI ENGINEERING INC.
CONSULTING ENGINEERS TEL: 229-4237
CE&S CORRAL BUILDING
SECTIONS
ALLOWABLE LOADS

S3
SEPT 1, 05



SECTION 1
SCALE 1 = 300

BEI ENGINEERING INC.
CONSULTING ENGINEERS TEL: 229-4237

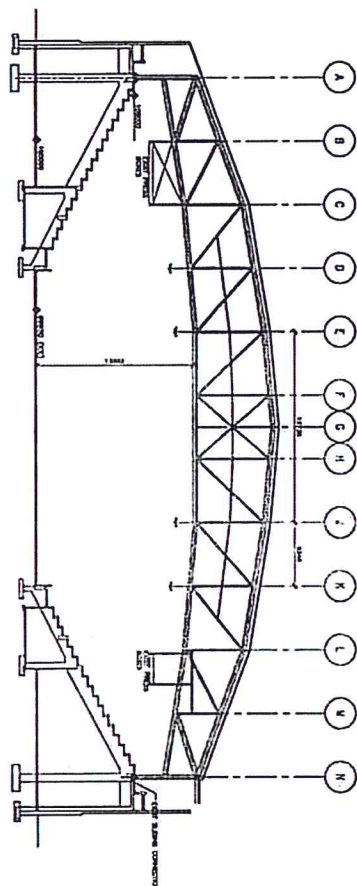
CE&S CORRAL BUILDING
SECTIONS
ALLOWABLE LOADS

S4

SEPT 1, 05

BEI ENGINEERING INC.
 10000 W. 10th Ave., Suite 100
 Denver, CO 80202
 Tel: (303) 755-4377 Fax: (303) 755-4400

- SECTION 1: STRUCTURE, DRAWING TO BE USED IN CONJUNCTION WITH THE RELEVANT ARCHITECTURAL DRAWING. THE STRUCTURE SHALL BE DESIGNED TO BE USED IN CONJUNCTION WITH THE RELEVANT ARCHITECTURAL DRAWING. THE STRUCTURE SHALL BE DESIGNED TO BE USED IN CONJUNCTION WITH THE RELEVANT ARCHITECTURAL DRAWING. THE STRUCTURE SHALL BE DESIGNED TO BE USED IN CONJUNCTION WITH THE RELEVANT ARCHITECTURAL DRAWING.

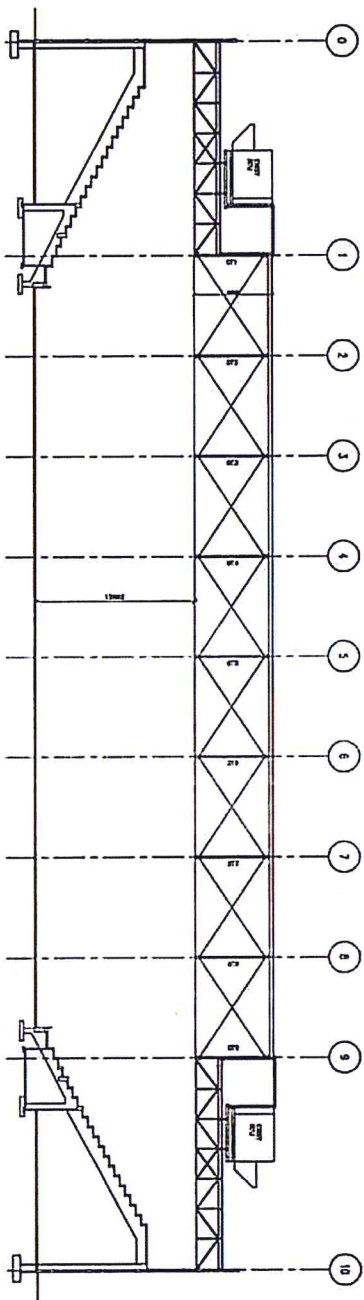


SECTION 1
 SCALE 1/8" = 1'-0"

UNIFORM ALLOWABLE ADDITIONAL LOADS:

TYPE OF LOAD	UNIFORM LOAD (PSF)	POINT LOAD (KIP)
DECK	10	10
ROOF	10	10
WIND	10	10
SEISMIC	10	10
OTHER	10	10

ALL LOADS ARE UNIFORM AND SHALL BE APPLIED TO THE ENTIRE SURFACE OF THE STRUCTURE. THE LOADS SHALL BE APPLIED TO THE ENTIRE SURFACE OF THE STRUCTURE. THE LOADS SHALL BE APPLIED TO THE ENTIRE SURFACE OF THE STRUCTURE. THE LOADS SHALL BE APPLIED TO THE ENTIRE SURFACE OF THE STRUCTURE.



SECTION 2
 SCALE 1/8" = 1'-0"

PROJECT
 STAMPEDE CORRAL

CALCULATED BY: STAMPEDE CORRAL

DATE: 01/14/02

SCALE: AS NOTED

DATE: 01/14/02

SCALE: AS NOTED

DATE: 01/14/02

SCALE: AS NOTED

S1.2

2



BTY Group

BTY is one of Canada's most successful and experienced Quantity Surveying and Cost Management consultancies.

Since 1977, BTY has earned a reputation for providing clients with professional and practical advice of the highest calibre. The diversity of our client base attests to our ability to apply critical analysis and thinking to the task at hand. We have provided support to clients for capital investment in the health, education, research, leisure, retail, residential and commercial sectors

We have provided consulting services for over \$50 billion of construction projects in the last forty years.

For all the services we offer, BTY listens to your current and upcoming needs. We provide innovative alternatives and consistently deliver the required solutions with cost-conscious creativity. Since we serve clients whose needs span the entire life of an asset, from needs assessment through asset delivery and beyond, we believe that BTY integrated approach represents a better way to deliver KNOWLEDGE TO BUILD WITH.

Resources

The current complement of the BTY offices is 100 technical staff and includes Quantity Surveyors, Construction Estimators and Professional Engineers, all of whom have detailed knowledge and understanding of the many factors affecting construction costs. As a full service Quantity Surveying practice, we have the background required to provide a full range of services including capital cost planning, estimating, life cycle costing, risk and sustainable design analysis.

We make extensive use of a variety of automated systems during the performance of our duties. These systems include cost estimating software, word processing, spreadsheet and project scheduling programs that are used for the preparation of cost reports and other documentation. Our quantity take-offs are prepared with the assistance of computer driven digitizers that run in conjunction with our proprietary estimating program.

In addition to the resources based in our Calgary office, we can also draw on the project experience and knowledge of our Canadian offices that are located in Vancouver, Edmonton, Calgary, Saskatoon, St. Catharines, Toronto, Ottawa, Montreal, our American offices located on Scottsdale, Orlando, Seattle, Los Angeles, Atlanta, Denver, Cleveland and our EMEA offices in Ankara, Turkey and Cairo, Egypt.



CANADA

Vancouver

Toronto

Calgary

Edmonton

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Montreal

Ottawa

St. Catharines

UNITED STATES

Scottsdale

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Seattle

Los Angeles

Atlanta

Denver

Cleveland

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BTY.COM

*People to count on.
Knowledge to build with.*



CORRAL CENTRE

Calgary, AB

March 22, 2017

Order of Magnitude Estimate # 2

404 6th Avenue SW
Suite 645
Calgary, AB
T2P 0R9
+T: 403.269.5155

BTY.COM



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Tier 2 Renewal Considerations	1 page
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APPENDIX II : Drawings	8 pages



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1.0 INTRODUCTION

The estimate presented in this report provides an assessment of the direct and indirect construction costs for the Corral Centre located in Calgary, AB.

The estimated costs contained in this report are based on schematic design drawings, schedules and reports prepared by Gibbs Gage Architects and their consulting engineers. The estimate is based on the information listed in section 10 "Documentation". The documents provided are not sufficiently detailed to allow the project to proceed for a fixed-price tender call. The estimate provides a reasonable cost envelope within which the project design can be developed. Further estimates based on more detailed design information may, however, vary from this baseline.

The estimate is for the hard construction cost and the projects "soft" costs. The soft costs on a project typically includes; professional fees/disbursements, planning, administrative, financing costs, project commissioning, development cost levies, permits, testing, field analysis, site services connection fees, project management fee, owner's planning/administration cost, project insurance, furnishings, fittings & equipment, food services equipment, payable GST and soft cost contingency. A general rule of thumb is soft cost are 25% of the hard cost.

Detailed specifications are not completed at the conceptual design stage and therefore, cost assumptions for the anticipated final design products had to be made. As well, final design decisions will be made during the design process and preparation of tender documents. The order of magnitude estimate (Class D) estimate reflects those drawings and information made available at the time the estimate was prepared and may not totally reflect the final tender package.

A complete description of the work, including the associated cost, is summarized under the "Cost Plan" appendix in this report. The purpose of the cost plan is to identify to The City of Calgary, Gibbs gage Architects and their consulting engineers; the components, items, renovated spaces, new construction quantity of materials and methods of construction utilized to produce the order of magnitude estimate (Class D). In simplicity, the cost plan is a large shopping list of construction items, materials, and methods. If items in the order of magnitude estimate are not required or desired, the items may be removed from the estimate/design and the cost will be reduced. If additional items are required or desired, which are currently not included in the estimate, then either additional funds will be required, or savings must be incorporated elsewhere in the design to offset the cost increase.

The estimate is not representative of the low bid that will be received at the time of tendering. An indication of the range of bids expected can only be estimated at the time of the tender based on the final contract documents, specific market conditions at the time of tender, including number of other projects out to tender at the same time, interest in project and availability of specified materials in local market. The current estimate represents a fair and reasonable value for what is currently shown on the conceptual drawings, design reports and those requirements as discussed with Gibbs Gage Architects and their consulting engineers: assuming adequate coverage from both the General Contractors and associated sub

In order to maintain the budget parameters established in this report, BTY strongly recommends that further cost estimates be prepared at major design stage milestones to track and monitor the cost of the proposed design.

Should you have any queries regarding the content of this report, please do not hesitate to contact:

Mark Ravelle, PQS, MRICS | Partner

BTY Group

MarkRavelle@bty.com

Tel: 403.269.5155



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2.0 PROJECT DESCRIPTION

The scope of work, as extracted from Gibbs Gage Architects report, can be summarized as follows:

"The Corral Centre is a 6500 seat ice hockey venue originally built in 1950 and renovated in 1980 as a venue for the Calgary Flames until a new arena, the Saddledome, was built in 1983. The scope of work was to do a non destructive evaluation of the major building components in the building with the expectation of what significant improvements would be required to have the facility ready to host Ice Hockey during the 2026 Olympics.. Specifically we were asked to look at the following:"

- Field of Play –ice plant condition, dasher board condition
- Existing Building Shell – envelop issues and roof condition
- Roof Structure – Ability to support "Jumbotron" score clock and identify the height over the existing ice surface
- Spectator capacity- code requirements with respect to rake, accessibility, upper level seating bowl,
- Spectator Amenities- washroom count and accessible washrooms, as well as the number and type of concession
- Athlete and Support Amenities- location for new change rooms
- Electrical and Lighting- 2000 lux broadcast lighting levels
- Mech/Civil – HVAC upgrades, plumbing loads

A site investigation was held on February 24th, with members of the consultant team and representatives from the Calgary Stampede. Drawings have since been provided by the Stampede and are listed in the Appendix. Beyond the above noted items, we were requested to review the building for potential code non-compliance and other issues that may have cost implications to the renovation to make suitable for the Olympic Games. In most of these conditions the current non-compliance can likely be grandfathered pending the scale and scope of alterations to the building.

Additional consideration for cost implications were requested by the CBEC committee that looked at the following 3 criteria/tiers:

Tier 1: Essential Improvements

"costs associated with creating a legacy for the facility"

Tier 2: Renewal Considerations

"costs associated with facility revitalization for another 20-35 years of use"

Tier 3: Legacy Considerations

"costs associated with enhancing the facility for better or newer experiences/opportunities"

3.0 GROSS FLOOR AREAS

The gross floor area of the project measured in accordance with the guidelines established by the Canadian Institute of Quantity Surveyors is:

Location	Area m ²	Area sf
Corral Centre	11,100 m ²	119,480 sf
Total Gross Floor Area	11,100 m²	119,480 sf



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4.0 DEFINITIONS

The estimate for the project has been prepared and summarized in the following categories. Items A and D to I are considered "soft cost" and are specifically excluded from the current "hard" construction cost. The scope of work covered within each category is as follows:

A. Land Cost:

These costs include the acquisition of the site and associated fees, service obligations and property purchase tax.

B. Construction:

This category encompasses all direct and indirect construction costs including building(s), associated site development work and general contractor's general requirements and fee.

C. Allowances

Allowances for cost increases as the design is developed and/or the work is performed on site.

D. Professional Fees:

Within this section professional fees have been estimated for the primary design team consultants including: the architect, structural, mechanical & electrical engineers, and the cost consultant. Other specialist consultants and an allowance for disbursements are also included. Where available, all consultant fees have been calculated based on the current schedule of recommended charges published by professional associations.

E. Municipal & Connection Fees:

This section includes an estimate for all project related fees and charges required as part of the development by the city and other authorities having jurisdiction. These costs include Development Cost Charges (DCC's), Building Permits, levies and associated legal and survey fees. These costs are based on current city formulas and schedules.

F. Management & Overhead:

The project management fee is charged by a company or individual providing project management services. The Owner's Planning and Administrative cost covers the owner's project-related management costs. Provisions are also included for project insurance, commissioning the facility prior to handover and move-in costs.

G. Project Contingency:

This allowance is provided as an owner's contingency to cover changes to non-construction items.

H. Furnishings, Fittings & Equipment:

The Furnishings, Fittings & Equipment estimate for the project has been compiled using a combination of BTY Group's own historical cost data and information specific to this project. The percentage of construction costs, ranges from 3% to 4% (depending on the building usage)

I. Taxes

The amount is adjusted to reflect rebates available to certain types of project.

J. Escalation

This is an allowance for increases in prices of inputs to the project, occurring after the date of the estimate, on the final cost of the project. This allowance is calculated based on BTY's projected annual escalation rates as stated in this report.



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5.0 CONSTRUCTION COST SUMMARY: LOCATION

The estimated construction and project cost may be summarized as follows:

Description	Tier 1	Tier 2	Tier 3
Base Cost	\$9,356,000	\$11,499,000	\$17,164,000
General Requirements	\$1,404,000	\$1,725,000	\$2,575,000
Net Construction Cost	\$10,760,000	\$13,224,000	\$19,739,000
Design Contingency (15%-20%)	\$2,152,000	\$2,522,000	\$3,499,000
Change Order Allowance (5%)	\$646,000	\$789,000	\$1,164,000
Total Construction Cost	\$13,558,000	\$16,535,000	\$24,402,000
Escalation Allowance (0%)	\$0	\$0	\$0
Total Construction Cost	\$13,558,000	\$16,535,000	\$24,402,000
Soft Cost (24%-25%)	\$3,255,000	\$3,969,000	\$5,936,000
Total Project Cost	\$16,813,000	\$20,504,000	\$30,338,000
Gross Floor Area (m ²)	11,780 m ²	11,780 m ²	11,930 m ²
Constr. Cost/m ² Mar. 2017 \$\$	\$1,151/m ²	\$1,404/m ²	\$2,045/m ²
Constr. Cost/sf Mar. 2017 \$\$	\$107/sf	\$130/sf	\$190/sf
Project Cost/m ² Mar. 2017 \$\$	\$1,427/m ²	\$1,741/m ²	\$2,543/m ²
Project Cost/sf Mar. 2017 \$\$	\$133/sf	\$162/sf	\$236/sf



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6.0 COMPARISON WITH NEW CONSTRUCTION

The estimate cost of the renovation/addition can be compared with the cost of a new facility:

Description	Gross Floor Area	Cost per m ²	Amount\$
1 Corral Centre Renovations & Addition	11,930 m ²	\$2,543/m ²	\$30,338,000
2 New 6,500 seat arena	17,100 m ²	\$4,875/m ²	\$83,000,000

Note: The above estimated costs include general requirements & fees, design/construction contingencies and 'soft' costs.

7.0 SEPARATE PRICES

The following separate price is excluded in the current estimate.

Description	Amount\$
1 Demolish and Replace Entire Seating Bowl	\$14,000,000

Note: The above estimated cost include general requirements & fees, design/construction contingencies and 'soft' costs.

8.0 EXCLUSIONS

The estimate specifically excludes the following:

- Land costs
- Removal of contaminated soil and/or rock excavation (if applicable)
- Removal of hazardous materials (if applicable)
- Video screens & Jumbotron
- Concession/kitchen equipment
- Zamboni
- Unforeseen ground conditions/associated extras, off-site works
- Financing costs
- Legal fees and expenses
- Phasing of the works and accelerated schedule
- Decanting & moving
- Cost escalation past summer of 2017

9.0 TAXES

The estimate excludes payable Goods & Service Tax (H.S.T.)



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10.0 PROJECT SCHEDULE & ESCALATION

No cost escalation allowance has been included in the estimate. BTY strongly recommends that the client establish a separate budget to cover the escalation cost from the date of this estimate to the mid-point of construction for the project. Our current projected escalation rates are shown below.

Current BTY Group Forecast	2017	2018	2019
	1%	1%	3%

11.0 PRICING

The estimate has been priced at current rates taking into account the size, location and nature of the project. The unit rates utilized are considered competitive for a project of this type, bid under a stipulated lump-sum form of tender in an open market, with a minimum of five (5) bids, supported by the requisite number of sub-contractors.

The estimate allows for labour, material, equipment and other input costs at current rates and levels of productivity. It does not take into account extraordinary market conditions, where bidders may be few and may include in their tenders disproportionate contingencies and profit margins.

12.0 RISK MITIGATION

BTY Group recommends that the Owner, Project Manager and Design Team carefully review this document, including exclusions, inclusions and assumptions, contingencies, escalation and mark-ups.

Requests for modifications of any apparent errors or omissions to this document must be made to BTY Group within ten (10) days of receipt of this estimate. Otherwise, it will be understood that the contents have been concurred with and accepted.

It is recommended that BTY Group design and propose a cost management framework for implementation. This framework would require that a series of further estimates be undertaken at key design stage milestones and a final update estimate produced which is representative of the completed tender documents, project delivery model and schedule. The final updated estimate will address changes and additions to the documents, as well as addenda issued during the bidding process. BTY Group is unable to reconcile bid results to any estimate not produced from bid documents including all addenda.

In order to maintain the budget parameters established in this report, BTY strongly recommends that further cost estimates are prepared at major design stage milestones to track and monitor the cost of the proposed design as it evolves. The major milestone estimates are typically carried out at the Program, Schematic Design, Design Development, 50% Working Drawings, 75% Working Drawings and 95% Working Drawings stages.



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13.0 CONTINGENCIES

Design Allowance

A design contingency of Fifteen (15%) to Twenty Percent (20%) has been included in the estimates to cover modifications to the program, drawings and specifications during the design. This allowance should be re-considered as the design proceeds, being ultimately reduced to zero at the tender stage.

Construction Allowance

An allowance of Five Percent (5%) has been included in the estimate for changes occurring during the construction period of the project. This amount may be expended due to site conditions or if there are modifications to the drawings/specifications.

Project Contingency

A soft cost contingency of Three Percent (3%) of the soft costs has been included in the project cost plan to cover changes to non-construction items.

14.0 DOCUMENTATION

The following documentation was used as the basis for preparing this estimate:

Description	Pages	Date
BEI Engineers Inc.		
S1/S2/S3/S4 CE&S Corral Building Structural Drawings	4 pages	1-Sep-05
S1.1/S1.2 Stampede Corral Structural Drawings	2 pages	14-Jan-02
S1.1/S1.2 Corral Building Allowable Loads	2 pages	1-Jun-11
Unknown		
S1 Section	1 page	no date
Corral Bleachers	1 page	no date
Corral Concourse Floor Plan	1 page	no date
Gibbs Gage Architects		
Reid Jones Christoffersen (RJC) - Structure		
Remedy Engineering - Mechanical		
SMP Engineering - Electrical		
ThermoCarb - Refrigeration		
CORRAL CENTRE - FACILITY ASSESSMENT FOR ICE HOCKEY AND SLEDGE HOCKEY - CBEC : MARCH 10TH, 2017 (17013)	24 pages	10-Mar-17



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APPENDIX I : Cost Plans

Tier 1 Essential Improvements

Tier 2 Renewal Considerations

Tier 3 Legacy Considerations



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1.0 QUANTITIES AND UNIT RATES: Tier 1 Essential Improvements

Location / Description	Quantity	Rate	Cost
------------------------	----------	------	------

1.1 FIELD OF PLAY

1.1.1 Rink Slab Replacement

Concrete slab on grade: rink slab - 135mm refrigerated slab	1,750 m ²	\$114 /m ²	\$200,000
Concrete slab on grade: rink slab - 125mm heated slab	1,750 m ²	\$117 /m ²	\$205,000
Selective building demolition: rink slab	1,750 m ²	\$57 /m ²	\$100,000
Concrete slab on grade: rink slab- granular base	1,750 m ²	\$73 /m ²	\$128,000
Gravel excavation: rink slab	1,270 m ³	\$31 /m ³	\$39,000
Weeping tile system	1,750 m ²	\$50 /m ²	\$88,000
Total Rink Slab Replacement	1,750 m²	\$434 /m²	\$760,000

1.1.2 Infill Slab Replacement

Concrete slab on grade: infill slab - 150mm	324 m ²	\$170 /m ²	\$55,000
Slab edge thickening: infill slab	180 lm	\$139 /lm	\$25,000
Strip footings	200 lm	\$175 /lm	\$35,000
Concrete walls: 250mm x 1.8m	360 m ²	\$685 /m ²	\$247,000
Selective building demolition: remove 6' concrete bleachers	324 m ²	\$200 /m ²	\$65,000
Concrete slab on grade: infill slab- granular base	200 m ²	\$88 /m ²	\$18,000
Total Infill Slab Replacement	324 m²	\$1,373 /m²	\$445,000

1.1.3 Rink Accessories : Event Level

Ice rink dasher boards	170 lm	\$1,529 /lm	\$260,000
Hockey rink netting (20' high)	1,000 m ²	\$40 /m ²	\$40,000
Miscellaneous accessories	11,100 m ²	\$9 /m ²	\$100,000
Total Rink Accessories	11,100 m²	\$36 /m²	\$400,000

1.2 BARRIER FREE REQUIREMENTS

1.2.1 Elevator : Event Level

Pit footing	10 m ²	\$840 /m ²	\$8,000
Pit walls	18 m ²	\$650 /m ²	\$12,000
Concrete slab on grade (new opening & make good)	9 m ²	\$400 /m ²	\$4,000
Concrete suspended slab (new opening & structural support)	20 m ²	\$1,000 /m ²	\$20,000
Concrete block shaft wall	148 m ²	\$357 /m ²	\$53,000
Elevator	2 stop	\$50,000 /stop	\$100,000
Mechanical & electrical	50 m ²	\$400 /m ²	\$20,000
Total Elevator	2 stop	\$109K /stop	\$217,000



draft

Corral Centre
Order of Magnitude Estimate # 2
March 22, 2017

1.0 QUANTITIES AND UNIT RATES: Tier 1 Essential Improvements

Location / Description	Quantity	Rate	Cost
1.2.2 Barrier Free Washrooms (7 no)	63 m ²	\$3,800 /m ²	\$239,000
<u>1.3 BLEACHERS</u>			
1.3.1 Replace Wood Bleachers (say 15% of total seats)	975 seats	\$200 /seat	\$200,000
1.3.2 Alterations to Lower Level Bleacher Access	10 loc	\$7,500 /loc	\$75,000
<u>1.4 BROADCAST REQUIREMENTS</u>			
1.4.1 Additional Camera Locations	4 loc	\$15,000 /loc	\$60,000
1.4.2 Cosmetic Improvement to Press Box	110 m ²	\$1,350 /m ²	\$150,000
<u>1.5 SPECTATOR ENHANCEMENTS</u>			
1.5.1 Jumbotron Score Clock Structural Improvements	84 lm	\$2,100 /lm	\$175,000
1.5.2 Jumbotron Score Clock Allowance	1 no		NIC
1.5.3 Cosmetic Improvement to Private Boxes	150 m ²	\$1,350 /m ²	\$200,000
<u>1.6 ATHLETE AMENITIES</u>			
1.6.1 New Lockers Rooms (underneath +15 walkway)	680 m ²	\$4,300 /m ²	\$2,924,000
<u>1.7 ROOFING</u>			
1.7.1 Replace Fascia	260 lm	\$150 /lm	\$39,000
<u>1.8 ICE PLANT</u>			
1.8.1 Refrigeration System & Piping ⁽¹⁾			
Refrigeration system	1,750 m ²	\$171 /m ²	\$300,000
Underslab piping	1,750 m ²	\$171 /m ²	\$300,000
Total Refrigeration System & Piping	1,750 m²	\$343 /m²	\$600,000

⁽¹⁾ Estimate provided by ThermoCarb Ltd.



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1.0 QUANTITIES AND UNIT RATES: Tier 1 Essential Improvements

Location / Description	Quantity	Rate	Cost
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1.9 MECHANICAL

1.9.1 Plumbing & Drainage

Fixtures	150 fixture	\$1,290 /fixture	\$194,000
Domestic Water - hot water heaters	11,100 m ²	\$5 /m ²	\$56,000
Sanitary Waste and Vents	11,100 m ²	\$5 /m ²	\$56,000
Total Plumbing & Drainage	11,100 m²	\$28 /m²	\$306,000

1.9.2 Sprinklers	11,100 m²	\$4 /m²	\$39,000
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1.9.3 HVAC & Controls

HVAC Renovations	11,100 m ²	\$20 /m ²	\$222,000
Controls	11,100 m ²	\$7 /m ²	\$83,000
Total HVAC & Controls	11,100 m²	\$27 /m²	\$305,000

1.10 ELECTRICAL

1.10.1 Distribution

New distribution - event power	11,100 m ²	\$7 /m ²	\$83,000
Temporary generator - tie-in	11,100 m ²	\$3 /m ²	\$28,000
UPS power - allow 100kw	11,100 m ²	\$10 /m ²	\$111,000
Total Electrical Distribution	11,100 m²	\$20 /m²	\$222,000

1.10.2 Lighting and Power

Lighting - replace existing, exits	11,100 m ²	\$90 /m ²	\$999,000
Lighting - sports lighting	11,100 m ²	\$25 /m ²	\$278,000
Power receptacles	11,100 m ²	\$10 /m ²	\$111,000
Mechanical power	11,100 m ²	\$5 /m ²	\$56,000
Total Electrical Distribution	11,100 m²	\$130 /m²	\$1,444,000

1.10.3 Systems

Fire Alarm	11,100 m ²	\$20 /m ²	\$222,000
Communication	11,100 m ²	\$3 /m ²	\$28,000
Access control	11,100 m ²	\$3 /m ²	\$28,000
CCTV/ security	11,100 m ²	\$5 /m ²	\$56,000
Sound - temporary	11,100 m ²	\$20 /m ²	\$222,000
Total Electrical Distribution	11,100 m²	\$50 /m²	\$556,000



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Corral Centre
Order of Magnitude Estimate # 2
March 22, 2017

1.0 QUANTITIES AND UNIT RATES: Tier 1 Essential Improvements

Location / Description	Quantity	Rate	Cost
General Requirements	12.0%		\$1,123,000
Profit	3.0%		\$281,000
Design Contingency	20.0%		\$2,152,000
Construction Contingency	5.0%		\$646,000
Escalation Contingency	0.0%		\$0
Total Estimated Construction Cost	11,780 m²	\$1,151 /m²	\$13,558,000

Soft Costs (24%)

Design and Engineering Fees	12.0%		\$1,627,000
Cost Consultancy/Independent Certifier	0.4%		\$54,000
City Administration/PM Fees	3.0%		\$407,000
Legal Fees	0.5%		\$68,000
Permits, etc.	1.1%		\$149,000
Material Testing (Third Party)	1.0%		\$136,000
Furniture, Fittings & Equipment	3.0%		\$407,000
Soft Cost Contingency	3.0%		\$407,000
Total Estimated Project Cost : Essential Improvements	11,780 m²	\$1,427 /m²	\$16,813,000



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Corral Centre
Order of Magnitude Estimate # 2
March 22, 2017

2.0 QUANTITIES AND UNIT RATES: Tier 2 Renewal Considerations

Location / Description	Quantity	Rate	Cost
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2.1 WASHROOMS

2.1.1 Replace East Washrooms	186 m ²	\$3,100 /m ²	\$577,000
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2.2 ICE RESURFACER ROOM

2.2.1 New Ice Resurfacer Room	40 m ²	\$2,150 /m ²	\$78,000
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2.3 ATHLETE AMENITIES

2.3.1 Rebuilt Existing Locker Rooms to Dressing Rooms	380 m ²	\$2,150 /m ²	\$816,000
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2.3.2 Rebuilt Existing North Locker Rooms	250 m ²	\$2,690 /m ²	\$672,000
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General Requirements	12.0%		\$257,000
Profit	3.0%		\$64,000
Design Contingency	15.0%		\$370,000
Construction Contingency	5.0%		\$143,000
Escalation Contingency	0.0%		\$0

Total Estimated Construction Cost : Tier 2	11,780 m²	\$253 /m²	\$2,977,000
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Soft Costs (24%)

Design and Engineering Fees	12.0%		\$357,000
Cost Consultancy/Independent Certifier	0.4%		\$12,000
City Administration/PM Fees	3.0%		\$89,000
Legal Fees	0.5%		\$15,000
Permits, etc.	1.1%		\$33,000
Material Testing (Third Party)	1.0%		\$30,000
Furniture, Fittings & Equipment	3.0%		\$89,000
Soft Cost Contingency	3.0%		\$89,000

Total Estimated Project Cost : Renewal Considerations	11,780 m²	\$313 /m²	\$3,691,000
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Corral Centre
Order of Magnitude Estimate # 2
March 22, 2017

3.0 QUANTITIES AND UNIT RATES: Tier 3 Legacy Considerations

Location / Description	Quantity	Rate	Cost
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3.1 BLEACHERS

3.1.1 Rework Stairs with Additional Access Points	10 stairs	\$25,000 /stair	\$250,000
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3.2 GREEN ROOMS

3.2.1 Rebuilt Existing Locker Rooms to Green Rooms	380 m ²	\$2,150 /m ²	\$816,000
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3.3 ARRIVAL/GATHERINGS/TICKETING & CONCOURSE

3.3.1 New Pre-Function/Ticketing Entrance	150 m ²	\$3,770 /m ²	\$565,000
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3.3.2 Rebuild Concessions	440 m ²	\$1,720 /m ²	\$756,000
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3.4 EXTERIOR ENVELOPE

3.4.1 Reclad/Insulation to East & West Facades	4,000 m ²	\$750 /m ²	\$3,000,000
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3.5 MECHANICAL

3.5.1 HVAC	11,100 m ²	\$25 /m ²	\$278,000
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General Requirements	12.0%		\$680,000
Profit	3.0%		\$170,000
Design Contingency	15.0%		\$977,000
Construction Contingency	5.0%		\$375,000
Escalation Contingency	0.0%		\$0

Total Estimated Construction Cost : Tier 3	11,930 m²	\$659 /m²	\$7,867,000
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Corral Centre
Order of Magnitude Estimate # 2
March 22, 2017

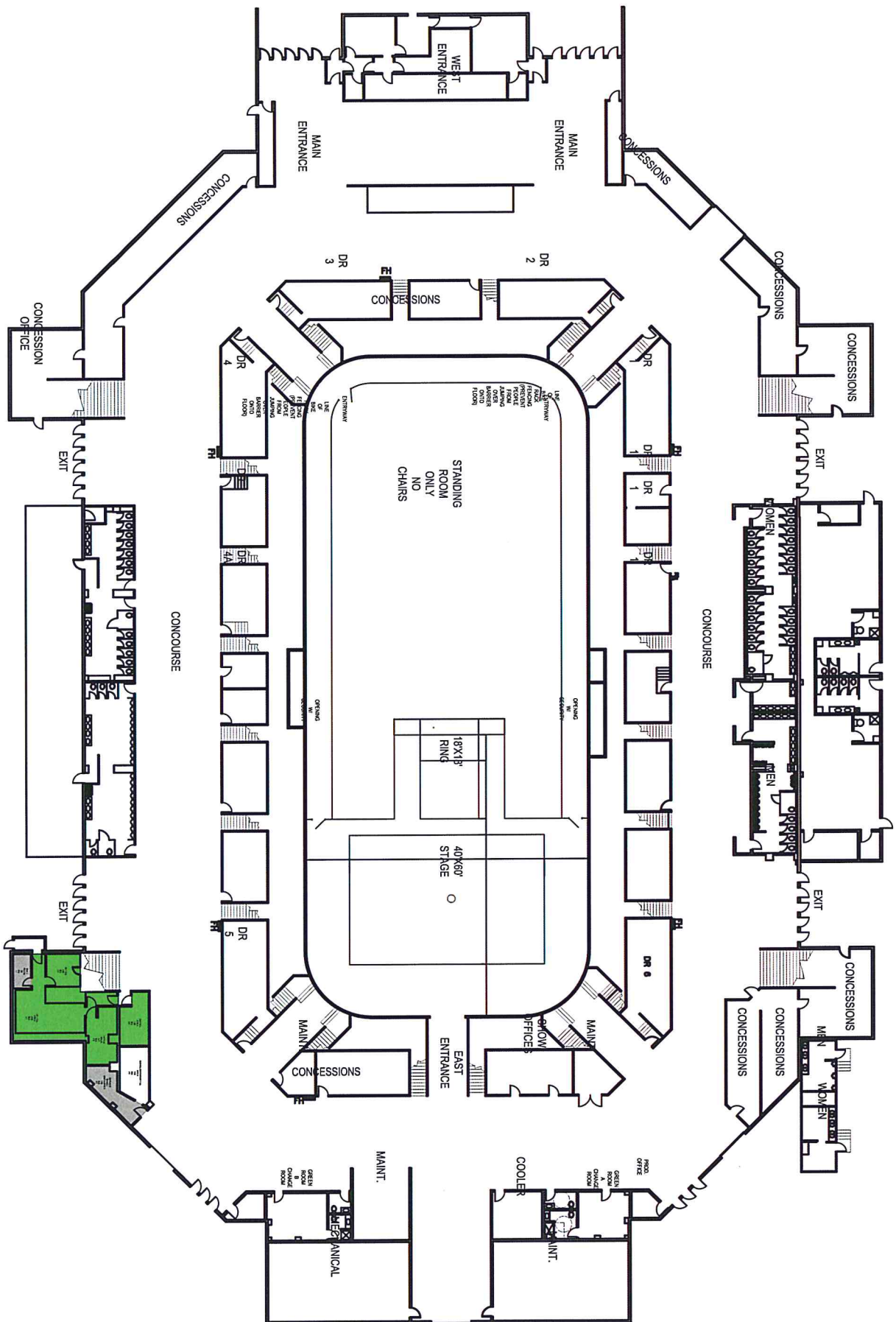
3.0 QUANTITIES AND UNIT RATES: Tier 3 Legacy Considerations

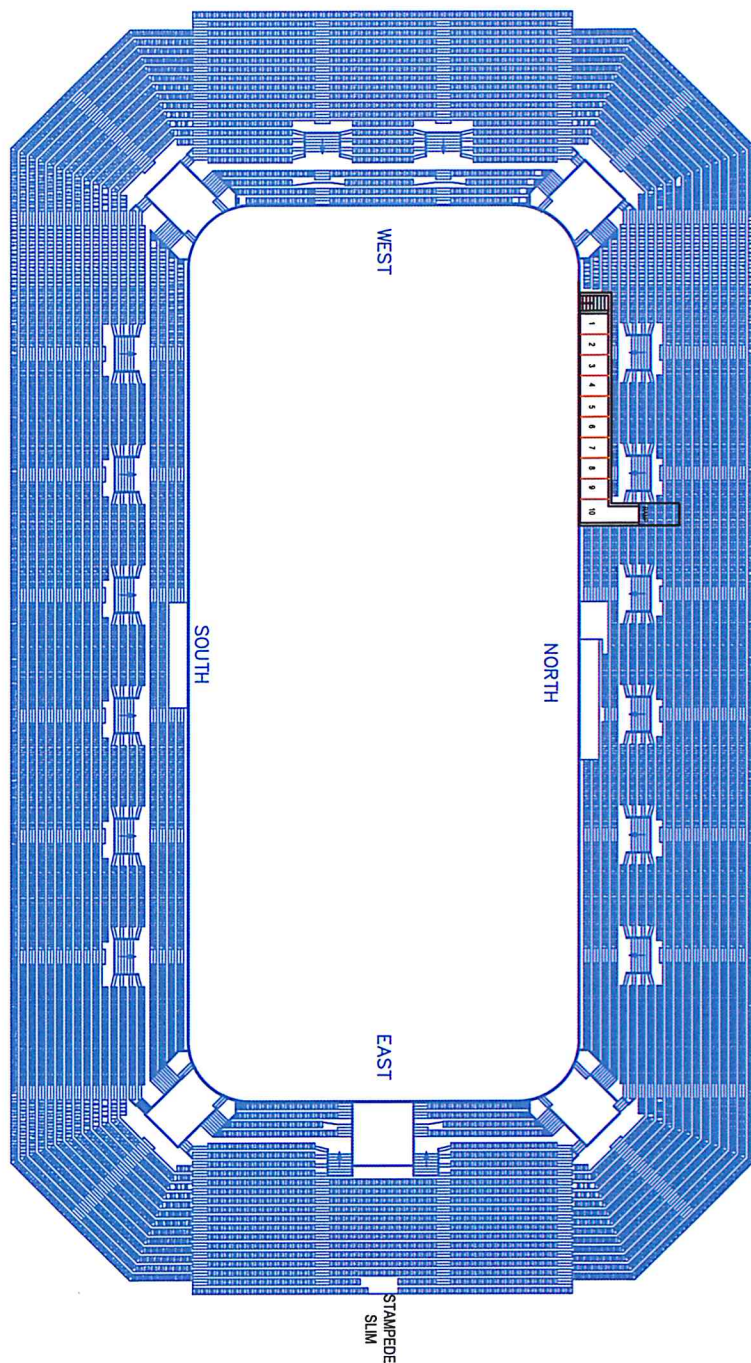
Location / Description	Quantity	Rate	Cost
<u>Soft Costs (25%)</u>			
Design and Engineering Fees	12.0%		\$944,000
Cost Consultancy/Independent Certifier	0.4%		\$31,000
City Administration/PM Fees	3.0%		\$236,000
Legal Fees	0.5%		\$39,000
Permits, etc.	1.1%		\$87,000
Material Testing (Third Party)	1.0%		\$79,000
Furniture, Fittings & Equipment	4.0%		\$315,000
Soft Cost Contingency	3.0%		\$236,000
Total Estimated Project Cost : Tier 3	11,930 m²	\$824 /m²	\$9,834,000

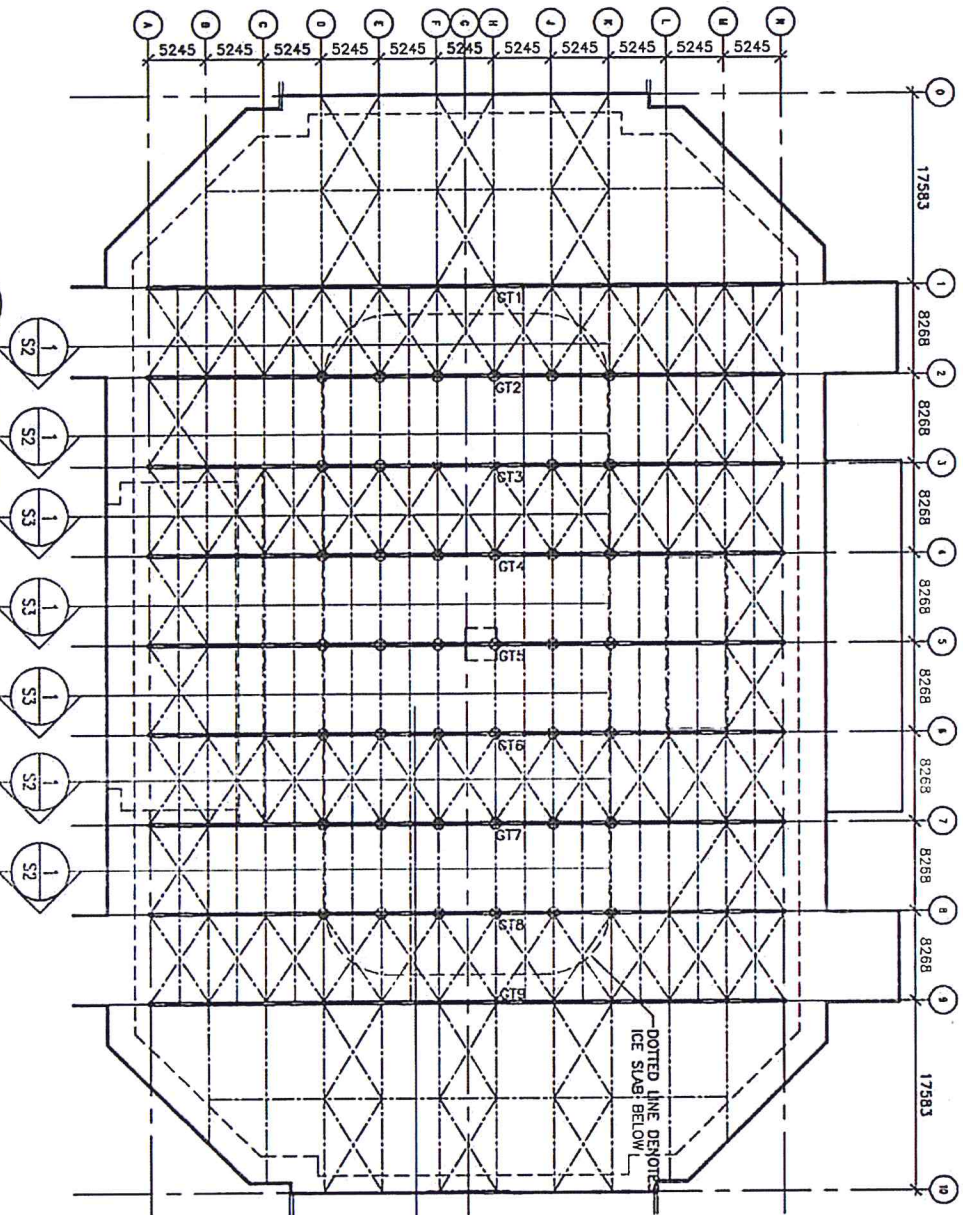


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APPENDIX II : Drawings







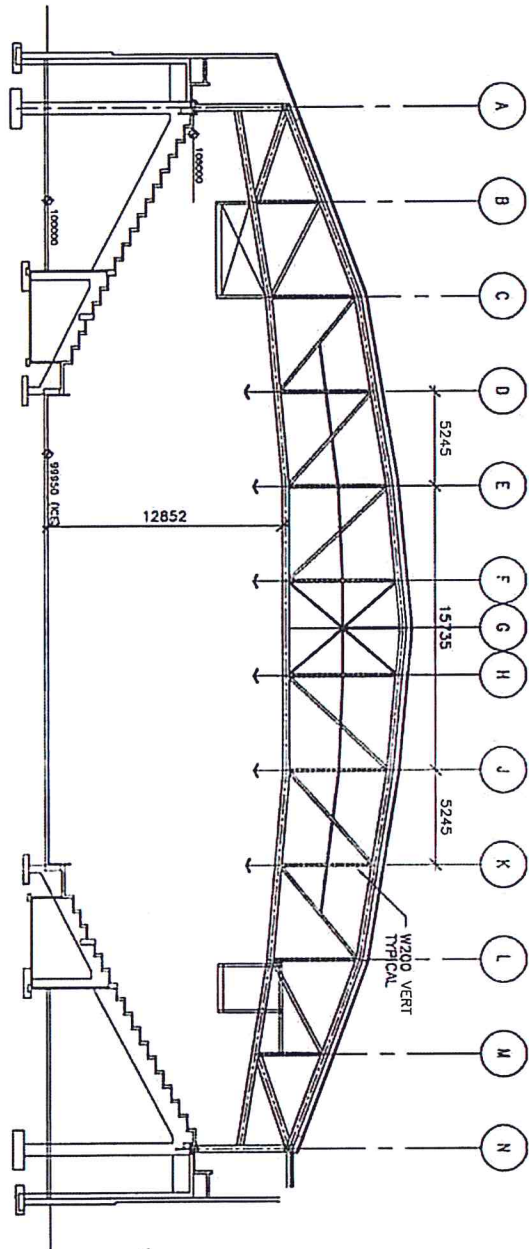
PLACEMENT OF ANY LOAD EXCEEDING THE LOADS SPECIFIED ON DRAWINGS S2 & S3 EXISTING STRUCTURAL MEMBERS WILL REQUIRE STRENGTHENING OF EXISTING STRUCTURAL MEMBERS TO BE SUSPENDED AT SPECIFIED GRIDS ONLY AT BOTTOM CHORD PANEL POINTS

LOADS MAY BE HANGED OFF GIRDER CENTER ALONG BOTTOM ANGLE TIES OR PURLINS AS SHOWN ON 2/S2 & 2/S3

NO ALLOWANCE FOR DYNAMIC EFFECT IS INCLUDED

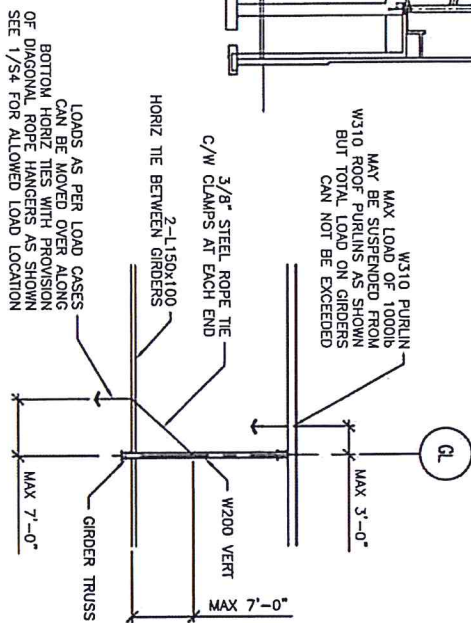
1 ROOF PLAN
SCALE NTS

BEI ENGINEERING INC.	
CONSULTING ENGINEERS TEL. 229-4237	
CE&S CORRAL BUILDING	
ROOF PLAN	
ALLOWABLE LOADS	S1
SEPT 1, 05	



1 ELEVATION
SCALE 1 = 300

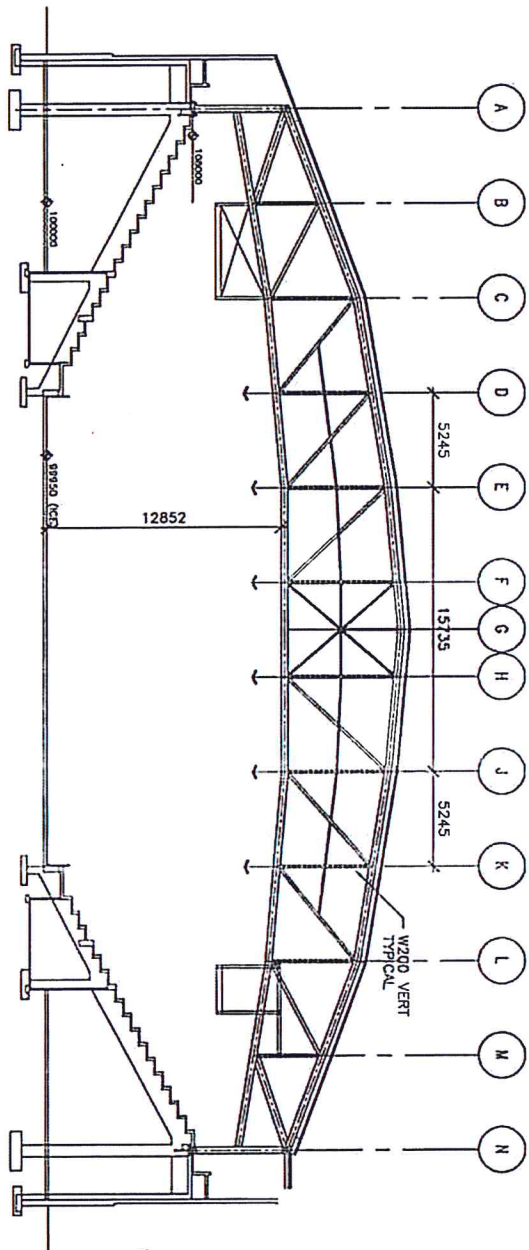
MAXIMUM ALLOWABLE ADDITIONAL LOADS
ON GIRDERS GT2, GT3, GT7 & GT8:
LOAD CASE 1: 4000 lb / GRIDS D, E, J & K
LOADS CAN BE APPLIED SIMULTANEOUSLY
OR
LOAD CASE 2: 4000 lb / GRIDS D & K PLUS 1500 lb / GRIDS E, F, H & J
LOADS CAN BE APPLIED SIMULTANEOUSLY
NO ADDITIONAL LOADS ALLOWED ON GIRDERS GT1 & GT9



2 SECTION
SCALE 1 = 200

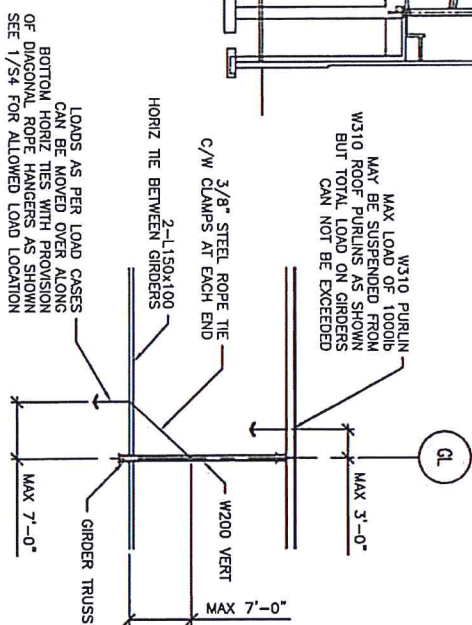
BEI ENGINEERING INC.
CONSULTING ENGINEERS TEL: 229-4237
CE&S CORRAL BUILDING
SECTIONS
ALLOWABLE LOADS S2

SEPT 1, 05



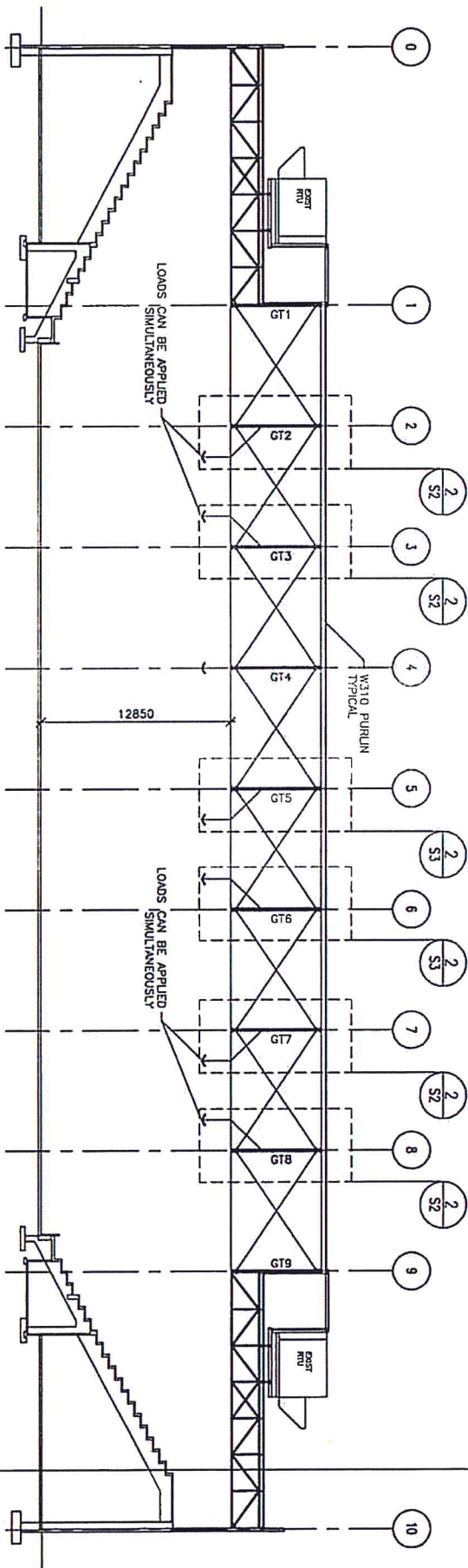
1 ELEVATION
SCALE 1 = 300

MAXIMUM ALLOWABLE ADDITIONAL LOADS
ON GIRDERS GT4, GT5 & GT6:
LOAD CASE 1: 1000 lb / GIRDERS D, E, J & K
LOADS CAN BE APPLIED SIMULTANEOUSLY
OR
LOAD CASE 2: 1000 lb / GIRDERS D & K PLUS 500 lb / GIRDERS E, F, H & J
LOADS CAN BE APPLIED SIMULTANEOUSLY
NO ADDITIONAL LOADS ALLOWED ON GIRDERS GT1 & GT9

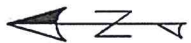


2 SECTION
SCALE 1 = 200

BEI ENGINEERING INC.
CONSULTING ENGINEERS TEL: 229-4237
CE&S CORRAL BUILDING
SECTIONS
ALLOWABLE LOADS
S3
SEPT 1, 05



SECTION 1
SCALE 1" = 300



1 ROOF PLAN
SCALE 1" = 200'

[illegible][illegible]PROJECT
STAMPEDE CORRAL

CALGARY EXHIBITION & STAMPEDE
DRAWING:
ROOF PLAN
ALLOWABLE ADDITIONAL LOADS
SUSPENDED FROM ROOF

DRUGS:	CHLORDA:
WK:	TM
DATE DRT:	PUL RCE:
	0149
DATE DRUGS:	DRUGS RECALD:
JAN 14, 02	AS NOTED

2

[illegible]

Category	Year	Value	Unit
Total	2000	1000	kg
	2001	1000	kg
Cattle	2000	1000	kg
	2001	1000	kg
Buffaloes	2000	1000	kg
	2001	1000	kg
Goats	2000	1000	kg
	2001	1000	kg
Sheep	2000	1000	kg
	2001	1000	kg

[illegible]



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We make extensive use of a variety of automated systems during the performance of our duties. These systems include cost estimating software, word processing, spreadsheet and project scheduling programs that are used for the preparation of cost reports and other documentation. Our quantity take-offs are prepared with the assistance of computer driven digitizers that run in conjunction with our proprietary estimating program.

In addition to the resources based in our Calgary office, we can also draw on the project experience and knowledge of our Canadian offices that are located in Vancouver, Edmonton, Calgary, Saskatoon, St. Catharines, Toronto, Ottawa, Montreal, our American offices located on Scottsdale, Orlando, Seattle, Los Angeles, Atlanta, Denver, Cleveland and our EMEA offices in Ankara, Turkey and Cairo, Egypt.



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UNITED STATES

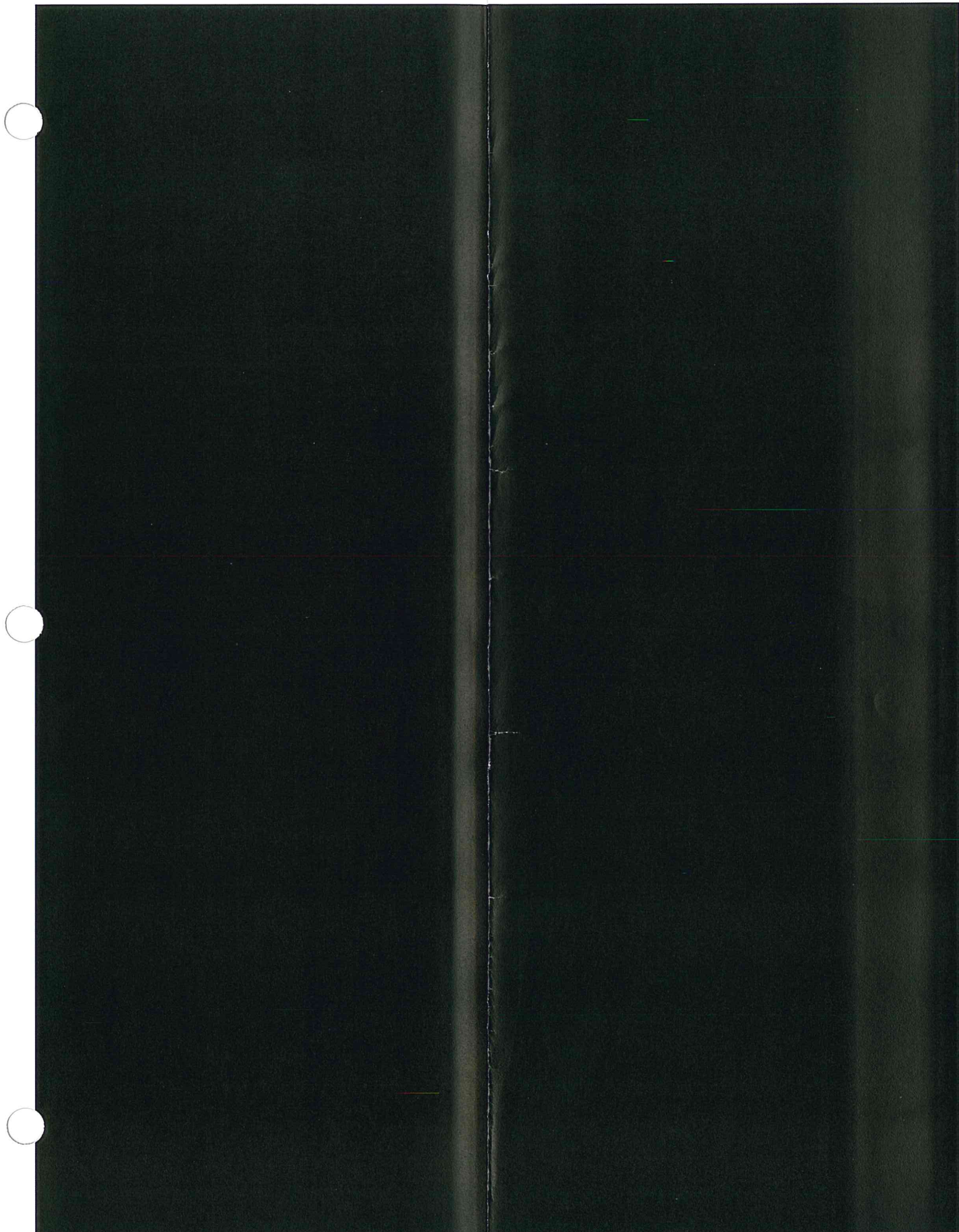
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May 24, 2017

Marco De Iaco
Director, Olympic Bid Exploration
Calgary Bid Exploration Committee
550, 400 3 Ave SW
Calgary, AB T2P 4H2

Dear Mr. De Iaco,

In an effort to clarify the total project value of a stand-alone 5000 seat arena, and with no architectural/structural design, we believe this estimate to be conceptual and equal to a Class D or Level 5 cost estimate.

In addition to our own experience we have resourced input from BBB Architects, Dialog, Gibbs Gage and Entuitive – all of whom have significant Recreation/Arena experience throughout Canada and have participated in many public projects of this scope and magnitude.

The 5000 permanent seat bowl could grow to 5500 – 5700 total seating capacity converted for “concert style” events and hard surface sporting functions. Examples of projects investigated ranged from completed and operating facilities over the last 5 years, to current “in-design/on the books” projects not yet in construction.

Overall, amongst the design teams engaged, there is an agreed on “rule of thumb/conceptual costing” approach for the Total Project Cost – including all hard, soft and FF&E costs.

The range of estimates vary between \$9,500 and \$12,500 per fixed seat, which places the 5000 seat arena at a Total Project Cost of between \$48M and \$63M, estimated in 2017 Canadian dollars.

We are confident in providing this estimate to the Calgary Bid Exploration Committee.

Yours truly,

A handwritten signature in blue ink, appearing to read 'Michael McKenna', with a stylized flourish at the end.

Michael McKenna
Director of Operations

