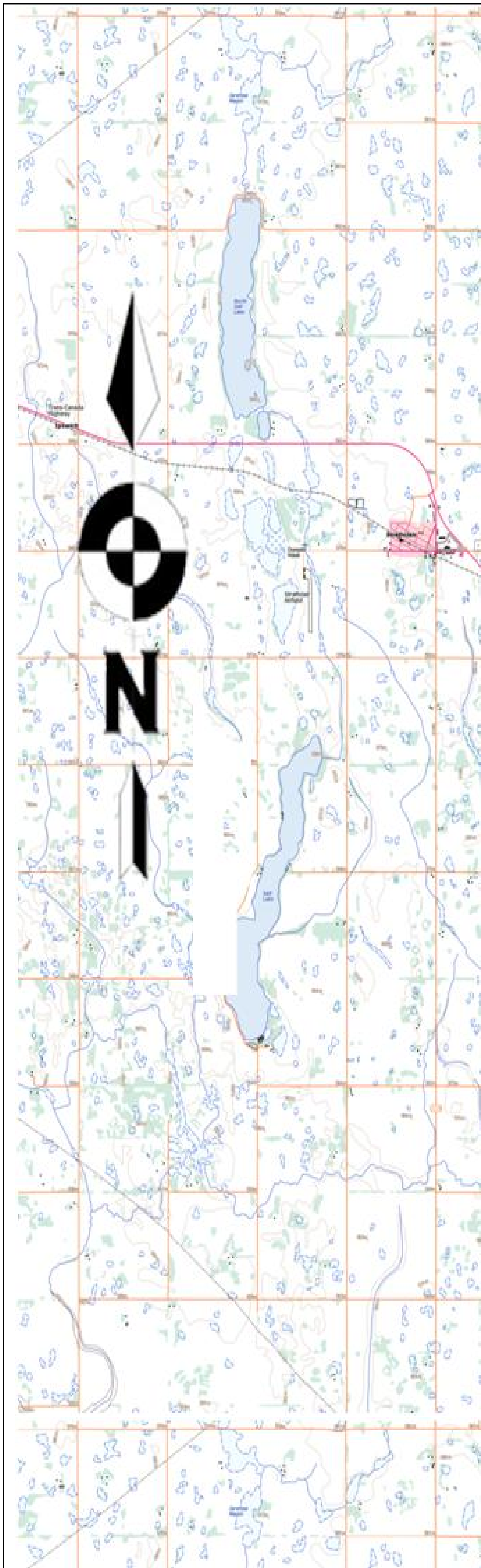


RM of Strathclair
Salt Lake & Oak River Watershed

Hydrological Assessment for Flood Control Planning & Environmental Impact Assessment

From Field Work Data 2010-11

Project and Impact Studies on:

North Salt Lake
Center Salt Lake
South Salt Lake
Oak River Watershed
Surrounding Lands

Bob Sheedy

This Report contains:

Part 1 - Hydrological Assessment for Flood Control Planning

Part 2 - Environmental Impact Assessment

Part 3 - Water Quality

Part 4 - Water Sample Analysis

Part 1 - Hydrological Impact Assessment - Table of Contents

Part 1 - Index of Figures

Location

- The area effected by drainage comprises an rectangle extending from the NW corner at N 50 28.997 W100 27.700 to the SE Corner at N50 .178 W100 25.400
- The primary area of the Oak River watershed affected lies within a rectangle with the NW corner at N50 18.629 W 100 28.848 and the SE extent at N50 18.629 W100 26.729
- The Salt Lakes (3) lie between a series of north south ridges extending some 3.8 kilometers miles north of Highway 16 (North Salt Lake) and 9.3 kilometers south of highway 16 to tip of South Salt Lake, just west of the village of Strathclair, Manitoba.
- Highway and CPR railway intersect the north end of Central Salt Lake.
- A rolling topographical feature along the east side of the lake system isolates possible drainages and leaves the two northernmost lakes without an outlet.
- The terrain consists mainly of agricultural fields with many prairie pothole sloughs scattered throughout. Tree cover consists of less than 10%.

Part 1 - Hydrological Impact Assessment

Figure 1 - Topographical Google Overview of Effected Area

Overview

In drier periods Center Salt Lake was a salt flat for most recent historical decades, with any entry waters evaporating over varying time periods. A road even crossed it from the old landfill area to a western road allowance, now flooded or fallen into disuse.

The history of manmade intervention in the hydrology of the Salt Lakes and associated drainage patterns in the Rural Municipality of Strathclair encompassed many factors over lengthy periods of time but greatest impacts began circa 2005. North and Central salt lakes have had little consideration in watershed management -- planning and policies in the past -- by railway improvements and maintenance and/or highway redirection and improvements.

Major problems in the area culminate in the overflow of North Salt Lake into Center Salt Lake which results in flooding of agricultural land. During certain periods of heavy rainfall and/or run-off, the village of Strathclair is threatened by flooding. The roadbeds of Highway 16 and the CPR are also threatened or nearly so as in 2011. Part of the town's run-off water passes near or through the town of Strathclair and then directly into North Salt Lake, even though planners from various infrastructural projects were aware that the lakes have no defined outlet.

Such oversights taken into consideration, the largest factor influencing current conditions is an upsurge in moist climatic conditions over the past decade.

Aforementioned changes in land use and infrastructure projects have had profound impacts. The drainage problem was made even more critical when the CPR did an upgrade on their road bed and removed an old wooden culvert that diverted part of the runoff into a more eastern reach of the Oak River System. The RM of Strathclair claims that the culvert is still included in the CPR Railway plans but doesn't exist in reality. The Eastern water flows through the town of Strathclair and then around the town site to the south where it flows along the south side of Road 95N crosses roadway 128W and then is diverted southward along a natural watercourse that flows ultimately into South Salt lake. During a recent improvement of Highway 16, more water was diverted that has to pass into the salt lake system or find its way through other watershed locations to end in the Oak River.

All of these factors have to be addressed at some future day (Phase 2 and 3) since the Salt Lakes cannot handle such volumes through evaporation. For Center Salt Lake, the only means available other than emergency releases under an Emergency Measure Order is evaporation. Emergency Measures Orders usually are difficult to control and can be disruptive for both for infrastructure and agriculture.

As of the year 2010 the attitude of most involved is that once the water passes where it is an immediate problem for any single entity or enterprise, it now becomes someone else's worry.

Impact of Changing Agricultural Methods and Practices

In recent years, agricultural practices has seen major changes in the way land use and water issues are viewed. As the rural population ages, young people tend to leave farming to a few who remain to accumulate more and more land. To manage the land, larger and larger equipment is required to farm thousands of acres, requiring seeding during a narrow period between the time when land is dry enough to plant and the expiry date of crop insurance. The window is a time of extreme activity with large tractors with multi-tired axles pulling cultivators, air seeders and fertilizing equipment in a broad, long train extending many meters further than in years past. Modern farming practices are impeded when working around potholed sloughs, often having to avoid double seeding or double fertilization. The tendency is to drain sloughs with shallow ditches and use the earth removed to fill in the same minor wetland or one adjacent. The practice ensures rapid runoff and earlier planting times. It also allows fast and uniform planting without having to navigate around the wetland in future planting or harvest. Consequently almost every large farm complex has a backhoe and an scraper as part of its field equipment.

The rapid run-off ends in the roadside sloughs or other prepared water ways to find its way into drainage systems across the prairies. During spring run-off or devastating rain events the practice causes problems for others who occupy land downstream. In the case of the Strathclair region, all water that doesn't evaporate has to enter the Oak River system and pass into the Assiniboine River to arrive at the Forks, in Winnipeg, to further threaten the city or pass through the Portage diversion to raise the level of Lake Manitoba. Other communities located downstream from Winnipeg, such as Selkirk and Lockport are affected. Lake Manitoba levels were strongly affected during 2011 from similar drainages throughout the prairies. Farmers interviewed during the 2010-11 field period agreed that the practice is detrimental to watershed management but would like their neighbors to be the ones to refrain from such drainage practices. Their own equipment is much too large to negotiate around potholes and sloughs. They in turn felt that they have to simply cultivate any historical waterways that occupy any given field. The practice impedes water flow in such historical channels.

Figure 2 - Modern Equipment for the Modern Farm

Nip Creek

In the Rural Municipality of Strathclair a classic example of such a drainage complex is Nip Creek which flows into Jeramas Marsh and then south into the Salt Lake(s) complex. There is no outlet beyond Center Salt Lake, other than the evaporation which occurred in the past – but in drier decades.

As anyone with access to Google earth can observe, the Nip Creek watershed has developed into such a complex structure that, in itself, has been become an impediment to rapid runoff. Ultimately, all such waters must either evaporate or end up in North Salt Lake -- which overflows into Center Salt Lake, where it has flooded agricultural land.

From there emergency releases made with straight-sided trenches do not allow for regulated flows.

In 2011 Center Salt Lake breached Road94N (Baker's Road) and flowed in an uncontrolled manner for some weeks.

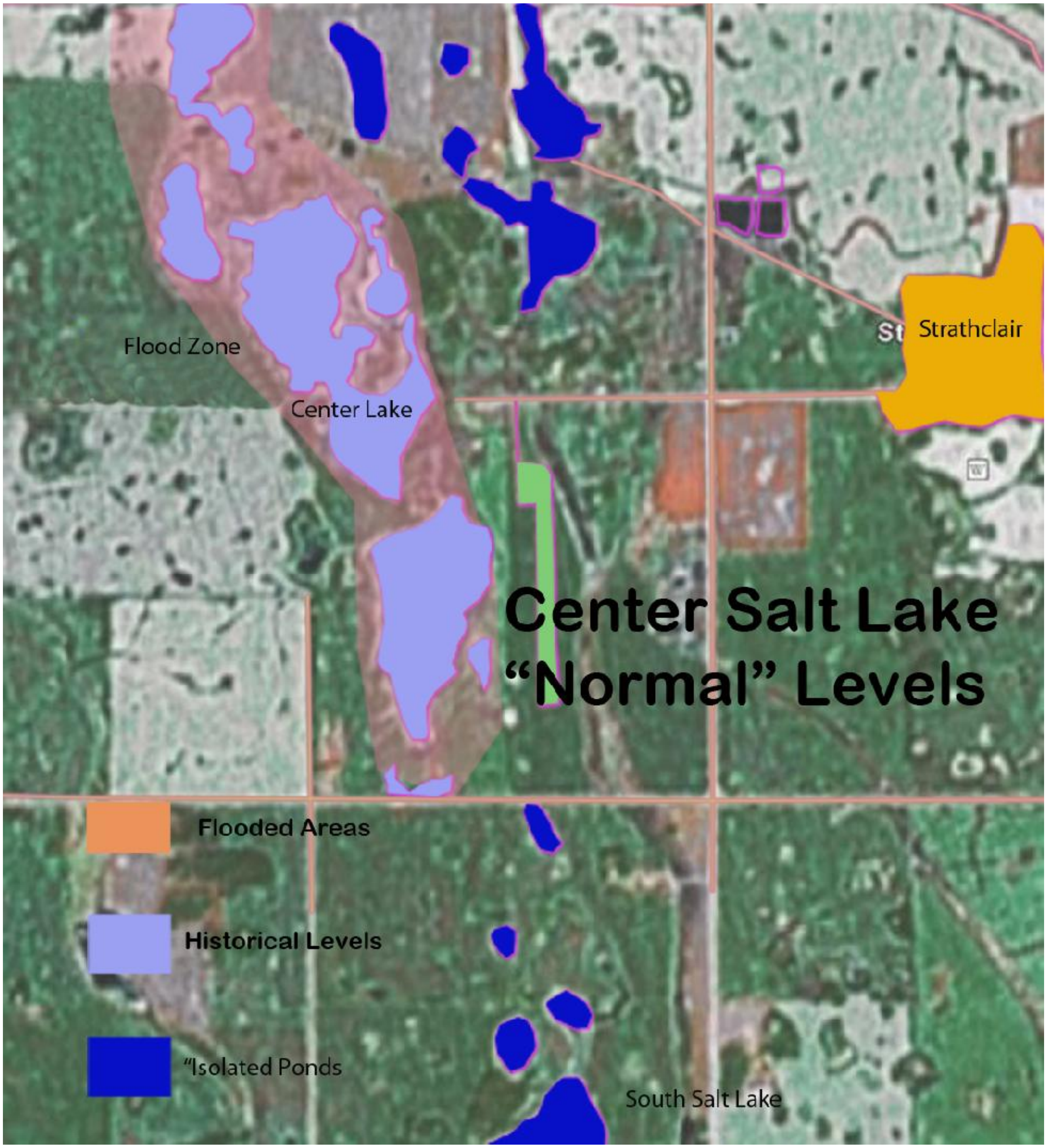


Figure 3 - Historical Levels - Center Salt Lake

In the past personnel from the Rural Municipality have used whatever means they could, to get rid of water when it inundated the town of Strathclair and surrounding environs. Knee-jerk, ad-hoc actions, such as draining excess floodwater into north or center salt lake, only exacerbated the problem. In effect, such emergency responses have only forestalled and predisposed future emergencies.

It was the purpose of the 2010-11 field work and report to recommend a comprehensive strategy that is economically , yet environmentally sound, to mitigate such flooding runoffs. A best-case solution forms around turning North and especially Center salt lake into a connected reservoir to regulate releases; much as does the Shellmouth Dam regulates flows into the Assiniboine River. Under normal conditions water could be retained until an optimum time for release. Under the conditions found in 2011 it is unlikely that all of the water could be retained, but any excess could be maintained and monitored in a discrete trench system rather than flow uncontrolled over at least two roadways.

The strategy also involves further curtailing of new agricultural drainages into systems like Nip Creek (which falls under Provincial Regulations) and, in a second phase and third phase, reworking the drainage patterns of Nip Creek and the water flowing through and around the town of Strathclair.

When completed, in drier periods, none or only minor releases would be required from North and Center Salt Lake, due to the restoration of evaporation, but the system must be reworked to handle the recent climatic changes that have escalated and magnified the present situation. Planning should always be geared to worst-case scenarios, such as occurred in the spring and early summer period of 2011. As of July 20th, 2011 several million cubic meters of water are backed up at what is known as Baker's Road (see maps) and the system has absolutely no remaining capacity. Any future excessive rain event will not pass through the sole submerged culvert under Highway 16 fast enough to prevent flooding and unsafe conditions. The CPR railway bridge would also be strongly affected.

Doing nothing is no longer an option

Evaporation and Center Salt Lake

Salt Lakes, by their very nature depend upon wind and sun induced evaporation. Enclosed watersheds, such as Center Salt Lake in the RM of Strathclair, MB , are completely dependent upon evaporation to maintain levels within the confines of their historical basins. Such evaporation depends upon shallow depth and sun heating, particularly by infrared rays heating the lake bottom in shallower areas. Wind is a very important factor also, especially under high summer heat conditions. As water level increases, such heating and subsequent evaporation is reduced proportionally. The surface area evaporation depends more upon wind rather than sunlight heating. In the flooded conditions of 2007-2011, only broad exposed areas received sun heating and that was reduced by wave action, creating turbidity, particularly in 2010. Further, in 2010 the water was heavily stained and little heating of lake bottom occurred so the deeper areas over historical basins were not affected by sun related heating and evaporation as in former periods.

In 2011 the water level increased more than a meter so the turbidity abated from lessened effects of wave action but evaporation was further inhibited.

With the current influx of water from higher periods of moisture and the aforementioned changes to inflows, the center lake can no longer evaporate enough water to maintain levels only into historical basins. In spite of wind-induced evaporation, levels will continue to rise and flood annually.

Wave action over shallow shoals creates strong turbidity in Center Salt Lake

Figure 4 - Wave action and Turbidity - Center Salt Lake 2010

Controlled Releases from a Designed Reservoir

It is recommended that Central Salt Lake and the upper layer of North Salt Lake be converted to reservoirs, to retain run-off until after flows have peaked in the Oak River System and are verified to be below flood stage. Both lakes should be maintained at a level never to recreate recent flooding events of 2009-11.

This would be achieved by two planned releases.

1. One monitored in the Spring after snow melt and ensuing run-off has fallen to a level to allow water to be released through the salt lakes and into the Oak River system
2. A monitored release for a longer period, in autumn, to extend from the cessation of water related recreation in South Salt Lake until the danger of frozen trenches demands closure of a penstock to be located on Central Salt Lake (or until the desired level is achieved).

Although likely requiring several seasons Center Salt Lakes should be drained to a level allowed by the numerous interconnecting basins and present-day existing railway and highway 16 culverts. In turn North Salt Lake could be lowered 2 meters from its 2011 level. Ideally, in favorable years, the level of the two lake systems should be retained near or below 566 meters, which prevents agricultural flooding

Center Salt Lake could be drained to 566meters. The configuration of the culvert under Highway 16 would dictate what lowered level North Salt Lake would achieve.

No release would be allowed to exceed what the capacity of the upper Oak River System can pass at any time and must be closely monitored, especially until the outlet head and rate is matched to the output.

The Oak River Watershed

Figure 5- Oak River Flats

Downstream Effects

- Immediately south of the Salt Lake Group, the Oak River system is poorly defined, low lying and prone to flooding in some areas.
- If utilized as part of the drainage system, care and monitoring would be needed in the amount of water allowed to pass through any upper reach of the Oak River system during any planned release. The southernmost culvert at the Riley road would serve as an indicator culvert to signal when a release from Center Salt Lake, through South Salt Lake might commence.
- The springtime release of water from Center Salt Lake would have to be regulated, reduced or even terminated for the early season, if land to be seeded is threatened or inundated.
- If required, the autumn release could be held in abeyance until harvest completes in fields flanking the lower-lying sections of the Oak River system if late summer water levels remain high.
- Late season monitoring would be required to prevent ice jams or flooding resulting from ice jams in the Oak River System. In the proposed project trenching portion, water from Central Salt Lake would simply stop flowing. Levels are not sufficient in the lake to overflow the proposed berm and service road flanking the trench.

Lack of Geodetic Information

During interviews with local folks and landowners in the Strathclair area, it became apparent that considerable controversy has been aroused over past overland flooding issues regarding North and Central Salt Lakes.

Several near-catastrophic rain events in the past were diverted by establishing and/or altering drainage patterns into North or Center Salt Lakes, either by RM personnel or by indirect effects of highway and/or railway improvements.

As a result of interviews of various area residents, opinions ranged from doing nothing with either lake to arresting farmers caught draining water into the system. Others suggested blocking inflow points such as Nip Creek and Jeramas Marsh or diverting water overland into the Little Saskatchewan River.

No matter what eventual plan or lack of same is eventually chosen and approved, some residents of the RM of Strathclair will continue less than satisfied.

The problem for planning a comprehensive drainage program was **further exacerbated by the lack of accurate benchmarks and reliable elevations throughout the entire area**.

All that was available was the topographical map put out by Department of Energy, Mines and Resources (062K08),with a 10 meter contour interval (which was totally unacceptable for critical evaluation purposes). Only one Canadian Geodetic Survey bench mark was available at the CPR bridge at the north end of Center Salt Lake.

By request, a second reliable GPS elevation was established by Manitoba Conservation - Water Stewardship Branch, onto a hydro pole located ½ mile east of the south end of Center Salt Lake. These were found to correlate well and a working datum of 567.618 HAE was established for future development/planning, at the south end of Center Salt Lake.

A 1½ inch wooden peg with its top at the exact level of 567.618 HAE is marked by a 3 foot lathe. That elevation in turn is extended onto an adjacent hydro pole and again to a brass screw inserted in the South Salt Lake signpost located at the road junction immediately SE of the Baker residence. (N50 23.275 W100 26.289).

Elevation of the screw is 573.844M and ground level at base of signpost is 572.510M HAE.

These elevations were set with a theodolite and sufficiently confirmed to fall within tolerances required for the project with a Trimble GPS ProXRT sub-foot GPS receiver and OMNISTAR real-time correction.

Other working elevations were established in various locations in the immediate region, usually at culverts and road intersections. None of these elevations and geodetic locations are considered accurate enough for legal land survey purposes but being in the range of 8 to 10 centimeters in the Z-axis are sufficiently accurate for decision-making when working out a comprehensive water control plan for the north and center salt lakes.

Elevations made by theodolite methods are nearer 1 cm accuracy for elevation (Z axis) but are not sufficiently confirmed by triangulation, regarding X-Y (longitude-latitude coordinates), to be established for legal survey purposes.

Regulating North and Center Salt Lakes from the North and East to Little Saskatchewan River

From the earliest point of 2010-11investigations, speculative assurances were made by area individuals that all excess water could be drained from North Salt Lake through portions of Nip Creek to the Little Saskatchewan River. At least two areas hosted such water movements, indicated by nearby adjacent sloughs draining in either direction. Speculation suggested that a simple trench could be dug between them, thereby lowering North Salt Lake and, by extension, Center Salt Lake.

Two such locations do in fact exist and are indeed located in close proximity. They are shown on the accompanying topo map segment .

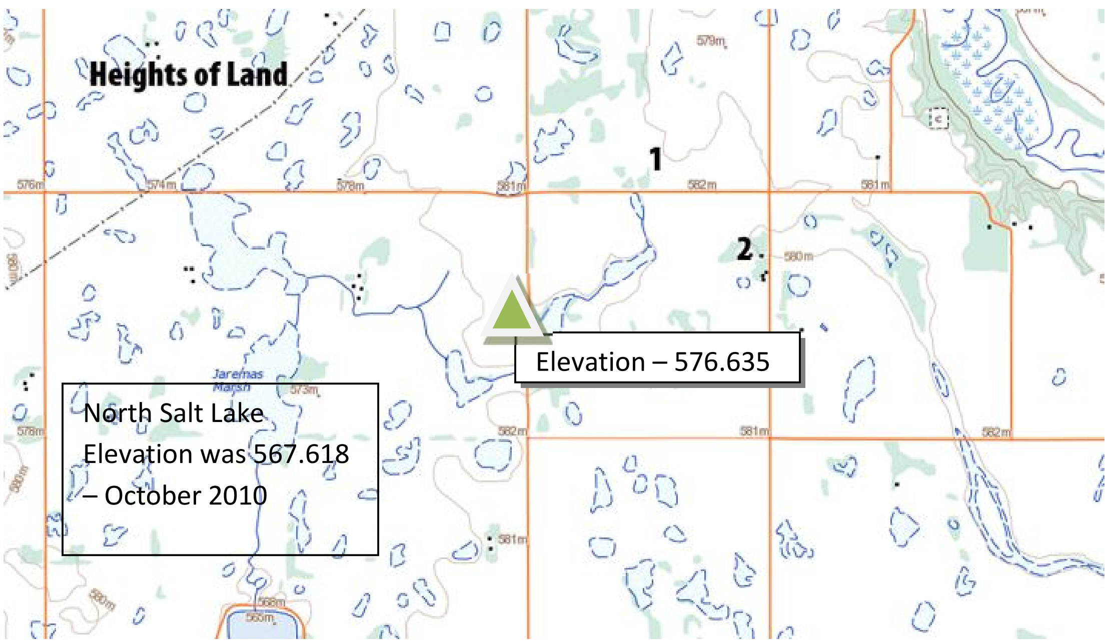


Figure 6 - Height of Land - Nip Creek and Environs

However the suggested approach has two major hurdles.

1. Jeramas Marsh, the confluence for Nip Creek, is at a considerably higher elevation than North Salt Lake.
2. Vertical Z axis heights for elevations 1 and 2 are located at elevations approaching and/or exceeding 580 meters above HAE.

3. The surface of the water in North Salt Lake was at 567.618 meters HAE in 2010 -- presently flooding valuable agricultural land. Any trench would have to be at least 2 meters lower than North Salt Lake surface.
4. Consequently, utilizing Nip Creek as a water control mechanism would entail excavations over a circuitous distance of 5 kilometers and exceeding an eventual depth of 12+ meters.
5. Other more practical routes were considered and they too were rejected.

It should be noted however that portions of Nip Creek flow very near to the Height of Land between the two watersheds. For a relatively moderate expenditure, 50% of the Nip Creek flow could be diverted into the Little Saskatchewan watershed. (Phase 2 planning)

Evaluation of Oak River Drainage Possibilities

Because of controversy arising from the two past emergency drainages across the Reg and Susan Moffat Lands and into South Salt Lake, a comprehensive effort was instituted to seek a by-pass route avoiding such controversial routes and instead utilizing a watercourse which is part of the Oak River watershed located west of the salt lakes system. An accompanying map shows the routes evaluated, chosen by what initially appeared to be favorable elevations from preliminary observations or from recommendations of local citizens. Ultimately a few were chosen for further evaluation and subsequent discrimination by rental of a sub-foot Trimble GPS system.

Route 1 was evaluated from the aspect of reversing a natural drainage feature, by deepening the existing slope and thereby saving much in excavation costs. Excess water could be brought through other low lying areas to the northern portion of the aforementioned west creek which is a reach of the Oak River watershed. However, after establishing the levels involved by both GPS and a theodolite, the possibility was rejected since it would be a very expensive project.

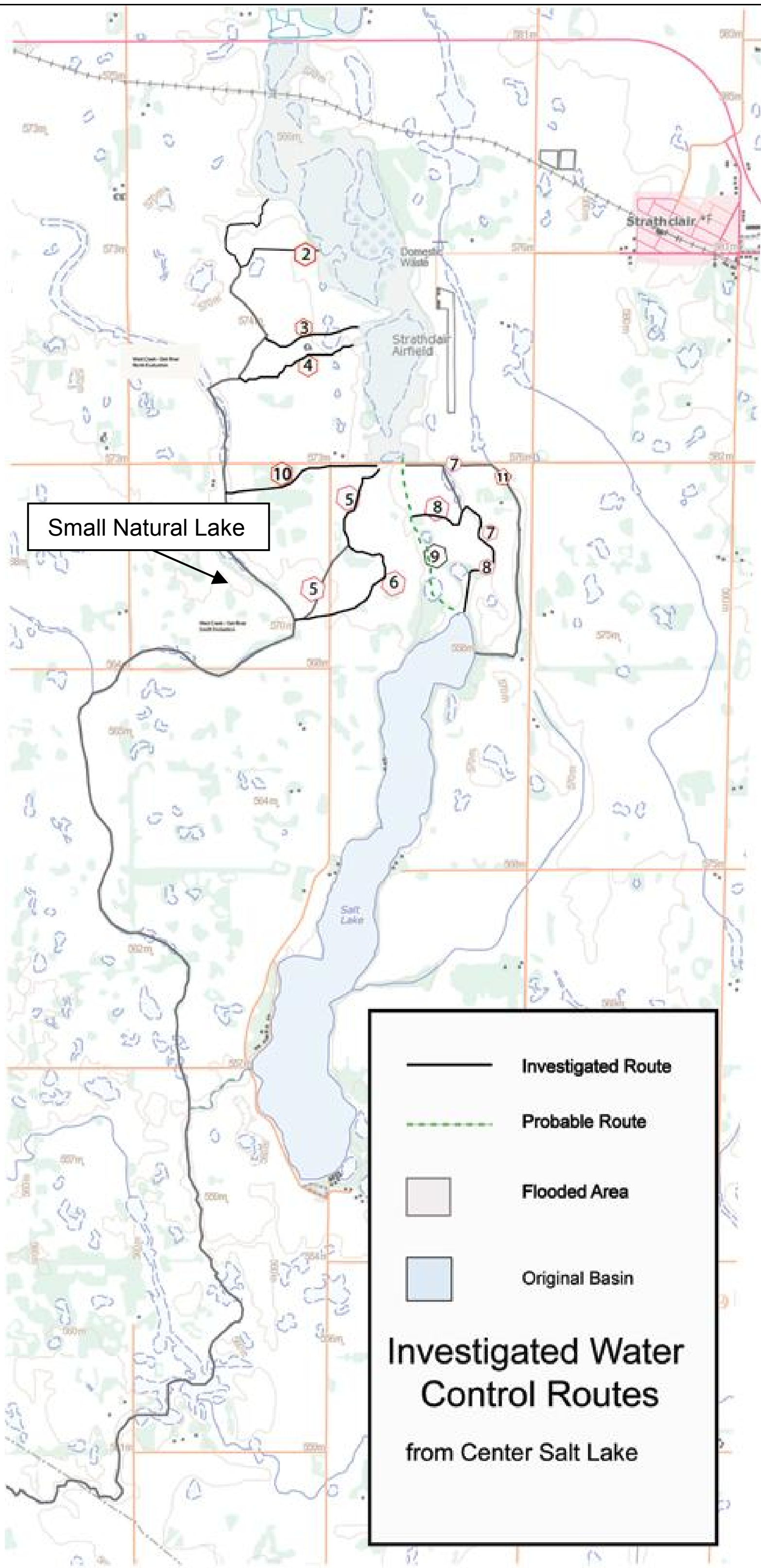
Route 2 was evaluated since it utilized an unused road allowance and thereby reduced the number of landowners needed to agree to allow drainages across their lands. It also went though the same low-lying areas needing drainage for improved agricultural purposes. Again, such a circuitous route involved high costs regarding the excavations to address such required trenching depths.

Routes marked 3 and 4 were rejected for the same reasons with the addition of disturbing agricultural practices by bisecting fields in areas not needing improved drainage.

Routes 1 to 4 would also require the deepening of the west portion of the Oak River Creek to a slope to allow proper and complete drainage through a defined trench. It would also involve lowering the historical level of the small pond located on the Cummings property to allow drainage. After establishing the accurate level of that pond via Trimble GPS, routes 1 to 4 were rejected.

Route 10 was a more direct route, flanking the side of the E-W road allowance immediately west of the south end of Center Salt Lake, but also required eventual passage though the same pond on the Cummings property. Moreover, the elevations to be addressed by trenching would create a very steep debenture for the ratepayers of the RM of Strathclair, as well as a major hazard in the form of a very deep, roadside trench.

Route 11 was rejected for the same reason, as well as high costs. The elevations involved in 10 and 11 are just too great to consider reasonable for funding as a project by a Rural Municipality.



Routes Investigated and evaluated for possible water control flow routes to the Oak River watershed.

Factors considered were elevation changes, probable excavation\construction costs and outright practicality.

Figure 7 - Water Diversion Routes Investigated

Routes 5 and 6 were considered since an existing trench was formerly dug to drain water from an area on the Watson-Winstone property line. The ditch would have great savings in excavation costs for part of the project but the remaining portions are fraught with obstacles. Route 5 would pass under the road to South Salt Lake and would have to be an underground system, not allowed by Manitoba Water Stewardship. Route 6 would require only a culvert to traverse the road but would have to pass through a series of normally dried-out seasonal sloughs at higher elevations before bisecting the Watson property.

Again the excavation costs would be very high and either route would be a nuisance to agricultural practices and operation of larger field equipment.

Route 7 was successfully utilized during the first EMO release in 2009 and would not entail excessive expense as a permanent solution. It does present a problem for the landowners (Reg and Susan Moffatt) by bisecting valuable pasture land, creating an obstacle and hazard to cattle and other livestock. Since planned releases from a North/Center Salt Lake reservoir would be for longer periods than a normal two week emergency order, the obstacle would be onerous for said landowners. There is also the problem of residual salinity of the broader areas of the ravine leading down to South Salt Lake, which again is in use as pasture/hay land. The 2009-11 discharges created a great deal of erosion in the valley approaching the shores of South Salt lake.

Route 8 was used in 2010 under an EMO and successfully lowered the North-Center Lake complex by 40cm. However it again bisects the Moffatt land and presents the same set of problems for the landowners, even at a reduced rate of flow than the emergency 2010 release. Other than the aforementioned problems, the levels for Route 8 are the optimums of all choices for permanent solutions.

A better compromise is **Route 9**. Levels aren't as favorable as Route 8, after passing south from the former route 8, but would not add greatly to excavation costs. Since it would flank a property line for the last segment, impacts on agricultural practices would be lessened. Livestock would be fenced away from all trenching, since it is utilized for oil seed and/or cereal crops. The route passes through low-lying weedy areas, and bisects the Winstone property in areas presently unused for agriculture. It would provide better draining for the Winstone property since the natural slope of the property's contours would lead down to planned entry locations in the proposed berm on the west side of the completed trench and a proposed raised service road on the eastern side would prevent further flows across the Moffatt property. (see attached graphics)

A photo taken during the 2010 EMO discharge that bisects the Moffatt pasture.

Uncontrolled releases are sources of high erosion, hazardous to human activity and to livestock directly

Figure 8 Uncontrolled water release 2010

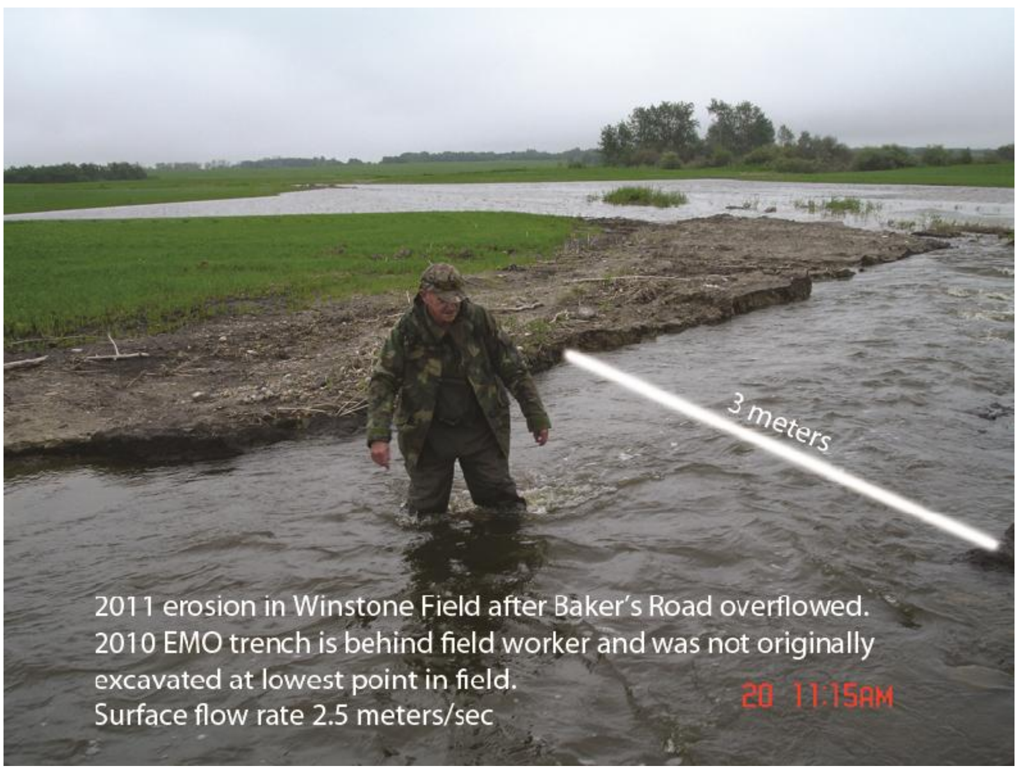


Figure 9 - Spontaneous uncontrolled overland flooding -3.374 cm3/sec - 2011

Baker's Road (Road 95N along the south flank of Section 27, Range 22, Twp 16) cannot be considered a barrier to the rising waters in Center Salt Lake. Nor can the Winstone field (NW1/4 of Section 27-16-22) contain it as proven in 2011. No holding capacity in Center Salt Lake will be available in the spring of 2012 and flooding will be immediate. However, in 2011, the Oak River System managed to contain the flow depicted here without overland flooding. However, the effect on South Salt Lake was disastrous.

Future planning must consider conditions such as occurred in early to mid 2011.

 Figure 10 - Erosion in Moffatt valley- 2010 EMO route	 Figure 11 - Cabin flooded- South Lake 2011
Erosion is excessive in the valley utilized for EMO drainage in 2009 and 2010. When Baker's Road breached in 2011 the flow was somewhat less but erosion continued and there is no easy or economical way to address it. The route should not be used except in dire circumstances.	A cabin on South Salt Lake. June20th, 2011. Similar damage or even worse can be expected in future if water levels in Center Salt Lake are not lowered and becomes a reservoir. Uncontrolled or spontaneous releases damage infrastructure.
 Figure 12 - Flooding and damage - Road 94N	 Figure 13 - Flooding and damage - South Lake 2011
Baker's Road - June 2011 - Unrestricted flow for 150 meters, plus whatever capacity the submerged culvert could discharge.	Road at South Salt Lake outlet point - June20_2011

Bathymetric Surveys

Because nothing was known regarding depths and basin configurations of the water bodies involved, all three Salt Lakes were subjected to a sonar/bathymetric survey. Before promoting the plan to utilize Center and/or North Salt Lakes as a reservoir, some idea was required of what volume might be retained before flooding began. Also a configuration was required of the multiple basins in Center Salt Lake and their elevations as related one to another for filling, overflow and drainage sequences.

The Datum used is extrapolated from 567.618 HAE for North and Center Salt Lakes and can be further extrapolated by subtracting the values of the depth contours on each individual map.

Basically the majority of run-off water enters North Salt Lake through Nip Creek, Highway 16 and the CPR railway drainage ditches and into Central Salt Lake from various drainages, the primary being the ditches found along and north of the abandoned dump road.

North Lake overflows into Center Lake from under highway 16 and/or under the CPR railway bridge.

Each basin in the Center Lake overflows southward and collects, since there is no outlet. The deepest area in Center Salt Lake is south of the abandoned dump and floods over the Baker farmlands to abut the E&W road at the south end of Center Salt Lake (Road 94N).

At present there are no drainage points beyond that point other than those provided by emergency orders. Emergency trenches have been filled as per requirement of such EMO prerequisites.

A program should be instituted to control the water levels of Center and North Salt Lakes and introduce a licensed, controlled release program to mitigate future flooding.

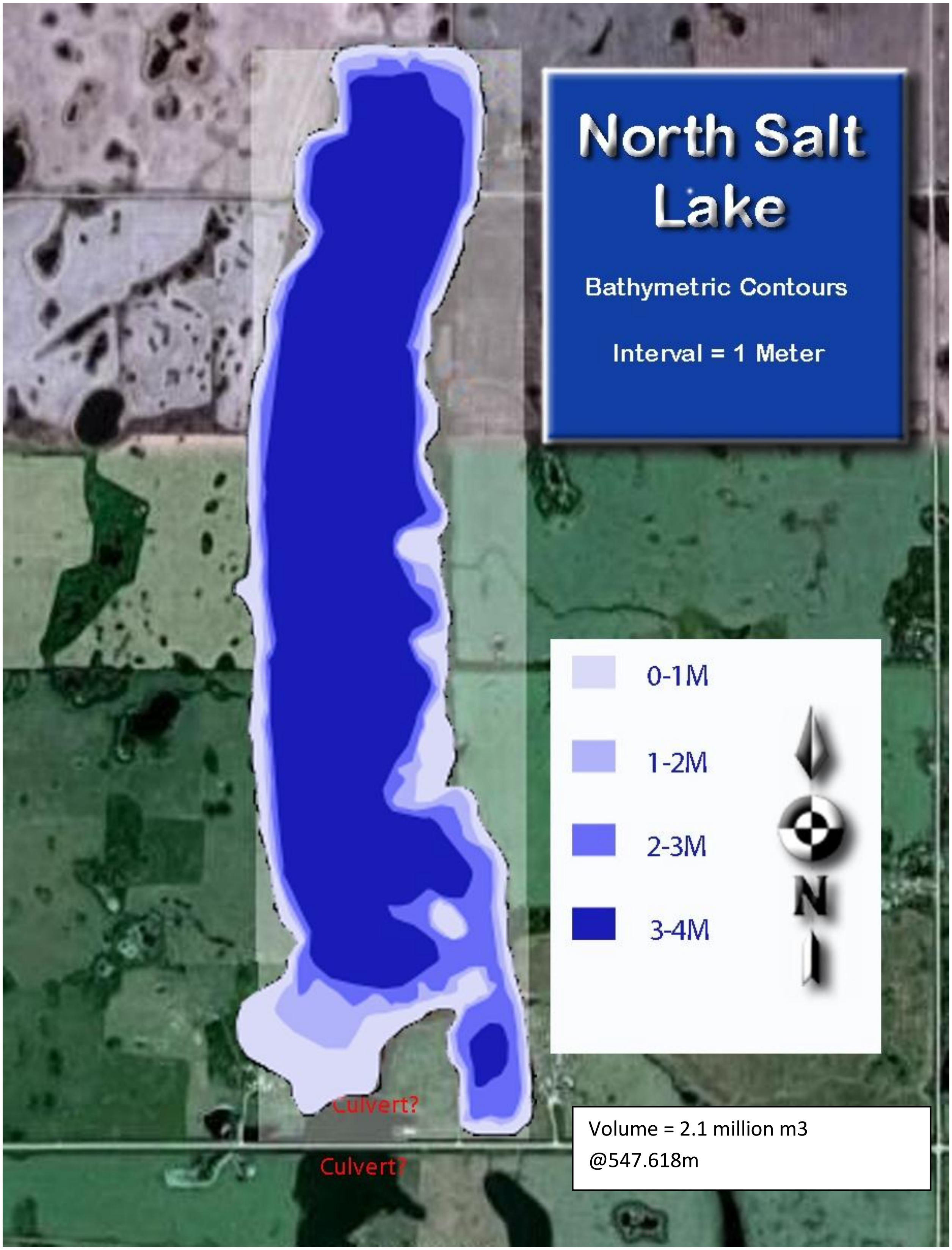


Figure 14 - North Salt Lake Bathymetric survey

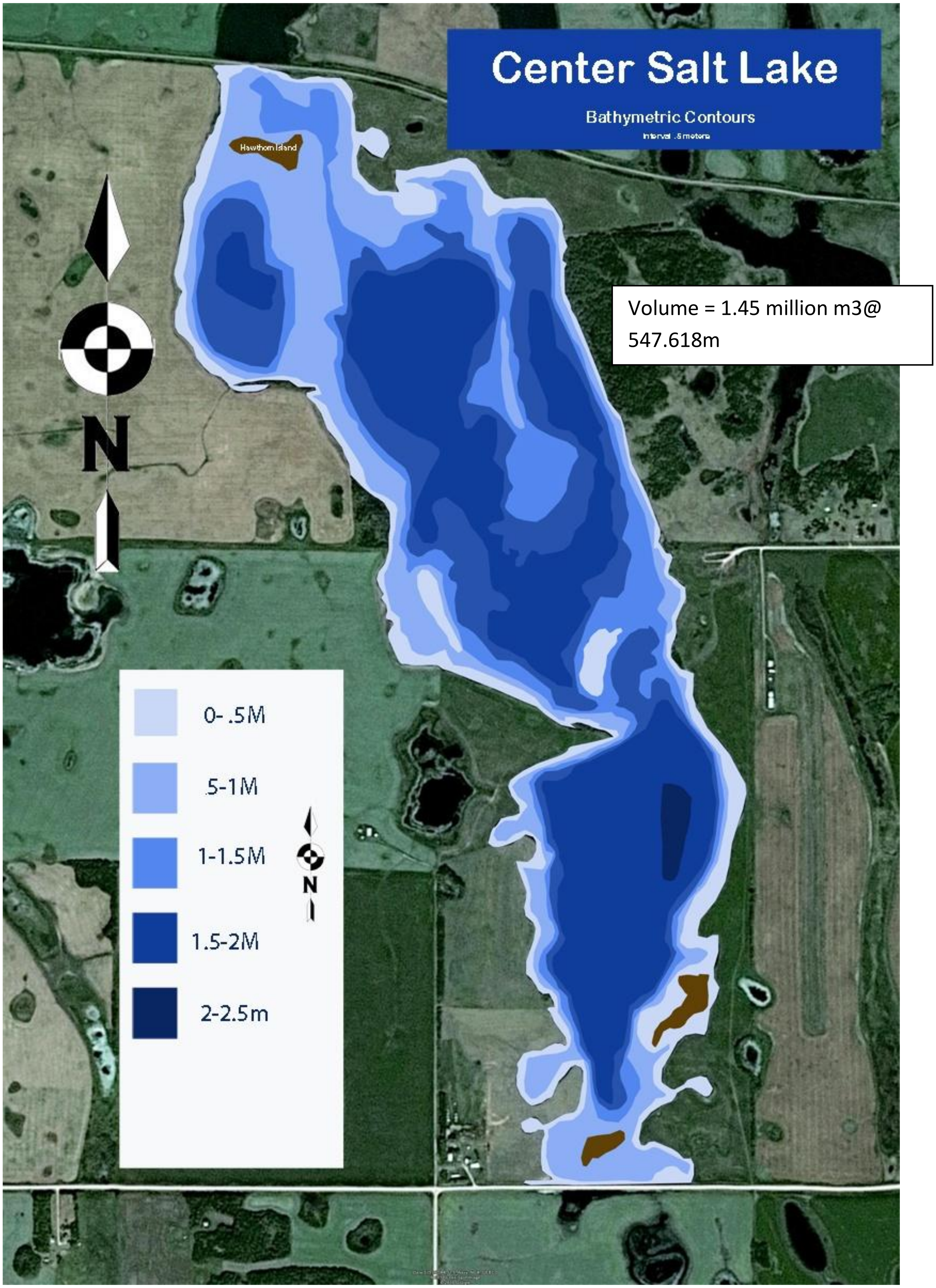


Figure 15 - Center Salt Lake Bathymetric survey

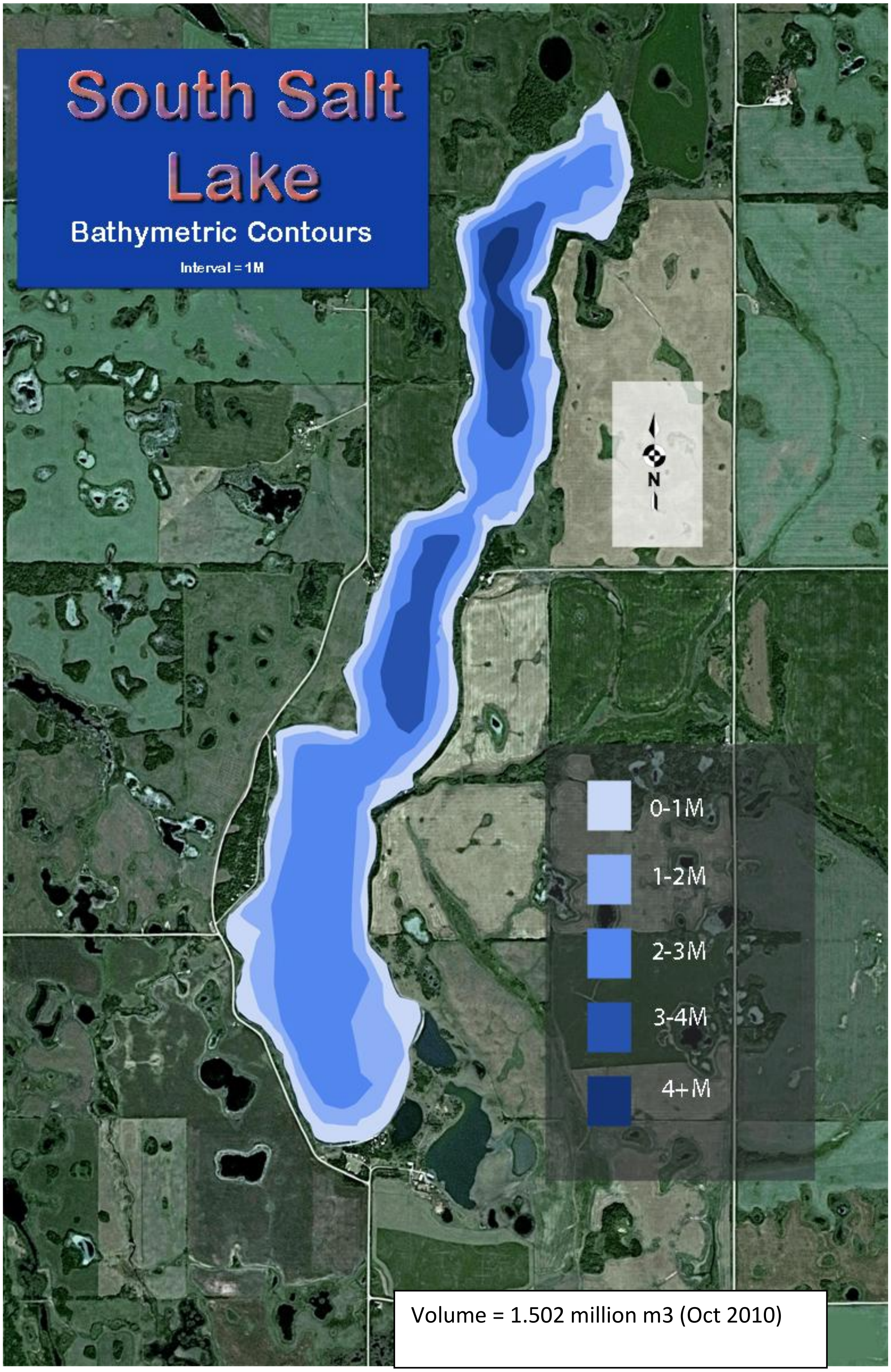
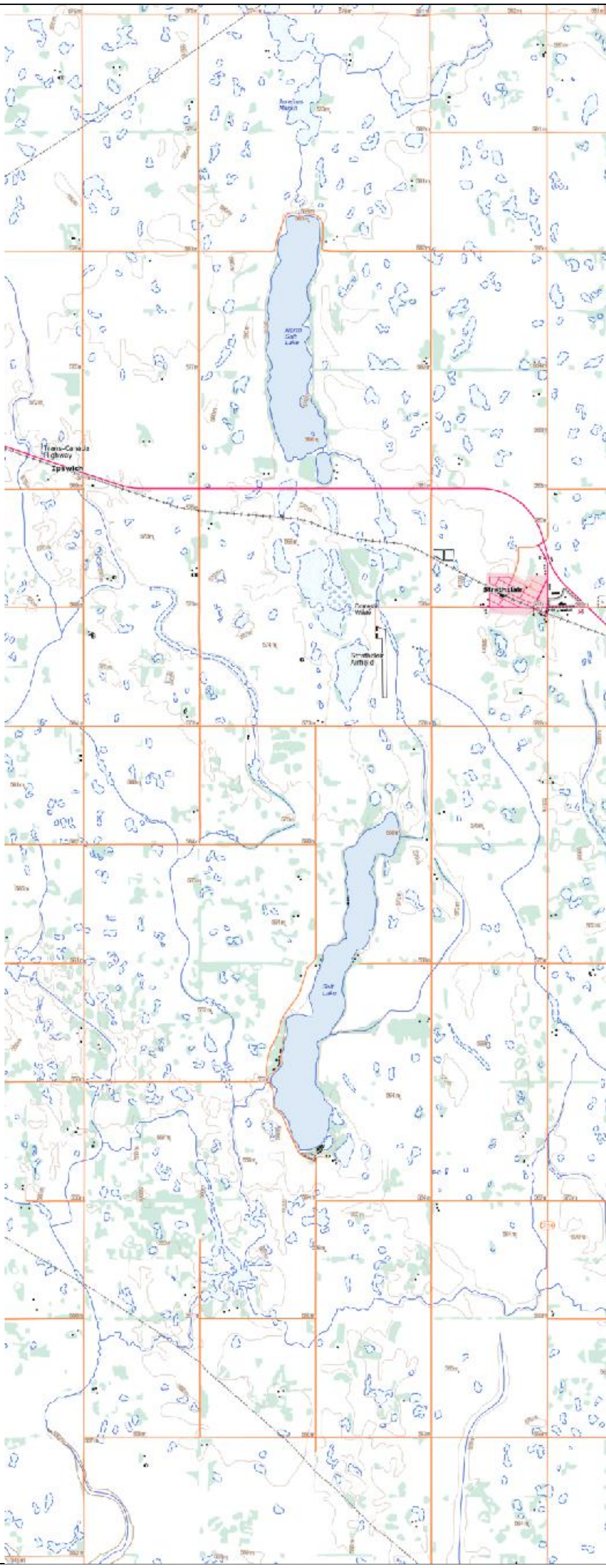


Figure 16 -South Salt Lake Bathymetric survey



General Location & Layout of Water Control

Structures, Berms and Trench Excavations

Preliminary overview based on data, elevations and observations from field work 2010

Project Planning

Overview of Proposed Trenching and Maintenance Development

Based on study of elevations, bathymetric soundings and costs, **the recommendation forwarded** is that a trench be excavated spanning the distance from the south end of Center Salt Lake across the Winstone and Watson properties to a natural pond spanned by the property line of Watson-Moffat lands.

The first foldout graphic is a Google Earth projection of the Project work area, showing drainage routes and protective berms to prevent passage of water down the former EMO release routes. A service road would be built with part of excess excavation material to create a protective berm along eastern flank of trench.

Center Salt Lake is in the foreground. The first “pond” shown is dried out during normal summer conditions and was filled with water at the time of the Google photography in late spring 2010.

The service road in the lowest area depicted will be constructed by utilizing excavation materials and excess from areas of higher elevations, to prevent flow eastward into Moffatt land along former EMO trenching.

The southern small pond on the Moffat-Watson property line pond (Figure 17 below), where the excavated trench terminates , would act a settling pond prior to the water entering the natural watercourse, downhill SE to the marsh(Figure 18 below), through the proposed culvert and then into South Salt Lake. From South Salt Lake the water would enter the Oak River System.

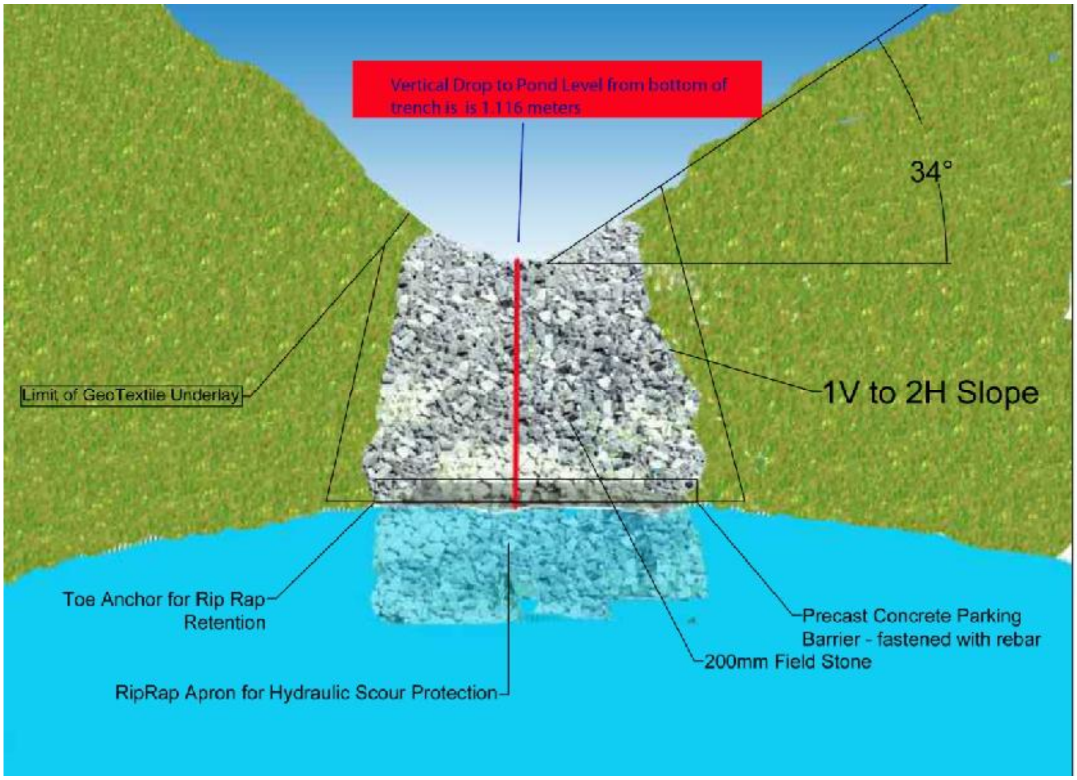


Figure 17 - Entry point to Southern Pond

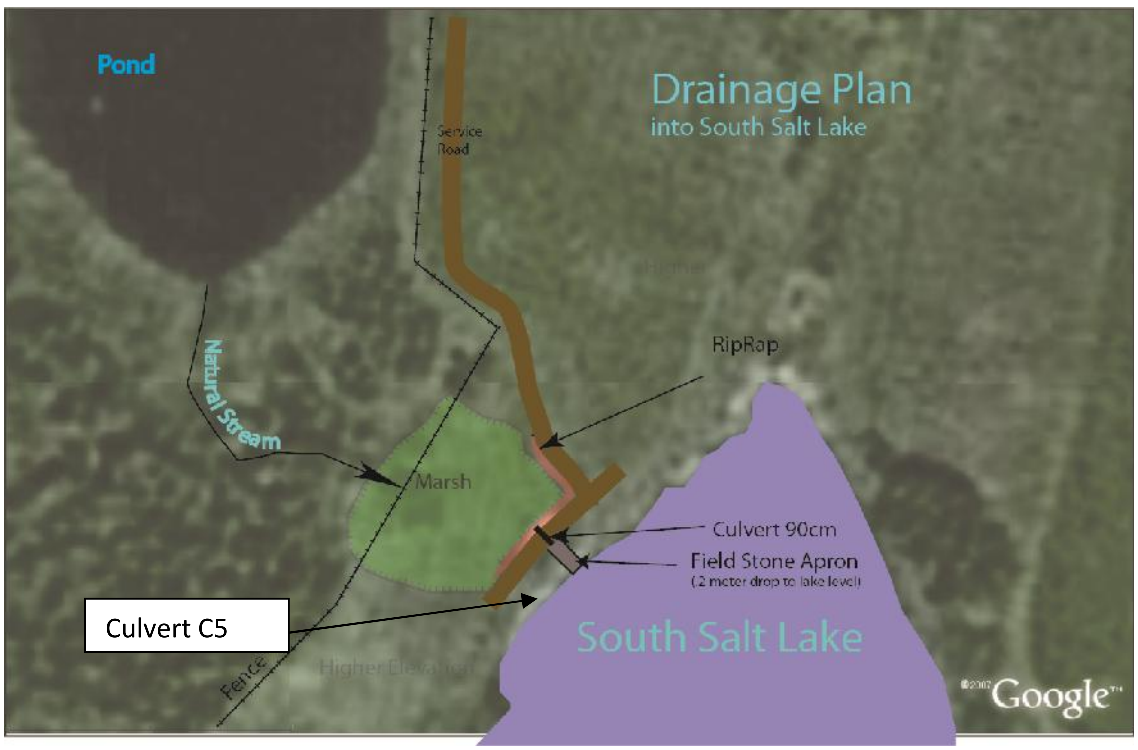


Figure 18 - Drainage Plan - South Salt Lake entry point

From the pond water would exit through a natural watercourse heavily overgrown by sedge grasses and shrubbery, to pass through an access culvert and ultimately to exit over a designed bed of field stone into South Salt Lake. The drop from culvert C5 to the lake is in the order of .2 meters. (See Figure 18)

The flows through the trench would be controlled by a proper penstock with a secure wheel-operated worm drive (Figure 19 below) that could precisely regulate flows through the gate to match the flows allowed by the Oak River watershed sections and prevent excessive water elevations in South Salt Lake.

Water Control Device

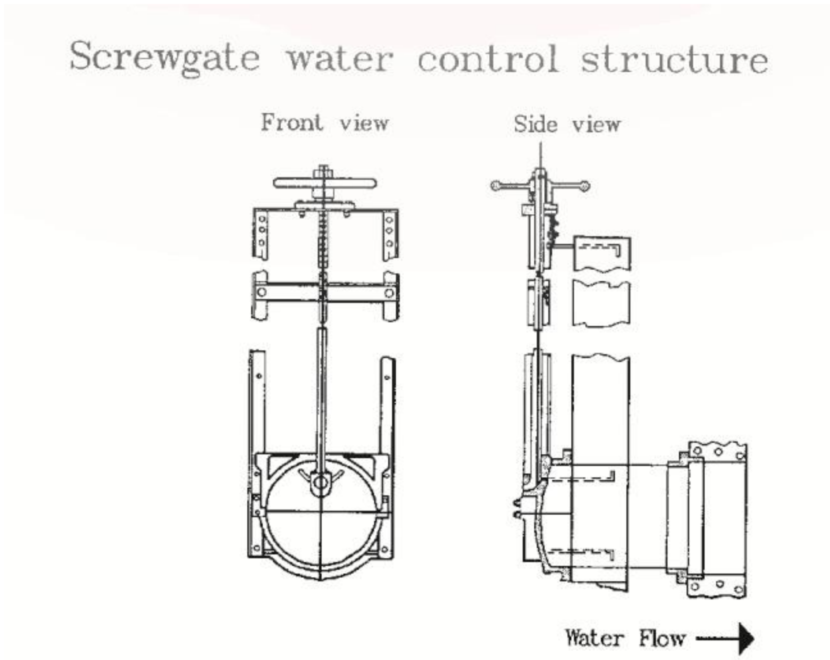


Figure 19 - Water Control Device

The main outlet from center salt Lake into the southern segment of the trench involves a cast iron penstock mounted to a premade frame, which in turn can be bedded into a system using a heavy walled ribbed plastic culvert. (metal, including galvanized metal will deteriorate through corrosion over time from salt water effects). The cement mount must consist of a high percentage of fly ash to prevent deterioration from longtime exposure to saline conditions.

Planning and Procedure

The southern portion of the trench should be excavated to the aforementioned specifications.

A small coffer dam would be built to allow work to take place across the Baker Road (Roadway 94N)

The penstock structure can be emplaced and properly bedded.

The coffer dam would be breached and excavation would then proceed northward for 225 meters to reach the original southern Center Lake basin and prepare it for future releases to lower it to the intended reservoir level of 566 meters HAE. The trench would be constructed at 3 to 1 dimensions, 1.6 meters side over a flat bottom. The flanks of the trench would be fenced off.

Center Salt Lake will remain a shallow lake, with .3 to 1.1 meters of water in its southernmost basin. During catastrophic wet periods the lake would become a temporary reservoir to prevent overland flooding and damage to infrastructure in the Oak River system.

The discharge through Baker's Road (Road 94N) would be through a 90cm ribbed, heavy-walled PVC culvert that will not corrode from repeated exposure to saline flows. It will have a trash rack at the intake and protective anti-ice stakes before the penstock. The culvert would be set at a 2% slope through Roadway 94N to guarantee fullest barrel. The discharge drop at the exit end of the culvert, southward through the Winstone field, would be .3 meters to ensure sufficient head to drain with sufficient velocity. The exit end at the pond spanned by the Moffatt-Watson property line would be 1 meter lower than the north end of the trench. The purpose of such a minor slope would be intended to mitigate erosion of the seeded grass trench bottom. Observations during the runoff period in 2011 revealed that flows of 2.5 meters per second created extensive erosion through the surface matrix existing at the critical low points. Consequently, the trench purpose would be intended for drainage over extended periods rather than a means to quickly reduce water levels in center and north salt lakes, as was attempted in 2009 and 2010. The 2011 experience clearly indicates that a 90 cm culvert would allow a drawdown that must extend for several months to achieve a working reserve in center salt lake, without creating flooding and shoreline erosion on South Salt Lake, or overwhelming the planned 90cm culvert to be installed later in 2011 at the outlet on S. Salt Lake. The 90cm arrangement throughout has been proven not to cause overland flooding in the Oak River system.

The trench would be designed at a 3 to 1 ratio. For every meter of depth the surface width would be three meters, which would allow small excavation/maintenance equipment to enter trench and maintain it, as well as the flanks and berms. The bottom of the trench would be flat, 1.6 meters in width allowing passage of smaller skid-steer maintenance machinery.

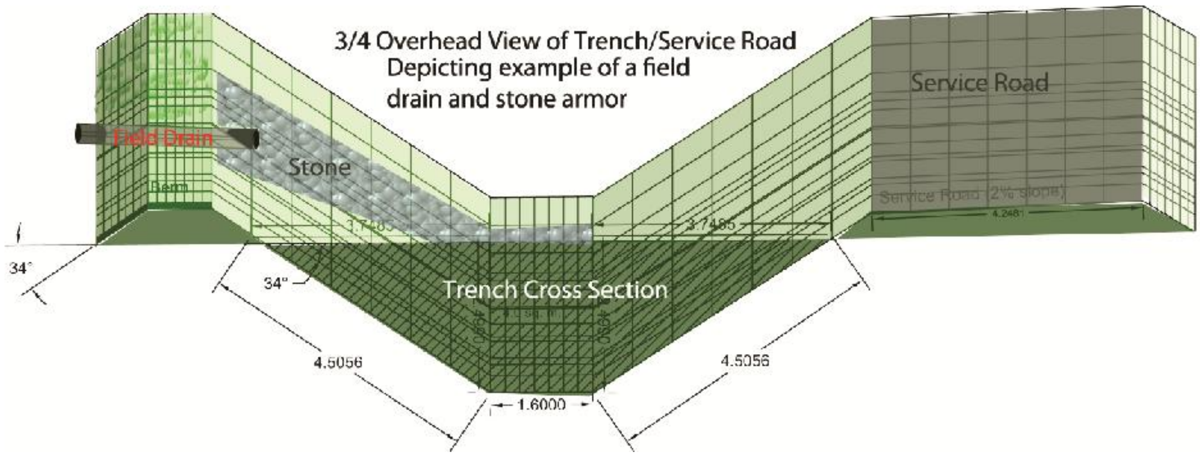


Figure 20 - The Trench and Service Road Layout- 3D view

Example at a depth of 2.5 meters

A 1.5 meter wide berm (minimum width) will be constructed on the west side of the trench until the elevation increase at N50 22.958 W100 25.667. (In higher elevations no berm would be required on western flank). When required, the berm would vary in dimensions to suit the height required in lower lying areas. (See alignment 6 profile- Map2).

At topographical drainage collection points, indicated on Map2, shorter sections of 38cm culvert would allow run-off drainage from field into trench at armored points.

In higher elevations, no berm would be required on the eastern flank, but an earthen service roadway would flank the entire trench on the east flank while serving as a protective berm. At lowest elevations, the service road would prevent flows through the historical route of 2010 where it causes heavy erosion in the unprotected valley.

From the settling pond's exit, no berm would be needed until the proposed culvert is reached on the Moffatt property at the South Lake (culvert C5 - Map2). An armored section of the service road would be required to ensure that all water passes through the proposed culvert and does not cut through the roadway extending to the Moffatt land's small field located along on the lakeshore and on west side of the outflow.

The flow from the culvert C5 to the lake would be over a bed of 150mm field stone to prevent siltation and erosion into South Salt Lake.

No pond involved would be drained, as delineated on accompanying map. The southern pond would actually be deepened by roughly .3 meters but would receive an increase in salinity from water passing though its basin.

About the 2 Main Maps

The two main maps, 1 and 2, were drafted to reveal a detailed profile of the trenches involved, both north of Roadway 94N and south. Locations can be spotted on either map and then examined in the alignment profiles at the top of each.

They also depict other arrangements and infrastructures such as culverts, fences, gates and field drains.

Map1

The Northern trench will extend from water depth of 1.8 meters (below 2010 datum of 567.618) to the head of the penstock for a distance of 224.18 meters. It is to be excavated at a ratio of 3Width to 1Depth. The bottom of the trench will be uniform in grade, in effect simply extending the level of Center Salt Lake at 566mHAE which would allow for a head of .9 meters above the culvert barrel at the 2010 datum and 2 meters at the 2011 lake level. The purpose is to allow for diminished lateral flows to avoid erosion of the seeded grass trench(s) downstream and yet allow for lake level drawdown over extended periods.

The 90cm cast iron penstock will be circular and attached to the dual layered 90 cm ribbed plastic culvert with a gasket. Both in turn will be packed with clay to prevent seepage along the culvert flanks, under roadway 94N. The culvert will slope at -2% and have a .3 meter drop at the exit end onto a prepared bed of field stone extending for 3 meters in the southern trench. From there it will flow south as shown in Map 2.

The northern trench will be fenced at 3 meters on the western side and 5 meters on the eastern flank, the latter allowing maintenance machinery to pass along the trench flank but inside the fenced area.

No cattle or other traffic should be permitted and the entry gated as in the map layout. During times of excessive flooding both sides of the trench may be inaccessible.

On the south side of the road a 40cm culvert (labeled C1 on Map 2) would be required to allow water to pass under the proposed service road and into the southern trench. The C1 culvert would be necessary in times of rainfall and spring snowmelt. Culvert C1 would be located almost a meter above the bottom of the proposed southern trench and would not be subject to backflow.

The junction of the proposed service road would be located east , along Road 94N.

The route of the northern trench segment was chosen since it would be the least expensive method.

Map 2

The original culvert crossing Road 94N will be either plugged or removed. The 90 cm plastic culvert and penstock arrangement will replace it. The beginnings of the southern segment of the trench begins in an existing ditch that flanks Road 94N on the south for some 300 meters to the west. This ditch must remain since it is essential for draining snowmelt and excessive rainfall for a large portion of the field that comprises NW22-16-22. The southern segment of the proposed trench will adjoin the former ditch which will be deepened only as necessary at the outflow from the culvert/penstock. Final depth for that short zone would be at .3 meters below the bottom of the culvert barrel.

Culvert C1 would drain alongside the southern flank of Road 94N, both for rainfall and snowmelt, under the proposed service road and into the trench. Its final discharge point would be about a meter higher in elevation than the bottom of the proposed trench at that point.

The service road would be gated on the south side of Culvert C1 in an attempt to cut down on the traffic by the curious and those wishing to use the service road(s) for purposes other than maintenance by RM personnel or their appointed contractors.

The trench would extend southward to the zone of least natural elevation (460 to 500 meters south). There the service road on the western flank would be built up with excess excavated material and strengthened so no water will leak or overflow into the route utilized for the EMO release in 2010.

40cm culverts would be located at C2, C3, C4 and C6 either through the western berm or under the service road on the west, as required from a study of field run-off in the early spring of 2011.

After 540 meters no further berming would be required on western flank of the trench. Excavated material could be utilized in several other areas, especially in the aforementioned lowest area.

The service road flanking the trench segment would end at 985 meters.

At 935 meters the service road branch to the east, through another gate and down slope to the eventual outflow into South Salt Lake. Some 200mm field stone would be emplaced at the low area located at 60 meters, to allow runoff to pass across roadway without erosion. No culvert would be needed at that point. The service road would be armored where it flanks the marsh at 385 to 400 meters. (See Figure 18 for more detail). The purpose of the rip rap would ensure that any excess water in the marsh not breach the service road and would force the water to flow though the 90 cm culvert and into South Salt Lake.

The drop from the trench to the pond at the end of the excavated trench would be armored and an apron of field stone placed at the entrance to the pond to prevent turbidity and erosion from the minor hydraulic surge. The entire change in elevation would be 1.1 meters at a 1V 2L slope.(50%). The 200mm stone would be underlain with anchored geotextile cloth. A toe anchor for the riprap, comprised of a single precast parking lot curb, would be firmly fastened by 6 foot lengths of rebar. (See Figure 17 for more detail)

There will be no need to do anything to the exit from the pond or to the small stream passing down to the marsh at the outlet. It is well treed, buffered with native shrubs, cattails and sedge grasses throughout its entirety. The slope is gradual, (-.06%), one of the main reasons the eventual decision was made to utilize this route rather than risk further erosion in those outlined and rejected formerly.

The marsh before 90mm culvert C5, the outlet, would ensure that no silt would enter South Salt Lake during a planned and controlled discharge.

The discharge from the culvert would be over 100mm+ field stone armor.

Conclusions:

Some controversy has arisen in past times regarding discharges into South Salt Lake but from a fiscal and practical point of view there are no alternatives other than to pass excess water levels in north and center salt lake through the south water body and into the Oak River system. As proven in 2011 the water will flow anyway but in a very damaging and uncontrolled manner.

Also proven in 2011 is the fact that water passing from Center Salt Lake through a 90cm culvert would not cause overland flooding in the Oak River System

The south lake has the sole outlet to the Oak River system and the elevations to utilize other adjacent water courses, east and west of the system, are too great to overcome without extreme expense.

Concerns over the "polluting" of the south lake are unfounded and addressed elsewhere in the report, **Environmental Impact Assessment**. Other than annual excrement input from thousands of waterfowl the water remains free of contaminants.

In 2011 the flow from Center Salt Lake was almost silt free and the South Lake turbidity free by July 1st.

Phase 2 & 3 – Studies to Assess the Reduction of Water Flowing into North and Center Salt Lakes from Nip Creek, Highway 16 and CPR Ditches

Phase 1 -- the main trench comprises the foremost necessary building block in an ongoing program. After monitoring the watershed flows during the 2011 spring season, it is unlikely that Phase 1 of the comprehensive program will completely alleviate the flooding problems in the area during periods of excessive moisture or catastrophic rain events such as occurred in 2005. That rainfall in 2005 which was the genesis of the current situation which was further exacerbated by a series of unwise ad hoc remedies.

The two major sources of inflows into North Salt Lake and onward to Center Salt Lake come from Jeramas Marsh, located north of North Salt Lake and the trench that flows immediately south of the Strathclair sewage lagoons and directly into North Salt Lake.

Jeramas Marsh receives most of its water from Nip Creek which drains two minor watersheds within the Oak River Watershed. Both join East of the Randy McIntyre Farm complex and empty in Jeramas Marsh. Jeramas Marsh then overflows into North Salt Lake which in turn overflows through a single 90cm culvert located under Highway 16, under the CPR bridge and into the Center Salt lake basins.

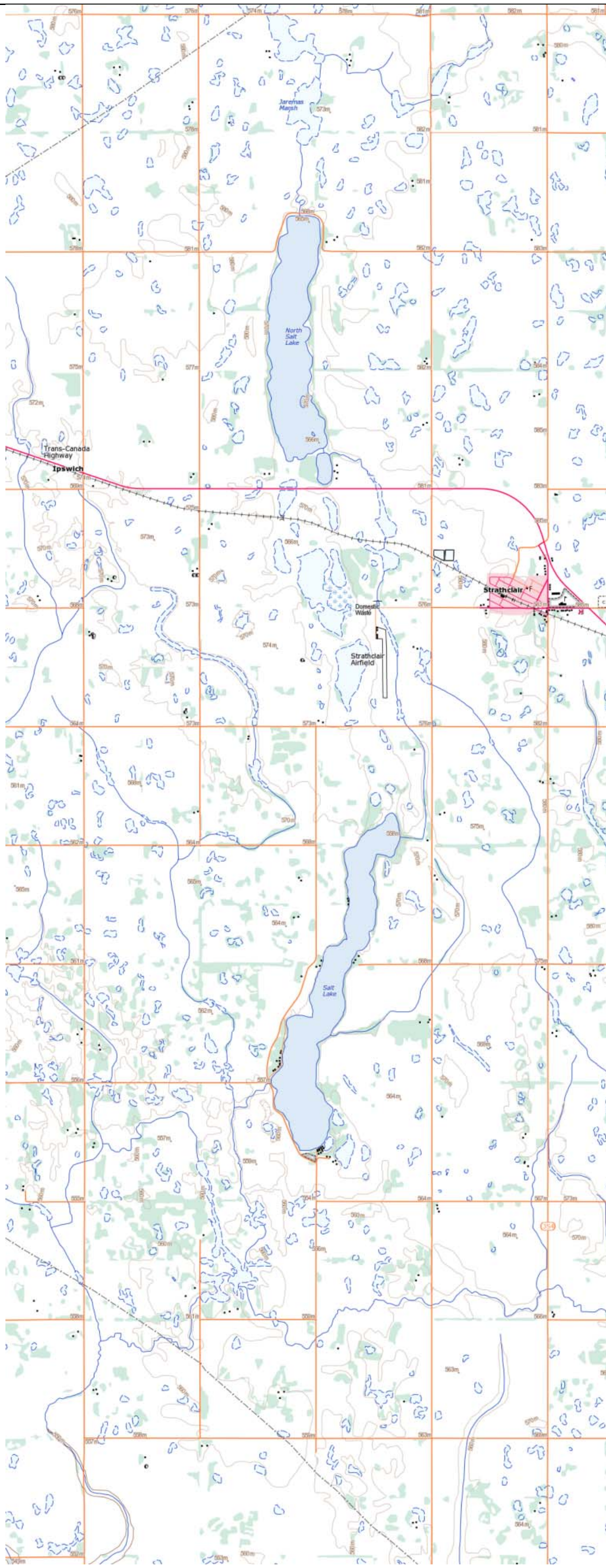
Phase 2:

Evaluate the possibility and impact(s) of diverting a percentage of the Nip Creek water from the minor watershed directly eastward along the north side of Road 99N and into a tributary of the Little Saskatchewan River. While the Little Saskatchewan River is actually part of a different watershed the choice would be either to approve the aforementioned diversion or continue to risk overwhelming the reservoir reserve planned in Phase 1, during high moisture periods such as occurred in 2011. A case can be proven for a social exemption for the rule of never diverting into another watershed.

Phase 3:

The problems inherent from the “upgrading” of the CPR roadbed and Highway 16 will continue and a portion of the flows, now depending upon the salt lakes as their present watershed, must be diverted more directly into the Oak River system. Moreover some maintenance of such water courses would likely be required downstream. Several possibilities exist, some of which are outlined on the Provinces watershed maps. These or portions of these should be examined to see if a route could be achieved that would prevent some of the water flowing through town or around town to be sent directly into a tributary of the Oak River system instead. Currently the water flows into North Salt Lake and into South Salt Lake.

Both present routes are problematic during spring runoff and during other periods of high moisture. A percentage of water could be diverted into an existing tributary that would not overwhelm the Oak River capacity. In any case all of the creeks and flows end up in the same place, at Riley's Marsh, whether they flow through South Salt Lake or any of the other channels. The outflows from Riley's remains the same, provided the reserve outlined in Phase 1 does not overflow Baker's Road, 94N as it did in 2011.



Strathclair Salt Lake Complex

Work Area + Watershed Topographical Map

10 meter contour Interval

Part 2: Environmental Impact Assessment

From Field Work Data 2010-11

Impact Study on:

North Salt Lake
Center Salt Lake
South Salt Lake
Oak River Watershed
Surrounding Lands

Bob Sheedy 2011
2011

Part 2 - Table of Contents

Part 2 - Photos and Graphics Index

Location

- The area effected by drainage comprises an rectangle extending from the NW corner at N 50 28.997 W100 27.700 to the SE Corner at N50 .178 W100 25.400
- The primary area of the Oak River watershed affected lies within a rectangle with the NW corner at N50 18.629 W 100 28.848 and the SE extent at N50 18.629 W100 26.729
- The Salt Lakes (3) lie between a series of north south ridges extending some 3.8 kilometers miles north of Highway 16 (North Salt Lake) and 9.3 kilometers south of highway 16 to tip of South Salt Lake, just west of the village of Strathclair, Manitoba.
- Highway and CPR railway intersect the north end of Central Salt Lake.
- A rolling topographical feature along the east side of the lake system isolates possible drainages and leaves the two northernmost lakes without an outlet.
- The terrain consists mainly of agricultural fields with many prairie pothole sloughs scattered throughout. Tree cover consists of less than 10%.

Figure 1- Bird's Eye View of Affected Area

Figure 2 - Natural outlet to S. Salt Lake

Attach 11x17 Overview Map Here

Historical Usages

- The primary industry in the area is agriculture – mixed with cattle farming but mainly cereal and oil seeds.
- A killing plant and abattoir was located near the south shore of North Salt Lake up until some time in the early 1960s. All effects from it have been long-since degraded.
- There are no petrochemical or agricultural storage sites near the 3 salt lakes or on the immediate watershed.
- A landfill site was decommissioned circa mid-1990s. Water tests taken from the immediate vicinity where ground water movements through the soils immediately extant did not reveal any residual pesticides or other harmful factors. Any organic contaminants would have degraded long ago.
- South Salt Lake is a well known recreational entity, with a public beach, campsite and numerous cottages. Several “squatters” have also set up in areas along the eastern shore.

Proposed Project Intent

The study was implemented to evaluate the impact of turning Center and perhaps the upper layer of North Salt Lake into a reservoir system, by holding water during the peak of normal run-off periods and/or weather events that would overload the Oak River System. The project would also allow the lowering of current water levels and create the capacity to increase in volume without flooding adjacent agricultural lands as has been the problem in recent years. The intent is to allow two licensed releases annually.

- If deemed appropriate after consultations, as below, in the spring, after snowmelt runoff peak and before seeding along effected reaches of the Oak River watershed.
- In the autumn, after the cessation of South Salt Lake water-related recreational activities and after the harvest of low lying areas along the effected Oak River Watershed, if necessary.
- That Manitoba Conservation – Water Stewardship and the RM of Blanshard be notified and/or consulted before commencing any releases of water though the proposed penstock and trench to South Salt Lake and on into the Oak River System
- Manitoba Conservation – Water Stewardship will be consulted before opening the penstock during catastrophic weather events.

Center Salt Lake will be drained to a goal of 565.6 18 meters HAE and, when possible, allowed to reach a maximum of 566.2 meters HAE, which will avoid flooding of agricultural land. In turn North Salt Lake would be limited to 566.2 meters HAE level so no agricultural land will be inundated.

Effects on land and water use

- Agriculture will be unaffected by the projects, other than three farmers reclaiming land that is presently flooded and water control levels becoming regulated to protect against future flooding.
- Water sports and the resort/beach area at South Salt Lake will be unaffected other than gradual fluctuations in salinity as more fresh water is "flushed" through the system.
- This again will fluctuate since salinity will increase upstream during dryer periods when evaporation is greatest and natural salts accumulate when no discharges are planned. Salinity will become affected when water discharges through the system during wet periods.
- An increase in salinity both in water column and in bottom sediments can be expected in the low lying areas of lesser stream current in the zone immediately south of South Salt Lake (see figure3 - EV-1).

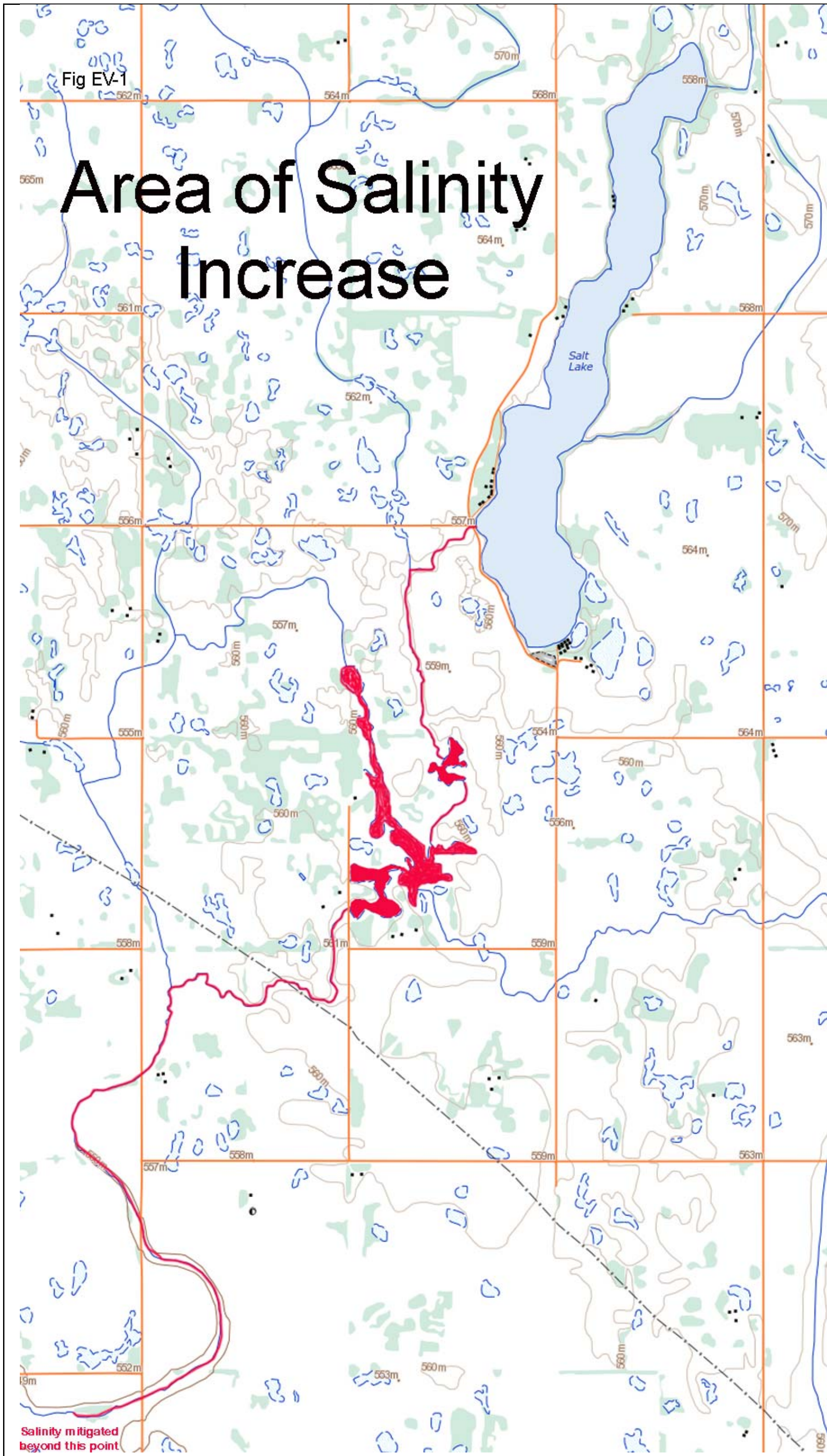


Figure 3- EV-1 Area of Increased Salinity

Map delineates areas of increased salinity in water, pond bottoms and stream sediments

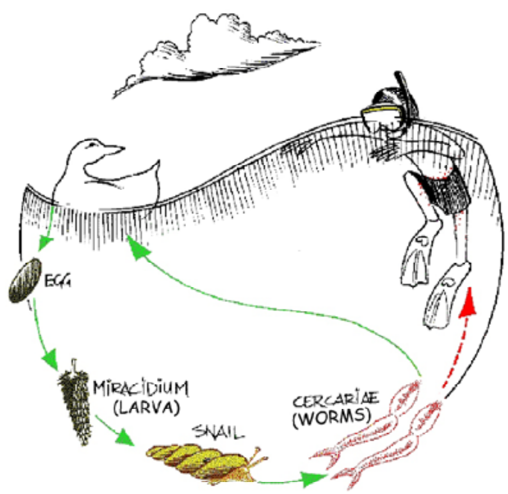
Effects decrease exponentially as distance and currents decrease or increase.

Historical and Parks Impact

- There are no provincial or national parks in the areas.
- No historical monuments or lands are affected.
- There will be no physical impact on the campground located at the south end of South Salt Lake, other than a temporary increase in water levels along beach during a regulated and planned discharge.

Recreational Impacts

- Care must be taken to not interfere or damage docks and other lakeside structures on South Salt Lake during water releases from Center and North Salt Lakes.
- Signs suggesting the presence of **"swimmer's itch**" were posted in 2010 at the south beach of South Salt Lake.
- In some areas, the term is also known as "duckworm itch" since waterfowl and shore birds play a large role in the spread and outbreak of the problem. The extensive weed growth in South Salt Lake (see fig EV-2 and the text box) may harbor the snails and minuscule flatworm parasitical larvae (**trematode** parasites known as **schistosomatidae)** involved. No definitive baseline has been established to know whether such populations grew from the claimed effects of saline EMO discharges from and through Center Salt Lake in 2009 and 2010 or by the increase of 2010 freshwater run-off which also enters South Salt Lake through the creeks located on the east and north east. Probably neither was involved by changes in water chemistry, but rather the genesis was from increased zones of shallow water and associated weed growth created by upstream flooding.



- Swimmer's itch, also called ***cercarial dermatitis***, is an allergic skin reaction that comes from swimming in water where the tremetode flatworms are present in quantity. Aquatic birds or mammals living near the water can become infected with the parasite. The parasite lays eggs in the animal or bird that end up in their feces, which hatch into larvae. These larvae then infect a certain type of aquatic snail and are re-released as developed larvae (called cercariae) into the water. The larvae burrow into the skin of people swimming in lakes (or an ocean) causing a red papule-like itchy rash to develop. The larvae cannot survive long on human skin so they die off, but not without first causing an allergic reaction. From penetrating the body of snails, the tremetode parasitical flatworms develop and then swim forth to seek new hosts. They often collect in aquatic weeds where water fowl comes to feed but sometimes wind will concentrate significant populations in shallow water (such wading beaches as where humans are usually located) and then mistakenly penetrate human skin rather than that of aquatic waterfowl, their main natural carrier

- North Salt Lake has areas of extensive weed growth, developed especially by recent flooding of shallower areas such as the Fraser Moffatt agricultural lands. If drained to its former depth and to its original abrupt basin configuration, such weed growth would drastically reduce.
- More likely the snails and associated **tremetodes** increase in these shallow weedy zones created by flooding. Such areas attract large numbers of feeding ducks and geese who thrive on all three salt lakes and become the carriers transporting the snails and larvae by assimilating them along with plant life. This cycle passes into the water along shorelines from bird feces washing from the shore, from the holding areas in the water by large migrating flocks and by normal aquatic bird species feeding on weed growth during warm summer periods.
- Center Salt Lake is almost **devoid of aquatic vegetation**, other than some forms of algae in shallow areas, and does not host large populations of the aquatic snails needed to pass the tremetode parasite from ducks and geese to plant life to snails. Its present broad widths from its flooded stage does periodically host large populations of resting migratory waterfowl which often move from lake basin to lake basin when disturbed by hunters, eagles and other natural predators.
- A reduction in broad, flooded, shallow zones on all three lakes would curtail some of this parasitic activity but make three salt lakes less attractive for waterfowl. South Salt Lake will not see a reduction in lake depth other than normal evaporation. It has a natural outlet.
- Water releases from the two northern salt lakes and the baring of their shallow flats by draining, twice annually during wet periods, would be expected to mitigate the cycle that creates the environment for “swimmers itch” and a host of other microorganism cycles dependant upon water fowl excrement. The mudflats would attract large numbers of other shorebirds.
- South Salt Lake will not be reduced in volume or depth and weed growth will continue in shallower areas. An area immediately off the South Salt Beach recreational beach was surveyed for aquatic plant life in 2010 and substantial zones were present, as it is throughout the lake with the exception of deeper areas. This potamogeton weed is favorite water fowl forage and a host for the snails needed for part of the life cycle. Swimmers should either avoid it or it could be removed by simple “weed-dredging” the area usually utilized by swimmers and children who generally wade.
- During a “weather bomb” with hurricane force north winds, in November 2010, vast amounts of the aquatic plants potamogeton zosterformis, potamogeton pusillus and chara were piled onto

the beach shore by wave action. It will no doubt be removed in spring 2011 prior to the commencement of recreational water sport activities.

- No other excessive biological implications were noted in water samples from any of the three salt lakes, taken in 2010 and tested by a laboratory approved by Manitoba Conservation- Water Stewardship. (See attached appendix)

South Salt Lake Impacts 2011

It is worth noting that South Salt Lake was subjected to flooding and high turbidity in early 2011. Locals have always maintained that such turbidity was never there prior to the extreme EMO release of 2010. Since no water had entered from Center Salt Lake in early 2011 a study was made to determine the source of the 2011 turbidity and siltation. It was also noted that the increase in depth of Center Salt Lake had mitigated wave activity and associated turbidity. In fact, Center Lake was, in early 2011, the clearest of the three water bodies.

Locals opposed to the proposed trench project immediately addressed the problem source to increased spring activity in the basin of S. Salt Lake. That may be true in part, in the matter of increased pressure in the aquifers, but springs rarely increase turbidity and certainly not to the extent of that witnessed in May 2011. A tour of the entire lake perimeter soon identified the true sources.

The following 4 photos and the areas outlined on them reveal the genesis to be overland flooding through agricultural areas and burst beaver dams.

Figure 4 - East of S. Salt Lake1
Area outlined in blue revealed a massive volume of water flowed directly to S. Salt Lake from across agricultural land. Darkest areas are naked trenches and a source of silt.

Figure 5 - Early heavy inflow to S. Salt Lake
Area outlined (light green grass) was an earlier heavy flow to S. Salt Lake

Figure 6 - S. Salt Lake source- inflow
Another heavy flow that passed on to S. Salt Lake

Figure 7 - Heavy Flows and Erosion (siltation)

All of this erosion ended up in South Salt Lake in early spring 2011 as silt.

Impact on Wildlife (Mammalian)

- Considerable numbers of coyote and fox tracks were noted along shorelines during the survey period of 2010.
- Raccoons, beavers, muskrats and white-tailed deer were observed on many occasions.
- One moose, one fox and one black bear were observed at South Salt Lake campground.
- A bear was also observed feeding on the crops located between Center and South Salt Lakes.
- No impact should be made on mammalian species by the project. No beaver dams will be disturbed if the chosen route is utilized.
- No rare or endangered mammals were observed.

Reptilian and Amphibian

- A few frogs were noted along Central Salt Lake shorelines but were not numerous -- as would be expected in areas of increased salinity
- Large numbers of garter snakes (*thamnophis)* were observed along lakes shores and crossing roadways during the increased late autumn activities of the species.
- No spotted salamanders (*ambystoma maculatum*) were observed, either crossing roadways or when investigating shore lines or when involved in mapping activities. However, field work began after their peak migration activities and they are secretive and difficult to locate during other periods.

Avian

- North Salt Lake hosts a bald eagle's nest and several eagles were observed during the survey period. Several common prairie gull species were present.
- Great blue and green herons and bitterns were noted on several occasions. They appeared to be hunting minnows along shallow lake shores.
- Center Salt Lake is a host for many shore birds. Willets, avocets and spotted sandpipers were common. Migratory species were mainly greater yellowlegs, phalaropes and dunlins.
- Flocks of white pelicans and double-crested cormorants were observed on South Salt Lake on several occasions. Cormorants were photographed drying wings from recent hunts, denoting the presence of minnows and/or fish species.

- Large flocks of snow and Canada geese remained during a long interruption in their migrations in the same period in 2010 caused by favorable weather conditions.
- Potential impacts on migratory bird life would be minor since both periods will occur during times when all basins will be nearing peaks prior to planned discharges. The aforementioned lack of extensive shallow-based aquatic plant growth created by the proposed water control project will make the North Salt Lake complex less attractive to feeding migratory bird life. It will remain a major resting area since it is largely undisturbed by human activity or hunting.
- The exposed mudflats on Center Salt Lake appear to attract many migratory and local wading birds such as sandpipers and herons.
- There is a small but important area at the outlet on South Salt Lake which appears to provide a resting/feeding area for migratory birds in the spring and late autumn. (See Area Important to Migratory Birds)

Fish

No known sport or coarse fish were noted during the survey period of 2010. There was anecdotal evidence of a yellow perch (*Perca flavescens*) caught in South Salt Lake which is quite probable since larger outflows through the Oak River System have been instituted in the past two spring seasons. Yellow perch will follow minnow migrations.

Minnows are known to travel upstream as far as possible during such flows and have entered all three lakes extensively. Only five-spine sticklebacks (*Culaea inconstans)* were noted in all three salt lakes but a few emerald shiners were spotted in the Oak River reach.

Extensive schools of minnows were noted during sonar based bathymetric studies in North and Center Salt Lakes and were visibly viewed during run-off. This was especially so in small entering rivulets from the "weather bomb" that occurred in early November, particularly in the discharge entering Center Salt Lake just north of the abandoned landfill site.

The presence of double-crested cormorants since 2005 is in keeping with a reduction in salinity and incursions of piscatorial life best adapted to brackish aquatic environments, such as sticklebacks and fathead minnows

Invertebrate

- Dragonflies and damselflies were prominent in populations in 2011
- All three salt lakes host hordes of scuds (*gammarus pulex*) and water boatmen (*Corixa).* In early November an explosion in the water flea population (*daphnia*) occurred in North and Center Salt Lakes. The density of the population was so heavy that they were a problem while gathering clean water samples for laboratory tests.
- No caddisflies or mayflies were observed.
- Chironomid populations on all three lakes amazed even long-time residents in the spring of 2011. They are a sign of quality benthic health.

Figure 8 - Extreme chironomid populations on all three salt lakes

Impact on Wildlife Conclusions

- No rare or threatened animals, fish, reptiles, amphibians, invertebrates or plants were found during the 2010 field work period.
- Although somewhat turbid and saline the Salt Lakes located in the RM of Strathclair are healthy aquatic environments for all forms of life, from invertebrate through piscatorial to the largest mammals. Cattle and wildlife drink the water, birds flock to their abundant forage. However, with thousands of waterfowl excreting annually in all 3 lakes, no water in any of the lakes should be considered potable without treatment or boiling.
- Most basic invertebrates thrive.
- All three lakes are an important area for migratory waterfowl and shore birds, whether local or those traveling to and from the far north

Impacts on Aquatic Vegetation in the Oak River Watershed

In the upper reaches, the cattails and sedge grasses along shore and flanking the stream beds are well suited to absorbing the higher pH as nutrients and appear to be either surviving or thriving.

- However, long term effects on this zone should be monitored over the first decade after the water control project is completed.
- Areas of greatest downstream impact will be in broad, low-lying, slow-flowing areas such as centered at N50 19.190 W100 27.374 - Riley's Marsh. Some accumulation of salts can be expected in such non-agricultural marsh areas but effects on wildlife should be similar to that found in shallower areas of the upper Salt Lakes.
- These areas can be monitored annually by simple photographic means.

Mitigation Measures and Residual Environmental Effects

- Future mitigation measures inducing control of the two upper Salt Lake systems, through planned and controlled releases during off-peak periods in the Oak River flow, would have some effects on the area downstream of South Salt Lake.
- Two major EMO releases and another caused by over-road breaches have passed through the system in 2009-2010 without apparent observable damage to vegetation or wildlife. The existence of plants species, such as water plantain (*alisma-plantago-aquatica*) in the immediate downstream sections of the upper Oak River portion indicates that the increase in salinity is mitigated to a considerable degree as other reaches join the flow from South Salt Lake and the distance from that source/outlet increases.
- The collection point at Riley's marsh re-grew normal populations of cattails and sedges in 2011.
- High water levels in South Salt Lake in 2011 caused some rather severe shoreline erosion, prompting cottage owners to request a EMO release. At the time a strong release was in the Oak River system from the discharge from Shoal Lake and the city of Brandon was under threat. No capacity existed for other than what went through the culvert, which in turn had been raised by ice-out. Gaining control over the water in North and Center Salt Lake would assist in mitigating such shoreline erosion in the future. Yet these are the very folks opposed to the control structure and trench!

Strathclair Waste Water Effluent and Impoundments

- The discharge of waste water from the village of Strathclair into North Salt Lake is under license with Water Stewardship Manitoba Environment.
- Waste water is periodically discharged into flows terminating in North Salt Lake as per license.
- Volume is of small consequence compared to broad catchment presently directed into the three salt lake systems. A third lagoon cell became active in July 2011, further mitigating contaminants flowing to North Salt Lake
- Detrimental effects of this effluent does not appear in water samples taken in either 2008 and 2010 (see attached appendix – Water Quality)

Abandoned Land Fill on Center Salt Lake

The abandoned land fill on the eastern flank of Center Salt Lake has been a concern and source of virulent rhetoric for a number of folks who own land or visit the area; some cottage owners on the South lake or those involved with cottage owners taking the lead. Higher water levels have allowed encroachment to the edges of the former landfill, allowing strong wave action to erode the flanks to cause caving and the exposure of numerous items formerly buried.

One of the priorities was an examination of this zone by a disinterested third party who would not be influenced by the variety of opinions. For that reason, the procedure was free of any preconception and the chain of security regarding the samples ensured.

A separate set of water samples were deliberately taken nearest the most unsightly zone and where water appeared to be leaching from an extreme weather event in early November. They were tested for the locally claimed pesticide residue supposedly leaking through the soil and into the lake.

No indicators were found in the water samples to suggest any strong sources of pollution, pesticides or otherwise.

While unsightly, the abandoned land fill does not, at present, create any detrimental effects on the watershed. Excess fill taken from the proposed trenching and excavation project could be trucked to once again bury the items exposed and the proposed controlled water levels in Center Salt Lake should prevent any future erosion by wave activity. A second choice may be to armor the face of the slope with geotextile cloth should it become necessary, not regarding the presence of pollutants, but rather to mitigate erosion during periods of higher water levels in Center Salt Lake.

Land Use Designation and Ownership Related Issues

- No Crown land is involved in the planned water control
- Moffatt Land is owned by Reg and Susan Moffatt and will be expropriated as needed (if required).
- Winstone land is owned by Gerald Winstone and will be expropriated as needed (if required).
- Watson Land is owned by Scott and Lisa Watson and will be expropriated as needed (if required).
- Baker land is owned by Wayne and Cathy Baker and will be expropriated as needed(if required).
- The Baker's appear to be willing to sign permission without the expropriation process.
- All lands are currently designated as Agricultural.

Sensitive Area of Bird Related Interest

Figure 9- Area of Bird Interest

The outwash from the culvert on South Salt Lake is rich in forage that attracts varied migratory bird life.

Hordes of gammarus scuds, water boatmen and daphnia wash through the culvert, being drawn by the slow currents over a wide area to the inflow of the culvert barrel.

While some of the early avian migratory arrivals will later nest in Manitoba environs, they appear to build up in numbers in this small but important flooded, but shallow, enclave. Perfectly suited for waders and shore birds it attracts, willets, phalaropes, marbled godwits, avocets, bitterns, great blue and black-crowned herons, greater yellowlegs, dunlins, least, spotted and solitary sandpipers, all of Manitoba "puddle ducks" and even one snowy egret that arrived for a brief stay in July 2011.

None of these birds are endangered or even rare but it is rare to see so many of them, in such a wide variety, in such an accessible area, where birder folks can observe them from two roadways. They also appear to be rather cooperative, often resisting near approaches to flush them for wing patterns and barring to make positive identification. The following photo was taken in a channel when the S. Salt Lake road breached. Similar populations regularly flow through the culvert into the shallow broad area outlined in Figure 9.

Figure 10 - gammarus scuds - Road breach S. Salt Lake

Figure 11 - Phalaropes stop by during migration

Figure 12 - Various sandpipers and waders favor the spot

The landowner has expressed a desire to have a single discrete trench deepened to reclaim the land for agricultural purposes. Some thought should be given by those empowered to issue such license prior to granting same. This is a small but unique area, seemingly as yet "undiscovered" by those of the birding world and should at some point be afforded some protection and preservation.

While small and perhaps little known it is deserving of such.

Follow-up and Monitoring

- Releases should be made only when flow capacity is available in the Oak River reaches.
- An “indicator” culvert should be chosen and established in the effected reach of the Oak River system, with a visible graduated scale which can be related to such capacity and flows over a period of time. Such a culvert would make inspection and flow evaluation a simple matter. The penstock discharge at the south end of Center Salt Lake can be regulated accordingly.
- The penstock should be controlled by a wheel actuated worm drive and locked with a padlock to prevent vandalism or operation independent of appointed RM personnel monitoring the regulated discharge.
- Monitoring must be done throughout each release period by human visitation to critical sites. It must be understood that sudden rainstorms or other weather events can create flows in other reaches of the Oak River that can induce downstream flooding when combined with a planned salt lake discharge. The penstock discharge must be immediately scaled back during such events.
- The pH and salinity of the three effected lakes and reaches can be monitored with a handheld electronic meter to build a reporting database derived from annual release periods.
- Annual effects on vegetation should be monitored, even by simple photographic means taken from defined locations.

Conclusions

Water issues formed very vitriolic topics anywhere in the Canadian Prairies during 2011. Almost everyone has a water-borne issue of some kind and some deep rifts have been driven between long-standing members of local populaces. The area surrounding the RM of Strathclair is no different.

After a public meeting, called to gain public opinion regarding the excavation of a trench to alleviate water levels in the two northernmost salt lakes and Jeramas Marsh, a number stood and gave their widely varying opinions. A number came forward at the end of the meeting and asked the author of this report for further investigations on their behalf. The follow up revealed that most only wanted support for their side of issues unrelated to the trenching project. These often pertained to something a neighbor either upstream or down slope was planning or had already implemented. Some were valid and will be further examined in Phase 2 and 3 but others were self-serving and clearly designed to 'get the water moving from off my land so I can plant earlier'.

However, most simply expressed that they didn't want water flowing near and certainly not across their land, in any form. The general consensus one has to interpret in the end is that the water in the 2 northern lakes and Jeramas Marsh can stay there. "It's not their problem."

Unfortunately it will <u>not</u> remain. Water of such depth is slow to evaporate. Even a so-called "normal" winter in 2011-12 will create an immediate overflow and there is no capacity to contain it in the spring of 2012. The 45 cm gained by the EMO release in 2010, throughout Center and North Salt Lakes is gone.

Just as it burst over Baker's Road and again at South Salt Lake, so it will do so again. This time it will threaten the same for Highway 16 and further soften the CPR roadbed which saw trains throttled to 10mph in the late spring of 2011. The 90cm culvert under Hwy16 simply cannot pass water quickly enough for a rapid melt, should one occur. It is submerged and inefficient, lacking proper venting. The railway bridge has been sandbagged already, along all exposed quadrants.

To ignore the situation is like a group of poker players only gambling with flood, not cards, and all involved know it.

There are no outstanding <u>physical</u> environmental issues with excavating a trench as laid out in the accompanying Hydrological Assessment Impact Report, other than those few caveats mentioned formerly in this writing. All remaining issues are <u>social</u> and they too can be addressed and mitigated in the ongoing plans for Phase 2 and 3.

In all scenarios, whatever may be found and forwarded, the trench is the primary necessity and the subject of this Environmental Impact Assessment.

Attached are Parts 3 and 4

Water Quality Study

Water Analysis Study

Parts 3 and 4

Water Quality Assessment

Part 3 - Water Evaluations generated from a YSI 566 Sonde

Water quality measurements were made in October 2010 from a calibrated sonde and YSI meter on three salt lakes and at 2 points on the Oak River downstream from South Salt Lake. An extra sampling was done at the abandoned landfill on Center Salt Lake.

The parameters measured are more accurate than those from the laboratory which uses flocculation methods on dissolved oxygen, etc.

The parameters measured were:

- Water Depth of sampling
- Water temperature at probe

3 Electrical properties

  - Ms/c/cm
  - Ms/cm
  - Conductivity
- TDS – Total Dissolved Solids
- Salinity
- % of Dissolved Oxygen
- Dissolved Oxygen in ppm
- pH
- ORP – Oxygen Reduction Potential (usually associated with polluted water)

The results are shown in 6 attached tables to follow

Part 4 - Water Evaluations from Laboratory Tests

4 complete water samples were sent to Maxxam Laboratories to test for the presence of pesticides as well as a full chemical analysis. The samples were taken from South Salt Lake and North Salt Lake. Two were taken from Center Salt Lake. One was intended to examine any out flow from abandoned landfill site.

One of major interest was taken at the abandoned landfill adjacent to an area where water was seeping through the soil after a recent major rain event. The water sample was taken at a distance of 2 meters (out in the lake) from that seepage.

The results are posted in the attached tables.

Water Quality Profiles

Name of Water			Time of Sample	Secchi Disk (m)
Oak River- Culvert #2		**Notes:**	15L49	Bottom visible- .3M
Date	**Air Temp**	See associated map for GPS location	**Wind Dir./Velocity(km)**	
			N/A	

Depth (Meters)	H20 Temp (C)	ms/c/cm	ms/cm	Conductivity	TDS	Sal	% Dissolved O2	DO	pH
0.3	8.02	4.048	2.735	365.62	2.631	2.15	134	15.65	8.34
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Water Quality Profiles

Name of Water							Time of Sample		Secchi Disk (m)
Oak River- Culvert #1			Notes:				15:26		Bottom visible
Date		Air Temp	Taken at first culvert where it exits the low swampy area. Slow current.				Wind Dir./Velocity(km)		
Oct21_2010		N/A					N/A	N/A	

Depth (Meters)	H20 Temp (C)	ms/c/cm	ms/cm	Conductivity	TDS	Sal	% Dissolved O2	DO	pH
0.4	6.49	4.107	2.655	376.71	2.669	2.18	61.7	7.48	8.18
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Water Quality Profiles

Name of Water								**Time of Sample**		**Secchi Disk (m)**
North Lake			**Notes:**					14:02		0.65
Date		**Air Temp**	See Associated map for sample location					**Wind Dir./Velocity(km)**		
Oct21_2010								N	5	
Depth (Meters)	**H20 Temp (C)**	**ms/c/cm**	**ms/cm**	**Conductivity**	**TDS**	**Sal**	**% Dissolved O2**	**DO**		**pH**
0.65	8.24	6.374	4.333	230.77	4.143	3.48	117.6	13.54		8.41
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Water Quality Profiles

Name of Water			Notes:				Time of Sample		Secchi Disk (m)
Center Salt Lake - South End							12:41		0.1
Date		Air Temp	Taken out from road				Wind Dir./Velocity(km)		
Oct21 2010							N	5	

Depth (Meters)	Temp (C)	ms/c/cm	ms/cm	Conductivity	TDS	Sal	% Dissolved O2	DO	pH
0.5	3.9	4.84	2.89	346	3.146	2.57		11.79	8.22
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Water Quality Profiles

Name of Water						Time of Sample		Secchi Disk (m)
Center Salt Lake - Dump			Notes:			13:24		0.1
Date	Air Temp	Taken out from old abandoned landfill				Wind Dir./Velocity(km)		
						N	5	

Depth (Meters)	H20 Temp (C)	ms/c/cm	ms/cm	Conductivity	TDS	Sal	% Dissolved O2	DO	pH
0.5	7.09	7.144	4.701	212.74	4.644	3.93	116.4	13.74	8.36
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Water Quality Profiles

Name of Water						Time of Sample		Secchi Disk (m)
South Salt Lake		Notes:				12:21		0.7
Date	Air Temp					Wind Dir./Velocity(km)		
Oct21_2010	N/A	Taken out from cilvert Outlet				N	5	

Depth (Meters)	Temp (C)	ms/c/cm	ms/cm	Conductivity	TDS	Sal	% Dissolved O2	DO	pH
0.5	6.42	4.365	2.816	355.12	2.837	2.32	93	11.28	8.43
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Part 4

Water Quality

Sample Analysis for 4 Samples

November 2010

Center Salt Lake (2)

North Salt Lake (1)

South Salt Lake (1)

Analysis by Maxxam Labs

2010

Success Through Science®

Attention: MURRAY RAPLEY
RURAL MUNICIPALITY OF STRATHCLAIR
BOX 160
STRATHCLAIR, MB
Canada R0J 2C0

Report Date: 2010/11/26

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B0A9531
Received: 2010/11/09, 09:00

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	4	2010/11/12	2010/11/12	74-C-002	Based on SM-2320B
Biochemical Oxygen Demand	4	2010/11/15	2010/11/15	74-C-016	Based on SM-5210B
Chlorophyll A (water) (1)	4	N/A	2010/11/10	056-02	Based on SM-10200 H
Chloride by Automated Colourimetry (1)	4	N/A	2010/11/12	BRN-SOP 00234 R3.0	Based on EPA 325.2
Colour (True)	4	N/A	2010/11/10	74-C-059	Based on SM-2120B
Chromium, Hexavalent (1)	4	N/A	2010/11/16	BRN SOP-00238 R4.0	SM - 3500Cr B
Conductivity	4	N/A	2010/11/10	74-C-003	Based on SM-2510B
Hardness Total (calculated as CaCO3) (1)	4	N/A	2010/11/15		
Elements by CRC ICPMS (dissolved) (1)	4	N/A	2010/11/16	BRN SOP-00206	Based on EPA 200.8
Na, K, Ca, Mg, S by CRC ICPMS (total) (1)	4	2010/11/09	2010/11/15	BRN SOP-00206	Based on EPA 200.8
Elements by CRC ICPMS (total) (1)	4	2010/11/12	2010/11/14	BRN SOP-00206	Based on EPA 200.8
Nitrogen (Total) (1)	4	2010/11/16	2010/11/15	BRN SOP-00242 R3.0	Based on SM-4500N C
Ammonia-N Dissolved (1)	4	N/A	2010/11/15		
Nitrate + Nitrite (N) (1)	4	N/A	2010/11/15		Based on USEPA 353.2
Diagnostic Pesticide Scan in Water (1)	4	2010/11/15	2010/11/17	BRN SOP-00336 R5.0	BCMOE/ EPA 8270D
Filter and HNO3 Preserve for Metals (1)	4	N/A	2010/11/15	BRN WI-00006 R1.0	Based on EPA 200.2
pH	4	N/A	2010/11/10	74-C-001	SM4500-H+A,B
Orthophosphate by Konelab (1)	4	N/A	2010/11/12	BRN SOP-00235 R5.0	SM 4500 P F
Sulphate by Automated Colourimetry (1)	4	N/A	2010/11/16	BRN-SOP 00243 R1.0	Based on EPA 375.4
Carbon (total) (Calc. - Org. + Inorg.) (1)	4	N/A	2010/11/22	CAL WI# 0013	
Total Dissolved Solids (Filt. Residue) (1)	4	N/A	2010/11/12	BBY6SOP-00033	SM 2540C
Carbon (DIC) (1)	2	N/A	2010/11/18	BRN SOP-00244 R2.0	Based on SM-5310C
Carbon (DIC) (1)	2	N/A	2010/11/23	BRN SOP-00244 R2.0	Based on SM-5310C
Carbon (Total Inorganic) (1)	4	N/A	2010/11/12	BRN SOP-00244 R2.0	Based on SM-5310C
TKN (Calc. TN, N/N) total (1)	4	N/A	2010/11/16		
Carbon (Total Organic) (1)	4	N/A	2010/11/16	BRN SOP-00224 R4.0	Based on SM-5310C
Phosphorus-P (Total, dissolved) (1)	4	2010/11/10	2010/11/12	BRN SOP-00236 R4.0	SM-4500PF
Total Phosphorus (1)	4	N/A	2010/11/12	BRN SOP-00236 R4.0	SM 4500
Phosphate-P (Total, particulate) (1)	4	N/A	2010/11/12	CAL SOP-0108, EDM SOP-0043	Calculation
Total Suspended Solids (1)	4	N/A	2010/11/12	BRN SOP-00277 R5.0	Based on SM - 2540 D
Turbidity	4	N/A	2010/11/10	74-C-056	Based on SM-2130B
Pesticides in Water Subcontract (2)	4	2010/11/26	2010/11/15		

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(1) This test was performed by Maxxam Vancouver
(2) This test was performed by Maxxam Ontario (from Winnipeg)

Encryption Key

Janelle Kochan

Janelle Kochan

26 Nov 2010 09:02:16 -06:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

JANELLE KOCHAN, B.Sc,
Email: JKochan@maxxam.ca
Phone# (204) 772-7276 Ext:2209

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		Y32525	Y32526		Y32527		
Sampling Date		2010/11/08 11:15	2010/11/08 10:30		2010/11/08 09:10		
	Units	**#1 OF 4 CENTER LAKE**	**#3 OF 4 CENTER LAKE DUMP**	**RDL**	**#2 OF 4 - SOUTH LAKE**	**RDL**	**QC Batch**
Parameter							
Chlorophyll a	ug/L	80.1	62.3	0.1	103	0.1	4425962
Subcontract Parameter	N/A	ATTACHED	ATTACHED	N/A	ATTACHED	N/A	4456269
Calculated Parameters							
Filter and HNO3 Preservation	N/A	LAB	LAB	N/A	LAB	N/A	4415454
Total Hardness (CaCO3)	mg/L	2460	2310	0.5	1070	0.5	4411731
Demand Parameters							
Biochemical Oxygen Demand	mg/L	13	12	1	10	1	4427728
Misc. Inorganics							
Conductivity	uS/cm	14100	14300	1	7250	1	4423397
Alkalinity (Total as CaCO3)	mg/L	610	610	1	400	1	4423464
Total Organic Carbon (C)	mg/L	38.0	38.7	0.5	28.0	0.5	4430847
pH	pH Units	8.9	8.8		8.9		4423408
Bicarbonate (HCO3)	mg/L	600	600	0.5	410	0.5	4423464
Carbonate (CO3)	mg/L	74	72	0.5	41	0.5	4423464
Hydroxide (OH)	mg/L	ND	ND	0.5	ND	0.5	4423464
Anions							
Orthophosphate (P)	mg/L	0.71	0.71	0.01	0.008	0.001	4417538
Dissolved Sulphate (SO4)	mg/L	5200	5400	50	2900	50	4432391
Dissolved Chloride (Cl)	mg/L	240	220	5	110	0.5	4424423
Metals							
Hex. Chromium (Cr 6+)	mg/L	0.003	0.004	0.001	0.004	0.001	4431587
Nutrients							
Dissolved Ammonia (N)	mg/L	0.082	0.078	0.005	0.26	0.005	4426288
Total Carbon (C)	mg/L	50	53	0.5	31	0.5	4414500
Particulate Phosphate (P)	mg/L	0.20	0.20	0.02	0.229	0.002	4414501
Dissolved Phosphorus (P)	mg/L	0.82	0.81	0.02	0.051	0.002	4417533
Total Total Kjeldahl Nitrogen (Calc)	mg/L	3.7	3.7	0.2	3.0	0.2	4411556
Dissolved Inorganic Carbon (C)	mg/L	ND	ND	0.5	ND	0.5	4435764
Total Inorganic Carbon (C)	mg/L	12.4	14.5	0.5	3.5	0.5	4421542
Nitrate plus Nitrite (N)	mg/L	0.04	0.02	0.02	0.12	0.02	4428888
Total Nitrogen (N)	mg/L	3.8	3.7	0.2	3.1	0.2	4426518
Total Phosphorus (P)	mg/L	1.02	1.02	0.02	0.279	0.002	4417535

ND = Not detected
RDL = Reportable Detection Limit

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		Y32525	Y32526		Y32527		
Sampling Date		2010/11/08 11:15	2010/11/08 10:30		2010/11/08 09:10		
	Units	**#1 OF 4 CENTER LAKE**	**#3 OF 4 CENTER LAKE DUMP**	**RDL**	**#2 OF 4 - SOUTH LAKE**	**RDL**	**QC Batch**
Physical Properties							
True Colour	Col. Unit	52	48	5	16	5	4423452
Total Suspended Solids	mg/L	63	58	4	23	4	4418344
Total Dissolved Solids	mg/L	6900	7400	10	3700	10	4422971
Turbidity	NTU	25	23	0.1	11	0.1	4418127

RDL = Reportable Detection Limit

Explanations of Physical Properties

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RURAL MUNICIPALITY OF STRATHCLAIR

Maxxam Job #: B0A9531
Report Date: 2010/11/26

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		Y32528		
Sampling Date		2010/11/08 12:40		
	Units	**#4 OF 4 - NORTH LAKE**	**RDL**	**QC Batch**
Parameter				
Chlorophyll a	ug/L	69.0	0.1	4425962
Subcontract Parameter	N/A	ATTACHED	N/A	4456269
Calculated Parameters				
Filter and HNO3 Preservation	N/A	LAB	N/A	4415454
Total Hardness (CaCO3)	mg/L	2110	0.5	4411731
Demand Parameters				
Biochemical Oxygen Demand	mg/L	7	1	4427728
Misc. Inorganics				
Conductivity	uS/cm	12700	1	4423397
Alkalinity (Total as CaCO3)	mg/L	500	1	4423464
Total Organic Carbon (C)	mg/L	34.3	0.5	4430847
pH	pH Units	8.7		4423408
Bicarbonate (HCO3)	mg/L	520	0.5	4423464
Carbonate (CO3)	mg/L	48	0.5	4423464
Hydroxide (OH)	mg/L	ND	0.5	4423464
Anions				
Orthophosphate (P)	mg/L	0.70	0.01	4417538
Dissolved Sulphate (SO4)	mg/L	4600	50	4432391
Dissolved Chloride (Cl)	mg/L	220	5	4424423
Metals				
Hex. Chromium (Cr 6+)	mg/L	0.001	0.001	4431587
Nutrients				
Dissolved Ammonia (N)	mg/L	0.053	0.005	4426288
Total Carbon (C)	mg/L	49	0.5	4414500
Particulate Phosphate (P)	mg/L	0.08	0.02	4414501
Dissolved Phosphorus (P)	mg/L	0.81	0.02	4417533
Total Total Kjeldahl Nitrogen (Calc)	mg/L	2.9	0.2	4411556
Dissolved Inorganic Carbon (C)	mg/L	ND	0.5	4435764
Total Inorganic Carbon (C)	mg/L	15.1	0.5	4421542
Nitrate plus Nitrite (N)	mg/L	0.02	0.02	4428888
Total Nitrogen (N)	mg/L	2.9	0.2	4426518
Total Phosphorus (P)	mg/L	0.90	0.02	4417535

ND = Not detected
RDL = Reportable Detection Limit

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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		Y32528		
Sampling Date		2010/11/08 12:40		
	Units	**#4 OF 4 - NORTH LAKE**	**RDL**	**QC Batch**
Physical Properties				
True Colour	Col. Unit	33	5	4423452
Total Suspended Solids	mg/L	27	4	4418344
Total Dissolved Solids	mg/L	5800	10	4422971
Turbidity	NTU	6.2	0.1	4418127

RDL = Reportable Detection Limit

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RURAL MUNICIPALITY OF STRATHCLAIR

Maxxam Job #: B0A9531
Report Date: 2010/11/26

SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		Y32525	Y32526	Y32527	Y32528		
Sampling Date		2010/11/08 11:15	2010/11/08 10:30	2010/11/08 09:10	2010/11/08 12:40		
	Units	**#1 OF 4 CENTER LAKE**	**#3 OF 4 CENTER LAKE DUMP**	**#2 OF 4 - SOUTH LAKE**	**#4 OF 4 - NORTH LAKE**	**RDL**	**QC Batch**
FOOD GROUP PARAMETERS							
Chlorothalonil (Daconil)	ug/L	ND	ND	ND	ND	1	4426067
Parameter							
4,4'-methoxychlor	ug/L	ND	ND	ND	ND	0.1	4426067
a-Chlordane	ug/L	ND	ND	ND	ND	0.06	4426067
Deltamethrin	ug/L	ND	ND	ND	ND	0.04	4426067
g-Chlordane	ug/L	ND	ND	ND	ND	0.06	4426067
Propanil	ug/L	ND	ND	ND	ND	0.2	4426067
Organochlorine Pesticides							
Lindane (BHC), gamma-	ug/L	ND	ND	ND	ND	0.1	4426067
PESTICIDE RESIDUE							
Carboxin	ug/L	ND	ND	ND	ND	0.08	4426067
Surrogate Recovery (%)							
2-FLUOROBIPHENYL (sur.)	%	81	78	55	77		4426067
D5-NITROBENZENE (sur.)	%	77	76	55	73		4426067
p,p'-DDE13C12 (sur.)	%	53	54	42	58		4426067
TERPHENYL-D14 (sur.)	%	76	77	55	75		4426067
Triphenyl phosphate (sur.)	%	76	78	55	76		4426067

ND = Not detected
RDL = Reportable Detection Limit

The MCLG for glyphosate is 0.7 mg/L or 700 ppb.

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RURAL MUNICIPALITY OF STRATHCLAIR

Maxxam Job #: B0A9531
Report Date: 2010/11/26

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		Y32525	Y32526		Y32527	Y32528		
Sampling Date		2010/11/08 11:15	2010/11/08 10:30		2010/11/08 09:10	2010/11/08 12:40		
	Units	**#1 OF 4 CENTER LAKE**	**#3 OF 4 CENTER LAKE DUMP**	**RDL**	**#2 OF 4 - SOUTH LAKE**	**#4 OF 4 - NORTH LAKE**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS								
Dissolved Aluminum (Al)	ug/L	23	20	10	12	28	10	4426000
Total Metals by ICPMS								
Total Aluminum (Al)	ug/L	691	526	6	27	138	3	4421865
Total Antimony (Sb)	ug/L	ND	ND	1	0.7	ND	0.5	4421865
Total Arsenic (As)	ug/L	13.0	12.5	0.2	13.6	10.2	0.1	4421865
Total Barium (Ba)	ug/L	42	39	2	10	31	1	4421865
Total Beryllium (Be)	ug/L	ND	ND	0.2	ND	ND	0.1	4421865
Total Bismuth (Bi)	ug/L	ND	ND	2	ND	ND	1	4421865
Total Boron (B)	ug/L	1580	1530	100	2070	1440	50	4421865
Total Cadmium (Cd)	ug/L	ND	ND	0.02	0.01	ND	0.01	4421865
Total Chromium (Cr)	ug/L	ND	ND	2	ND	ND	1	4421865
Total Cobalt (Co)	ug/L	ND	ND	1	ND	ND	0.5	4421865
Total Copper (Cu)	ug/L	2.6	2.3	0.4	4.1	1.0	0.2	4421865
Total Iron (Fe)	ug/L	944	806	10	51	202	5	4421865
Total Lead (Pb)	ug/L	1.1	1.1	0.4	1.6	0.3	0.2	4421865
Total Lithium (Li)	ug/L	1490	1470	10	932	1390	5	4421865
Total Manganese (Mn)	ug/L	207	180	2	40	38	1	4421865
Total Mercury (Hg)	ug/L	ND	ND	0.04	ND	ND	0.02	4421865
Total Molybdenum (Mo)	ug/L	3	2	2	2	2	1	4421865
Total Nickel (Ni)	ug/L	4	4	2	1	2	1	4421865
Total Selenium (Se)	ug/L	0.3	0.3	0.2	0.1	0.2	0.1	4421865
Total Silicon (Si)	ug/L	5130	4650	200	1940	850	100	4421865
Total Silver (Ag)	ug/L	ND	ND	0.04	ND	ND	0.02	4421865
Total Strontium (Sr)	ug/L	1100	1050	2	245	769	1	4421865
Total Thallium (Tl)	ug/L	ND	ND	0.1	ND	ND	0.05	4421865
Total Tin (Sn)	ug/L	ND	ND	10	ND	ND	5	4421865
Total Titanium (Ti)	ug/L	15	14	10	ND	ND	5	4421865
Total Uranium (U)	ug/L	6.7	6.5	0.2	2.4	5.1	0.1	4421865
Total Vanadium (V)	ug/L	ND	ND	10	ND	ND	5	4421865
Total Zinc (Zn)	ug/L	ND	ND	10	ND	ND	5	4421865
Total Zirconium (Zr)	ug/L	1	ND	1	ND	ND	0.5	4421865
Total Calcium (Ca)	mg/L	157	150	0.1	48.9	116	0.05	4412767

ND = Not detected
RDL = Reportable Detection Limit

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		Y32525	Y32526		Y32527	Y32528		
Sampling Date		2010/11/08 11:15	2010/11/08 10:30		2010/11/08 09:10	2010/11/08 12:40		
	Units	**#1 OF 4 CENTER LAKE**	**#3 OF 4 CENTER LAKE DUMP**	**RDL**	**#2 OF 4 - SOUTH LAKE**	**#4 OF 4 - NORTH LAKE**	**RDL**	**QC Batch**
Total Magnesium (Mg)	mg/L	502	471	0.1	230	442	0.05	4412767
Total Potassium (K)	mg/L	108	102	0.1	65.9	103	0.05	4412767
Total Sodium (Na)	mg/L	2100	1990	0.1	1080	1840	0.05	4412767
Total Sulphur (S)	mg/L	2150	2040	6	1010	1830	3	4412767

RDL = Reportable Detection Limit

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments

Sample Y32525-04 Elements by CRC ICPMS (dissolved): RDL raised due to sample matrix interference.

Sample Y32526-04 Elements by CRC ICPMS (dissolved): RDL raised due to sample matrix interference.

Sample Y32527-04 Elements by CRC ICPMS (dissolved): RDL raised due to sample matrix interference.

Sample Y32528-04 Elements by CRC ICPMS (dissolved): RDL raised due to sample matrix interference.

Sample Y32525-08 Elements by CRC ICPMS (total): RDL raised due to sample matrix interference.

Sample Y32526-08 Elements by CRC ICPMS (total): RDL raised due to sample matrix interference.

Results relate only to the items tested.

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Quality Assurance Report

Maxxam Job Number: NB0A9531

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4417533 CK	Matrix Spike	Dissolved Phosphorus (P)	2010/11/12		105	%	80 - 120
	Spiked Blank	Dissolved Phosphorus (P)	2010/11/12		102	%	80 - 120
	Method Blank	Dissolved Phosphorus (P)	2010/11/12	ND, RDL=0.002		mg/L	
	RPD	Dissolved Phosphorus (P)	2010/11/12	0.7		%	20
4417535 CK	Matrix Spike	Total Phosphorus (P)	2010/11/12		96	%	80 - 120
	Spiked Blank	Total Phosphorus (P)	2010/11/12		94	%	80 - 120
	Method Blank	Total Phosphorus (P)	2010/11/12	ND, RDL=0.002		mg/L	
	RPD	Total Phosphorus (P)	2010/11/12	1.6		%	20
4417538 CK	Matrix Spike	Orthophosphate (P)	2010/11/12		103	%	80 - 120
	Spiked Blank	Orthophosphate (P)	2010/11/12		100	%	N/A
	Method Blank	Orthophosphate (P)	2010/11/12	0.002, RDL=0.001		mg/L	
	RPD	Orthophosphate (P)	2010/11/12	5.0		%	20
4418127 RR6	Method Blank	Turbidity	2010/11/10	ND, RDL=0.1		NTU	
	RPD [Y32525-02]	Turbidity	2010/11/10	0.8		%	20
4418344 TW2	Matrix Spike	Total Suspended Solids	2010/11/12		105	%	80 - 120
	Spiked Blank	Total Suspended Solids	2010/11/12		102	%	80 - 120
	Method Blank	Total Suspended Solids	2010/11/12	ND, RDL=4		mg/L	
	RPD [Y32527-03]	Total Suspended Solids	2010/11/12	8.3		%	25
4421542 TL2	Matrix Spike	Total Inorganic Carbon (C)	2010/11/12		NC	%	80 - 120
	Spiked Blank	Total Inorganic Carbon (C)	2010/11/12		109	%	80 - 120
	Method Blank	Total Inorganic Carbon (C)	2010/11/12	ND, RDL=0.5		mg/L	
	RPD	Total Inorganic Carbon (C)	2010/11/12	0.6		%	20
4421865 JSW	Matrix Spike	Total Arsenic (As)	2010/11/15		93	%	80 - 120
		Total Beryllium (Be)	2010/11/15		101	%	80 - 120
		Total Cadmium (Cd)	2010/11/15		95	%	80 - 120
		Total Chromium (Cr)	2010/11/15		99	%	80 - 120
		Total Cobalt (Co)	2010/11/15		99	%	80 - 120
		Total Copper (Cu)	2010/11/15		97	%	80 - 120
		Total Lead (Pb)	2010/11/15		98	%	80 - 120
		Total Lithium (Li)	2010/11/15		111	%	80 - 120
		Total Nickel (Ni)	2010/11/15		100	%	80 - 120
		Total Selenium (Se)	2010/11/15		102	%	80 - 120
		Total Uranium (U)	2010/11/15		93	%	80 - 120
		Total Vanadium (V)	2010/11/15		95	%	80 - 120
		Total Zinc (Zn)	2010/11/15		89	%	80 - 120
	Spiked Blank	Total Arsenic (As)	2010/11/14		97	%	80 - 120
		Total Beryllium (Be)	2010/11/14		108	%	80 - 120
		Total Cadmium (Cd)	2010/11/14		105	%	80 - 120
		Total Chromium (Cr)	2010/11/14		101	%	80 - 120
		Total Cobalt (Co)	2010/11/14		100	%	80 - 120
		Total Copper (Cu)	2010/11/14		113	%	80 - 120
		Total Lead (Pb)	2010/11/14		106	%	80 - 120
		Total Lithium (Li)	2010/11/14		112	%	80 - 120
		Total Nickel (Ni)	2010/11/14		106	%	80 - 120
		Total Selenium (Se)	2010/11/14		101	%	80 - 120
		Total Uranium (U)	2010/11/14		106	%	80 - 120
		Total Vanadium (V)	2010/11/14		98	%	80 - 120
		Total Zinc (Zn)	2010/11/14		116	%	80 - 120
	Method Blank	Total Aluminum (Al)	2010/11/14	ND, RDL=3		ug/L	
		Total Antimony (Sb)	2010/11/14	ND, RDL=0.5		ug/L	
		Total Arsenic (As)	2010/11/14	ND, RDL=0.1		ug/L	
		Total Barium (Ba)	2010/11/14	ND, RDL=1		ug/L	
		Total Beryllium (Be)	2010/11/14	ND, RDL=0.1		ug/L	
		Total Bismuth (Bi)	2010/11/14	ND, RDL=1		ug/L	
		Total Boron (B)	2010/11/14	ND, RDL=50		ug/L	

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Quality Assurance Report (Continued)

Maxxam Job Number: NB0A9531

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4421865 JSW	Method Blank	Total Cadmium (Cd)	2010/11/14	ND, RDL=0.01		ug/L	
		Total Chromium (Cr)	2010/11/14	ND, RDL=1		ug/L	
		Total Cobalt (Co)	2010/11/14	ND, RDL=0.5		ug/L	
		Total Copper (Cu)	2010/11/14	ND, RDL=0.2		ug/L	
		Total Iron (Fe)	2010/11/14	ND, RDL=5		ug/L	
		Total Lead (Pb)	2010/11/14	ND, RDL=0.2		ug/L	
		Total Lithium (Li)	2010/11/14	ND, RDL=5		ug/L	
		Total Manganese (Mn)	2010/11/14	ND, RDL=1		ug/L	
		Total Mercury (Hg)	2010/11/14	ND, RDL=0.02		ug/L	
		Total Molybdenum (Mo)	2010/11/14	ND, RDL=1		ug/L	
		Total Nickel (Ni)	2010/11/14	ND, RDL=1		ug/L	
		Total Selenium (Se)	2010/11/14	ND, RDL=0.1		ug/L	
		Total Silicon (Si)	2010/11/14	ND, RDL=100		ug/L	
		Total Silver (Ag)	2010/11/14	ND, RDL=0.02		ug/L	
		Total Strontium (Sr)	2010/11/14	ND, RDL=1		ug/L	
		Total Thallium (Tl)	2010/11/14	ND, RDL=0.05		ug/L	
		Total Tin (Sn)	2010/11/14	ND, RDL=5		ug/L	
		Total Titanium (Ti)	2010/11/14	ND, RDL=5		ug/L	
		Total Uranium (U)	2010/11/14	ND, RDL=0.1		ug/L	
		Total Vanadium (V)	2010/11/14	ND, RDL=5		ug/L	
		Total Zinc (Zn)	2010/11/14	ND, RDL=5		ug/L	
		Total Zirconium (Zr)	2010/11/14	ND, RDL=0.5		ug/L	
	RPD	Total Aluminum (Al)	2010/11/14	NC		%	20
		Total Antimony (Sb)	2010/11/14	NC		%	20
		Total Arsenic (As)	2010/11/14	NC		%	20
		Total Barium (Ba)	2010/11/14	NC		%	20
		Total Beryllium (Be)	2010/11/14	NC		%	20
		Total Bismuth (Bi)	2010/11/14	NC		%	20
		Total Boron (B)	2010/11/14	NC		%	20
		Total Cadmium (Cd)	2010/11/14	NC		%	20
		Total Chromium (Cr)	2010/11/14	NC		%	20
		Total Cobalt (Co)	2010/11/14	NC		%	20
		Total Copper (Cu)	2010/11/14	NC		%	20
		Total Iron (Fe)	2010/11/14	NC		%	20
		Total Lead (Pb)	2010/11/14	NC		%	20
		Total Lithium (Li)	2010/11/14	NC		%	20
		Total Manganese (Mn)	2010/11/14	NC		%	20
		Total Mercury (Hg)	2010/11/14	NC		%	20
		Total Molybdenum (Mo)	2010/11/14	NC		%	20
		Total Nickel (Ni)	2010/11/14	NC		%	20
		Total Selenium (Se)	2010/11/14	NC		%	20
		Total Silicon (Si)	2010/11/14	NC		%	20
		Total Silver (Ag)	2010/11/14	NC		%	20
		Total Strontium (Sr)	2010/11/14	NC		%	20
		Total Thallium (Tl)	2010/11/14	NC		%	20
		Total Tin (Sn)	2010/11/14	NC		%	20
		Total Titanium (Ti)	2010/11/14	NC		%	20
		Total Uranium (U)	2010/11/14	NC		%	20
		Total Vanadium (V)	2010/11/14	NC		%	20
		Total Zinc (Zn)	2010/11/14	NC		%	20
		Total Zirconium (Zr)	2010/11/14	NC		%	20
4422971 TW2	Matrix Spike	Total Dissolved Solids	2010/11/12		110	%	80 - 120
	Spiked Blank	Total Dissolved Solids	2010/11/12		106	%	80 - 120
	Method Blank	Total Dissolved Solids	2010/11/12	ND, RDL=10		mg/L	
	RPD	Total Dissolved Solids	2010/11/12	1.5		%	20

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Quality Assurance Report (Continued)

Maxxam Job Number: NB0A9531

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4423397 RR6	Calibration Check	Conductivity	2010/11/10		101	%	96 - 104
	Method Blank	Conductivity	2010/11/10	ND, RDL=1		uS/cm	
	RPD [Y32525-02]	Conductivity	2010/11/10	1.6		%	5
4423452 RR6	Method Blank	True Colour	2010/11/10	ND, RDL=5		Col. Unit	
	RPD [Y32526-02]	True Colour	2010/11/10	2.1		%	20
4423464 RR6	Calibration Check	Alkalinity (Total as CaCO3)	2010/11/12		94	%	85 - 115
	Method Blank	Alkalinity (Total as CaCO3)	2010/11/12	1, RDL=1		mg/L	
	RPD [Y32528-02]	Alkalinity (Total as CaCO3)	2010/11/12	2.8		%	9
		Bicarbonate (HCO3)	2010/11/12	3.4		%	20
		Carbonate (CO3)	2010/11/12	0		%	20
		Hydroxide (OH)	2010/11/12	NC		%	20
4424423 BB3	Matrix Spike	Dissolved Chloride (Cl)	2010/11/12		88	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2010/11/12		93	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2010/11/12	ND, RDL=0.5		mg/L	
	RPD [Y32525-04]	Dissolved Chloride (Cl)	2010/11/12	3.8		%	20
4425962 NBN	Spiked Blank	Chlorophyll a	2010/11/10		93	%	80 - 120
	Method Blank	Chlorophyll a	2010/11/10	ND, RDL=0.1		ug/L	
	RPD	Chlorophyll a	2010/11/10	2.2		%	25
4426000 AWO	Method Blank	Dissolved Aluminum (Al)	2010/11/16	ND, RDL=3		ug/L	
4426067 SY	Spiked Blank	2-FLUOROBIPHENYL (sur.)	2010/11/16		78	%	43 - 116
		TERPHENYL-D14 (sur.)	2010/11/16		79	%	33 - 141
		Triphenyl phosphate (sur.)	2010/11/16		78	%	50 - 130
		D5-NITROBENZENE (sur.)	2010/11/16		72	%	35 - 114
		4,4'-methoxychlor	2010/11/16		60	%	50 - 130
		Lindane (BHC), gamma-	2010/11/16		72	%	50 - 130
		p,p'-DDE13C12 (sur.)	2010/11/16		78	%	40 - 130
	Method Blank	2-FLUOROBIPHENYL (sur.)	2010/11/16		83	%	43 - 116
		TERPHENYL-D14 (sur.)	2010/11/16		81	%	33 - 141
		Triphenyl phosphate (sur.)	2010/11/16		81	%	50 - 130
		D5-NITROBENZENE (sur.)	2010/11/16		79	%	35 - 114
		Chlorothalonil (Daconil)	2010/11/16	ND, RDL=1		ug/L	
		4,4'-methoxychlor	2010/11/16	ND, RDL=0.1		ug/L	
		a-Chlordane	2010/11/16	ND, RDL=0.06		ug/L	
		g-Chlordane	2010/11/16	ND, RDL=0.06		ug/L	
		Lindane (BHC), gamma-	2010/11/16	ND, RDL=0.1		ug/L	
		p,p'-DDE13C12 (sur.)	2010/11/16		78	%	40 - 130
4426288 SF1	Matrix Spike [Y32528-07]	Dissolved Ammonia (N)	2010/11/15		NC	%	80 - 120
	Spiked Blank	Dissolved Ammonia (N)	2010/11/15		100	%	80 - 120
	Method Blank	Dissolved Ammonia (N)	2010/11/15	ND, RDL=0.005		mg/L	
	RPD [Y32528-07]	Dissolved Ammonia (N)	2010/11/15	0.9		%	25
4426518 DC6	Matrix Spike	Total Nitrogen (N)	2010/11/15		NC	%	80 - 120
	Spiked Blank	Total Nitrogen (N)	2010/11/15		101	%	80 - 120
	Method Blank	Total Nitrogen (N)	2010/11/15	ND, RDL=0.02		mg/L	
	RPD	Total Nitrogen (N)	2010/11/15	2.5		%	20
4427728 RR6	Calibration Check	Biochemical Oxygen Demand	2010/11/15		99	%	81 - 119
	Method Blank	Biochemical Oxygen Demand	2010/11/15	ND, RDL=1		mg/L	
	RPD	Biochemical Oxygen Demand	2010/11/15	0		%	20
4428888 IC4	Matrix Spike	Nitrate plus Nitrite (N)	2010/11/15		NC	%	80 - 120
	Spiked Blank	Nitrate plus Nitrite (N)	2010/11/15		103	%	80 - 120
	Method Blank	Nitrate plus Nitrite (N)	2010/11/15	ND, RDL=0.02		mg/L	
	RPD	Nitrate plus Nitrite (N)	2010/11/15	2.5		%	25
4430847 TL2	Matrix Spike	Total Organic Carbon (C)	2010/11/16		104	%	80 - 120
	Spiked Blank	Total Organic Carbon (C)	2010/11/16		99	%	80 - 120
	Method Blank	Total Organic Carbon (C)	2010/11/16	ND, RDL=0.5		mg/L	

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Quality Assurance Report (Continued)

Maxxam Job Number: NB0A9531

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4430847	TL2	RPD [Y32528-07]	Total Organic Carbon (C)	2010/11/16	3.7		%	20
4431587	NBN	Matrix Spike [Y32527-09]	Hex. Chromium (Cr 6+)	2010/11/16		98	%	80 - 120
		Spiked Blank	Hex. Chromium (Cr 6+)	2010/11/16		101	%	80 - 120
		Method Blank	Hex. Chromium (Cr 6+)	2010/11/16	ND, RDL=0.001		mg/L	
		RPD [Y32527-09]	Hex. Chromium (Cr 6+)	2010/11/16	NC		%	20
4432391	BB3	Matrix Spike	Dissolved Sulphate (SO4)	2010/11/16		NC	%	80 - 120
		Spiked Blank	Dissolved Sulphate (SO4)	2010/11/16		99	%	80 - 120
		Method Blank	Dissolved Sulphate (SO4)	2010/11/16	ND, RDL=0.5		mg/L	
		RPD [Y32525-04]	Dissolved Sulphate (SO4)	2010/11/16	0.4		%	20
4435764	TL2	Matrix Spike	Dissolved Inorganic Carbon (C)	2010/11/18		118	%	80 - 120
		Spiked Blank	Dissolved Inorganic Carbon (C)	2010/11/18		97	%	80 - 120
		Method Blank	Dissolved Inorganic Carbon (C)	2010/11/18	ND, RDL=0.5		mg/L	
		RPD	Dissolved Inorganic Carbon (C)	2010/11/18	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Calibration Check: A calibration standard analyzed at different times to evaluate on-going calibration accuracy.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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