HCTP Plant Wide Odour Control Assessment

Presentation to Neighbourhood Liaison Committee

May 1, 2006

TORONTO

AWS Engineers & Planners Corp.

PURPOSE OF THE STUDY

- Fully investigate and quantify odourous air emissions due to wastewater treatment operations at HCTP
- Develop conceptual odour mitigation measures

HCTP Plant Wide Odour Control Assessment

- City not under any MOE order to perform odour assessment
- Worst odour sources currently produce noticeable odours in surrounding community at times
- Recommend how to reduce odour impact to acceptable levels
- Ultimate hypothetical objective odour limit of 1 odour unit (ou) at nearest receptor, although limits higher elsewhere
- Conceptual designs implemented as capital projects in future
- Effectiveness in controlling odours, achieved cost-effectively

PROJECT TEAM

AWS Engineers & Planners Corp.

Prime Consultant and Project Team Leader

Odor and Corrosion Technology Consultants, Inc.

Expertise in Odour Control and Corrosion Prevention

Canadian ORTECH Environmental Inc.

Odour emission sampling, measurement and characterization

RWDI West Inc.

Odour modelling

HIGHLAND CREEK TREATMENT PLANT (HCTP)

- Rated at 218,000 m^3/d, with average flow of 165,000 m^3/d
- Serves population of approximately 310,000
- Staged construction:
  - Old Plant (1956)
  - New Plant (1975 and 1980)

HCTP Plant Wide Odour Control Assessment

HCTP Plant Wide Odour Control Assessment

- Located in industrial/residential area (park on south, residential neighbourhoods north and east, industrial park west)
- Limited buffer zone surrounding plant
- Walking paths in park to south less than 5 metres from plant fence line

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PROPOSED PROCESS CHANGES AND IMPROVEMENTS

- Headworks grit collection system reliability improvements
  - Channel covers remain in place longer, reduced odour
- Separate waste activated sludge thickening facilities, removing waste activated sludge from the primary clarifiers
  - Simplify operation of primary clarifiers, reduced odour and corrosion in primary effluent channels
- Improved sludge dewatering equipment
  - Enable lower sludge blanket in primary clarifiers, reduced odour
- Improved incineration:
  - Newer Fluidized Bed Incinerators enable more complete combustion at higher, more uniform temperatures, reduced odour

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STUDY METHODOLOGY

- **Identify** all **odour sources** with potential for off-site odour impacts
- **Sample** all potential **odour sources** to determine individual contribution to off-site impacts (2 rounds)
- **Determine mass odour emission rate** for **each source**, develop **source ranking**
- **Model** impacts of **measured emissions**, calibrated for HCTP and surrounding community
- **Conduct community odour survey** to verify **model results** and **community odour impacts**
- **Develop viable odour control strategies** to **mitigate odours** at each source impacting surrounding community
- **Model mitigated odour options**, including **process optimization impacts**, to **determine** potential odour release **improvements**
- **Determine capital** and **operating costs** for proposed solutions and **recommend cost-effective design**

CURRENTLY INSTALLED ODOUR CONTROL TECHNOLOGIES

- Headworks Building
  - Ozone contactor for screen and grit channel exhaust fans (non-operational)
- Aeration Facilities
  - Wet chemical packed tower scrubbers

ODOUROUS COMPOUNDS IN WASTEWATER

- Ammonia, hydrogen sulphide, sulphur dioxide (inorganic – no carbon)
- Turbulence and hydraulic outfalls generate droplets, increase surface area of liquid, drive out more odourous compounds as free gases

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- Technologies evaluated aimed at capture and treatment of odour after release as vapour or gas (most applicable to range of odour compounds and concentrations at HCTP):
  - Activated carbon
  - Biofilters
  - Bioscrubbers
  - Wet packed tower scrubbers

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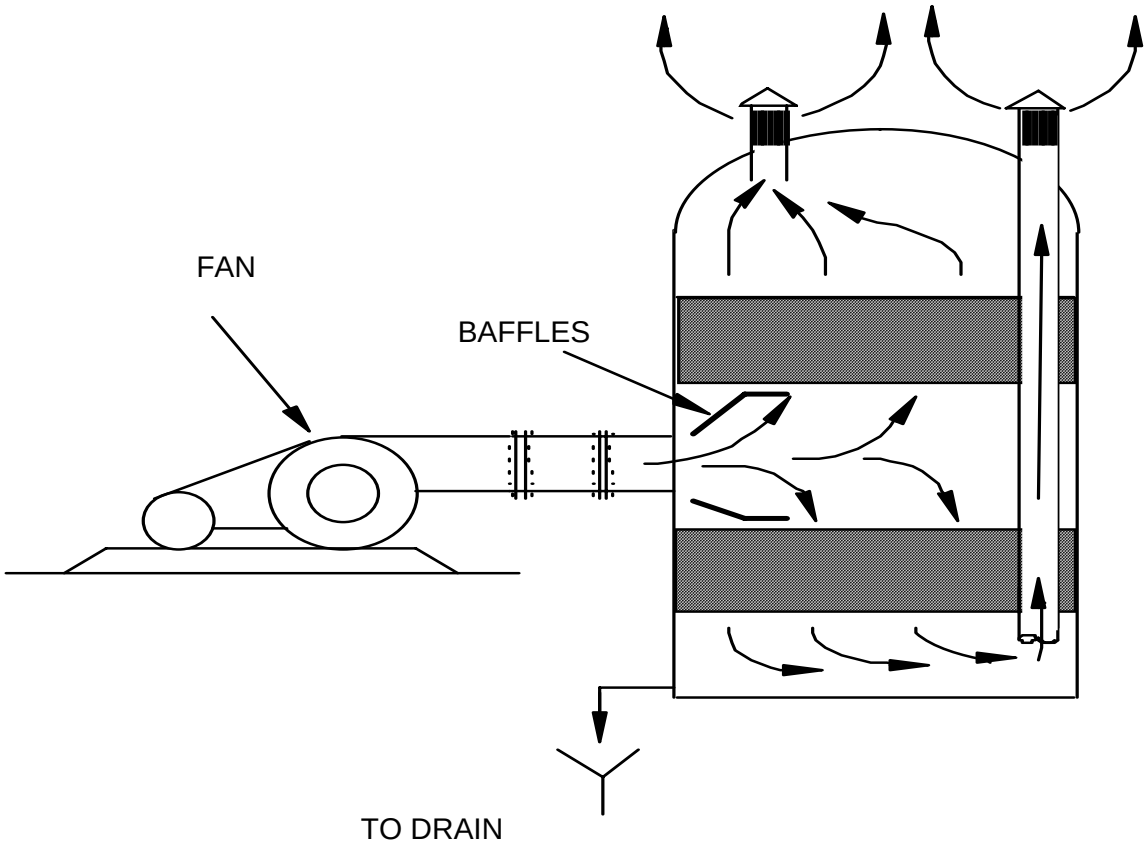

SINGLE STAGE, DUAL-BED CARBON ADSORBER SYSTEM

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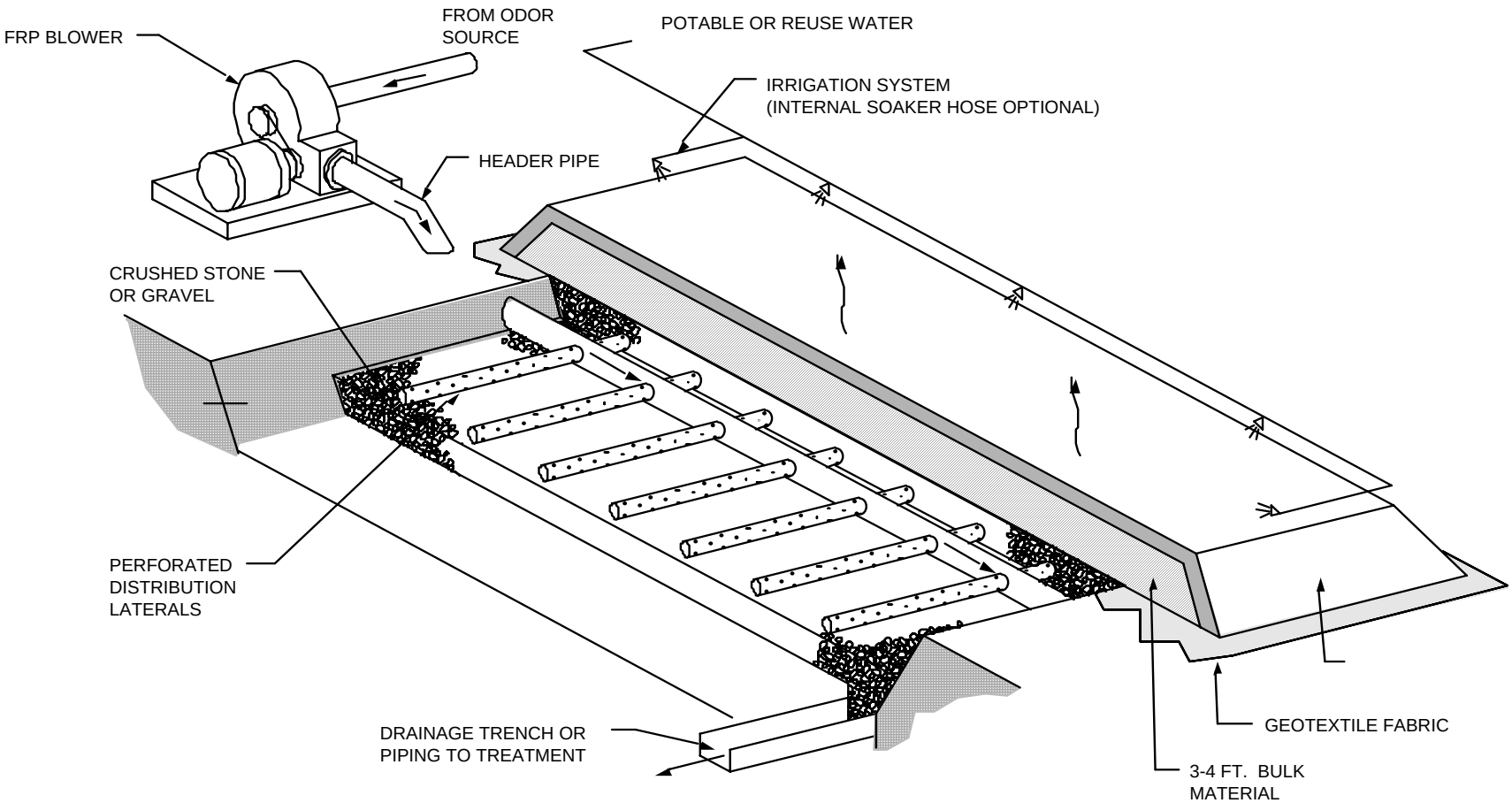

TYPICAL IN-GROUND BIOFILTER

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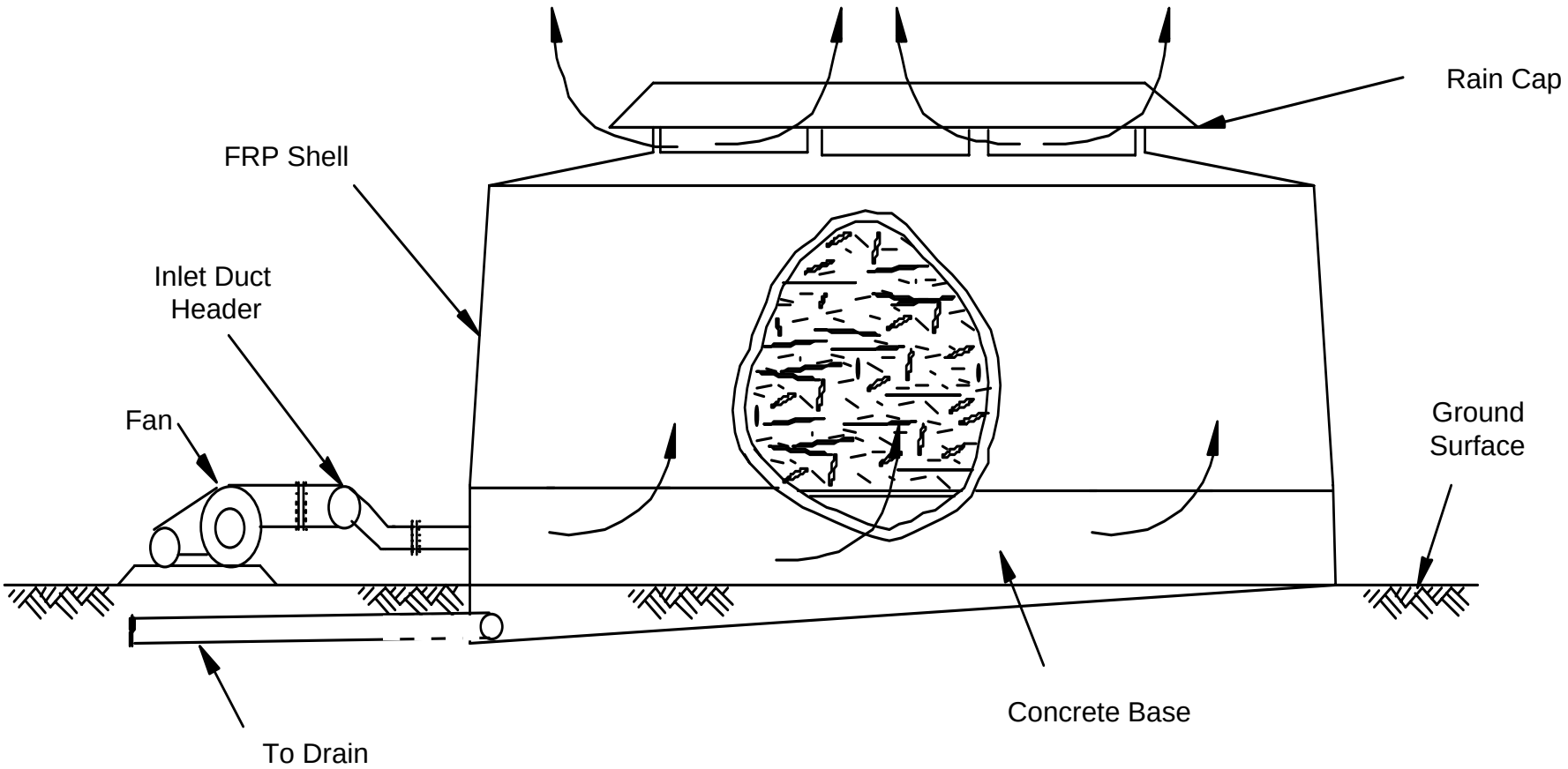

TYPICAL PACKAGED BIOFILTER

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IN-GROUND BIOFILTER

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PACKAGE BIOFILTER SYSTEM

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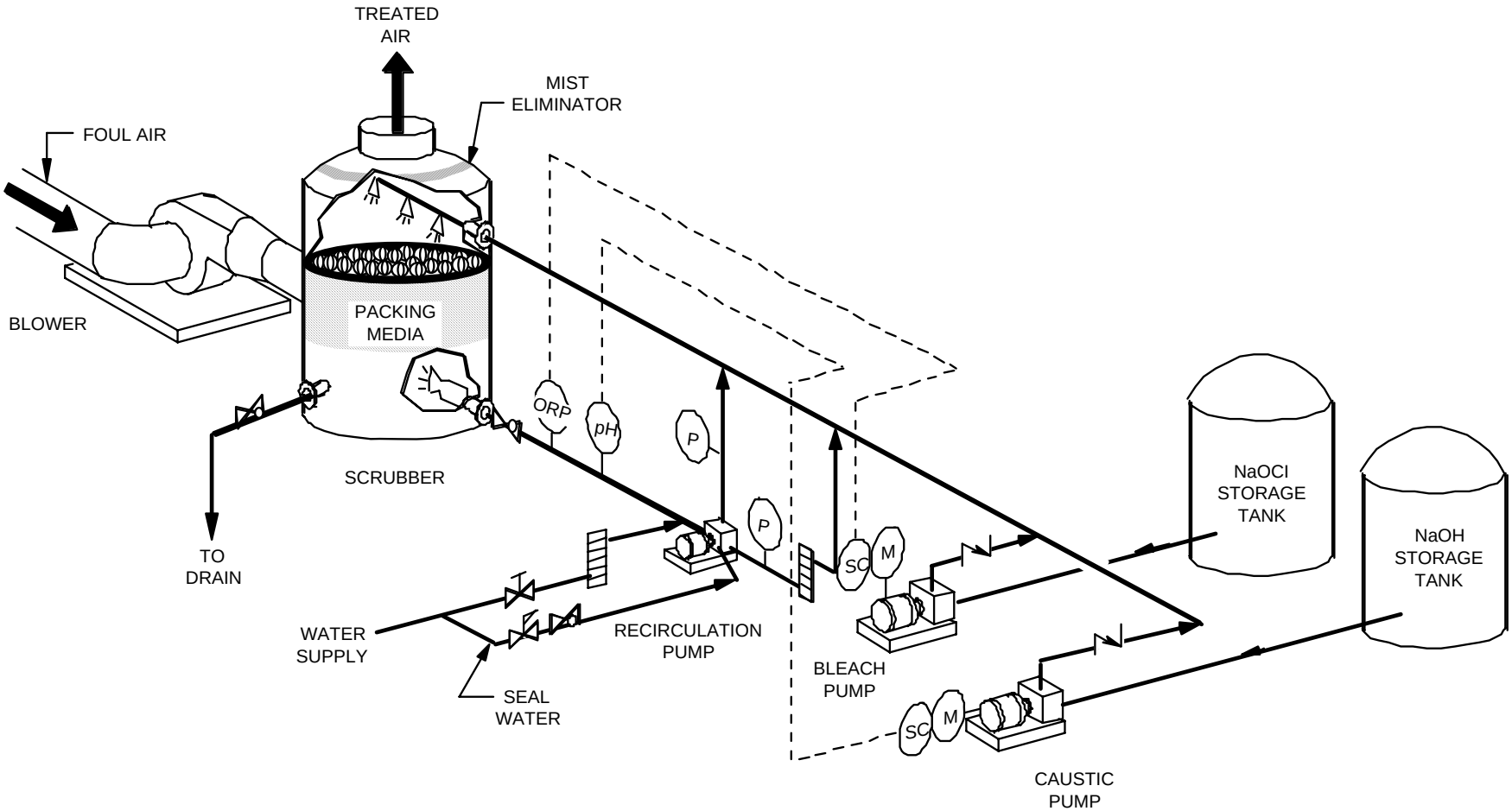

TYPICAL SINGLE-STAGE PACKED BED SCRUBBER SYSTEM

ODOUR TECHNOLOGY SUMMARY

- Bioscrubbers not considered most appropriate for HCTP because organic odour compounds constitute large percentage of airstream and would be largely untreated
- Wet packed tower scrubbers most maintenance intensive, use very large amounts of chemical, and require that sodium hydroxide and sodium hypochlorite stored on-site; also have been historically ineffective at HCTP
- Carbon adsorbers and biofilters considered suitable technologies to treat odourous air streams at HCTP
- Carbon adsorbers preferred technology where airstream generally dry with low odour concentrations (e.g., headworks room air)
- Biofilters preferred technology for airstreams with elevated humidity (e.g., headworks grit channels), as well as high and sustained hydrogen sulphide concentrations and/or volatile organic compounds, providing long-term reliability and treatment efficiency

PHASE I ODOUR CONTROLS

- Highest odour sources
- Combination of process optimization recommendations to reduce odour and need for new odour control systems
- Facilities with lowest potential to be substantially modified by planned capital improvement projects
- Headworks Facility, Primary Clarifiers, Aeration Tanks currently comprise approximately 90% of total HCTP odour emission

Headworks Facility

- Decommission ozone system & selected fans
- Retrofit grit channel system/keep covers in place
- Replace existing operating space exhaust fans
- Replace residual container/covered unit
- Improved housekeeping & SOP (doors closed)
- Exhaust collected air to new biofilter

Primary Clarifiers

- Operate to maintain thinner sludge blanket
- Reroute WTP discharge downstream
- Cover overflow weir sections
- Install concrete corrosion protection
- Install scum collection area covers
- Exhaust air to new biofilter
- Install corrosion protection

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Aeration Tanks

- Decommission existing ozone and wet packed tower odour control systems
- Exhaust air to new biofilter

Incinerator

- Decommission existing exhaust fans
- Install new fans and discharge to new stack

LEGEND:

- Complaint Receptors
- Community Odour Survey Receptors

Maximum 10-Minute OU Concentrations
2km from HCTP
Source Group: ALL-Round 1

True North

Highland Creek Odour Study - Toronto, Ontario

Project #04-1490

Drawn by: KAR	Figure: 3	RWDI
Approx. Scale:	1:20000	
Date Revised:	Jan. 14, 2005	

Figure 7-8
Phase II Modelling Results

LEGEND:
- Complaint Receptors
- Community Odour Survey Receptors

Maximum 10-Minute OU Concentrations
6km from HCTP
Source Group: ALL-Round C

Highland Creek Odour Study - Toronto, Ontario

True North

Drawn by: KAR | Figure: 8
Approx. Scale: 1:45000
Project #04-1490 | Date Revised: Apr. 21, 2005

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ODOUR REDUCTION IMPACT

- Suggested Phase I odour control measures modelled using CALPUFF model developed for background conditions
- Results show significant reduction of odours within community
  - 89% reduction in number of exceedences greater than 1 odour unit
  - 96% reduction in number of exceedences greater than 5 odour units
  - peak 10 minute odour threshold dropped from 499 odour units to 16 odour units
- Phase I modelling assumed that biofilters would be an odour source, with odour detection threshold at 350 odour units
- As this was considered without odour character, biofilters and secondary clarifiers ended up being most significant remaining odour sources

PHASE II ODOUR CONTROLS

- Remaining odour sources and contingency measures from Phase I in attempt to achieve 1 odour unit at nearest receptor
- Remaining odour sources still causing off-site odour impacts generally large area sources with low detection thresholds (i.e., ash lagoons, primary clarifier settling zones)
- Other sources: new biofilters, general room exhausts from Headworks Facility
- Assumed that all new dispersion stacks 65 m tall (maximum height considered by MOE)

Headworks Facility

- Decommission general exhaust fans
- Exhaust fans to new dual media carbon adsorber
- Cover existing biofilter and convey to new stack

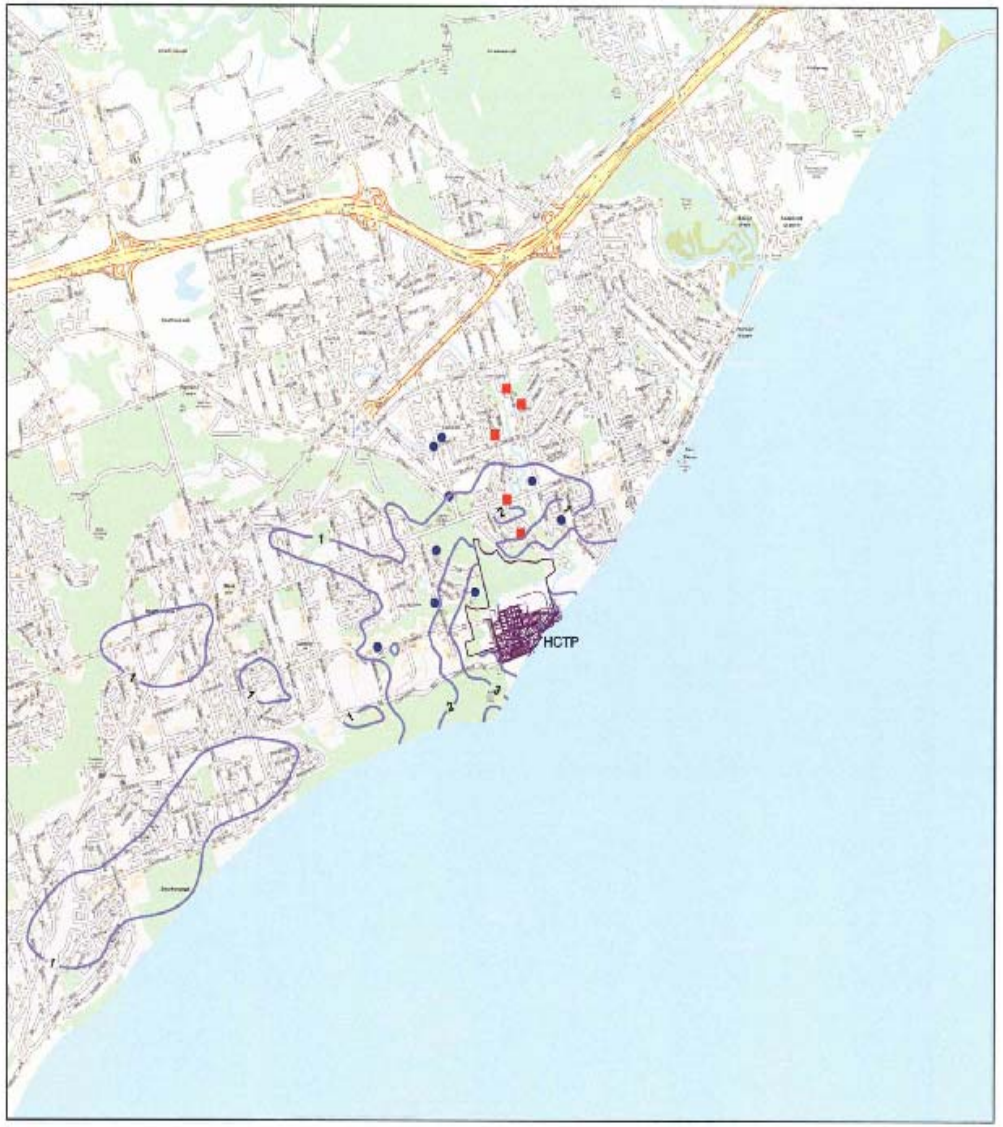
Primary Clarifiers

- Retrofit to chain-and-flight collector mechanisms
- Install corrosion resistant low-profile covers
- Exhaust air to biofilter
- Expand biofilter
- Cover expanded biofilter
- Install new dispersion fans to new stack

Incinerator

- Cover existing ash lagoons with low profile removable covers
- Exhaust air from below covers to new stack

Figure 7-8
Phase II Modelling Results



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CONTINGENCY MEASURES

- Project Team experience is that well operating biofilters do not cause off-site odour complaints
- If biofilter is found to contribute to off-site odours after Phase I improvements have been incorporated, then unit would be retrofitted with perimeter concrete footings and removable flat aluminum cover, new biofilter exhaust dispersion fans installed, and exhaust routed to new 2300 mm diameter, 65 metre tall dispersion stack

ODOUR REDUCTION IMPACT

- Suggested Phase II odour control measures modelled using CALPUFF model developed for background conditions
- Results show reduction of odours within community
  - 98% reduction in number of exceedences greater than 1 odour unit
  - Objective of 1 odour unit not achieved, despite extreme measures to cover, treat and disperse remaining odour emissions

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SUMMARY

- Several capital projects ongoing at HCTP to increase treatment efficiency
- “Facility Forecast” and “Biosolids and Residuals Master Plan” being prepared, and could substantially alter some of the most significant odour sources at HCTP
- Odour control systems are currently used at HCTP, but are either old or misapplied treatment technologies for particular source and type of odour
- Odour dispersion modelling of existing conditions indicated fairly significant off-site odour impact in community, with 9,595 exceedences of 1 odour unit and 3,634 exceedences of 5 odour units per year
- Maximum predicted existing condition off-site odour impact was 499 odour units at the trail receptor on the south plant boundary
- Odour control measures, including optimization of existing wastewater treatment systems and new odour control systems, are required in order to reduce off-site impact substantially

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- Two phased approach is suggested in order to contain and treat odours generated at HCTP:
  - Phase I – install some odour control systems for the Headworks, Primary Clarifiers, Aeration Tanks, and Incinerator Complex exhaust
  - Phase II – additional measures considered after Phase I constructed and operational, and further monitoring performed to assess level of odour reduction achieved

PHASE I

- Mixture of wastewater process improvement recommendations and new facilities to mitigate odours from highest odour emitting sources at HCTP
- Suggested Phase I improvements would achieve 90% reduction in off-site odour exceedences at 11 sensitive receptors
- Estimated capital cost: $9.54 million (including 30% contingency, but excluding taxes) plus 15% for design, contract administration and site inspection); estimated total cost: $11.74 million

PHASE II

- Suggested Phase II improvements focus on remaining odour sources at HCTP and contingency measures, after Phase I improvements implemented
- Phase II odour control technologies would be considered once impact of Phase I improvements quantified, and recommendations and implementation of “Facility Forecast” and “Biosolids and Residuals Master Plan” have been realized
- Primary clarifiers will have been operated with lower sludge blanket depths once processing constrictions corrected
- Suggested Phase II improvements would virtually achieve goal of 1 odour unit at 11 sensitive receptors, but only if secondary clarifiers are assumed not to be an offensive odour source

PHASE II (Cont'd)

Estimated capital cost: $18.75 million (including 30% contingency, but excluding taxes) plus 15% for design, contract administration and site inspection); estimated total cost: $23.07 million

Questions?

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AERATED GRIT CHANNEL COVERS